December 4, 2017

Hwy 46 Project DEIS comments
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To: Lyn Medley

Our undersigned organizations are very concerned at the proposed scope and intensity of the Hwy 46 project http://www.fs.usda.gov/project/?project=47109. Our primary concerns are that the ecological costs of extensive road construction and non-restorative forestry will outweigh the purported benefits.

The Hwy 46 DEIS proposes up to:

- Appx. 3,000 acres of commercial logging, including both thinning and regen harvest
- 398 acres of other work, such as: fuel reduction, understory enhancement, and meadow restoration
- 9.3 miles of temporary road construction and rerouting
- 119 miles of work on existing roads
- Logging of 988 acres of native, fire-regenerated stands

Our groups have long supported careful restoration work on the Willamette National Forest, including significant acreage of variable commercial thinning in dense young stands that can benefit from such work. This project appears to move into controversial areas, such as logging older stands and regen harvest. Before making any significant decisions on this project, we urge the FS to modify the scope of this project and focus on restoration efforts that have broad agreement among stakeholders.

Our organizations prefer Alternative 3 regarding the logging prescriptions because older-naturally regenerated areas are avoided. We would encourage early seral creation and sugar pine work contemplated in both Alternatives to be abandoned. Any sugar pine restoration can be accomplished by planting in recently burned areas. In terms of the road work, this alternative is only marginally better. The Forest Service needs to dramatically reduce its already existing road system.

Project Need:

The summary of the project within the DEIS describes a need to "help improve stand conditions, diversity, density and structure with thinning, gaps, and dominant tree release" because stands in

the project area have suffered from fire suppression. There is also a "project need" to create early seral habitat (post-fire habitat) because of "continued fire suppression." There is a need for hazardous fuel reduction and restore sugar pine all the product of fire suppression. DEIS at 2-3. What the DEIS does not mention is that there has been a large fire in or adjacent to the project area. There has been associated management activities, commercial logging, fuels reduction, fire break creation that is not referenced in this DEIS. The FS needs to take a hard look at what the impacts of this recent fire, and whether or not this project is still needed.
For example, how much of the project area burned this past summer? How much early seral habitat was created? Did any of these areas contain sugar pine? How much of the hazardous fuel reduction around Breitenbush was already conducted during the fire-logging activities?

If the true purpose and need for this project was habitat focused and restorative, it appears that many of the concerns may have been taken care of this past summer, and maybe much of it will be taken care of naturally given the past few fire seasons, and there is no need for logging, especially in the reserves. The FS does state that one purpose and need for the project is commercial logging to "supply a reliable supply of timber products." This is only applicable to the matrix lands within the project area, and the public is still not made aware of how much timber was commercially logged during the fire season. How many board feet, what age of trees, where was the logging located? Is there still a need to supply timber products after the logging associated with the fire for which no NEPA analysis was conducted. These are cumulative impacts that need to be considered, especially given the proximity and relative location to the project area.

The FS says it will analyze the effects of the recent fires in the FEIS. DEIS at 13. Why did the FS move forward with the DEIS given that these fires have such an enormous impact on the entire purpose and need for this project? It is wildly inappropriate that the only opportunity the public will have to weigh in on the FS's analysis of this important fire will be in the administrative appeal stage. The FS could have simply waited a month to publish this DEIS. The fires are out now, please re submit for public comment the DEIS with the fire-analysis. The FS issuing a project almost solely based on the fire suppression mitigation while an enormous fire is burning in the project area is totally ridiculous, and highlights that the primary purpose and need for this project is to generate timber volume. If this is truly the case, say so, and drop the reserves and riparian areas and the sugar pine and meadow creation.

NEPA Analysis:

We appreciate that the FS developed an alternative that omitted from treatment naturally fire-regenerated stands from logging in Alternative 3. The DEIS notes that these stands are different than the plantations slotted for logging because they are older, have larger trees, have developing understories with a greater diversity of tree species. This gets to our request in the scoping comments to provide detailed information on the condition of each stand proposed for treatment. Essentially we wanted the FS to elaborate on the significant difference between the plantations in the project area and the fire-regenerated stands. However, the DEIS still largely lumps both of these areas together for analysis, simply noting that the stands are "similar" while proposing them for largely identical logging prescriptions. The public needs to be made aware of the significant difference of these forest types.

Sugar Pine:

In the scoping notice the Forest Service proposed 430 acres of Sugar Pine restoration. This has decreased 94 acres proposed in Alternative 2. We are interested in why various areas that were initially considered for this prescription were dropped. Was it due to concerns over logging in mature forests or the presence of listed species.

We urged the Forest Service to drop these older areas from any logging and refocus any sugar pine planting and restoration into second-growth plantations, and our organization and our members would benefit from the FS's reasoning on why these older areas were proposed for this type of logging and why again they were dropped from consideration. Please include this information in the FEIS.

Again, we do not believe the costs of entering these older areas will outweigh the benefits to restoring sugar pine. Removing trees in these areas to benefit sugar pines will remove biological material that will sustain the forest ecosystem in the long-term. Smaller trees in these forested areas will naturally die off and provide organic material and sustenance for these older trees. We would ask that the Forest Service conduct a thorough cost-benefit analysis, analyzing the costs of removing organic material and the effects on the long-term viability of these trees with the benefits of temporary openings that will be created. If the Forest Service does decide to proceed in these areas, it should develop an alternative with very low diameter limits on the tree felling and limiting the logging to hand felling and leaving the felled trees in place to contribute to biological material for these areas. Again, focusing sugar pine restoration in plantations where there will be greater canopy openings and access to sunlight would be a better area for these efforts.

Also, please inform us if any of the burned areas contained sugar pine because the need for any sugar restoration at all could have been taken care of by the burning this past summer.

Riparian logging:

The Forest Service is considering approximately 800 acres of riparian reserve logging. Our organizations prefer that there is no commercial logging in riparian reserves, and no tree removal in these areas. Even when these areas have been logged in the past, we believe these areas are suffering from the previous removal of biological material that leads to depletion in nutrients that would have recruited from natural mortality. Further tree removal will acerbate these problems, and again that the benefits from increased openings do not outweigh the costs will removal, and that these openings will naturally occur over time with natural mortality. Alternative 3 reduces by a couple hundred acres the proposed riparian logging acreage, but there is no Alterative that omits Riparian logging or restricts riparian logging to an alternative that contains all non-commercial logging with all trees felled remaining in place. Additionally, the only riparian reserve areas that should be targeted, should be formerly logged second growth, not naturally regenerating areas.

Our presumption here is that any proposed logging is designed to accelerate changes that are already happening naturally. This logging will have adverse effects that are avoided by relying on natural processes. See Lutz. J.A. 2005. The Contribution of Mortality to Early Coniferous Forest Development. MS Thesis. University of Washington.

http://faculty.washington.edu/chalpern/Lutz_2005.pdf. This reality needs to be fully accounted for and weighed in the DEIS.

We would also like the Forest Service to proceed with an understanding that fire, insects and disease are all essential processes that create and maintain healthy forests. These processes are NOT *problems*, but rather *solutions* to the alleged dense conditions within stands. Riparian areas are generally less prone to "high severity" effects from fire and insects, because the conditions on lower slopes tend to be relatively cool and moist and less windy which tends to moderate fire effects. Also, trees living on lower slopes near streams tend to be less water stressed and better able to defend themselves from insects.

The proposed action alternative puts forth logging in 183 acres of riparian reserves over 80 years old. To the extent that the Forest Service is considering riparian logging in older stands, Cascadia strongly objects to logging riparian reserve stands over 80 years old. There is just no need. The superficial resemblance to younger stands is not a reason to log these older stands. At this age, stand growth has slowed and they need to hold onto their biomass and let it begin accumulating in live and dead pools. Logging will export valuable habitat structure and it will increase stand vigor and delay recruitment of dead wood which is critical both instream as well as upland portions of riparian reserves. Natural processes are operating to develop high quality habitat without the need for intervention. Once stands reach 80 years old the FS need to put much more focus on the first three words of the NWFP standards for riparian reserves "TM-1. Prohibit timber harvest,…" (NWFP ROD p C-31).

Cascadia is concerned that a reduction in instream wood recruitment violates the "do not retard" standard of the Aquatic Conservation Strategy. Logging in the riparian reserves to create bigger trees faster which would then presumably fall in streams emphasizes only large wood recruitment instream while ignoring the equally important need for wood recruitment in the upland portion of the riparian reserves. We are also concerned the Forest Service will perpetuate the myth that thinning enhances future wood recruitment, when in reality any increase in very large wood in the distant future comes that the expense of significant reduction in wood recruitment in functional sizes classes. Please take a hard look at these issues and trade-offs in the DEIS.

Further, from an ecological perspective there is no such thing as too much wood. Cascadia believes that the current standards for snags and dead wood were a product of political compromise and are biologically outdated. More dead wood is needed to meet a wider variety of life needs and more green trees are needed over time to recruit that dead wood. The Forest Service can't continue to manage against dead wood while its standards are known to be inadequate. See Rose, C.L., Marcot, B.G., Mellen, T.K., Ohmann, J.L., Waddell, K.L., Lindely, D.L., and B. Schrieber. 2001. Decaying Wood in Pacific Northwest Forests: Concepts and Tools for Habitat Management, Chapter 24 in Wildlife-Habitat Relationships in Oregon and Washington (Johnson, D. H. and T. A. O'Neil. OSU Press. 2001) http://web.archive.org/web/20060708035905/http://www.nwhi.org/inc/data/GISdata/docs/chapter24.pdf

Weigh the trade-offs associated with logging in riparian reserves.

The agency often claims that logging in riparian reserves is necessary to improve attributes other than large wood. However, these benefits are often minor and transitory, and do not outweigh the significant long-term adverse effect of logging on recruitment of dead wood. The agency must focus on the most significant contributions of vegetation toward ACS objectives and the most significant effects of logging on the ACS objectives.

If the agency intends to log in riparian reserves to increase some nebulous goal like "vegetation diversity and complexity," then please explain why the biophysical indicators for the ACS objectives do not include any mention of vegetation diversity or complexity. See the Jazz Thinning Preliminary Analysis, 2011. http://a123.g.akamai.net/7/123/11558/abc123/forestservic.download.akamai.com/11558/www/nepa/66739_FSPLT2_062946.pdf.

Aquatic Conservation Strategy Objectives and Related Indicators.

	Aquatic Conservation Strategy Objectives								
Indicators	**#1**	**#2**	**#3**	**#4**	**#5**	**#6**	**#7**	**#8**	**#9**
Temperature		X		X				X	X
Sediment				X	X	X		X	X
Chemical Contamination				X				X	X
Physical Barriers	X	X						X	X
Substrate			X		X	X			X
Large Woody Debris			X					X	X
Pool Frequency			X						X
Pool Quality			X						X
Off-Channel Habitat	X	X	X						X
Refugia	X	X						X	X
Width/Depth Ratio			X					X	X
Streambank Condition			X			X		X	X
Floodplain Connectivity	X	X	X				X	X	X
Peak/base Flows					X	X	X		
Drainage Network Increase					X	X	X		
Riparian Reserves	X	X	X	X	X	X		X	X

The Northwest Forest Plan and its supporting documentation make clear that the primary value of riparian vegetation is as a source of large wood and shade, not vegetation diversity and canopy layering, as often asserted by the agency to justify logging in riparian reserves. Agencies have admitted this in the past: "[t]he primary function of Riparian Reserves is to provide shade and a source of large wood inputs to stream channels." Medford BLM 2013. Pilot Thompson EA, p 3-76. http://www.blm.gov/or/districts/medford/plans/files/PT_EA_ForWeb.pdf

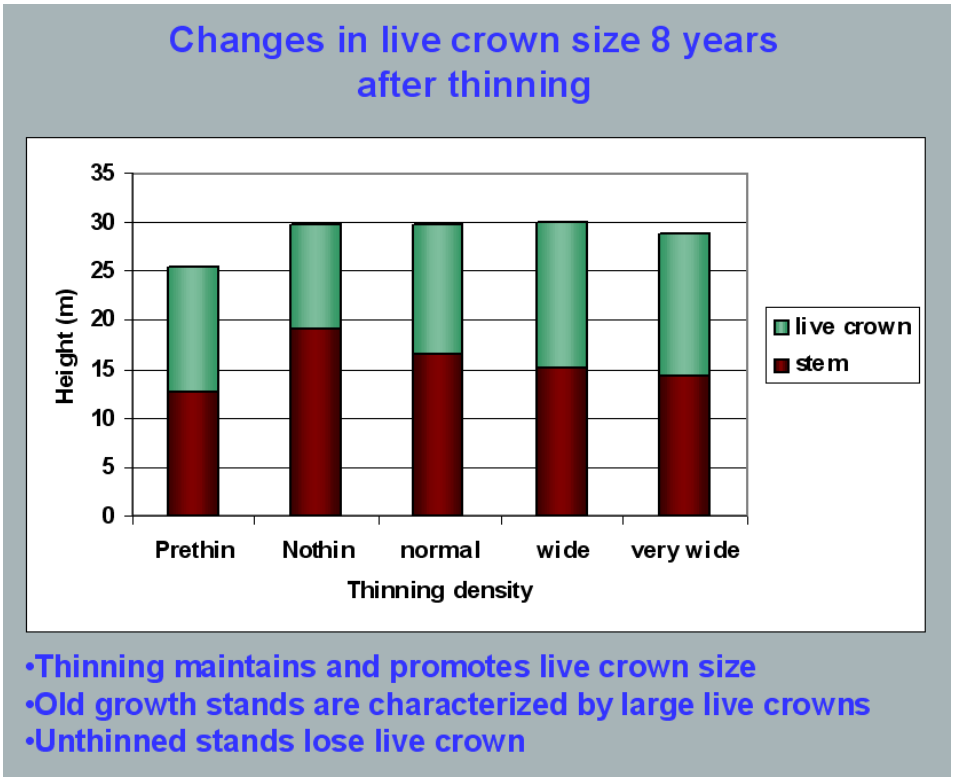
The effects of logging on dead wood are significant and long term, adversely affecting a core function of the reserves, while the purported benefits to vegetation diversity are minor and transitory, and affect secondary purposes of the reserves.

> Large Wood
> Large quantities of downed trees are a functionally important component of many streams (Swanson et al. 1976; Sedell and Luchessa, 1982; Sedell and Froggat, 1984; Harmon et al. 1986; Bisson et al. 1987; Maser et al. 1988; Naiman et al. 1992). Large woody debris influences channel morphology by affecting longitudinal profile, pool

> formation, channel pattern and position, and channel geometry (Bisson et al. 1987). Downstream transport rates of sediment and organic matter are controlled in part by storage of this material behind large wood (Betscha 1979). Large wood affects the formation and distribution of habitat units, provides cover and complexity, and acts as a substrate for biological activity (Swanson et al. 1982; Bisson et al. 1987). Wood enters streams inhabited by fish either directly from the adjacent riparian zone from tributaries that may not be inhabited by fish, or hillslopes (Naiman et al. 1992).
> Large wood in streams has been reduced due to a variety of past and present timber harvesting practices and associated activities. Many riparian management areas on federal lands are inadequate as long term sources of wood.
> …
> Riparian Ecosystem Components
> …
> Riparian vegetation regulates the exchange of nutrients and material from upland forests to streams (Swanson et al. 1982; Gregory et al. 1991). Fully functional riparian ecosystems have a suite of characteristics which are summarized below. Large conifers or a mixture of large conifers and hardwoods are found in riparian zones along all streams in the watershed, including those not inhabited by fish (Naiman et al. 1992). Riparian zone-stream interactions are a major determinant of large woody debris loading (House and Boehne 1987; Bisson et al. 1987; Sullivan et al. 1987). Stream temperatures and light levels that influence ecological processes are moderated by riparian vegetation (Agee 1988; Gregory et al. 1991). Streambanks are vegetated with shrubs and other low-growing woody vegetation. Root systems in streambanks of the active channel stabilize banks, allow development and maintenance of undercut banks, and protect banks during large storm flows (Sedell and Beschta 1991). Riparian vegetation contributes leaves, twigs, and other forms of fine litter that are an important component of the aquatic ecosystem food base (Vannote et al. 1980).

1993 FEMAT Report, pp V-13, V-25.

The effects of thinning on crown development are also not very significant.



Aquatic/Riparian Ecosystem Dynamics and Associated Management Implications - Recent Findings. Powerpoint, 32.6M. This topic was presented at the Regional Interagency Executive Committee meeting on January 7, 2003. http://www.reo.gov/library/presentations/Szaro_present_Aquatic_Rip_Final.ppt

Stimulating the development of a diverse understory is often used as a justification for thinning, but this may not be justified in stands older than about 40 years. A systematic review of 917 Forest Inventory and Analysis (FIA) plots in western Oregon (mostly on non-federal lands) found, "Contrary to expectations of canopy closure, mean canopy cover by age class rarely exceeded 85 percent, even in unthinned productive young conifer forests. Possibly as a result, effects of stand age on understory vegetation were minimal, except for low levels of forbs found in 20- to 40-year-old wet conifer stands. … Although heavily thinned stands had lower total cover, canopy structure did not differ dramatically between thinned and unthinned stands. Our findings suggest potential limitations of simple stand succession models that may not account for the range of forest types, site conditions, and developmental mechanisms found across western Oregon." McIntosh, Anne C.S.; Gray, Andrew N.; Garman, Steven L. 2009. Canopy structure on forest lands in western Oregon: differences among forest types and stand ages. Gen. Tech. Rep. PNW-GTR-794. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. 35 p. http://www.fs.fed.us/pnw/pubs/pnw_gtr794.pdf.

This seems to indicate that the benefits of thinning may be best realized in dense stands younger than 40 years old. This study also showed that in wet conifer stands the mean Canopy Height Diversity Index and the mean Simpson's Diversity Index of tree heights leveled off at about age 65. This study also looked at canopy conditions after three levels of thinning intensities (heavy, light, and none). "Mean cover of the lower canopy layer was nominal for all three thinning intensities. … There were no evident trends between understory cover and thinning history; both shrub and forb cover were fairly similar among the three thinning intensities. … The lack of a

strong effect of crown closure on understory cover may be related to our finding that mean crown cover did not exceed 85 percent. … We expected greater cover of understory vegetation in thinned than in unthinned stands but did not detect significant differences in this analysis."

> [W]hile specific structural attributes of forest ecosystems have been correlated with certain species, it is uncertain how such species will respond to treatments designed to recreate these features. There is always the possibility that in our attempt to create a structural attribute we think is important, we eliminate another attribute that is equally important, but unrecognized. One example is that attempts to restore spotted owl habitat by heavily thinning to accelerate the development of large diameter nesting trees could actually delay spotted owl recovery by reducing production of the large down wood utilized by the species it preys upon (Forsmanet al., 1984; Carey, 1995; Northet al., 1999). Similarly, heavily thinning stands to accelerate the development of marbled murrelet nesting trees also create open stands with a dense understory that is ideal habitat for a number of corvid species that prey on marbled murrelet nest eggs (USFWS, 2010). Riparian thinning efforts to create long-term supplies of very large diameter instream wood that can initiate complex wood jam formation (e.g., key pieces) are also likely to reduce the supply of large diameter wood that will create pools (Beechie and Sibley, 1997; Beechieet al., 2000; Fox and Bolton, 2007). Thus, we suggest that any efforts to actively restore riparian forests for the benefit of certain species should be treated as scientific experiments and proceed cautiously, skeptically, and with robust pre- and post-treatment data collection efforts. Hypothesized effects of thinning on riparian forest structure and the use of that structure by targeted species should be tested against empirical data.

Pollock, Michael M. and Timothy J. Beechie, 2014. Does Riparian Forest Restoration Thinning Enhance Biodiversity? The Ecological Importance of Large Wood.Journal of the American Water Resources Association (JAWRA) 50(3): 543-559. DOI: 10.1111/jawr.12206. http://oregon-stream-protection-coalition.com/wp-content/uploads/2014/07/Pollock-and-Beechie.-2014.-Riparian-thinning-and-biodiversity.pdf

Density-dependent versus density-independent mechanisms

The agencies often emphasize that mortality is not a significant contributor to instream wood recruitment, implying that the effect of thinning on density dependent mortality may not be a big deal. However, the agencies also need to recognize that thinning in potential wood source areas significantly reduces the total amount of wood available for natural processes to act upon.

Since natural disturbance occurs in both thinned and unthinned stands, the proper comparison is not between density-dependent versus density-independent sources of dead wood, but rather the total recruitment of dead wood from all sources in thinned versus unthinned areas.

Also, thinning increases the spacing between trees which means that tree fall events tend to remain isolated rather than triggering small scale contagious tree-fall events that help introduce heterogeneity and recruit more dead wood. Each standing tree has potential energy that could do work on other trees, and stands with fewer trees are capable of doing less work in terms of self-thinning and small scale contagious disturbance. See 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. 257–275. This study showed that mortality from mechanical

damage ("crushing disturbance") from falling limbs and trees and snow loads can be a more significant factor than suppression mortality. In fact, mechanical damage produced four times more deadwood biomass than suppression mortality. Please analyze this trade-off in the DEIS.

Thinning reduces the amount of trees and therefore reduces the amount of potential energy available to do ecological "work" including recruitment of more and larger wood than recruited by suppression mortality alone. Friesen (2009) said:

> Lutz (2005) found in sampled unthinned young stands on the HJA that suppression mortality was observed in >80% of plots and was more than 2.5 times as common as mechanical damage (windthrow, stem snap, and crushing). However, *biomass* lost to mortality via mechanical damage was nearly four times that lost via suppression because mechanical damage killed larger stems.

Cheryl Friesen 2009. THINNING AND DEAD WOOD: "BEST AVAILABLE SCIENCE" December 15, 2009. http://ecoshare.info/projects/central-cascade-adaptive-management-partnership/synthesis-papers-tools/ 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. "Snag fall and fragmentation added so much wood to the ground—thousands of meters of log length per hectare—that it probably constitutes a significant ecological disturbance in itself, a kind of rain of logs.")

In January 2013, the Science Review Team Wood Recruitment Subgroup reported their "Key Points" regarding the effects of commercial thinning on wood recruitment in riparian reserves:

> … In general, there is very little published science about the effects of thinning on dead wood recruitment and virtually none on thinning effects on wood recruitment in riparian zones. We conducted some limited simulation modeling to illustrate some of the relationships between thinning and dead wood recruitment. The simulations (and comparison of models) were not comprehensive or a rigorous analysis of thinning effects and should be viewed as preliminary. Below we provide 15 key points from our efforts:
>
> Key Points
>
> 1. Thinning is most beneficial in dense young stands. Existing literature and stand development theory suggest that the greatest potential ecological benefits of thinning to accelerate the development of older forest structure (e.g. large trees, large dead trees, spatial structural and compositional heterogeneity, etc.) comes in dense uniform plantations less than 80 years and especially less than 50 years old. The benefits of thinning for older forest ecological objectives are less clear in stands over 80 years of age. Hence, our report focused primarily on plantations less than 50 years of age.
>
> 2. Results may not be applicable to all stand conditions. For this synthesis, many of our conclusions were based on modeling the effects of thinning 30 to 40 year old Douglas-fir plantation stands that range in density from 200 to 270 trees per acre (tpa). We consider such stands moderately dense, as young plantation stand densities range from less than 100 to greater than 450 tpa. In terms of dead wood production, higher density stands are likely to see more benefits from thinning, and lower density stands less benefits.

3. Accurate assessments of thinning effects requires site-specific information. The effects of thinning regimes on dead wood creation and recruitment (relative to no-thinning) will depend on many factors including initial stand conditions, particularly stand density, and thinning prescription—it is difficult to generalize about the effects of thinning on dead wood without specifying the particulars of the management regime and stand conditions. To these ends, the NEPA analysis needs to provide a site-specific, quantitative analysis to show that silviculture is needed to meet ACS objectives in these riparian reserves.

4. Conventional [i.e., commercial] thinning generally produces fewer large dead trees. Thinning with removal of trees (conventional thinning) will generally produce fewer large dead trees across a range of sizes over the several decades following thinning and the life-time of the stand relative to equivalent stands that are not thinned. Generally, recruitment of dead wood to streams would likewise be reduced in conventionally thinned stands relative to unthinned stands. This result is highly relevant to the proposed logging to meet ACS objectives.

5. Conventional [i.e., commercial] thinning can accelerate the development of very large diameter trees. In stands that are conventionally thinned, the appearance of very large diameter dead trees (greater than 40") may be accelerated by 1 to 20 years relative to unthinned plantations, depending on thinning intensity and initial stand conditions. Trees of such sizes typically begin to appear 5 to 10 decades after thinning 30 to 40 year old stands. Note: any small gains in *very large* trees, comes at the expense of large numbers of *large* trees, so net benefits to ACS objectives are highly unlikely.

6. Nonconventional [i.e., non-commercial] thinning can substantially accelerate dead wood production. Stands thinned with prescriptions that leave some or all of the dead wood may more rapidly produce both large diameter dead trees in the short-term and very large diameter dead trees (especially greater than 40") in the long-term, relative to unthinned stands. Instream wood placement gets wood into streams much sooner than by natural recruitment, and can offset negative effects of thinning on dead wood production.

7. Assessments of thinning effects may vary depending on the forest growth model. The previous statements are supported by three stand simulation models (FVS, ORGANON, and ZELIG). However, the magnitude and timing of effects of thinning on dead wood recruitment and stand growth varied among models.

8. Dead wood in streams comes from multiple sources. Dead wood in streams is primarily recruited through near-stream inputs (e.g. tree mortality and bank erosion) and landslides and debris flows. All types of recruitment are important and the relative importance varies with site and stream characteristics.

9. 95% of near-stream wood inputs come from within 82 to 148 feet of a stream. The distance of near-stream inputs to streams varies with forest conditions and geomorphology. Empirical studies indicate that 95% of total instream wood (from near-stream sources) comes from distances of 82 to 148 feet. Shorter distances occur in young, shorter stands and longer distances occur in older and taller stands. Don't forget: riparian

reserves were established to serve both aquatic and terrestrial objectives, and many terrestrial wildlife depend on abundant snags and dead wood, not just large .

10. Thinning can increase the amount of pool-forming wood under certain conditions. Thinning can increase the amount of pool-forming wood only when the thinned trees are smaller in diameter than the average diameter of pool-forming wood (which varies with stream size). Smaller wood is functional in smaller streams, which means that thinning any commercial-sized trees near small streams is unlikely to advance ACS objectives.

11. The function of instream wood varies with size and location. Large instream wood can serve as stable "key" pieces that create instream obstructions and form wood jams by racking up numerous smaller pieces of wood that are mobile during high flows. Such wood jams typically consist of a wide range of piece sizes and provide multiple ecological functions that vary with stream size and gradient.

12. Effects of thinning on instream wood needs to be placed in a watershed context. Assessing the relative effect of riparian thinning on instream wood loads at a site and over the long term requires an estimation of the likely wood recruitment that will occur from the opposite bank, from upstream transport, and the rate of decay and downstream transport of wood from the site.

13. The ecological effects of thinning needs to be placed in a watershed context. Watershed-scale perspectives are needed to restore streams and riparian vegetation. The ecological effects of thinning on instream habitat will vary depending upon location in the stream network. Riparian management practices can be varied to match the ecological functions of streams.

14. Variation in thinning is essential (i.e. don't do the same thing everywhere). Variation in thinning prescriptions will produce more variable forest and wood recruitment conditions, which may more closely mimic natural forest conditions. Using a variety of treatments is also consistent with the tenets of adaptive management in situations where the outcomes of treatments are uncertain.

15. Healthy, diverse forests contain many dead trees. Numerous terrestrial forest species require large dead or dying trees as essential habitat. Some directly, others indirectly; to support the food web within which they exist. Abundant large snags and large down wood on the forest floor are common features of natural forests and essential for the maintenance of biological diversity.

Thomas Spies, Michael Pollock, Gordon Reeves, and Tim Beechie 2013. Effects of Riparian Thinning on Wood Recruitment: A Scientific Synthesis - Science Review Team Wood Recruitment Subgroup. Jan 28, 2013, p 36.
http://www.mediate.com/DSConsulting/docs/FINAL%20wood%20recruitment%20document.pdf

The assumption that "thinning can accelerate development of very large diameter trees" should be kept in proper perspective:

- The alleged gain in very large trees is very minor, compared to not logging;

- The alleged gain in very large trees is overwhelmed by the significant loss of functional wood in smaller size classes (including "large" wood), and even "medium " and "small" wood that serves vital functions in small streams that are typical in most projects; and
- The alleged gain in very large trees is in the distant future and more speculative; while the loss of smaller functional wood is in the near-term and more certain. Predicting future mortality in thinned stands is difficult. If the trees do not die and fall down there is no benefit in terms of down wood.

We do appreciate that the Forest Service considered some "streamside fall and leave" treatments, DEIS at 44, but we are unclear on why these prescriptions were limited to the thin 60 foot no-harvest buffers. Trees outside of these buffers are going to be large enough to reach these streams and much of the science discussed above urges the retention of trees outside of these thin no-harvest buffers to benefit downed food in these riparian areas. We would like to see an explanation with scientific support of why the fall and leave strategy is not important outside of the 60-foot no harvest buffers selected by the FS in the FEIS.

Creation of Early Seral Habitat:

Cascadia Wildlands and Oregon Wild urges the Forest Service to omit the proposed regeneration harvest designed to create artificial early seral forest. Mature forest conservation remains a much more important conservation priority than the creation of early seral forest. There is not really a shortage of early seral forest which is abundant on non-federal land. The sheer quantity of early seral on private lands partially compensates for the lack of habitat quality. Also, wildlife associated with early seral forest are not at risk. Those species generally tend to be mobile, generalists and opportunistic.

Furthermore, there are many ways to enhance early seral habitat without sacrificing mature forest areas or areas that will soon develop in mature forest, such as, improving practices on non-federal land and refraining from salvage logging. Climate change is expected to increase disturbance and will solve the early seral habitat problem.

Logging proponents say that regen forest is needed to enhance early seral forest which is in short supply, but this assertion is not well supported:

> The amount of early-successional forest on the landscape within the range of the northern spotted owl is probably greater now than at any time in the past. ... Any species that find optimum habitat in burned forests must have had the dispersal and reproductive capabilities to find and reproduce in these dispersed and infrequent patches of habitat. In general, species associated with early-successional conditions are good dispersers, have high reproductive rates, and are able to persist in small patches of habitat that result from small-scale disturbance (Hunter 1990, Smith 1966)....
>
> Compared to their historic populations, species associated with these early-successional conditions have increased in abundance. For example, Raphael et al. (1988) estimated that populations of 11 species of birds have probably tripled over historic numbers, and another 4 species have more than doubled. Raphael et al. (1988) and Raphael (1988) compared the estimated abundance of amphibians, reptiles, birds, and mammals from historic times to their present abundance and concluded that the early-successional

associates that have increased over time were associated with more open, drier conditions; were widely distributed (larger total geographic ranges than species associated with late-successional conditions); and, had wider ecological tolerances (i.e., they occupy a greater variety of habitat types). As noted by Harris (1984), birds associated with early-successional forest are more often migrants whereas late-successional associates are generally permanent residents. These studies also show that whereas some species associated with early-successional conditions reach their maximum abundance in early-successional forest, none of the species were restricted to that successional stage.

...

The creation of early-successional conditions as a result of logging has produced a different pattern on the landscape than the pattern that likely would have resulted solely from natural disturbance. Patches of early-successional forest are now more evenly distributed across the landscape, and sizes of patches are smaller. This pattern may have resulted in a more widespread distribution of early-successional species than in the past.

…

[T]here is currently additional acreage of early-successional forest intermixed in a fragmented pattern within all of the Late-Successional Reserves and Riparian Reserves on federal lands within the range of the northern spotted owl. As well, natural disturbances will continue to create early-successional conditions. The federal forest lands occur within a broader landscape of nonfederal lands where additional early-successional forest will be created through logging and other management activity. These lands will contribute to the maintenance of early-successional forest over time.

1994 NWFP FSEIS, pp 3&4-203 – 204.

Also, at a regional scale there is no shortage of early seral forest. In fact, there's already too much early seral in Oregon. Janet Ohmann. Trends in Early Seral Forest at the Stand and Landscape Scale. http://www.slideshare.net/ecoshare/janet-l-ohmann-trends-in-early-seral-forest-at-the-stand-and-landscape-scale. (Slides 12, 29 show there is "no shortage of early seral" in Coastal Oregon, and early seral "exceeds the HRV" [historic range of variability].)

Please address these conflicting scientific opinions and studies on the overall abundance of early seral habitat in the DEIS.

Further, there are many ways of enhancing early-seral habitat without sacrificing mature forests, for instance, we could:

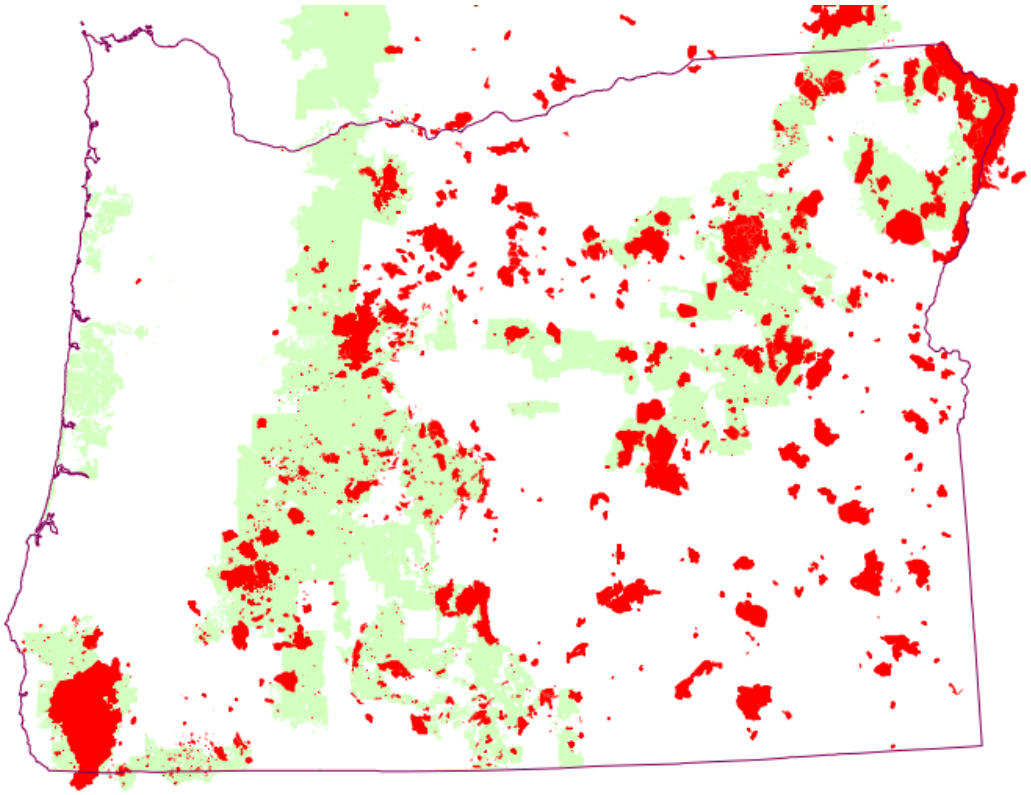
- Modify the way we fight fire and how we react after fire, e.g., leave areas to recover naturally after fire instead of salvage logging and replanting which more closely resembled industrial clearcutting;
- Modify practices on non-federal lands to encourage greater retention of live and dead trees during harvest, tolerate slower conifer re-establishment and greater diverse of native vegetation, e.g., discourage herbicide spraying to control competing native vegetation;
- Embed structure-rich "gaps" (e.g. patches of very heavy thinning) in our young stand thinning projects in formerly logged plantations. See Miller, Randall. 2014. Practitioners Approach to Early Seral Habitats on Lands Managed Primarily for Older Forest, or There is More to Healthy Forests than Conifer Trees. Siuslaw NF.

http://www.slideshare.net/ecoshare/09-practitionersapproachtoearlyseralhabitatsonlandsmanagedprimarilyforolderforestorthereismoretohealthyforeststhanconifertreesmiller; Cheryl Friesen and Norm Michaels 2010. Effects of Incorporating Gaps into Commercial Thinning Prescriptions: Best Available Science, 3-30-2010, Central Cascades Adaptive Management Partnership (CCAMP). http://ecoshare.info/projects/central-cascade-adaptive-management-partnership/synthesis-papers-tools/

- Extend the early seral character of existing very young stands that are starting to become dominated by conifers.

As an example, the Salem BLM's 2013 decision on the Molalla Late-Successional Reserve Habitat Enhancement Project thins 2000 acres of young plantations (less than 40 y.o.) to variable canopy of 80-120 tpa. The goal is to set stand on a trajectory to develop multiple canopy layers and increase stand diversity. Within treated stands, BLM will create 1-5 acre patches with density reduced to 20 tpa, with the goal to develop of high-quality early seral habitat in near term while enhancing late successional diversity over the long-term.

Here is a map showing fire perimeters in eastern and western Oregon over the last two decades. There is presumably a significant amount of early seral habitat associated with these fires.



? http://www.mtbs.gov/compositfire/mosaic/bin-release/burnedarea.html

Our comments on the Coos Bay Wagon Road and Roseburg BLM Secretarial Pilot Projects shed further light on this issue:

Complex early seral forest

One of the primary restoration objectives we keep hearing for these projects is the need to restore *complex early seral forest*. This may well be an important goal. However, this goal needs to be validated and if valid, alternative means of meeting the goal must be explored. With a little thought and creativity one can see that many ways to increase rare early seral habitat without sacrificing rare mature & old-growth forests.

Validation of the early seral habitat objective requires, among other things, asking if the current and projected amount of early seral habitat might be adequate to meet the needs of the opportunistic and generalist species that tend to occur in those areas. Only the interior valleys (and a few ridgetops) of western Oregon likely had persistent early seral conditions, while most of the federal forest landscape had transient early seral conditions associated with disturbances. Early seral wildlife species likely evolved to take advantage of early seral conditions when and where it could be found in the shifting mosaic of seral conditions.

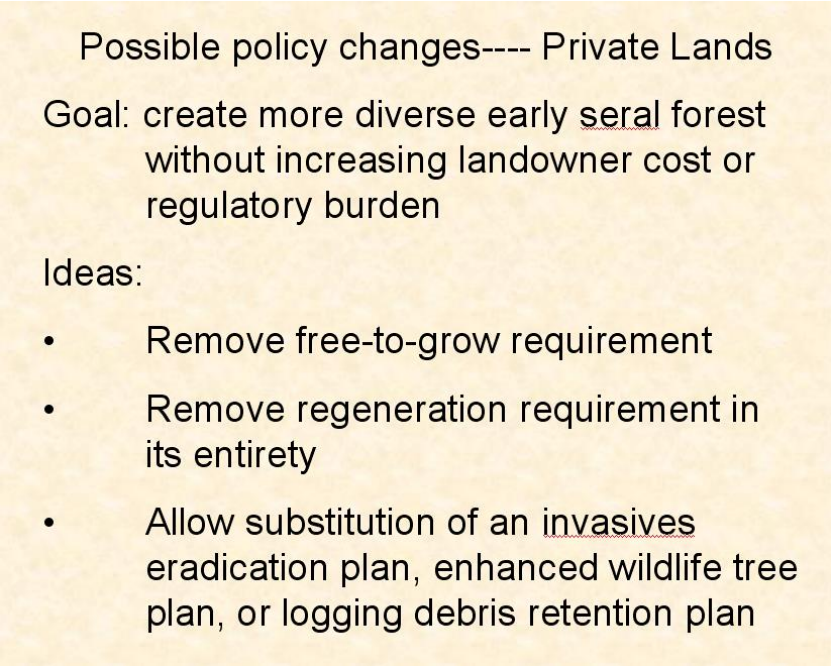
Natural disturbance processes continue to operate across the landscape, including fire, wind, ice storms, landslides, floods, volcanoes, native insects, native disease, etc. Each of these helps create various sized patches of early seral forests every year. Many predict that climate change will increase the frequency of these natural events, suggesting that any shortage of early seral conditions might just take care of itself. "Ecologically, increased distribution and frequency of disturbances may result in increased distribution and dominance of early successional ecosystems dominated by fire adapted species..." Lemieux, Christopher J., Daniel J. Scott, Rob G. Davis and Paul A. Gray. 2008. Changing Climate, Challenging Choices: Ontario Parks and Climate Change Adaptation. University of Waterloo, Department of Geography: Waterloo, Ontario http://web.archive.org/web/20101023221023/http://www.fes.uwaterloo.ca/geography/faculty/danielscott/PDFFiles/NRCAN-Report-FINAL.pdf [fn/ Conversely, it may become harder to maintain existing late-seral ecosystems and species, so existing late-successional old-growth forests should be retained in order to avoid making the shortage of late seral forest worse.]

There is widespread recognition that early seral forest is produced in abundance on non-federal lands (through industrial clearcutting). Current industrial forest practices does not produce *high quality* or *long-lasting* early seral forest. It is also true, but not widely recognized that the *absolute abundance* of early seral forest on non-federal lands might partially mitigate for its lack of quality.

Early seral vegetation also exists along many streams, rock outcrops, meadows, as well as roadsides, landings, and other disturbed sites throughout the forest. An honest assessment of the early seral shortage must account for the quantity, quality and functionality of all these early seral forest elements.

If there is indeed a shortage of complex early seral forest, we must evaluate a full range of alternative ways of increasing either the quantity and/or quality of such features. Alternatives that have been suggested include:

(a) Reform forest practices on non-federal lands to retain more legacy structures and allow a longer period of conifer establishment and more vegetation diversity after harvest, as suggested by Norm and Debora Johnson in 2007 —



K. Norm Johnson, Debora L. Johnson. 2007. Policies to Encourage Diverse, Early Seral Forest in Oregon: What Might We Do? http://www.reo.gov/ecoshare/ccamp/good_forest_opening/powerpoints/Early%20seral%20talkrevfinal.ppt

(b) Rely on natural processes such as fire, wind, insects, etc. Since the public has been misinformed that natural forest mortality processes are undesirable, this approach would work best if we increase public tolerance for natural processes. This approach may also require reform of fire suppression policies and post-fire salvage logging and replanting, as suggested by Norm Johnson, Jerry Franklin, and others in 2007 Early Seral Forest Symposium. http://www.reo.gov/ecoshare/ccamp/Good_Forest_Opening.shtml.

(c) Aggressive pre-commercial thinning in existing very young stands or failed plantations to extend the early seral stage, as suggested in the Chalk Parker Project on the Middle Fork District of the Willamette National Forest;

(d) Create patches of heavily-thinned, structure-rich "gaps" in variable density thinning projects in dense planted stands <80 years old, as suggested by numerous projects around the region.

All these alternative methods would allow meaningful restoration of early seral forest conditions without unnecessarily sacrificing mature forests.

Oregon Wild 2011. Scoping Comments on the Wagon Road and Roseburg BLM Secretarial Pilots. http://www.oregonwild.org/oregon_forests/forest-management/in-your-forests/files-for-eyes-on-the-agencies/Wagon_Road_and_Roseburg_Pilots_scoping_6-29-2011_BLM.pdf

Climate change may increase early seral and provide ample future opportunities to introduce sugar pine after disturbances.

Efforts to artificially enhance or create early seral habitat and introduce sugar pine should recognize that climate change might take care of this for us, and in fact might make it much harder to hang on to the mature forests we have. "Ecologically, increased distribution and frequency of disturbances may result in increased distribution and dominance of early successional ecosystems dominated by fire adapted species..." Lemieux, Christopher J., Daniel J. Scott, Rob G. Davis and Paul A. Gray. 2008. Changing Climate, Challenging Choices: Ontario Parks and Climate Change Adaptation. University of Waterloo, Department of Geography: Waterloo, Ontario http://web.archive.org/web/20101023221023/http://www.fes.uwaterloo.ca/geography/faculty/danielscott/PDFFiles/NRCAN-Report-FINAL.pdf. Conversely, it may become harder to maintain existing late-seral ecosystems and species, so existing late-successional old-growth forests should be retained in order to avoid making the LSOG shortage worse.

There is no peer reviewed scientific justification for the contention that early seral forest needs to be created. The proposal to create early seral habitat in this area raises a number of questions we would like answered in the DEIS:

In previous Forest Service early seral analyzes, the Forest Service states that in the entire Pacific Northwest there was an average of 5 to 20 percent of the land base in early-seral habitat. This includes areas east and west of the Cascades. If you again rely upon these numbers, could you please specify what land base or area was averaged to generate these numbers (i.e. all of Oregon and Washington?). Second, given the extremely different fire regimes west and east of the Cascades, the Forest Service needs to be more specific with this data. This number is the sole justification for the creation of early seral habitat in this area. This project is occurring at high elevation, west side rain-forests. Please provide an estimate (and the scientific support/data for this estimation) of the amount of early-seral forest that existed in the Hwy 46 project area.

Also given that it is recognized that private timber lands and small-scale agricultural lands can provide early-seral habitat for species like deer and elk, please quantify the amount of early-seral habitat being provided in the project area and watershed by these types of operations. Although we recognize that private timber lands may provide early seral habitat for only 5 to 10 years following harvest, they still provide some of this habitat benefit, albeit for a shorter period of time. Using acres numbers for private timber lands in the watershed and project area, and assuming 40 years rotations please factor these lands into your desired future conditions for the project area and watershed.

Addressing these issues is critical for the Forest Service to take an adequate hard look at early-seral forest creation. This forestry approach is relatively untested Further, Drs. Norm Johnson and Jerry Franklin's concepts have come under heavy criticism from the academic community.

The Forest Service is jumping the gun by attempting to artificially create young early-seral forest without first justifying its creation through historical evidence or conducting a full accounting of what is being provided by agricultural lands, private forest lands, roadsides, transmission lines, etc. It is simply not sufficient to say that there was anywhere from 5% to 30% of the entire Pacific Northwest in early-seral conditions in the past to justify its creation in west-side Cascade

high-elevation rainforest. The Forest Service must use its project area level or at the very least watershed level of analysis.

Also in the FEIS, please analyze the amount of early seral anticipated to be created in the Pacific Northwest and the project area from fire. This is especially significant here given the ongoing fire at the time this DEIS was published. There are an ever-increasing amount of fires across the landscape, but the Forest Service continue to salvage log these lands. If the agency is serious about the need for high value early-seral habitat, it should not be salvage logging, and the analysis should model and predict the amount to be created by future fires, taking into the increasing frequency and severity of these fires from climate change. Please include this information in the FEIS.

Even if this project area is dominated by mid- and late-seral vegetation, the analysis should also account for the fact that there are some watersheds where early seral habitat is vastly over-abundant, so continued conservation in project areas like this help mitigate for the regional shortage of late successional habitat.

And if this information and data does not exist yet because the concept of early-seral forest creation is novel, given that the Northwest Forest Plan was created to transition early and mid-seral forests into late-successional forests, the Forest Service should wait for plan level analysis and study before jumping into irretrievable commitment of public mature forests.

There is an ongoing scientific controversy and uncertainty over the efficacy of created early-seral forest out of mature forest that is currently providing nesting habitat for the rapidly declining northern spotted owl that was elaborated upon in the recent decision concerning the White Castle timber sale, which similarly purported to create early seral habitat.

Additionally in the FEIS, please take into account the episodic nature of fires and the natural creation of early seral habitat. Areas the size of this project area could go without large-scale stand replacing fires for extended periods. The current condition of forests in the project area may therefore be within the historic range of variability. Looking at larger scales, there are very large fires not far away from this project area (such as the B&B fire, and all the Sisters District fires) where early seral habitat is abundant. The project area is potentially between fire cycles right now, but future fire can be expected to create abundant early seral habitat in time.

Alternative 3 does reduce but does not eliminate the proposed early-seral habitat creation, and we are still curious to see how much habitat was created by the fires that occurred and if the FS is considered salvage logging that would eliminate some of the recently created, natural early-seral habitat. Please include this information in the FEIS or the republished DEIS.

Finally, the FS states that the early-seral habitat creation through clearcutting will benefit the western bumblebee. Is there any science to demonstrate that western bumblbees thrive is post-logging early-seral environments? We are curious about how this species fares in newly creation plantations and whether the application of herbicides influences the successful entry or re-entry of this species into logged and sprayed areas. Is the FS spraying the early-seral areas? Will this impact the bee? Do complex early-seral habitats benefit the species more than clearcut? The DEIS states that there are no western bumblebees in the project area, how will this early seral

habitat benefit them if they are not present? How close is the nearest documented population? Please address these questions in the FEIS or the republished DEIS.

Stream Flows:

The DEIS notes that both Alternatives will have negative impacts on stream flows in the project area. The chart on page 114 of the DEIS notes these negative riparian impacts associated with logging which is generally prohibited in the riparian areas. However, the Forest Service also states that these impacts "would be immeasurable and are therefore not anticipated to be adverse." *Id.* How are the effects immeasurable if on the following page the decrease in flows is measured? This is an ACS violation.

Scenic Views:

Our organizations and our members use and enjoy the forested areas around Breitenbush and the proposed project area. This includes areas accessible by trail and those not accessible by trail. If the Forest Service decides to move forward, it should ensure that the project has as minimal as an impact on the existing visual quality of the project area as possible. Our members prefer the area in its present existing condition, and knowledge of logging and/or road construction associated with this project would discourage our membership from attending Breitenbush and exploring these areas.

The DEIS states that appx. 300 acres of areas that are classified as "retention" are going to be commercially thinned. The FS states that this will done in such a way that it will not be evidence to a forest visitor. Please elaborate further in the FEIS how this is possible. The DEIS simply states that "Proposed treatments in alternatives 2 and 3 fall well within allowable scenic quality ranges set by the Forest Plan." DEIS at 215. This is not the hard look required under NEPA. What type of logging is going to take place in these areas, are there any proposed gaps, what type of yarding will be used? It is our understanding that landscape architects were used to develop these scenic overlays, are landscape architects still employed by the Willamette National Forest? What are you basing the assumption that these treatments will not be visible to forest visitors upon? Are you generating view sheds from certain viewing points or trails? Some analysis here is necessary, especially given the recreational popularity in this area and the Breitenbush River's Wild and Scenic eligibility. It is difficult to imagine that the forest visitor will not see fresh stumps, yarding damage, large stump fields in the gaps, or the temporary roads and landings constructed to facilitate the logging. We are very concerned about these impacts and the nearly 300 acres of logging proposed in these areas. Conclusory sentences in the DEIS are simply not sufficient.

These conclusions also seem to conflict with assessment of the logging impacts in other sections of these DEIS: "Logging slash, skid trails and exposed stumps would be noticeable in the short term after harvest activity has concluded but would become less noticeable over time (3-6 years) as vegetative recovery takes place."

The DEIS does included an image to simulate the impacts of logging adjacent to a camping site located in the project area at some "valued scenic viewpoints." What level of thinning did this image simulate and how was the image created? Was this exercise duplicated for every view site referenced in the DEIS? The DEIS repeatedly states that view impacts will be minimal and

perhaps not apparent to the casual forest visitor. How is the FS supporting this statement and assumption? Is modeling being used? How exactly are the images being altered to accurately reflect changes? It looks as if the FS is simply lightening the images, we are curious how these conclusions are being made. Please elaborate in the FEIS.

We appreciate that the Forest Service is considering restrictions in the project's implementation and on hauling associated with the project. The presence of logging trucks on roads our members use to visit and explore the area make them personally unsafe, and knowledge of the project's current implementation could prevent them from visiting Breitenbush and contributing to the local economy there. Additionally, the operation of logging equipment and of other industrial activities associated with the project could ruin their experience at Breitenbush, and exploring the nearby areas.

IRAs:

The FS is proposing ground based logging in an IRA. Does this involve temporary road construction in the IRA? This area should be dropped or thinned by hand. Logging the IRA is not justified by any of the exemptions in the National Forest Roadless Conservation Rule.

Recreation:

The FS discloses a myriad of effects on the numerous various recreational activities that are offered in the project area. However, the FS never attempts to cumulate these effects. How many folks will be turned away by closures? How many folks will witness active operations? The FS estimates numbers of visitors, it can estimate these impacts. These impacts need to be discussed and disclosed and incorporated into the economic impact of the project.

Wild and Scenic Rivers:

The FS simply admits in this section that it will violate the Forest Plan by leaving visible stumps, evidence of logging in the wild and scenic corridor. This is illegal. These restrictions exist for a reason, and these stumps could later be used to disqualify this area for Wild and Scenic eligibility. This is significant. The FS cannot simply write off these restrictions because they make logging in the area expensive. Why does any alternative simply not contain this illegal logging?

Road Construction:

The Forest Service is proposing to construct over nine miles of road to facilitate logging with this project. This is extensive and costly. We would ask that the Forest Service consider alternatives that contain no new road construction or renovation and that any areas only accessible by new roads or reconstructing or repairing existing roads be dropped from consideration.

The DEIS should analyze the potential impacts on recreation new roads will have on this high use area. New roads not only attract illegal off road vehicle use but also attract trash dumping, firearm waste, littering, and other illegal activity. These activities could impact the desirability of the area and its appeal to recreationists. These activities and construction could also impact any wilderness or remoteness character of the area. Please address these issues in the DEIS.

The Willamette National Forest's current road system is over-sized and unaffordable. We strongly support a thoughtful, strategic approach to improving public access to the forest, reducing negative impacts from forest roads to water quality, aquatic habitat, and wildlife habitat, and improving watersheds and forest resiliency by returning expensive, deteriorating and seldom used forest roads to the wild.

Site-Specific Analysis

Our scoping comments asked the Forest Service to provide site-specific details and analysis of the road activities proposed for the Hwy 46 project. We requested information showing, by drainage, (1) the miles of road that would be decommissioned in advance of creating temporary roads, (2) the miles of temporary roads that would be decommissioned and a timeline for that decommissioning, and (3) the location and miles of proposed maintenance work on the existing road system, and the timeline for that work. In response, the Forest Service has provided some information but key details still are not disclosed.

For example, the analysis states 232 total road miles exist in the project planning area and that 170 miles will remain open under Alternatives 2 and 3. *See, e.g.*, DEIS at 204.

- How many of the 232 miles of road in the project area are system roads?
- How many miles of unauthorized, non-system roads exist in the project area? Where are the unauthorized, or non-system roads?
- How does the Forest Service plan to manage the non-system roads?

The total system miles analyzed on Table 63 appears to be incorrect. DEIS at 325.

- What is the total number of system road miles in the project area?

The information provided in the DEIS and Table 63 (Appendix H) fails to provide any estimated timelines for the proposed road work. It also fails to provide any information about the aquatic risk or future needs of each of the roads in the project area. *See, e.g.*, DEIS at 315 (stating that a road identified in the RIS to be analyzed for decommissioning "needs to remain on system for resource administration" without addressing whether the road presents a high aquatic risk, or defining what resource administration is needed and how far into the future). This prevents meaningful public comment on the Forest Service's proposed road activities.

- Which roads were rated high aquatic risk, low aquatic risk, high need, or low need?

To disclose its analysis of all roads in the project area, the Forest Service should consider including additional columns for its roads table that disclose the objective maintenance level of the road segments based on any previous NEPA decisions, the risks and benefits of the roads, whether it is needed or unneeded, and the proposed maintenance level or treatment under each action alternative.

The Forest Service references a travel and road management plan developed specifically for this project, that includes details regarding road status, conditions, stream culvert locations and conditions, road maintenance levels, and management classifications, which is located in a transportation analysis file. DEIS at 200. Much of this information is precisely the type of site-specific information that should be disclosed in the DEIS so as to inform the public and allow for meaningful comment. This information is also necessary to understand the baseline the agency is

comparing the alternatives to, which we noted in our scoping comments should be the official road system and not include undetermined, unauthorized, or other non-system roads. Because the DEIS lacks this site-specific information, we are unable to provide meaningful public comment on these points.

Impacts From Forest Roads

The best available science shows that forest roads cause significant adverse impacts to National Forest resources. *See, e.g.*, 66 Fed. Reg. at 3208 ("Scientific evidence compiled to date [2001] suggests that roads are a significant source of erosion and sedimentation and are, in part, responsible for a decline in the quality of fish and wildlife habitat."). A 2014 literature review from The Wilderness Society surveys the extensive and best available scientific literature—including the Forest Service's General Technical Report synthesizing the scientific information on forest roads (Gucinski 2001)—on a wide range of road-related impacts to ecosystem processes and integrity on National Forest lands.[1] Erosion, compaction, and other alterations in forest geomorphology and hydrology associated with roads seriously impair water quality and aquatic species viability. Roads disturb and fragment wildlife habitat, altering species distribution, interfering with critical life functions such as feeding, breeding, and nesting, and resulting in loss of biodiversity. Roads facilitate increased human intrusion into sensitive areas, resulting in poaching of rare plants and animals, human-ignited wildfires, introduction of exotic species, and damage to archaeological resources.

Roads, Trails, and Invasive Species

Roads contribute to the spread of invasive species. Roads themselves—regardless of whether they are open or closed to the public—split apart the forest landscape, creating more buffers where invasive species are likely to grow. *See* 2014 TWS Literature Review at 11. The Forest Service should include in its analysis an assessment of how the roads in the project area are likely to provide a vector for the spread of invasive species by fragmenting the landscape and creating buffers that are less resistant and resilient to stressors like invasive species. It should also disclose how the proposed use of those roads by log hauling trucks and other motorists will further exacerbate the risk of spreading invasive species.

Forest Roads and Fire

Science shows that roads and trails play a role in affecting wildfire occurrence. *See* 2014 TWS Literature Review at 9 (noting human-ignited wildfires account for more than 90% of fires on national lands and are almost five times more likely in areas with roads). What's more, closed roads that remain on the landscape can affect where and how forests burn. *Id.* Because closed roads remain on the landscape and thus continue to allow for human caused wildfires, this further supports decommissioning more than 1.99 miles of system roads, including decommissioning the 1.37 miles of road slated for closure instead of changing those roads to ML1.

Climate Change & Forest Roads

[1] *See* The Wilderness Society, *Transportation Infrastructure and Access on National Forests and Grasslands: A Literature Review* (May 2014).

Climate change is a major challenge for natural resource managers because of the magnitude of potential effects and the related uncertainty of those effects. A robust analysis under NEPA of the forest road system and its environmental and social impacts is especially critical in the context of climate change.

Climate change intensifies the impacts associated with roads. For example, as the warming climate alters species distribution and forces wildlife migration, landscape connectivity becomes even more critical to species survival and ecosystem resilience.[2] Climate change is also expected to lead to more extreme weather events, resulting in increased flood severity, more frequent landslides, altered hydrographs, and changes in erosion and sedimentation rates and delivery processes.[3] Many National Forest roads are poorly located and designed to be temporarily on the landscape, making them particularly vulnerable to these climate alterations.[4] Even roads designed for storms and water flows typical of past decades may fail under future weather scenarios, further exacerbating adverse ecological impacts, public safety concerns, and maintenance needs.[5] At bottom, climate change predictions affect all aspects of road management, including planning and prioritization, operations and maintenance, and design.[6]

The Forest Service has a substantive duty under its own Forest Service Manual to establish resilient ecosystems in the face of climate change.[7] More broadly, the Forest Service has a mission to sustain the health, diversity, and productivity of the Nation's forests and grasslands to meet the needs of present and future generations. The agency's own climate change science identified above demonstrates how climate change places ecosystems on our national forests at risk. Thus to fulfill its mission, the Forest Service must address the risks of climate change when managing activities involving roadwork on our national forests.[8]

Here, the Forest Service must analyze in detail the impact of climate change and changing weather patterns on forest roads and forest resources. It should start with a vulnerability

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[2] 2014 TWS Literature Review at 9-14.
[3] *See, e.g.*, Halofsky, J.E. et al. eds., USDA, Forest Service, Pacific Northwest Research Station, *Adapting to Climate Change at Olympic National Forest and Olympic National Park*, PNW-GTR-844 (2011), pages 21-27.
[4] *See, e.g.*, *id.* at 36-38.
[5] *See, e.g.*, Strauch, R.L. et al., *Adapting transportation to climate change on federal lands in Washington State*, Climate Change 130(2), 185-199 (2015) (noting the biggest impacts to roads and trails are expected from temperature-induced changes in hydrologic regimes that enhance autumn flooding and reduce spring snowpack).
[6] Halofsky (2011) at 35.
[7] *See, e.g.*, FSM 2020.2(2) (directing forests to "[r]estore and maintain resilient ecosystems that will have greater capacity to withstand stressors and recover from disturbances, especially those under changing and uncertain environmental conditions and extreme weather events"); FSM 2020.3(4) ("[E]cological restoration should be integrated into resource management programs and projects . . . Primary elements of an integrated approach are identification and elimination or reduction of stressors that degrade or impair ecological integrity.").
[8] USDA, Forest Service, *National Roadmap for Responding to Climate Change* at 26 (2011), *available at* http://www.fs.fed.us/climatechange/pdf/Roadmapfinal.pdf, page 4 (outlining the agency's plans to respond to climate change through assessing risks and vulnerabilities, engaging to seek solutions, and managing for resilience).

assessment, to determine the project area's exposure and sensitive to climate change, as well as its adaptive capacity.[9] For example, the agency should consider the risk of increased disturbance due to climate change when analyzing this proposed project. It should include existing and reasonably foreseeable climate change impacts as part of the affected environment, assess them as part of the agency's hard look at impacts, and integrate them into each of the alternatives, including the no action alternative. The agency should also consider the cumulative impacts likely to result from the proposed project, proposed road activities, and climate change.[10] In planning for climate change impacts and the proposed road activities, the Forest Service should consider: (1) protecting large, intact, natural landscapes and ecological processes; (2) identifying and protecting climate refugia that will provide for climate adaptation; and (3) maintaining and establishing ecological connectivity.[11]

Mitigation

Given the numerous adverse impacts of this proposed action, the Forest Service must consider mitigation opportunities to counter expansions in the motorized footprint in places with important, scarce, or sensitive resources. *See, e.g.*, The White House, Presidential Memorandum: Mitigating Impacts on Natural Resources from Development and Encouraging Related Private Investment (Nov. 3, 2015), *available at* https://www.whitehouse.gov/the-press-office/2015/11/03/mitigating-impacts-natural-resources-development-and-encouraging-related (directing the Dept. of Agriculture "to avoid and then minimize harmful effects to land, water, wildlife, and other ecological resources (natural resources) caused by land- or water-disturbing activities, and to ensure that any harmful effects are effectively addressed"). The Forest Service should consider mitigation in the form of road decommissioning.

Wet Weather Log Hauling

Log hauling during wet weather has unacceptable water quality impacts and is decidedly NOT in the public interest. The NEPA analysis must take a hard look at the adverse water quality effects of log hauling during wet weather (if this activity is contemplated).

Statement of Purpose & Need in Relation to Roads

Applicable statutory and regulatory requirements should shape a project's statement of purpose and need. When the agency takes an action "pursuant to a specific statute, the statutory objectives of the project serve as a guide by which to determine the reasonableness of objectives outlined in an EIS." *Westlands Water Dist. v. U.S. Dept. of Interior,* 376 F.3d 853, 866 (9th Cir. 2004). Under subpart A of its travel rule, the Forest Service has a substantive duty to address its

[9] Halofsky (2011) at 36 ("potential climate change effects underscore the need to increase activity and be proactive in priority areas to avoid impacts associated with infrastructure failure.").
[10] *Id.* ("Managers will likely need to evaluate the density, location, design, and maintenance intensity of roads and related structures in the context of climate change to avoid escalating road maintenance costs associated with [climate change] impacts").
[11] *See* Schmitz, O.J. and A.M. Trainor, *Adaptation Approaches for Conserving Ecosystem Services and Biodiversity in Dynamic Landscapes Caused by Climate Change*, USDA Forest Service RMRS-P-71 (2014), pages 301-303.

over-sized road system. *See* 36 C.F.R. § 212.5. This underlying substantive duty must inform the scope of, and be included in, the agency's NEPA analysis. *See* Memorandum from James Peña, Regional Forester, to Forest Supervisors on Monitoring Travel Management NEPA Decisions for the Minimum Road System (Sept. 6, 2016) (hereafter 2016 Peña Memo) (explaining that "[w]hen integrated into restoration projects, the need for travel management actions may vary – for example, to address site-specific water quality issues, or wildlife habitat needs – with an underlying objective (purpose) to develop an environmentally sustainable MRS" and noting that "including these actions in the purpose and need highlights and demonstrates our commitment to travel management implementation"). After more than 15 years since finalizing the subpart A rules, the Forest Service can no longer delay in addressing this duty. The Forest Service should revise its statement of purpose and need to include the need to identify a minimum road system.

Consider Recommendations from the Willamette's Road Investment Strategy

Our scoping comments urged the Forest Service to consider the recommendations from the Willamette's forest-wide travel analysis report and to identify the minimum road system as part of its analysis of the proposed road activities. *See* Willamette National Forest, Road Investment Strategy (Sept. 2015), *available at* https://www.fs.usda.gov/Internet/FSE_DOCUMENTS/fseprd486402.pdf (last accessed Nov. 30, 2017). The analysis in the DEIS mentions the Road Investment Strategy (RIS) (DEIS at 23, 201-202), but fails to evaluate the road activities proposed for the Hwy 46 Project based on those recommendations. It makes no attempt to explain whether the road-related actions proposed in this project are consistent with the recommendations from that 2015 forest-wide report. It is possible this information is addressed in the travel and road management plan referenced in the analysis, but unfortunately as noted above the Forest Service fails to disclose this information to the public. DEIS at 200 (explaining the "travel analysis and plan considered such road-related items as safety, risk to resources, future expected use, public and private access, emergency access, and maintenance costs"). Appendix H to the DEIS lacks the necessary information to comply with subpart A of the roads rule. *See* 36 C.F.R. § 212.5(b)(2) ("Responsible officials must review the road system on each National Forest and Grassland and *identify the roads . . . that are no longer needed to meet forest resource management objections*"). Instead, it merely lists the recommendations from the TAR (which as explained below are inadequate) but fails to explain any differences from those recommendations to the proposed road actions under this project. *See* DEIS, Appendix H at 312-333.

In addition, our scoping comments highlighted specific areas where the Willamette's RIS falls short of what is legally required under subpart A of the agency's road rules. In particular, the RIS does not explain why the forest recommends maintaining roads with a high risk (to aquatics and natural resources) and a low benefit. To the extent that the RIS failed to identify unneeded roads for decommissioning, the Forest Service must do so now. DEIS at 312, Appendix H (noting that the RIS recommended roads remain closed, analyze for closure, analyze for decommissioning, defer recommendation for later analysis, remain open, or priority road). In particular, where the RIS deferred any recommendation for later analysis ("DR"), because the Forest Service is now making site-specific decisions for these roads it must provide an assessment of the aquatic risks of these roads and identified benefits. Simply citing "resource administration" is insufficient to explain why a certain road is needed as part of the minimum road system. With its cursory application of the RIS to this project, the Forest Service glosses over these important details that

are necessary to identifying unneeded roads on the landscape and moving towards a minimum road system, as required by the agency's own rules. *See* 36 C.F.R. § 212.5.

- What qualifies a road as a priority road?
- Did the agency only consider future timber management needs when identifying priority roads?

Identify the Minimum Road System

Our scoping comments urged the Forest Service to identify the minimum road system in light of the recommendations in the Willamette's RIS. The Forest Service faces many challenges with its vastly oversized, under-maintained, and unaffordable road system. 66 Fed. Reg. at 3244 ("the size of the existing forest road system and attendant budget constraints prevent the agency from managing its road system to the safety and environmental standards to which it was built."). The Willamette National Forest is no exception with costs to maintain system roads exceeding its annual maintenance budget. What's more, the impacts from roads to water, fish, wildlife, and ecosystems are tremendous and well documented in scientific literature. Given that with this project the Forest Service is considering changes to a large number of miles of roads, and given its large geographic scale, this is precisely the type of project to complete the next steps under subpart A. *See* 2016 Peña Memo ("Forests, Areas and Grasslands are strongly encouraged to assess all roads within a project area, when feasible since it may be many years before an opportunity arises again in a given watershed to address the MRS").

The 2016 Peña Memo identifies travel management decisions related to the minimum road system that require NEPA as including decisions to remove a route from the system, decommission a route or an unauthorized route, close a road, place a road in storage (ML1), or change the allowed class of motor vehicle or time of year for motor vehicle use. *See also* FSH 7715.

To identify the minimum road system, the Forest Service must consider whether each road segment the agency decides to maintain on the system is needed to meet certain factors outlined in the agency's own regulation. Consider whether each road segment is needed to:

> (1) Meet resource and other management objectives adopted in the relevant land and resource management plan;
> (2) Meet applicable statutory and regulatory requirements;
> (3) Reflect long-term funding expectations; and
> (4) Ensure that the identified system minimizes adverse environmental impacts associated with road construction, reconstruction, decommissioning, and maintenance.

36 C.F.R. § 212.5(b)(1). In assessing specific road segments, the Forest Service should also consider the risks and benefits of each road as analyzed in the travel analysis report, and whether the proposed road management measures are consistent with the recommendations from the travel analysis report. To the extent that the final decision in this project differs from what is recommended in the travel analysis report, the Forest Service must explain that inconsistency. *See, e.g.*, *Smiley v. Citibank*, 517 U.S. 735 (1996) ("Sudden and unexplained change . . . or change that does not take account of legitimate reliance on prior interpretation . . . may be 'arbitrary, capricious [or] an abuse of discretion") (internal citations omitted).

The Forest Service states that Alternatives 2 and 3 meet the proposed minimum road system in the planning area. DEIS at 204. But the minimum road system for the project area has not yet been identified. The RIS included a recommendation, but was not itself an agency decision. Therefore, the language referring to "meeting" that system is confusing. The agency must clarify whether it is proposing to determine the system roads identified under Alternatives 2 and 3 as the minimum road system. It must also explain in its analysis how the resulting road system achieves the factors defining a minimum road system under subpart A. Given that there are 232 miles of forest roads in the project area, and here the Forest Service identifies 170 miles as the minimum road system, did the agency determine that the remaining 62 miles are not needed?

Prioritize Unneeded Roads for Decommissioning

Subpart A of the Forest Service's own travel rules requires it to identify unneeded roads to prioritize for decommissioning or to be considered for other uses. 36 C.F.R. § 212.5(b)(2) ("Responsible officials must review the road system . . . and identify the roads . . . that are no longer needed . . . and that, therefore, should be decommissioned or considered for other uses"). *See also Center for Sierra Nevada v. U.S. Forest Service*, 832 F. Supp. 2d 1138, 1155 (E.D. Cal. 2011) ("The court agrees that during the Subpart A analysis the Forest Service will need to evaluate all roads, including any roads previously designated as open under subpart B, for decommissioning."). A decision to decommission roads should also consider recommendations from the Willamette's RIS. 36 C.F.R. § 212.5(b)(2) (requiring decisions about which roads are needed to be based on "a science-based roads analysis at the appropriate scale.").

We strongly support the Forest Service's modification to include decommissioning of 1.99 miles. DEIS at 200. However, this number is far too small given the challenges the Forest Service faces in maintaining its road system, the adverse impacts from the road system to the landscape, and in light of the 232 total road miles existing in the project area.

The process by which the Forest Service assessed the roads within this project area (based on the information provided in the DEIS and Appendices) runs contrary to the agency's own rule directing it to identify unneeded roads as a result of its travel analysis, and then prioritize those unneeded roads for decommissioning or other uses. As noted above, the Forest Service never identified unneeded roads in the project area, either as part of its travel analysis report on the forest-wide level or as part of this project-specific analysis.

The Forest Service states that storing 1.37 miles of roads will reduce the backlog of maintenance needs in the analysis area. DEIS at 204. To the extent the agency is storing certain roads for "resource protection," it should prioritize decommissioning these roads. *See, e.g.*, DEIS at 318 (identifying Forest Road 4600044 for closure "for resource protection" but failing to explain what future need the agency might have for the road that prevents it from being decommissioned).

Road decommissioning may temporarily increase sediment to streams but has dramatic reductions in the long run. The Forest Service's Rocky Mountain Research Station has spent over a decade monitoring the effectiveness of road treatments. A 2012 report evaluating pre and post treatment of roads showed an 80% reduction in sediment delivery to streams when roads

were decommissioned.[12] In addition, the 20-year monitoring report of the Northwest Forest Plan confirmed that watersheds that showed the most improvement in condition were those that completed road decommissioning.[13] Decommissioning road miles is consistent with the Forest Service's long-standing policy to "manag[e] access within the capability of the land."[14]

As forest road users and conservationists, we understand that a strategic reduction in road miles does not necessarily equate to a loss of access. Some roads are already functionally closed, either due to washouts, lack of use, or natural vegetation growth. Other roads receive limited use and are costly to maintain. Resources can be better spent on roads providing significant access than to spread resources thinly to all roads. This is why we urge a probing analysis of roads and strongly urge the Forest Service to decommission more than 1.99 miles of system roads.

Ensure Temporary Roads will in fact be Temporary

The Forest Service proposes to construct a little over 9 miles of temporary roads. Temporary roads must be closed within 10 years of completion of a project, per 16 U.S.C. 1608(a), unless the Forest Service re-evaluates the road and determines it to be necessary for the minimum road system. During the project, however, and for an additional 10 years after completion of the project, the temporary roads will continue to have very real impacts on the landscape. For example, temporary roads will continue to allow for harassment of wildlife, littering, fires, invasive plant distribution, and negative impacts to aquatic and riparian habitat, as well as the fish that depend on that habitat.

The agency must consider the effects of its proposal to use or reconstruct temporary roads when combined with the effects of its minimum road system.[15] It must consider how the proposed temporary roads will detract from the purpose of subpart A of the agency's own rules, to "identify the minimum road system needed for safe and efficient travel and for administration, utilization, and protection of the National Forest System lands." 36 C.F.R. § 212.5(b). This is especially true if the Forest Service fails to provide assurances that these roads will in fact be temporary. The Forest Service has a substantive duty to identify the minimum road system it determines is needed to, *inter alia*, ensure the "identified system minimizes adverse

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[12] Nelson N., Black T., Luce C. and R. Cissel, U.S. Forest Service Rocky Mountain Research Station, LRT Monitoring Project Update 2012.

[13] Northwest Forest Plan—The First 20 Years (1994-2013): Watershed Condition Status and Trend (Draft, May 2015), pages 3, 5, 66, 68, *available at* https://reo.gov/monitoring/reports/20yr-report/GTR_AREMP_DRAFT_MAY_2015.pdf (last accessed April 14, 2017) (noting the "decommissioning of roads in riparian areas has multiple benefits according to our model by improving both the riparian scores and typically the sedimentation scores.").

[14] 66 Fed. Reg. at 3208, 3215 (highlighting in 2001 that the Forest Service was "shifting from developing new roads" and increasing "emphasis on maintaining existing roads and improving access in other areas.").

[15] An agency's underlying substantive duty should inform the scope of the agency's NEPA analysis. *Westlands Water Dist. v. U.S. Dept. of the Interior,* 376 F.3d 853, 866 (9th Cir. 2004) (When an agency takes an action "pursuant to a specific statute, the statutory objectives of the project serve as a guide by which to determine the reasonableness of objectives outlined in an EIS.").

environmental impacts associated with road construction, reconstruction, decommissioning, and maintenance." 36 C.F.R. § 212.5(b). Under NEPA, it also has a duty to consider the effects of its proposed action when added to the existing road and trail system. *Wilderness Society v. U.S. Forest Service*, 850 F. Supp. 2d 1144, 1157-58 (D. Idaho 2012) (holding the Forest Service was arbitrary and capricious to conclude that designating 94 miles of user-created routes as non-system routes would have no significant impact).

The Forest Service should ensure that the temporary roads will in fact be temporary by committing to decommission all temporary roads within 5 years following completion of this project, and identify monitoring and enforcement to confirm that commitment. *See* DEIS at 48 (stating temporary roads will be decommissioned, but failing to provide any timeline or assurances). Based on its history of failing to implement its own decisions, we are very concerned that the Forest Service lacks any mechanism to verify or enforce its claims that the temporary roads will be closed following project completion.

Do reconstruct previously decommissioned temporary roads. Part of the Forest Service's proposal to use temporary roads would include reconstruction of temporary roads under both Alternatives 2 and 3. It should identify the prior decisions to use these temporary roads, the originally contemplated timeline for using these roads, and explain why they were not fully decommissioned following use. These old temporary roads should have been subject to the National Forest Management Act's requirement to close and re-vegetate the roads within 10 years after completion of their intended use. 16 U.S.C. § 1608(a). If these roads have any resource concerns, this information must be disclosed. Without the underlying information for these old temporary roads, the public is precluded from meaningful comment.

Alternatives

The Forest Service should consider a reasonable range of alternatives to the proposed actions, including an alternative that that avoids sediment delivery by not building any new roads—even if temporary. It should consider an alternative that includes decommissioning more than 1.99 miles of system roads. We urge the Forest Service to consider each of these reasonable alternatives that would still achieve the stated purpose and need (and in some cases better achieve the stated purpose and need) to provide a reasonable range of alternatives. As currently described, there is no range among Alternatives 2 and 3 in relation to storing or decommissioning roads.

	Alternative 1	Alternative 2	Alternative 3
Total roads	232 miles		
Open roads		170 miles	170 miles
Reconstruct or maintain		108 miles	98.2 miles
Store		1.37 miles	1.37 miles
Decommission	0 miles	1.99 miles	1.99 miles

Monitoring

Monitoring the impacts of specific actions contemplated under the Hwy 46 Project as they occur on the ground will be essential to ensure design features and potential mitigation measures are

implemented and effective. We suggest that (1) monitoring follow the new BMP proposed directives (USFS 2014), (2) the forest dedicate personnel to evaluate BMP implementation and effectiveness and to sign off on specific projects (it is not enough to have a monitoring plan that simply uses project files or field observations as the compliance check), and (3) that this information be readily accessible to state and federal agencies, as well as interested stakeholders.

Economics:

In the economics section, the DEIS only references costs associated with the NEPA planning and the money to be made from logging. This is woefully inadequate, please see the comments below again and incorporate these suggestions into the FEIS. There are economic impacts beyond those you mention. If the agency chooses to disclose the economic and other benefits of logging, they must also disclose the social costs. See *Sierra Club v. Sigler*, 695 F.2d 957, 979 (5th Cir. 1983), *Hughes River Watershed Conservancy v. Glickman*, 81 F.3d 437, 448 (4th Cir. 1996); *Columbia Basin Land Prot. Assn v. Schlesinger*, 643 F.2d 585, 594 (9th Cir. 1981).

The DEIS should discuss potential economic benefits and costs, direct and indirect, of the logging project and discuss the contributions to the local economy from the timber to be logged and jobs provided as compared to the economic benefits brought by clean water, unlogged forests, and recreation, particularly by the Breitenbush community and its over 25,000 annual guests. Already we have received extensive comments from the local residents and repeat Breitenbush guests over concerns to a reduction in tourism, not just during operations but also in the years to come as a result of resource damage and a reluctance to return based on the industrial activity.

The Forest Service should model and quantity the financial benefits generated from tourism in the community, and discuss potential impacts to this revenue from the project's implementation. NEPA analyses need to analyze the good and the bad. In this analysis, the Forest Service should model an assumption that the project's implementation will prevent all Brietenbush members from returning as a precautionary approach.

Again , the Forest Service needs to consider how much business Breitenbush brings to the surrounding counties and areas, and to contact Breitenbush specifically to consult on revenue and numbers on attendees and what percentage of these attendees use the surrounding forest lands, including the project area. These figures should be weighed against the purported value to the community generated from the project's implementation.

The economic value of forests extends well beyond recreation. The FS should consider the economic benefits of protected forests as an enhancement of the quality of life in the state which offers concrete economic benefits to every industry in the state.

The FS should consider the economic benefits of keeping carbon stored in unlogged forests by calculating the avoided costs of global climate change. Disclose the Social Cost of Carbon Dioxide as a proxy for the impacts of GHG emissions. GHG emissions from fossil fuels, logging, and other land management activities impose significant costs on society, such as the cost of damage caused by climate change and the costs of adapting to climate change and the cost of sequestering carbon to mitigate emissions. The Social Cost of Carbon Dioxide could be referred to as the "climate misery index" related to the human impacts of greenhouse gas emissions.

CEQ's draft guidance on NEPA and Climate Change recognizes that the Social Cost of Carbon Dioxide (SCC) is a "harmonized, interagency metric that can provide decisionmakers and the public with some context for meaningful NEPA review." 79 Fed. Reg. 77802, 77827. "The SCC estimates the benefit to be achieved, expressed in monetary value, by avoiding the damage caused by each additional metric ton (tonne) of carbon dioxide (CO2) put into the atmosphere. Ruth Greenspan and Dianne Callan, World Resources Institute, More than Meets the Eye: The Social Cost of Carbon in U.S Climate Policy, in Plain English (July 2011) at 1, http://pdf.wri.org/more_than_meets_the_eye_social_cost_of_carbon.pdf; Wentz, J. 2016. EPA's Use of the Social Cost of Carbon is Not Arbitrary or Capricious http://blogs.law.columbia.edu/climatechange/2016/03/07/epas-use-of-the-social-cost-of-carbon-is-not-arbitrary-or-capricious/.

The NEPA analysis should carefully disclose these social costs. The express purpose of SCC analysis is to provide an apples-to-apples basis for comparing a project's economic benefits with GHG pollution impacts (costs). Where SCC is not analyzed and disclosed, these impacts (costs) are hidden from the public and, in fact, often "paid for" by the broader environment and public in the form of degraded ecological resiliency, public health impacts, and more.

The agency must recognize that the federal estimate of SCC likely underestimates—perhaps significantly—the climate impacts of GHG pollution. As the U.S. Environmental Protection Agency has concluded: given current modeling and data limitations, [the federal SCC values] do[] not include all important damages. As noted by the IPCC Fourth Assessment Report, it is "very likely that [SCC] underestimates" the damages. The models used to develop SCC estimates, known as integrated assessment models, do not currently include all of the important physical, ecological, and economic impacts of climate change recognized in the climate change literature because of a lack of precise information on the nature of damages and because the science incorporated into these models naturally lags behind the most recent research.
EPA, The Social Cost of Carbon,
http://www.epa.gov/climatechange/EPAactivities/economics/scc.html

Fuels Reduction around Breitenbush:

Again, this cannot be properly commented upon until the FS analyzes the work that was done this past fire season, and the impact this fire has had upon future fire risk. We are reiterating the importance of mature forests, which we know was logged this fire season below:

Why Mature Forests Must be Protected.

> "As recognized by FEMAT, a conservation strategy for the Pacific Northwest must consider mature forests as well as OG. Forests are considered to enter maturity when their mean annual increment culminates, following which time they begin developing the characteristics that ultimately produce OG. Mature forests serve various important ecologic functions. They serve as future replacements for old-growth, help protect existing OG by reducing the starkness of age-class boundaries, and provide landscape connectivity and transitional habitat that compensate to some degree for the low levels of OG. Moreover, they are almost certainly more resistant to crown fires than younger forests, and hence contribute to buffering the landscape."

Late-Successional and Old-Growth Forests in the Pacific Northwest. Statement of DAVID A. PERRY Professor Emeritus. Department of Forest Science, Oregon State University, before the Subcommittee on Public Lands and Forests of the Committee on Energy and Natural Resources, United States Senate. March 13, 2008.

All logging, including thinning stands of any age, include some adverse impacts and trade-offs. Some impacts of logging are unavoidable, so there is no such thing as a logging operation that is 100% beneficial. Depending on how thinning is done thinning can have adverse impacts such as soil disturbance, habitat disturbance, carbon removal, spreading weeds, reduced recruitment of snags, road-related erosion and hydrologic impacts, moving fuels from the canopy to the ground, creating a hotter-dryer-windier microclimate that is favorable to greater flame lengths and rate of fire spread, etc. Some of these negative effects are fundamentally unavoidable, therefore all thinning has negative effects that must be compensated by beneficial effects such as reducing competition between trees so that some can grow larger faster, increased resistance drought stress and insects, increasing species diversity, possible fire hazard reduction, etc. It is generally accepted that when thinning very young stands, the benefits outweigh the adverse impacts and net benefits are likely. It is also widely understood that thinning older stands tends to have greater impacts on soil, water, weeds, carbon, dead wood recruitment so the impacts very often outweigh the benefits, resulting in net negative outcome on the balance sheet. As we move from young forest to older forests, the net benefits turn into net negative impacts, but where is that line? The authors of the Northwest Forest Plan took all this into account and determined that 80 years is a useful place to draw the line between forests that are likely to benefit from silviculture and those that are likely to experience net negative consequences. There is no new science to change that conclusion. In fact, new information developed since 1994 shows that dead wood is probably more valuable than previously thought - being important for a wide variety of ecological functions, not least of which is providing complex habitat that supports prey species for spotted owl and a variety of other predators both east and west of the Cascades. As stands become mature at around 80 years of age, they begin accumulating snags and dead wood from natural mortality processes. Thinning "captures mortality" and removes it from the forest thus preventing those trees from ever becoming snags and dead wood and interrupting the critical process whereby mature forests accumulate dead wood. The loss of recruitment of dead wood habitat when logging older stands is a long-term impact and provides a very strong argument against logging in stands over 80 years old. For further information see 1993 SAT Report pp 146-152. AND February 1991 Questions and Answers on A Conservation Strategy for the Northern Spotted Owl (prepared in response to written questions from the Senate Energy and Natural Resources Committee to the Interagency Scientific Committee on the May 1990 ISC Report. AND Jerry Franklin, David Perry, Reed Noss, David Montgomery, Christopher Frissell. SIMPLIFIED FOREST MANAGEMENT TO ACHIEVE WATERSHED AND FOREST HEALTH: A CRITIQUE. National Wildlife Federation. http://www.coastrange.org/documents/forestreport.pdf.

Robert Anthony reminded the regional executives in 2013 that:

> The long-term benefits of thinning in young plantations to create forests with characteristics of late-successional forests (e.g. large diameter standing and down wood) may outweigh any short-term negative effects on owls or their prey. However, as the age of forests selected for thinning increases, the short-term negative effects of such activities will likely increase and the benefits decrease. The Northwest Forest Plan specified a maximum age of 80 years for forests that are slated for thinning. The reasons for this

guideline were that (1) it was unclear if thinning could actually accelerate the rate at which naturally regenerated mature forests developed old forest conditions, and (2) spotted owls forage in mature forests, and thinning of these forests will likely reduce their quality as spotted owl habitat both in the short and long term. If these young forests are not currently good foraging habitat, they are gradually developing late-successional characteristics that will provide foraging habitat in the near future. Consequently, thinning in riparian forests >80 years old or any younger forests where thinning is not likely to accelerate the development of late-successional forest structure is not recommended. If these young forests are not currently good foraging habitat, they are gradually developing late-successional characteristics that will provide foraging habitat in the near future. Consequently, thinning in riparian forests >80 years old or any younger forests where thinning is not likely to accelerate the development of late-successional forest structure is not recommended.

Anthony, R.G. 2013. "Effects of Riparian Thinning on Marbled Murrelets and Northern Spotted Owls." Part III of the Science Review Team for the identification and interpretation of the best available scientific information to determine effects of riparian forest management. 28 January 2013.

The agency must carefully review and document their consideration of all the reasons not to log mature forests set forth in this paper: Doug Heiken 2009. The Case for Protecting Both Old Growth and Mature Forests. Version 1.8 April 2009.
https://www.dropbox.com/s/4s0825a7t6fq7zu/Mature%20Forests%2C%20Heiken%2C%20v%201.8.pdf?dl=0

Conservation of mature & old-growth trees helps achieve social goals. The social importance of conserving large trees is often under-appreciated. See Blicharska et al. (2014).

Abstract: In addition to providing key ecological functions, large old trees are a part of a social realm and as such provide numerous social-cultural benefits to people. However, their social and cultural values are often neglected when designing conservation policies and management guidelines. We believe that awareness of large old trees as a part of human identity and cultural heritage is essential when addressing the issue of their decline worldwide. Large old trees provide humans with aesthetic, symbolic, religious, and historic values, as well as concrete tangible benefits, such as leaves, branches, or nuts. In many cultures particularly large trees are treated with reverence. … Although the social and cultural role of large old trees is usually not taken into account in conservation, accounting for human-related values of these trees is an important part of conservation policy because it may strengthen conservation by highlighting the potential synergies in protecting ecological and social values.

Recognition of Social and Cultural Values of Large Old Trees
Large old trees have important ecological functions (Lindenmayer et al. 2012, 2013), but they often have enormous social significance as well; therefore, protecting them for ecological reasons also supports maintenance of aesthetic, symbolic, religious, and historic values (i.e., these different kinds of values can be protected in a synergetic manner).

> Many conservation policies already highlight the necessity to include people, their needs, and values in conservation decisions. … both tangible and intangible benefits provided by large old trees can be directly translated into the ecosystem services concept. … The context in which issues are represented has the potential to affect the actual action because context induces particular ways of understanding the issue and thus may lead to new types of actions in the policy process (Hajer 1995). Therefore, framing the conservation of large old trees from a human perspective, for whom they are protected and for whom they deliver important services, may facilitate creation and implementation of relevant policies. … This flagship function of large old trees appears to be more universal than that for other types of flagship species. The latter are usually limited to a particular environment and geographic area, whereas large old trees are highly valued by humans across cultural and environmental realms.

Blicharska, M.; Mikusiński, G. 2014. Incorporating social and cultural significance of large old trees in conservation policy. Conserv. Biol. 28(6):1558-1567. http://www.researchgate.net/profile/Grzegorz_Mikusinski2/publication/264673453_Incorporating_social_and_cultural_significance_of_large_old_trees_in_conservation_policy/links/5495bc800cf29b9448241278.pdf

The agency must protect mature forests because they are the best candidates to grow and develop into old-growth habitat in the shortest time frame.

1. There is a serious region-scale deficit in mature and old-growth forest habitat. Over time, the Northwest Forest Plan seeks to re-establish 3.44 million acres of mature and old-growth forest (http://web.archive.org/web/20030402090844/http://www.fs.fed.us/land/fm/oldgrow/oldgrow.htm). By continuing to log mature forests we are significantly delaying this recovery. If we are going to make a timely recovery from that deficit, and give struggling species a chance to survive the habitat bottleneck that we have created, we must protect mature forests so that they can become old-growth, and we must manage young forest so they can become mature.
2. The transition from mature forest to old growth is a process that takes time and varies depending on factors such as location and species and disturbance events. In a mature forest, all the ingredients are there to make old growth (e.g., large trees) and the scientists agree that these forests need protection to help meet the current old-growth forest deficit.
3. The architects of the Northwest Forest Plan found that many of our best large intact forest landscapes are mature forests, not old-growth. Some large forest fires burned westside forests between 1840 and 1910 and many such areas were skipped over by the timber harvest planners because they were more intent on converting the very old forests to tree plantations. These former fire areas, now mature forests, offer some of our best hopes of recreating large blocks of intact older forest.
4. Cutting mature forests is not needed for ecological reasons. These forests are already exhibiting the characteristics that provide excellent habitat and they continue to develop and improve without human intervention. As recognized in the Northwest Forest Plan standards and guidelines for Late Successional Reserves, stands over 80 years old do not need to be manipulated to become old-growth. All the ingredients are there, they just need time.

5. Mature forests provide essential habitat for the species we are most concerned with such as: spotted owl, marbled murrelet, Pacific salmon, and most of the "survey and manage" species.
6. Protecting mature and old-growth forest leads to a real ecological solution, while protecting only old-growth is merely a partial solution to an ecological problem that is bigger than just old-growth.
7. Cutting mature forest will remain controversial and socially unacceptable. If we seek to resolve conflict over management of older forests, protecting the old-growth while leaving mature forests unprotected would be only half a solution and would lead to more conflict. Shifting to a restoration paradigm gets everyone at the table working toward the same goal.
8. If mature forest is left unprotected, some members of the environmental community will distrust the agencies and oppose them on many fronts.
9. Leaving mature forests unprotected would leave substantial areas of roadless lands subject to future conflict. Many westside roadless areas may not qualify as old-growth, but still provide important values as roadless and mature forests.
10. Complicated environmental analysis will be required for logging mature forests compared to thinning plantations. Wildlife surveys will be needed. Environmental Impact Statements will more often be needed instead of abbreviated Environmental Assessments. Formal consultation under the Endangered Species Act will more often be triggered.
11. We do not need to log mature forest to provide jobs. Less than 2% of the jobs in Washington and Oregon are in the lumber and wood products sectors, and only a small fraction of those are on federal land and only a fraction of those are related to mature forest logging. Many more environmentally benign jobs are available in restoring roads, streams, thinning young plantations, and managing fire and recreation.
12. We do not need to log mature forest to prop up the economy. The NW economy has greatly diversified in the last decade. Our economy typically creates more new jobs every year than exist in the entire lumber and wood products sectors.
13. We do not need to log mature forest to prop up the timber industry. Less than 10% of the logging in Oregon and Washington in recent years has been on federal lands. Only a fraction of that is mature forest. Much more environmentally benign and socially acceptable timber can be derived from thinning young plantations or small diameter fuel reduction where it is appropriate.
14. Since managing these stands is not "needed" for any ecological reason or any economic or social reason, what would be the objective?
15. Standing in a mature forest, once gets the distinct feeling that "this beautiful place should not be destroyed by logging."

Spotted Owls:

The DEIS states that there are going to be 21 spotted owl sites impacted by the proposed timber sale. The large scope of this impact is important, every single spotted owl activity center in the project area is going to be impacted by the timber sale. The majority of this impact is from

commercial thinning, which the FS claims will treat and maintain the areas as spotted owl habitat. The FS has been thinning stands for over a decade now to restore or enhance spotted owl habitat. In the FEIS, please include any data or studies that look at spotted owl recolonization or use of thinned stands (pre and post logging activities). We are concerned that there are short-term impacts associated with commercial logging that will displace spotted owls or interrupt essential behavioral activities. It be useful to see information on how quickly spotted owls re-inhabit thinned stands or if young stands that were thinned were later recolonized by the species.

Additionally, the DEIS fails to take a hard look at numerous elements of this issue, including the invasion of the barred owl, cumulative impacts of past/ongoing logging associated with the fire season, and the impact of thinning on owl prey species. Barred owls are simply not mentioned, this is inappropriate. If barred owls are in the project area, this is significant as the species displaces the spotted owl. If the proposed logging has an impact on the spotted owl, even a very short term impact (temporary displacement), this could create an opening for the barred owls to move into these areas and further contribute to the spotted owl's decline. We discussed the barred owl concerns in our scoping comments, please ensure this issue is addressed in the FEIS.

Regarding prey species, the DEIS simply concludes: "Variable density thinning adds diversity to the stands which also benefits owls by providing more diverse habitats for prey species." But in previous FS projects and BLM projects, commercial thinning has been acknowledged to have short-term impacts on prey species, and cause temporary displacement and potentially affect recolonization of the logged areas. This is significant and needs to be discussed.

Again, this section in the DEIS is scant absent a Biological Assessment from Fish and Wildlife Service. Are these stands RA 32? Were RA 32 stands logged in this year's fire season? Were owl activity sites impacted by the logging this past fire season? This information is necessary, and seems inappropriately included and disclosed to the public for the first time in a FEIS. We would request a revised DEIS to be published following a full assessment of this fires this past year.

Deer and Elk:

The DEIS claims that deer and elk are struggling in the project area and that this is why additional clearcutting is needed. They base the struggling deer and elk status on "The current estimated elk population of about 3,000 for the Santiam WHU is well below the State Management Objective of 5,200." Please analyze the basis for the State Management Objective, it is our understanding the these objectives are not based in any science but rather on numbers optimized to sell hunting tags. It is inappropriate for the FS to rely upon these artificial numbers. Please rely upon actual historic levels or drop this purported support for clearcut logging from the FEIS.

The FS includes in the DEIS a model to assess elk and deer foraging in the project area and concludes that these are poor foraging areas. However, the model assumes that Douglas fir/hemlock forests provide poor nutritional value for elk. The DEIS elsewhere states that the historical condition of these forests are fir/hemlock forests. Should the FS be altering the project area to provide more deer and elk habitat if this runs counter to the historical condition of these forests?

Also this section is based upon this assumption: "the lack of large-scale fires in the project analysis area, cover for elk and deer is abundant and not limiting the populations" which likely needs to be revisited entirely.

Snags:

The FS admits there is going to be snag loss associated with the proposed logging. Despite the fact that the models used by the FS show that the snag levels will remain above the minimum thresholds (although the DEIS does appear to disclose some recent science that went unnamed that invalidated these models, please elaborate in the FEIS), we believe that the further reduction of snags and habitat for cavity nesting species runs counter to recommendations and standards in the Forest Plan.

The Hwy 46 DEIS and Appendix F (DecAID) failed to compare the effects of logging versus not logging on future recruitment of snags and dead wood. The Appendix compares current and reference conditions, but fails to product those numbers into the future as a result of logging versus no action. Quantifying effects and comparing alternatives are a basic requirement of NEPA. Appendix F does show that large snags and large wood are in short supply compared to the reference conditions, but the DEIS does not show that logging will make a bad situation worse. This problems is exacerbated by the fact that the LRMP standards for dead wood are outdated and call for retaining too few snags (and green trees for future recruitment) in light of new science indicating that wildlife need more dead wood than previously recognized. Rose, C.L., Marcot, B.G., Mellen, T.K., Ohmann, J.L., Waddell, K.L., Lindely, D.L., and B. Schrieber. 2001. Decaying Wood in Pacific Northwest Forests: Concepts and Tools for Habitat Management, Chapter 24 in Wildlife-Habitat Relationships in Oregon and Washington (Johnson, D. H. and T. A. O'Neil. OSU Press. 2001) http://web.archive.org/web/20060708035905/http://www.nwhi.org/inc/data/GISdata/docs/chapter24.pdf.

The Forest Service cannot provide any assurance that its plans and projects will assure viable populations of native wildlife that depend on dead trees. The Forest Service does not know how many snags are necessary to support viable populations of cavity associated species. The Forest Service has provided no credible link between DecAID tolerance levels, potential population levels, and/or viable populations. The Forest Service has also failed to reliably quantify existing and projected habitat for snag associated species.

An unavoidable impact of all commercial logging is to "capture mortality" which reduces valuable snag habitat in the short-term (via hazard tree felling) and in the long-term (via delayed recruitment and reduced overall recruitment). For example, in a thinning project on the Siuslaw National Forest "modeling stand #502073 over a 100-year cycle [using ORGANON] predicts a total stand mortality of 202 trees (>10 inches dbh) for the unthinned stand, while mortality for the thinned stand was two trees. Therefore, thinning will reduce density-dependent mortality within the stand by 99%."[16] There is no reason to think that thinning in densely stocked forests elsewhere would be any different.

The federal forest agencies now recognize that current methods and assumptions concerning snag habitat standards are outdated, and the old snag standards do not ensure enough snags to meet the intent of the standard, yet the agencies have not adjusted their management plans to

[16] NOAA April 4, 2006 Magnuson Act consultation on Essential Fish Habitat and Response to Siuslaw NF Lobster Project BA.

account for this new information nor have they developed new standards that are consistent with the latest scientific information.

As explained on the DecAID website:

> **Why is DecAID needed?**
>
> National Forest LRMP standards and guidelines for management of snags and down wood in the Pacific Northwest were based on wildlife species models and tools that were developed in the 1970s and 1980s (Thomas et al. 1979, Neitro et al. 1985, Marcot 1992, Raphael 1983). New information about the ecology, dynamics, and management of decayed wood has been published since then, and the state of the knowledge continues to change. Rose et al. (2001) report that results of monitoring indicate that the biological potential models are a flawed technique (page 602). There has been an evolution from thinking of large woody material as habitat structures, to thinking of decaying wood as an integral part of complex ecosystems and ecological processes.
>
> This paradigm shift has made the management of dead wood a much more complex task. We can no longer expect to go to our LRMPs or the biological potential model to get one number for the amount or size of snags and down wood that we can apply to all projects and to all acres. We are directed to use the best available science to manage ecosystems, and the best available science simply will not support business as usual for managing dead wood.

http://www.fs.fed.us/r6/nr/wildlife/decaid-guide/

A few of the problems with the old standards are:

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

Limitations of Existing Approaches for Assessing Wildlife-Dead Wood Relations.

Models of relationships between wildlife species and snags in the Pacific Northwest typically are based on calculating potential densities of bird species and expected number of snags used per pair. This approach was first used by Thomas et al. (1979). Marcot expanded this approach in Neitro et al. (1985) and in the Snag Recruitment Simulator (Marcot 1992) by using published estimates of bird population densities instead of calculating population densities from pair home range sizes. This approach has been criticized because the numbers of snags suggested by the models seem far lower than are now being observed in field studies

(Lundquist and Mariani 1991, Bull et al. 1997). In addition, the models provided only deterministic point values of snag sizes or densities and of population response ("population potential") instead of probabilistic estimates that are more amenable to a risk analysis and risk management framework.

In addition, existing models have focused on terrestrial vertebrate species that are primary cavity excavators. Thomas et al. (1979) and Marcot (1992) assumed that secondary snag-using species would be fully provided for if needs of primary snag-excavating species were met. However, McComb et al. (1992) and Schreiber (1987) suggested that secondary cavity nesting birds may be even more sensitive to snag density than are primary cavity excavators.

Furthermore, existing models do not address relationships between wildlife and down wood, nor do they account for species that use different types of snags and partially dead trees, such as hollow live and dead trees used by bats (Ormsbee and McComb 1998, Vonhof and Gwilliam 2007), Vaux's swift (*Chaetura vauxi*) (Bull and Hohmann 1993), American marten (*Martes americana*) (Bull et al. 2005), and fisher (*Martes pennanti*) (Zielinski et al. 2004).

Bruce G. Marcot , Janet L. Ohmann, Kim L. Mellen-McLean, and Karen L. Waddell. Synthesis of Regional Wildlife and Vegetation Field Studies to Guide Management of Standing and Down Dead Trees. Forest Science 56(4) 2010.
http://www.fs.fed.us/pnw/pubs/journals/pnw_2010_marcot002.pdf

The agencies need to prepare a EIS to consider a replacement methodology for maintaining species and other values associated with dead wood. This is especially critical because adequate dead wood is recognized as an essential feature of healthy forests and the Forest Service has identified lots of "management indicator species" associated with dead wood habitat.

Back in the early 1990s the Forest Service recognized the their forest plans were not adequate to maintain populations of spotted owls and they tried to develop plans to conserve spotted owl without following NEPA and NFMA procedures. The courts said they had to stop cutting owl habitat until they had complied with environmental laws. This is the same situation we find ourselves in today with dead-wood associated species. The agencies should stop harming dead wood habitat until they have a legal plan to conserve associated species over the long-term. *Seattle Audubon Society v. Epsy*, 998 F.2d 699, 704 (9th Cir. 1998) (an agency must re-examine its decision when the EIS "rests on stale scientific evidence and false assumptions").

Lessons Learned During the Last Fifteen Years

…

Several major lessons have been learned in the period 1979-1999 that have tested critical assumptions of these earlier management advisory models:

- Calculations of numbers of snags required by woodpeckers based on assessing their 'biological potential' (that is, summing numbers of snags used per pair, accounting for unused snags, and extrapolating snag numbers based on population density) is a flawed technique. Empirical studies are suggesting that snag numbers in areas used and selected by some wildlife species are far higher than those calculated by this technique.[226]
- Setting a goal of 40% of habitat capability for primary excavators, mainly woodpeckers,[369] is likely to be insufficient for maintaining viable populations.
- Numbers and sizes (dbh) of snags used and selected by secondary cavity-nesters often exceed those of primary cavity excavators.

- Clumping of snags and down wood may be a natural pattern, and clumps may be selected by some species, so that providing only even distributions may be insufficient to meet all species needs.
- Other forms of decaying wood, including hollow trees, natural tree cavities, peeling bark, and dead parts of live trees, as well as fungi and mistletoe associated with wood decay, all provide resources for wildlife, and should be considered along with snags and down wood in management guidelines.
- The ecological roles played by wildlife associated with decaying wood extend well beyond those structures per se, and can be significant factors influencing community diversity and ecosystem processes.

Rose, C.L., Marcot, B.G., Mellen, T.K., Ohmann, J.L., Waddell, K.L., Lindely, D.L., and B. Schrieber. 2001. Decaying Wood in Pacific Northwest Forests: Concepts and Tools for Habitat Management, Chapter 24 *in* ***Wildlife-Habitat Relationships in Oregon and Washington*** (Johnson, D. H. and T. A. O'Neil. OSU Press. 2001) http://web.archive.org/web/20060708035905/http://www.nwhi.org/inc/data/GISdata/docs/chapter24.pdf

The potential population models are based on the number of trees needed for nesting cavity-excavator birds, however, "[t]he high value of large, thick-barked snags in severely burned forests has as much to do with feeding opportunities as it does with nesting opportunities they provide birds." (Hutto. ConBio 20(4). 2006. http://web.archive.org/web/20060904175645/http://avianscience.dbs.umt.edu/documents/hutto_conbio_2006.pdf. The number of snags needed to support bird feeding, escape from predators, and other life functions, is different than, and likely higher than, the number of snags needed to support nesting, so the agencies' existing "potential population" snag standards are arbitrary and capricious.

The bottom line is that current management at both the plan and project level does not reflect all this new information about the value of abundant snags and down wood. The agency must avoid any reduction of existing or future large snags and logs (including as part of this project) until the applicable management plans are rewritten to update the snag retention standards. See also PNW Research Station, "Dead and Dying Trees: Essential for Life in the Forest," Science Findings, Nov. 1999 (http://www.fs.fed.us/pnw/sciencef/scifi20.pdf) ("Management implications: Current direction for providing wildlife habitat on public forest lands does not reflect findings from research since 1979; more snags and dead wood structures are required for foraging, denning, nesting, and roosting than previously thought.") and Jennifer M. Weikel and John P. Hayes, HABITAT USE BY SNAG-ASSOCIATED SPECIES: A BIBLIOGRAPHY FOR SPECIES OCCURRING IN OREGON AND WASHINGTON, Research Contribution 33 April 2001, http://www.fsl.orst.edu/cfer/snags/bibliography.pdf.

Most managers have a skewed conception of how many snags a healthy forest is supposed to have. For instance, the old-growth Douglas-fir/western hemlock forest at the site of the Wind River Canopy Crane has 59.5 snags/hectare larger than 51 cm dbh. Shaw, David C.; Franklin, Jerry F.; Bible, Ken; Klopatek, Jeffrey; Freeman, Elizabeth; Greene, Sarah; Parker, Geoffrey G. 2004. Ecological setting of the Wind River old-growth forest. Ecosystems. 7: 427-439. http://www.fs.fed.us/pnw/pubs/journals/pnw_2004_shaw001.pdf.

Another important ecological function provided by mortality is that it promotes evolutionary adaptation which is critical right now in the face of climate change.

> [R]esearchers were surprised to find that the mortality of established trees considerably promotes the adaptation of forests to the changing environment. … Evolution is promoted by the mortality of established trees. The researchers assumed that demographic characteristics of the trees would have a notable impact on their adaptability. Tree species differ for example so that birch matures at a considerably younger age than pine, and birch seeds spread more effectively than pine seeds. However, the results showed that these differences had only minor impacts. Instead, the mortality of established trees played a large role in the evolutionary adaptation.

Northern forests do not benefit from lengthening growing season. UNIVERSITY OF HELSINKI. PUBLIC RELEASE: 12-JAN-2010. http://www.eurekalert.org/pub_releases/2010-01/uoh-nfd011210.php

Importantly, for natural selection to occur, mortality must be caused by natural events like drought, insects, and fire, rather than through human choices about which trees will live and which will die.

Consider the following before relying on DecAID

The agency often tries to use DecAID as a substitute for the outmoded potential population methodology. DecAID, the Decayed Wood Advisor for Managing Snags, Partially Dead Trees, and Down Wood for Biodiversity in Forests of Washington and Oregon, http://web.archive.org/web/20030416095852/http://wwwnotes.fs.fed.us:81/pnw/DecAID/DecAID.nsf. Although DecAID helps bring together lots of useful information about snag associated species, the agency must recognize and account for the short-comings of DecAID and cannot rely on DecAID to provide the project-level snag standards because: DecAID is a tool designed for plan level evaluations, because DecAID itself has not been subjected to NEPA analysis and comparison to alternatives, and because DecAID is an inadequate tool for the purpose.

1. Before relying on DecAID, the agency must prepare a comprehensive NEPA analysis to consider alternative ways of ensuring viability of all species dependent upon snags and dead wood. While it is true that the "potential population" or "habitat capability" method is no longer considered scientifically valid, the agency has not yet considered a full range of alternative methods to replace the habitat capability method mandated in the forest plans.
2. While it is true that the new DecAID tolerance levels cannot be directly translated to "potential population" requirements in the LRMP and Eastside Screens, it should be obvious that 100% potential population is much more like "high" assurance than moderate or low assurance, so the Forest Service should be striving to meet 80% DecAID tolerance levels which provide a high level of assurance of meeting the needs of primary cavity excavators consistent with the Eastside Screens requirement to maintain enough snags to support 100% potential populations.
3. Before using DecAID, the agency must establish a rational link between the tolerance levels in DecAID and the relevant management requirements in the applicable resource management plan. For instance, since the Northwest Forest Plan and the Eastside Screens require maintenance of 100% potential population of at least some cavity-dependent species, the agency must explain why that does not translate into maintaining *100% of the potential tolerance level*. If the site is capable of supporting 80% tolerance levels, the agency should not be able to manage for 30-50% tolerance levels and still meet the 100% potential population requirement.

4. DecAID does not replace the discredited forest plan standards because DecAID is informational only. DecAID does not specify management objectives. The agency must specify the management objective based on project objectives, objectives for the land allocation and based on natural "range of variation." DecAID does not advise the agencies to manage for any particular tolerance level. DecAID is just information. The agency has to decide what tolerance level to manage for, but making that selection is a plan amendment requiring compliance with both NEPA and NFMA. See ONRC and HCPC v. Forsgren, (CV 02-368-BR) (Oregon District Court 2003). http://maps.wildrockies.org/ecosystem_defense/Resources_Species_Topics/Lynx/lynx%20NW%20Decision.pdf. Since large snags are outside the natural range of variability across the landscape, the agency must retain all large snags to start moving the landscape toward the natural range of variability, or the agency must carefully justify in the NEPA analysis every large snag it proposes to remove. See Jerome J. Korol, Miles A. Hemstrom, Wendel J. Hann, and Rebecca A. Gravenmier. 2002. *Snags and Down Wood in the Interior Columbia Basin Ecosystem Management Project.* PNW-GTR-181. http://www.fs.fed.us/psw/publications/documents/gtr-181/049_Korol.pdf. This paper estimates that even if we apply enlightened forest management on federal lands for the next 100 years, we will still reach only 75% of the historic large snag abundance measured across the interior Columbia Basin, and most of the increase in large snags will occur in roadless and wilderness areas.
5. DecAID snag levels for "unharvested" stands represent snags levels from a world where disturbances (e.g. fire, insects, disease) are artificially suppressed. The goal should not be to conduct a disturbance (such as thinning) that results in snag levels similar to an undisturbed stand. That makes no sense. Natural stands have periodic disturbances and pulses of snags that go along with those disturbances. The agencies need to get creative and learn to mimic natural disturbance which would always leave behind lots of dead trees. Logging that leaves behind only a few snags per acre is an UNusual disturbance event. The agencies need to learn to share the bounty of the forest with the forest itself.
6. The agency should not use "average" snag levels (e.g. 50% tolerance level) as a management objective within treatment areas, because treatments are essentially displacing natural disturbance events which would normally create and retain large numbers of snags, so disturbance areas should have abundant snags, not average levels of snags. It would be inconsistent with current science and current management direction to manage only for the mid-points and low points. The agency should manage for the full natural range dead wood levels, including the peaks of snag abundance that follow disturbance.
7. Be sure to use the DecAID tool appropriately. The agency must address the dynamics of snag habitat over time, by ensuring that recommended snag levels are maintained over time given typically high rates of snag fall and low rates of snag recruitment following fire. These dynamics are not accounted for in the DecAID advisor. The agency often misuses the DecAID decision support tool by looking at only a snap-shot in time. The agency relies on DecAID to analyze impacts on snag dependent species, but the agency fails to recognize that
    i. "DecAID is NOT: … a snag and down wood decay simulator or recruitment model [or] a wildlife population simulator or analysis of wildlife population viability. … Because DecAID is not a time-dynamic simulator … it does not account for potential temporal changes in vegetation and other environmental conditions, … DecAID could be

consulted to review potential conditions at specific time intervals and for a specific set of conditions, but dynamic changes in forest and landscape conditions would have to be modeled or evaluated outside the confines of the DecAID Advisor."

b. Marcot, B. G., K. Mellen, J. L. Ohmann, K. L. Waddell, E. A. Willhite, B. B. Hostetler, S. A. Livingston, C. Ogden, and T. Dreisbach. In prep. "DecAID -- work in progress on a decayed wood advisor for Washington and Oregon forests." Research Note PNW-RN-XXX. USDA Forest Service, Pacific Northwest Region, Portland OR. (pre-print) http://wwwnotes.fs.fed.us:81/pnw/DecAID/DecAID.nsf/HomePageLinks/44C813BC574BDFCC88256B3E006C63DF

c. To clearly and explicitly address the issue of "snag dynamics" the can start by reading and responding to the snag dynamics white paper on the DecAID website which says "To achieve desired amounts and characteristics of snags and down wood, managers require analytical tools for projecting changes in dead wood over time, and for comparing those changes to management objectives such as providing dead wood for wildlife and ecosystem processes" and includes "key findings" and "management implications" including "The high fall rate (almost half) of recent mortality trees needs to be considered when planning for future recruitment of snags and down wood. Trees that fall soon after death provide snag habitat only for very short periods of time or not at all, but do contribute down wood habitat. In fact, these trees are a desirable source of down wood as they will often begin as mostly undecayed wood and, if left on the forest floor, will proceed through the entire wood decay cycle with its associated ecological organisms and processes that are beneficial to soil conditions and site productivity." http://www.fs.fed.us/r6/nr/wildlife/decaid/pages/Snag-Dynamics.html).

8. The tolerance levels from DecAID may be too low to support viable populations of wildlife associated with dead wood, because anthropogenic factors that tend to reduce snags (e.g., firewood cutting, hazard tree felling, fire suppression, and salvage logging) may have biased the baseline data that DecAID relies upon to describe "natural" conditions. See Kim Mellen, Bruce G. Marcot, Janet L. Ohmann, Karen L. Waddell, Elizabeth A. Willhite, Bruce B. Hostetler, Susan A. Livingston, and Cay Ogden. *DecAID: A Decaying Wood Advisory Model for Oregon and Washington* in PNW-GTR-181, *citing* Harrod, Richy J.; Gaines, William L.; Hartl, William E.; Camp, Ann. 1998. *Estimating historical snag density in dry forests east of the Cascade Range.* PNW-GTR-428. http://www.fs.fed.us/pnw/pubs/gtr_428.pdf.
9. DecAID is still an untested new tool. The agencies must conduct effectiveness monitoring to determine whether the snag and down wood retention recommendations in the DecAID advisor will meet management objectives for wildlife and other resource values.
10. The "unharvested" inventory data used in DecAID may represent but a snapshot in time, and fail to capture the variability of dead wood over time, including the pulses of abundant dead wood that follow disturbances and may prove essential for many wildlife species.
11. DecAID must be used with extreme caution in post-fire landscapes because the data supporting DecAID does not include natural post-fire landscapes. ("The inventory data likely do not represent recent post-fire conditions very well … young stands originating after recent wildfire are not well represented because they are an extremely small

proportion of the current landscape … The dead wood summaries cannot be assumed to apply to areas that are not represented in the inventory data." "DecAID caveats" http://www.fs.fed.us/r6/nr/wildlife/decaid/ and http://www.fs.fed.us/r6/nr/wildlife/decaid/pages/Caveats-and-Cautions.html).

12. The Regional Ecosystem Office recommends managing dead wood in young stands within reserves to attain *biologically optimal* levels, not just *average* or *reference* levels. REO said "CWD objectives should be based on research that shows optimum levels of habitat for late-successional forest-related species, and not be based simply on measurements within natural stands." REO 7-9-1996 Criteria to Exempt Specific Silvicultural Activities in Late-Successional Reserves, http://www.reo.gov/library/policy/REO-694_comm_thin_criteria.doc. This means that information from DecAID reference stands should be supplemented with DecAID >80% tolerance levels to determine management objectives for dead wood in LSRs and riparian reserves.
13. DecAID relies on a wide range of sources in the literature, some of which recommend much higher levels of snag retention than reflected in the advisor. The agency NEPA analysis should disclose the published literature with higher levels of snag and wood retention and discuss their potential relevance for the project. ("the agency must disclose responsible opposing scientific opinion and indicate its response in the text of the final statement itself. 40 C.F.R. § 1502.9(b)." Center for Biological Diversity v. United States Forest Service, No. 02-16481 (9th Cir., Nov. 18, 2003).)
14. DecAID tolerance levels need careful explanation. These tolerance levels are very difficult to put in terms that are understandable by the general public, but if the Forest Service is going to use this tool they must make it understandable. The NEPA analysis should provide cumulative species curves for each habitat type and each forest structural stage and should explain the studies and publications that support the data points on the curves. What kind of habitat were the studies located in? What was the management history of the site? Was the study investigated nesting/denning, or roosting and foraging too?
15. DecAID does not account for the unique habitat features associated with some types of snags. DecAID primarily just counts snags and assumes that all snags of approximately the same size have equal habitat value, but this fails to account for the fact that certain types of snags and dead wood features are unique, such as: hardwood snags, hollow trees and logs, different decay classes, etc. The NEPA analysis must account for these features and the agency should disproportionately retain dead wood likely to serve these unique habitat functions.
16. DecAID authors caution that "it is imperative, however, to not average snag and down wood densities and sizes across too broad an area, such as across entire watersheds, leaving large areas within watersheds with snags or down wood elements that are too scarce or too small" Kim Mellen, Bruce G. Marcot, Janet L. Ohmann, Karen L. Waddell, Elizabeth A. Willhite, Bruce B. Hostetler, Susan A. Livingston, and Cay Ogden. *DecAID: A Decaying Wood Advisory Model for Oregon and Washington* in PNW-GTR-181. http://www.fs.fed.us/psw/publications/documents/gtr-181/042_MellenDec.pdf. While we agree that snags and down wood must not be averaged over wide areas, we also must emphasize that snags and down wood are far below historic levels on non-federal

lands[17], so in order to ensure viable populations of wildlife and avoid trends toward ESA listing, federal lands must be managed to compensate for the lack of down wood on non-federal lands.

17. DecAID appears to be based on the idea that the habitat needs of certain key wildlife species represent the best determinant of how much dead wood to retain, and this may in fact be true, but DecAID should also include cumulative curves for other ecological functions provided by dead wood, including: site productivity, nutrient storage and release, erosion control, sediment storage, water storage, water infiltration and percolation, post-fire micro-site maintenance, biological substrate, thermal mass, etc. How much dead wood is needed for these functions?
18. DecAID may be best used for program level planning rather than project level planning. See Dallas Emch and Gary Larson, 2006. Review & Analysis of Remainder of Comments on EA Supplements for Multiple Timber Sales on Mt. Hood & Willamette National Forests on Remand in ONRC Action v. Forest Service CV-03-613-KI (D.Or.). 4-10-06.
19. Any activity that degrades snag habitat is arbitrary and capricious until the agency develops new procedures in compliance with NEPA and NFMA or LFPMA. Compliance with old standards is meaningless, and in the absence of new standards, the agency cannot draw any credible conclusions about impacts to snag associated species. There is no way to use DecAID to comply with the east side screens' requirement to maintain 100% potential populations of cavity species (until the Forest Service develops some credible way to translate DecAID tolerance levels into potential population levels).
20. DecAID authors remind users that "DecAID does not recommend levels of dead wood. The user should define the goal based on the information in DecAID." http://www.fs.fed.us/r6/nr/wildlife/decaid-guide/CurranJunettaThin.shtml "DecAID provides information on snag and down wood in three tolerance levels, 30%, 50% and 80%. The 30% tolerance level is typically used when considering landscapes that have exhibited extensive harvest activity. The 50% tolerance level is typically used when considering matrix allocations and 80% is typically used when considering late-successional reserves." Young, Tiffany. 2010. Canyon Thin Project. Wildlife Specialist Report / Biological Evaluation. Willamette National Forest, Sweet Home Ranger District. 5 Dec 2010. See also, Willamette National Forest 2016. Lang Dam EA page 78, http://a123.g.akamai.net/7/123/11558/abc123/forestservic.download.akamai.com/11558/www/nepa/93958_FSPLT3_3908091.pdf.
21. The DecAID authors also remind users that "The EA should make it clear which data set (wildlife or vegetation data, harvested or unharvested plots for vegetation data) and wildlife habitat type are being used in the analysis. The best way to accomplish this is to cite the table or figure from DecAID that contains the information used." http://www.fs.fed.us/r6/nr/wildlife/decaid-guide/CurranJunettaThin.shtml

Snag retention standards overestimate habitat capability

The traditional snag habitat model used by the agency is based on outdated science[18] which vastly overestimates habitat capability for snag-dependent species because it fails to consider important factors such as:

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[17] See Pacific Northwest\GTR-765, Tabe 30, page 157. http://www.fs.fed.us/pnw/publications/gtr765/pnw-gtr765c.pdf

1. the model does not explicitly consider snag height so some snags may be too short for some species;
2. rates of snag fall rates over time;
3. snag recruitment rates over time;
4. use of space by each species;
5. the need for roosting structures [and foraging trees, and escape cavities] as well as nesting structures;
6. recent data on species needs from the Cascades and Blue Mountains has not been incorporated into the model
7. Numbers and sizes (dbh) of snags used and selected by secondary cavity-nesters often exceed those of primary cavity excavators.
8. the fact that snags should be retained in clumps AND dispersed to meet various species needs and ecological functions.
9. non-equilibrium conditions are ignored, i.e. some species rely on the natural large pulses of snags associated with large disturbances which are too often salvaged;
10. federal managers attempting to maintain viable populations of native cavity-dwellers need to consider generally degraded snag habitat conditions in heavily roaded areas and on adjacent and nearby non-federal lands.
11. The importance of a continuous supply of snags is under-appreciated, because down logs get covered in snow and become unavailable for foraging activities during winter.

Ohmann, McComb, & Zumrawi; SNAG ABUNDANCE FOR PRIMARY CAVITY-NESTING BIRDS ON NONFEDERAL FOREST LANDS IN OREGON AND WASHINGTON; *Wildl. Soc. Bull. 22:607-620,* 1994 http://web.archive.org/web/20041107222037/http://www.fs.fed.us/pnw/pubs/journals/ohmann-snagabundance.pdf. Rose, C.L., Marcot, B.G., Mellen, T.K., Ohmann, J.L., Waddell, K.L., Lindely, D.L., and B. Schrieber. 2001. Decaying Wood in Pacific Northwest Forests: Concepts and Tools for Habitat Management, Chapter 24 *in* ***Wildlife-Habitat Relationships in Oregon and Washington*** (Johnson, D. H. and T. A. O'Neil. OSU Press. 2001) http://web.archive.org/web/20060708035905/http://www.nwhi.org/inc/data/GISdata/docs/chapter24.pdf Schulz, Joyce, Terri T., Linda A. A spatial application of a marten habitat model. 1992, Wildl Soc. Bulletin 20:74-83.

The agency's analysis of snag retention and habitat for cavity dependent species is faulty at both a programmatic level and at a project level. The agency must defer any decision on this project until it reviews all the available new information and amends its management plan standards to provide adequate snags for wildlife and all other ecosystem functions.

Timing:

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[18] THOMAS, J. W., TECHNICAL EDITOR. 1979. Wildlife habitats in managed forests-the Blue Mountains of Oregon and Washington. U.S. Dep. Agric. Agric. Handb. No. 553. 512pp; CLINE, S. P., A. B. BERG, AND H. M. WIGHT. 1980. Snag characteristics and dynamics in Douglas-fir forests, western Oregon. J. Wildl. Manage. 44:773786; NEITRO, W. A., V. W. BINKLEY, S. P. CLINE, R. W. MANNAN, B. G. MARCOT, D. TAYLOR, AND F. F. WAGNER. 1985. Snags. Pages 129-169 *in* E. R. Brown, tech. ed. Management of wildlife and fish habitats in forests of western Oregon and Washington. U.S. Dep. Agric. For. Serv. Publ. R6F& WL-192-1985.

In numerous sections through the DEIS the FS limits operation activities to certain dates because of impacts to various species, impacts to recreation, impacts to the Breitenbush community. These restrictions are never centralized in one place in the DEIS. Would the FS please put in one place what activities are permitted when, which would make monitoring of any logging operations feasible.

Climate Change and Carbon Storage:

We would finally ask that the Forest Service conduct a thorough analysis of the project's effects on climate change and potential carbon storage. Despite the fact that these effects might be small on the global scale, every area must do its part for efforts to combat climate to become effective. I derive value from knowing that the Breitenbush area is helping to do its part to store carbon and combat climate change, and would like to Forest Service to analyze and take into consideration how much carbon will be removed and how the project's implementation will influence climate change.

The FS has a duty to provide high quality NEPA analysis. The Hwy 46 DEIS analysis of carbon and climate change does not meet that standard. NEPA requires federal agencies to rely upon "high quality" information and "accurate scientific analysis." 40 C.F.R. § 1500.1(b). The scientific information upon which an agency relies must be of "high quality because accurate scientific analysis, expert agency comments, and public scrutiny are essential to implementing NEPA." Idaho Sporting Congress v. Thomas, 137 F.3d 1146, 1151 (9th Cir. 1998) (internal quotations omitted); see also Portland Audubon Society v. Espy, 998 F.2d 699, 703 (9th Cir. 1993) (overturning decision which "rests on stale scientific evidence, incomplete discussion of environmental effects... and false assumptions")

"To take the required 'hard look' at a proposed project's effects, an agency may not rely on incorrect assumptions or data in an EIS." Native Ecosystems Council v. USFS. (9th Circuit August 11, 2005) http://www.elawreview.org/summaries/environmental_quality/nepa/native_ecosystems_council_v_u.html *citing* 40 C.F.R. §§ 1500.1(b) and 1502.24.

The National Forest Management Act's (NFMA) implementing regulations require the consideration of the "best available science" for all site-specific projects. 36 C.F.R. § 219.11 (2008); 36 C.F.R. § 219.35(d)(2000). Under the 2008 NFMA regulations, this requires documenting "how the best available science was taken into account in the planning process within the context of the issues being considered;" and "that the science was appropriately interpreted and applied." 36 C.F.R. § 219.11(a).

During ESA Section 7 consultation, the agency "shall use the best scientific and commercial data available." 16 U.S.C. § 1536(a)(2). "[T]he Federal agency requesting formal consultation," "shall provide the Service with the best scientific and commercial data available or which can be obtained during the consultation," to serve as the basis for the Fish and Wildlife Service's subsequent BO. 50 C.F.R. 402.14(d).

40 CFR 1500.1(b) "The information must be of high quality. Accurate scientific analysis, expert agency comments, and public scrutiny are essential to implementing NEPA."

40 CFR 1502.24 "Agencies shall insure the professional integrity, including scientific integrity, of the discussions and analyses in environmental impact statements."

To aid in the search for and use of "best available science" the agency should refer to this publication. Sullivan, P. J., J. M. Acheson, P. L. Angermeier, T. Faast, J. Flemma, C. M. Jones, E. E. Knudsen, T. J. Minello, D. H. Secor, R. Wunderlich, and B. A. Zanetell. 2006. Defining and implementing best available science for fisheries and environmental science, policy, and management. American Fisheries Society, Bethesda, Maryland, and Estuarine Research Federation, Port Republic, Maryland.
http://web.archive.org/web/20080705101501/http://www.uec-utah.org/PDF/Sullivan%20et%20al.%202006_AFS%20science.pdf

Climate Change: Do Not Ignore or Minimize Impacts

DEIS page 255 says "a project of this magnitude makes an infinitesimal contribution to overall [greenhouse gas] emissions. Therefore, at the global and national scales, the proposed action's direct and indirect contribution to greenhouse gasses and climate change would be negligible. In addition, because the direct and indirect effects would be negligible, the proposed action's contribution to cumulative effects on greenhouse gasses and climate change would also be negligible." This is wrong on many levels. First, why does the FS say this about greenhouse gases but not about this project's contribution to jobs and wood products which are also infinitesimal at a global scale? Second, the FS cannot conclude that this projects GHG emissions do not contribute to cumulative impacts. If that was true then there would be no global warming problem at all, because every individual contribution is small in comparison to the global problem. The FS does not seem to understand that climate change is by definition a problem of cumulative effects. All GHG emissions (from logging and all other sources) are part of the problem, and all carbon capture (such as by growing trees that are not logged) is part of the solution.

The NEPA analysis in the Hwy 46 DEIS must avoid minimizing this project's contribution to carbon emissions and global warming by saying the effects of this project would be negligible on a global scale. This is not an appropriate framework. Global climate change and ocean acidification are the result of the **cumulative** effects on the **global** carbon cycle which is spatially distributed. There is no single culprit, nor is there a silver bullet solution. All emissions are part of the problem, and all land management decisions must be part of the solution. Since the global carbon cycle is spatially distributed, carbon storage and carbon emissions will always we spread out around the globe, and the carbon flux at any given place and time may appear small, but *cumulatively* they help determine the temperature of our climate and the pH of our oceans. Given the current carbon overload in the atmosphere and oceans, the carbon consequences of every project must be carefully considered (rather than dismissed as negligible).

The agency may argue that logging a few small patches of forest won't make a difference in the global scheme of the climate problem, but as Voltaire said, "No snowflake in an avalanche ever feels responsible." The NEPA analysis must recognize that global warming will not be solved by one miraculous technological fix or by changing one behavior or one economic activity. The whole global carbon cycle must be managed to reduce carbon emissions and increase carbon

uptake. Recent evidence supports the conclusions that all net emissions of greenhouse gases are adverse to the climate. None can be considered *de minimus*. "We show first that a single pulse of carbon released into the atmosphere increases globally averaged surface temperature by an amount that remains approximately constant for several centuries, even in the absence of additional emissions. We then show that to hold climate constant at a given global temperature requires near- zero future carbon emissions. Our results suggest that future anthropogenic emissions would need to be eliminated in order to stabilize global-mean temperatures. As a consequence, any future anthropogenic emissions will commit the climate system to warming that is essentially irreversible on centennial timescales." H. Damon Matthews and Ken Caldeira. 2009. Stabilizing climate requires near-zero emissions. Nature Vol 455 | 18 September 2008 | doi:10.1038/nature07296.

Former D.C. Circuit Judge Wald wrote in a 1990 dissenting opinion, which was recently quoted with unanimous approval by the Ninth Circuit in Center *for Biological Diversity v. NHTSA*:

> [W]e cannot afford to ignore even modest contributions to global warming. If global warming is the result of the cumulative contributions of myriad sources, any one modest in itself, is there not a danger of losing the forest by closing our eyes to the felling of the individual trees?

538 F.3d at 1217. Similarly, the U.S. Supreme Court's decision in *Massachusetts v. EPA* noted that one cannot avoid responsibility to reduce and mitigate the climate problem by attempting to minimize the scale of one's contribution to the problem. ("While it may be true that regulating motor-vehicle emissions will not by itself reverse global warming, it by no means follows that we lack jurisdiction to decide whether EPA has a duty to take steps to slow or reduce it.... In sum, … [t]he risk of catastrophic harm, though remote, is nevertheless real. That risk would be reduced to some extent if petitioners received the relief they seek." 127 S.Ct. 1438, 1455 (2007) http://web.archive.org/web/20080610172128/http://www.supremecourtus.gov/opinions/06pdf/05-1120.pdf)

CEQ draft guidance on NEPA and climate change recognizes that disclosure of the incremental nature of GHG emissions attributable to any given project is merely a restatement of the nature of the climate problem itself and does not allow agencies to avoid disclosure and consideration of alternatives and mitigation:

> CEQ recognizes that many agency NEPA analyses to date have concluded that GHG emissions from an individual agency action will have small, if any climate change effects. Government action occurs incrementally, program-by-program and step-by-step, and climate impacts are not attributable to any single action, but are exacerbated by a series of smaller decisions, including decisions made by the government. Therefore, the statement that emissions from a government action or approval represent only a small fraction of global emissions is more a statement about the nature of the climate change challenge, and is not an appropriate basis for deciding whether to consider climate impacts under NEPA.
>
> Moreover, these comparisons are not an appropriate method for characterizing the potential impacts associated with a proposed action and its alternatives and mitigations. This approach does not reveal anything beyond the nature of the climate change

> challenge itself: The fact that diverse individual sources of emissions each make relatively small additions to global atmospheric GHG concentrations that collectively have huge impact.

77 Fed. Reg. 77802, 77825. (Dec. 24, 2014).

Forest Degradation is Just as Bad as Deforestation

DEIS page 255 also says "The Hwy 46 Project does not fall within any of these main contributors of greenhouse gas emissions. … The main activity in this [forestry] sector associated with GHG emissions is deforestation, which is defined as removal of all trees, most notably the conversion of forest and grassland into agricultural land or developed landscapes (IPCC 2000)." The FS is again minimizing the effects of its activities and avoiding its dual responsibilities to produce accurate NEPA analysis and help store carbon in forests. All emissions are a problem. Categories do not really matter. The atmosphere sees each molecule of CO2 and other GHG equally. Climate authorities recognize "forest degradation" is just as bad as deforestation.

The Copenhagen Accord recognizes the need to avoid dangerous climate change and the role of forests in climate mitigation.

> "…To achieve the ultimate objective of the Convention to stabilize greenhouse gas concentration in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system, we shall, recognizing the scientific view that the increase in global temperature should be below 2 degrees Celsius… We recognize the crucial role of reducing emission from deforestation **and forest degradation** and the need to enhance removals of greenhouse gas emission by forests and agree on the need to provide positive incentives to such actions"

http://www.climatesciencewatch.org/file-uploads/Copenhagen_Accord.pdf. This likely requires reducing atmospheric CO_2 concentrations below 350 ppm[19] and avoiding logging that would increase atmospheric carbon emissions. Boucher, D., and K. Belletti-Gallon, 2015. Halfway There? What the Land Sector Can Contribute to Closing the Emissions Gap. Union of Concerned Scientists. http://www.ucsusa.org/sites/default/files/attach/2015/01/ucs-halfway-there-2015-full-report.pdf ("Enormous amounts of carbon are released into the atmosphere when forests are cleared. "**Forest degradation" activities, such as selective logging, … are also significant emissions sources**.")

> **Forest degradation should be defined from a climate change perspective to include any human land-use activity that reduces the carbon stocks of a forested landscape relative to its carbon carrying capacity**. The climate change imperative demands that we take a fresh look at our forest estate. The carbon impacts of all land uses, including commercial

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[19] Rockström, J., W. Steffen, K. Noone, Å. Persson, F. S. Chapin, III, E. Lambin, T. M. Lenton, M. Scheffer, C. Folke, H. Schellnhuber, B. Nykvist, C. A. De Wit, T. Hughes, S. van der Leeuw, H. Rodhe, S. Sörlin, P. K. Snyder, R. Costanza, U. Svedin, M. Falkenmark, L. Karlberg, R. W. Corell, V. J. Fabry, J. Hansen, B. Walker, D. Liverman, K. Richardson, P. Crutzen, and J. Foley. 2009. Planetary boundaries:exploring the safe operating space for humanity. *Ecology and Society* 14(2): 32. [online] URL: http://www.ecologyandsociety.org/vol14/iss2/art32/. http://www.stockholmresilience.org/download/18.1fe8f33123572b59ab800012568/pb_longversion_170909.pdf. http://www.ecologyandsociety.org/vol14/iss2/art32/figure6.html.

logging, must be brought explicitly into our calculations in terms of their direct and indirect effects on forest degradation.

Brendan G. Mackey, Heather Keith, Sandra L. Berry and David B. Lindenmayer. 2008. Green Carbon: The role of natu ral forests in carbon storage. Part 1. A green carbon account of Australia's south-eastern Eucalypt forests, and policy implications. Australian National University. http://epress.anu.edu.au/green_carbon/pdf/whole_book.pdf.

The agency must account for all forest carbon loses, not just from deforestation, but also degradation. Sophie Yeo 2015. Blog - **Forest degradation as bad for climate as deforestation**, says report. 08 Apr 2015, http://www.carbonbrief.org/blog/2015/04/forest-degradation-as-bad-for-climate-as-deforestation,-says-report/

The DEIS failed to Take a Hard Look at the Competing Interests in Climate Mitigation and Climate Adaptation

DEIS page 255 says "The release of carbon associated with this project is justified given the overall change in condition increases forest resistance to release of much greater quantities of carbon from wildfire, drought, insects/disease, or a combination of these disturbance types (Millar et al. 2007)."

The President has established a clear policy mandate to minimize and mitigate impacts of federal land use:

> Section 1. Policy. It shall be the policy of the Departments of Defense, the Interior, and Agriculture; the Environmental Protection Agency; and the National Oceanic and Atmospheric Administration; and all bureaus or agencies within them (agencies); to avoid and then minimize harmful effects to land, water, wildlife, and other ecological resources (natural resources) caused by land- or water-disturbing activities, and to ensure that any remaining harmful effects are effectively addressed, consistent with existing mission and legal authorities. Agencies shall each adopt a clear and consistent approach for avoidance and minimization of, and compensatory mitigation for, the impacts of their activities and the projects they approve.
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> … Sec 2. Definitions … (f) "Mitigation" means avoiding, minimizing, rectifying, reducing over time, and compensating for impacts on natural resources. As a practical matter, all of these actions are captured in the terms avoidance, minimization, and compensation. These three actions are generally applied sequentially, and therefore compensatory measures should normally not be considered until after all appropriate and practicable avoidance and minimization measures have been considered.
>
> …
>
> Sec. 3. Establishing Federal Principles for Mitigation. … (b) Agencies' mitigation policies should establish a net benefit goal or, at a minimum, a no net loss goal for natural resources the agency manages that are important, scarce, or sensitive, or wherever doing so is consistent with agency mission and established natural resource objectives. When a resource's value is determined to be irreplaceable, the preferred means of achieving either of these goals is through avoidance, consistent with applicable legal authorities. Agencies should explicitly consider the extent to which the beneficial environmental outcomes that will be achieved are demonstrably new and would not have occurred in the absence of mitigation (i.e. additionality) when determining whether those measures adequately address impacts to natural resources.

Presidential Memorandum: Mitigating Impacts on Natural Resources from Development and Encouraging Related Private Investment. Nov 3, 2015. https://www.whitehouse.gov/the-press-office/2015/11/03/mitigating-impacts-natural-resources-development-and-encouraging-related In

the context of climate change this means that greenhouse gas emissions should be avoided and that the climate forcing effects of any emissions that do occur must be mitigated.

Sometimes climate change mitigation and adaptation are in complete harmony, such as protecting riparian forests that both store carbon and buffer streams from hydrological extremes caused by climate change. However, there are also times when efforts directed at climate change adaptation conflict with climate change mitigation goals. For instance, some people argue that we should reduce the density of federal forests so they are more resilient to soil-water stress caused by global warming. However, forest density reduction will accelerate the transfer of carbon from the forest to the atmosphere where it will contribute to global climate change.

Federal agencies must strive to harmonize climate change mitigation (carbon storage or avoided emissions) and climate change adaptation (making ecosystems more resilient to climate change). For example, if the agency uses climate change adaptation as a rationale for forest thinning, they must not only fully disclose the increased GHG emissions caused by their proposal, they must also consider alternatives that harmonize these competing goals, such as by thinning very lightly and retaining all of the medium and large trees that store most of the carbon.

The agencies often claim that density reduction treatments are expected to increase the resiliency of treated stands to the projected effects of climate change. But this small increase in resiliency comes at a tremendous cost. The NEPA analysis needs to disclose and consider the fact that logging will result in greenhouse gas emissions that make climate change worse. Think about that trade-off. Logging might make a small area more resilient to climate change while making climate conditions (and ocean acidification) worse for ecosystems all over the rest of the world. This significant trade-off needs to be carefully evaluated in the NEPA document.

Even well-intentioned logging also has impacts that make ecosystems less resilient to climate change. For instance, (i) roads and soil degradation make watershed less resilient to the expected effects of the amplified hydrologic cycle; (ii) reduction of complex forest structure and dense forest conditions makes certain species populations less resilient to climate change, including species associated with relatively dense forests and species associated with snags and dead wood. These species are already stressed by the cumulative effects of non-federal land management and fragmentation caused by past and ongoing management on federal lands; (iii) Also, "High overstory density can be resilient" when ladder fuel are absent and there is a gap between surface and canopy fuels. Terrie Jain (2009) Logic Paths for Approaching Restoration: A Scientis's Perspective, from Workshop: Restoring Westside Dry Forests - Planning and Analysis for Restoring Westside Cascade Dry Forest Ecosystems: A focus on Systems Dominated by Douglas-fir, Ponderosa Pine, Incense Cedar, and so on. May 28, 2009. http://ecoshare.info/projects/central-cascade- adaptive-management-partnership/workshops/restoring-westside- dry-forests/. New information indicates that El Ninos will likely become stronger even if we are able to limited warming to 1.5 degrees C. Guojian Wang, et al. 2016. Continued increase of extreme El Niño frequency long after 1.5 °C warming stabilization. Nature Climate Change (2017). doi:10.1038/nclimate3351. https://www.nature.com/nclimate/journal/vaop/ncurrent/full/nclimate3351.html. A bet-hedging strategy should retain trees of all sizes and stands of various densities. "Removal of most small trees to reduce wildfire risk may compromise the bet-hedging resilience, provided by small trees and diverse tree sizes and species, against a broad array of unpredictable future disturbances." William L. Baker and Mark A. Williams. 2015. Bet-hedging dry-forest resilience to climate-

change threats in the western USA based on historical forest structure. Front. Ecol. Evol., 13 January 2015 | doi: 10.3389/fevo.2014.00088.
http://journal.frontiersin.org/Journal/10.3389/fevo.2014.00088/full

Also, wildfire is mostly climate driven, not fuel driven, and the actual effects of fuel reduction on the spatial extent of wildfires is highly variable and fairly modest. "Analysis of simulation results from the 14 wildfires indicates that fuels treatments reduced the average size of any given wildfire by an estimated 7.2%, with amount of change correlated with the proportion of the landscape treated (Spearman's correlation p=0.692, n=14; P=0.008)." M. A. Cochrane, C. J. Moran, M. C. Wimberly, A. D. Baer, M. A. Finney, K. L. Beckendorf, J. Eidenshink, and Z. Zhu. 2012. Estimation of wildfire size and risk changes due to fuels treatments. International Journal of Wildland Fire. http://dx.doi.org/10.1071/WF11079. http://www.publish.csiro.au/?act=view_file&file_id=WF11079.pdf. This raises a serious question whether the modest increase in resilience really justifies the adverse effects of landscape fuel treatments on climate, wildlife, soil, water, etc.

When all these trade-offs are considered, we feel that climate change mitigation should receive emphasis over climate adaptation on federal land management (especially when adaptation efforts come with significant trade-offs). When climate change mitigation and adaptation may be in conflict, the agency needs to focus on reducing GHG emissions (or maintaining carbon stores). These mitigation actions are more important because (i) mitigation is shown to be more challenging (institutionally) and it is perennially under-achieved, (ii) mitigation has global benefits, and (iii) mitigation ultimately reduces the need for adaptation.

"According to a recently published analysis, increasing carbon storage could lead to more favorable conditions for northern spotted owls, pileated woodpeckers, olive-sided flycatchers, Pacific marten and red tree voles. These species may benefit from management policies that favor less intensive logging and longer periods between tree harvests." Nick Houtman 2016. Storing more carbon in western Cascades forests could benefit some wildlife species, not others. Phys.org News. November 17, 2016. http://phys.org/news/2016-11-carbon-western-cascades-forests-benefit.html, http://onlinelibrary.wiley.com/doi/10.1002/eap.1358/abstract

The DEIS Failed to Quantify Carbon Emissions and Forgone Opportunities to Capture Carbon in Growing Forests

The Hwy 46 DEIS failed to describe how many tonnes of CO2e would be emitted by this project, how big the carbon debt created by this project is, how long it would take to recapture that carbon, how much warming would occur during the time period it takes to recapture that carbon, and failed to quantify the forgone opportunity to capture carbon in unlogged forests under the no action alternative, etc.

Expert opinions and qualitative or relativistic descriptions of environmental effects are by themselves inadequate. NEPA analysis must be quantifiable and objective and explain the factual basis for conclusions regarding environmental effects, so that the general public can understand and provide meaningful comment. A October 2004 decision of the 9th Circuit Court of Appeals says:

> The problem with the entire table is that it does not provide any objective quantification of the impacts. Instead, the reader is informed only that a particular environmental factor will be "unchanged," "improved," or "degraded" and whether that change will be minor"

> or "major." The reader is not told what data the conclusion was based on, or why objective data cannot be provided. Such an analysis does not satisfy the admonition in *Neighbors of Cuddy Mountain* that "[g]eneral statements about possible effects and some risk do not constitute a hard look absent a justification regarding why more definitive information could not be provided." 137 F.3d at 1380.
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> …
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> Idaho Sporting Cong. v. Thomas, 137F.3d 1146, 1150 (9th Cir. 1998) "[A]llowing the Forest Service to rely on expert opinion without hard data either vitiates a plaintiff's ability to challenge an agency action or results in the courts second guessing an agency's scientific conclusions. As both of these results are unacceptable, we conclude that NEPA requires that the public receive the underlying environmental data from which a Forest Service expert derived her opinion."). Indeed, under the CEQ regulations, agencies are told that "public scrutiny [is] essential," 40 C.F.R. § 1500.1(b), and are charged to "encourage and facilitate public involvement in decisions," id. § 1500.2(d), so that "environmental information is available to public officials and citizens before decisions are made," id. § 1500.1(b). They are also told that NEPA documents "shall be written in plain language... so that decision-makers and the public can readily understand them." 40 C.F.R. § 1502.8. Even accepting the BLM's representation that "specialists" can understand the information in these EAs, the documents are unacceptable if they are indecipherable to the public.

Klamath-Siskiyou Wildlands Center v. BLM
http://web.archive.org/web/20070203054229/http://www.ca9.uscourts.gov/ca9/newopinions.nsf/B5D60B389785284288256F3B00544169/$file/0335461.pdf?openelement While the above decision was written to apply directly to cumulative effects analysis, the same rules should apply to all NEPA analyses of environmental effects.

The 9th Circuit has also warned that —

> … general statements about "possible" effects and "some risk" do not constitute a "hard look" absent a justification regarding why more definitive information could not be provided."

Blue Mountains Biodiversity Project v. Blackwood, (9th Circ, Dec 1998) http://laws.findlaw.com/9th/9835783.html *citing* Neighbors of Cuddy Mountain v. United States Forest Service, 137 F.3d 1372, 1380 (9th Cir. 1998).

NEPA analysis of climate change:

We have also seen in previous projects the Forest Service rely on the following assumption:

> "This project is also consistent with IPCC recommendations for land use to help mitigate climate change…. For the forestry sector, the report recommends forest management including management to "improve tree species" and increase biomass. The proposed action is consistent with these recommendations because it would improve stand conditions, diversity, density and structure, allowing the forest to adapt, persist and function better over time and into the future."

There are several problems here. First, commercial logging will not increase biomass or density. Logging will most certainly decrease forest biomass and density, by killing trees and exporting biomass from the site, and generally decreasing the carbon sequestration and increasing the rate

at which carbon is transferred form the forest to the atmosphere. Please demonstrate how logging will increase biomass.

Second, logging to help the forest "adapt, persist and function better over time" does not help store carbon. There is a carbon cost associated with logging, regardless of the Forest Service intention that it's good for forest health. Third, the analysis fails to distinguish between the effects of thinning plantations and logging mature forests, and regen harvest.

The NEPA analysis should start with an accurate and up-to-date inventory of carbon storage and carbon flows on federal land. This is required by both the National Forest Management Act (16 USC §1601(a)(1)&(2)) and the Federal Land Policy & Management Act (43 USC §1711(A)). The NEPA analysis should disclose and consider that logging has several adverse consequences on GHG pools and flows:

1. Logging kills growing trees that would otherwise continue to capture and sequester carbon through photosynthesis. Killing the trees also stops them from pumping carbon into the soil where a lot of carbon is stored. Forests deliver massive amounts of carbon into the soil as photosynthate that supports a vast below-ground ecosystem and as course woody debris. Logging kills the food supply for the below-ground ecosystem. "Contrary to commonly accepted patterns of biomass stabilization or decline, biomass was still increasing in stands over 300 years old in the Coast Range, the Sierra Nevada and the West Cascades, and in stands over 600 years old in the Klamath Mountains." Tara Hudiburg, Beverly Law, David P. Turner, John Campbell, Dan Donato, And Maureen Duane 2009. Carbon dynamics of Oregon and Northern California forests and potential land-based carbon storage. Ecological Applications, 19(1), 2009, pp. 163–180 http://terraweb.forestry.oregonstate.edu/pubs2/Hudiburg2009EA.pdf. Recent science affirms the carbon value of large and old trees:

> "[T]rees accelerate their growth as they get older and bigger, a global study has found. The findings, reported by an international team of 38 researchers in the journal Nature, overturn the assumption that old trees are less productive. It could have important implications for the way that forests are managed to absorb carbon from the atmosphere. "This finding contradicts the usual assumption that tree growth eventually declines as trees get older and bigger," said Nate Stephenson, the study's lead author and a forest ecologist with the US Geological Survey (USGS). "It also means that big, old trees are better at absorbing carbon from the atmosphere than has been commonly assumed." … "Rapid growth in giant trees is the global norm, and can exceed 600kg per year in the largest individuals," say the authors. The study also shows old trees play a disproportionately important role in forest growth. Trees of 100cm in diameter in old-growth western US forests comprised just 6% of trees, yet contributed 33% of the annual forest mass growth."

   Vidal, John 2014. NEWS: Trees accelerate growth as they get older and bigger, study finds - Findings contradict assumption that old trees are less productive and could have important implications for carbon absorption" The Guardian, Jan 15, 2014. http://www.theguardian.com/environment/2014/jan/15/trees-grow-more-older-carbon [*citing* Stephenson, N. L., A. J. Das, et al. 2014. Rate of tree carbon accumulation

increases continuously with tree size. Nature | Letter (2014) doi:10.1038/nature12914 http://www.nature.com/nature/journal/vaop/ncurrent/full/nature12914.html ("Thus, large, old trees do not act simply as senescent carbon reservoirs but actively fix large amounts of carbon compared to smaller trees; at the extreme, a single big tree can add the same amount of carbon to the forest within a year as is contained in an entire mid-sized tree. The apparent paradoxes of individual tree growth increasing with tree size despite declining leaf-level8, 9, 10 and stand-level10 productivity can be explained, respectively, by increases in a tree's total leaf area that outpace declines in productivity per unit of leaf area and, among other factors, age-related reductions in population density.")]

2. Logging "captures mortality" and truncates the "essential link between live and dead biomass pools" which interferes with the process of accumulation of dead wood biomass. "As forest stands grow older, dead biomass pools increase unless timber harvest removes live trees. Aggressive management reduces tree mortality which is input into dead biomass carbon pools; the result is the extremely low level of dead biomass, especially coarse woody debris in intensively managed forests." Krankina, O. 2008. REVIEW of Sierra Pacific Industries Report – "Carbon Sequestration in Californian Forests: Two Case Studies in Managed Watersheds" prepared for Defensders of Wildlife and others. http://web.archive.org/web/20081121203052/http://savethesierra.org/downloads/SPI_Review.pdf. "Allocation of C to dead wood pools increases with forest stand development and, in some cases, compensates for declining growth rates in older trees in terms of total ecosystem biomass accumulations (Harmon, 2001)." Nunery, J.S., Keeton, W.S., Forest carbon storage in the northeastern United States: Net effects of harvesting frequency, post-harvest retention, and wood products. Forest Ecol. Manage. (2010), doi:10.1016/j.foreco.2009.12.029.

3. Avoided logging of mature & old-growth forest = avoided emissions of GHG. Logging accelerates the rate of decomposition of wood through several mechanisms.
    a. Logging raises soil temperature thereby increasing the rate of decay of woody debris and the rate of decay of the below ground ecosystem, which converts carbon to gaseous form (CO2).
    b. Logging decreases the average piece size, and increases the surface area of the wood, thereby increasing the area exposed to biological decomposition.
    c. Logging debris is often burned, or as hog fuel, biomass, etc.

4. Some argue that logging is helpful because carbon is sequestered in wood products, but this assertion needs scrutiny:
    a. Of all the carbon that is killed and/or exposed to accelerated decay in a logging operation only a small fraction ends up as durable goods and buildings -- most ends up as slash, sawdust, waste/trim, hog fuel, and non-durable goods like paper. Some say that converting forest to wood products "delays" emissions, but in fact logging accelerates emissions because they are the result of a process that kills trees that would continue to actively sequester carbon if not logged, and logging involves tremendous waste in the logging process, milling process, construction/manufacturing process.
    b. Much of the wood products which can reasonably be considered "durable" are in fact less durable than leaving the carbon stored safely inside a mature tree that might live to be hundreds of years old. Most of our wood products are disposable.

It turns out that well-conserved forests on average store carbon more securely than our "throw-away" culture and economy does. Law, B. & M.E. Harmon 2011. Forest sector carbon management, measurement and verification, and discussion of policy related to mitigation and adaptation of forests to climate change. Carbon Management 2011 2(1). http://terraweb.forestry.oregonstate.edu/pubs/lawharmon2011.pdf ("To the extent that management can direct carbon into longer lived pools, it can increase the stores of carbon in the forest sector. Harvest of carbon is one proposed strategy to increase carbon stores. However, harvesting carbon will increase the losses from the forest itself and to increase the overall forest sector carbon store, the lifespan of wood products carbon (including manufacturing losses) would have to exceed that of the forest. Under current practices this is unlikely to be the case. A substantial fraction (25–65%) of harvested carbon is lost to the atmosphere during manufacturing and construction depending on the product type and manufacturing method. The average lifespan of wood buildings is 80 years in the USA, which is determined as the time at which half the wood is no longer in use and either decomposes, burns or, to a lesser extent, is recycled. However, many forest trees have the potential to live hundreds of years (e.g. 800 years in the Pacific northwest USA). Mortality rates of trees are generally low, averaging less than 2% of live mass per year in mature and old forests; for example, in Oregon, mortality rates average 0.35–1.25% in forests that are older than 200 years in the Coast Range and Blue Mountains, respectively [8]. Moreover, the average longevity of dead wood and soil carbon is comparable to that of live trees. When the loss of carbon associated with wood products manufacturing is factored in, it is highly unlikely that harvesting carbon and placing it into wood products will increase carbon stores in the overall forest sector. This explains why in all analyses conducted to date, wood products stores never form the majority of total forest sector stores.")

c. "… carbon is lost into the atmosphere during and after harvest as slash left on-site quickly decays. (See figures 14 and 15.) There are also losses of carbon that occur during the creation of forest products. These losses to decay and wood products make carbon sequestration slower when harvesting is allowed. The young timberlands that replace older harvested lands grow quickly, but hold less in total carbon stores than their older counterparts; the net sequestration from forest products adds to total carbon stores, but does not come close to the vast amounts of carbon stored in non-harvested older timberlands. This finding differs from other papers that have shown that the highest carbon mitigation can be reached when high productivity lands are used exclusively for wood products creation (Marland and Marland, 1992). The wood products considered in these studies were either long lasting or used for fuel purposes. Allowing harvested timber to be allocated to all types of wood products increases carbon emissions and results in no harvest regimes sequestering more carbon." Alyssa V. Shanks. 2008. Carbon Flux Patterns on U.S. Public Timberlands Under Alternative Timber Harvest Policies. MS Thesis. March 2008. http://ir.library.oregonstate.edu/dspace/bitstream/1957/8326/1/A_Shanks_Thesis_04%2002%2008_final.pdf.

d. BLM's WOPR FEIS shows that decades of converting old growth forests to plantations has reduced current forest carbon stores on BLM lands in western

Oregon by 149 million tons, while some of that wood was converted into wood products, only 11 million tons of that carbon remains stored in wood products today, so logging our public forests to make wood products results in approximately 13 times more carbon emissions than carbon storage. This is pieced together from WOPR FEIS Figures 3-17 (p 3-221) and Figure 3-18 (p 3-224). Further logging of mature forests will exacerbate this outcome.

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

f. Even a suppressed tree stores carbon better than a dead tree after it is logged, limbed, bucked, debarked, milled, planed, processed, trimmed, manufactured, used, and then discarded. Recent evidence shows hat slower-growing older trees tend to channel their energy into structural support and defense compounds to "maximize durability while minimizing … damage". Colbert & Pederson. 2008. Relationship between radial growth rates and lifespan within North American tree species. Ecoscience 15(3), 349-357 (2008). http://fate.nmfs.noaa.gov/documents/Publications/Black_et_al_2008_Ecoscience.pdf

The agency should fully mitigate for the effects of increased warming due to carbon emissions that result from logging for the full time period that the logging alternative stores less carbon than the no-logging alternative.

Projects involving partial removal should analyze and consider the following factors:

- As stands develop from young to mature to old they recruit large amounts of material from the live tree pool to the dead wood pool which continues to accumulate large amounts of carbon for centuries. Logging, even thinning, captures that mortality and can dramatically affect the accumulation of carbon in the dead wood pool.
- Thinning might help or hinder forest growth. Focusing tree growth of fewer stems may, over the long-term, increase the size, vigor, and longevity of the trees and increase ratio of wood volume to surface area which helps slow decay. But even if the growth rate of individual trees may be enhanced by thinning, the growth rate of the stand as a whole will decrease due to the removal of many growing trees. The

increase in volume growth on retained trees is less than the total volume growth of the whole stand in the absence of thinning. Furthermore, thinning can damage residual trees' roots, stems, and canopies which may inhibit growth rates (See Table 2 *in* Han-Sup Han and Loren D. Kellogg. 2000. Damage Characteristics in Young Douglas-fir Stands from Commercial Thinning with Four Timber Harvesting Systems. Western Journal of Applied Forestry. 15(1):27-33. http://andrewsforest.oregonstate.edu/research/related/ccem/pdf/WJAF.pdf);

- Opening the canopy may warm the soil and litter layers and increase the rate of soil respiration which is controlled in part by temperature. Fang, J. 2010. Soils emitting more carbon dioxide - Trend could exacerbate global warming. Scientific American | March 24, 2010. http://www.scientificamerican.com/article.cfm?id=soils-emit-carbon-dioxide. Bond-Lamberty and Thomson, 2010. Temperature-associated increases in the global soil respiration record, Nature 464, 579-582 (25 March 2010) | doi:10.1038/nature08930, http://www.nature.com/nature/journal/v464/n7288/full/nature08930.html ; Karhu, K., Fritze, H., Hämäläinen, K., Vanhala, P., Jungner, H., Oinonen, M., Sonninen, E., Tuomi, M., Spetz, P. & Liski, J. 2010. Temperature sensitivity of soil carbon fractions in boreal forest soil. Ecology 91(2): 370-376. http://www.ymparisto.fi/default.asp?contentid=351875&lan=en. Francesca M. Hopkinsa, Margaret S. Tornc, and Susan E. Trumbore. 2012. Warming accelerates decomposition of decades-old carbon in forest soils. PNAS June 26, 2012 vol. 109 no. 26 E1753-E1761. http://www.pnas.org/content/109/26/E1753.abstract?etoc ("Consistent with global ecosystem model predictions, the temperature sensitivity of the carbon fixed more than a decade ago was the same as the temperature sensitivity for carbon fixed less than 10 y ago. However, we also observed an overall increase in the mean age of carbon respired at higher temperatures…"). PNW Research Station 2012. Science Findings: Logging Debris Matters: Better Soil, Fewer Invasive Plants. issue one hundred forty five / August 2012. Mazza, R. *ed.* http://www.fs.fed.us/pnw/sciencef/scifi145.pdf ("... cooler soil temperatures led to slower soil respiration, and thus less carbon dioxide was released to the atmosphere…")
- Increased light levels could increase the rate of photodegradation of lignin thus allowing increased microbial access to cellulose and increasing respiration rates. Amy T. Austin, Carlos L. Ballaré. 2010. Dual role of lignin in plant litter decomposition in terrestrial ecosystems. PNAS March 9, 2010. Vol. 107 no. 10 4618-4622. doi: 10.1073/pnas.0909396107 http://www.pnas.org/content/107/10/4618.abstract?etoc.
- Thinning may increase or decrease fire hazard depending on the complex interaction of fuel structure (thinning may reduce small surface and ladder fuels or increase slash and remove medium and large trees that are relatively fire tolerant) and microclimate effects (thinning makes the stand hotter-dryer-windier);
- Thinning may increase stand diversity and the fraction of carbon stored in species other than dominant crop trees.
- Thinning in mid-seral and mature forests will "capture mortality" and truncate the important process of accumulating carbon pools in the forest floor. See Geisen, T. et al. 2008. Four centuries of soil carbon and nitrogen change after stand-replacing fire in a forest landscape of the western Cascade Range of Oregon. Canadian Journal of Forest Resources 38:2455-2464; and Thomas William Giesen. 2005. Four Centuries of Soil Carbon and Nitrogen Change After Severe Fire in a Western Cascades Forest

Landscape. MS THESIS. Oregon State University. Building up carbon stores in the forest floor takes time, and if the slow-to-decompose large material is removed from the site, the high rates of carbon accumulation found in old forests are not likely to materialize.

- There is no bonus wood from thinning. "In this as in other LOGS installations, the unthinned plots have consistently produced more total volume (CVTS) than any of the thinning treatments." Curtis, Robert O.; Marshall, David D. 2009. Levels-of-growing-stock cooperative study in Douglas-fir: report no. 18—Rocky Brook, 1963–2006. Res. Pap. PNW-RP-578. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. 91 p. http://www.fs.fed.us/pnw/pubs/pnw_rp578.pdf. "[T]he data have not supported early expectations of 'bonus' volume from thinned stands compared with unthinned. … [T]hinnings that are late or heavy can actually decrease harvest volume considerably." Talbert and Marshall. 2005. Plantation Productivity in the Douglas-fir Region Under Intensive Silvicultural Practices: Results From Research And Operations. Journal of Forestry. March 2005. pp 65-70 *citing* Curtis and Marshall. 1997. LOGS: A Pioneering Example of Silvicultural Research in Coastal Douglas-fir. Journal of Forestry 95(7):19-25.
- In May of 2011, a study on the effects of thinning and biomass utilization on carbon release and storage was published by Oregon State University. Among the findings of the study were: • Forest carbon pools always immediately decreased as a result of thinning, with reductions increasing as a function of heavier thinning. • After thinning, carbon pools remain lower throughout a 50-year period. • Carbon pool estimates for thinned stands remained lower even after accounting for carbon transferred to wood products. Clark, J., J. Sessions, O. Krankina, T. Maness. 2011. Impacts of Thinning on Carbon Stores in the PNW: A Plot Level Analysis. College of Forestry, Oregon State University. Corvallis, OR http://switchboard.nrdc.org/blogs/ngreene/Impacts%20of%20Thinning%20on%20Carbon%20Stores%20in%20the%20PNW_Final%20Report.pdf

Risk reduction logging does not help store carbon.

Even the Chief of the Forest Service recognizes these trade-offs. "[M]anagement practices, designed to restore ecosystem health, may in the near-term reduce total stored carbon below current levels." Gail Kimball, March 2009 Testimony before House Committee On Natural Resources, Subcommittee On National Parks, Forests, And Public Lands. http://www.fs.fed.us/congress/111thCongress/Documents/CY%202009%20Hearings/HNRC%202009-03-03%20Climate%20Change/2009-03-03A.Kimbell.pdf

Logging proponents often claim that logging will increase carbon storage controlling carbon emissions caused by natural processes such as fire and insect-induced mortality. This is simply counter-factual. In most cases, managing forests in an effort to control natural processes that release carbon will only make things worse by releasing MORE carbon. This is mostly because no one can predict where fire or insects will occur, so the treatments must be applied to broad landscapes, yet the probability of fire or insects at any given location remains low, and only a small fraction of the treated areas will actually experience fire or insects. As a result, many acres will be treated "unnecessarily" and therefore the cumulative carbon emissions from logging to

control fire and insects (plus the carbon emissions from fire and insects that occur in spite of control efforts) are greater than emissions from fire and insects alone.

Law & Harmon conducted a literature review and concluded …

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

Law, B. & M.E. Harmon 2011. Forest sector carbon management, measurement and verification, and discussion of policy related to mitigation and adaptation of forests to climate change. Carbon Management 2011 2(1). http://terraweb.forestry.oregonstate.edu/pubs/lawharmon2011.pdf.

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

- John L Campbell, Mark E Harmon, and Stephen R Mitchell. 2011. Can fuel-reduction treatments really increase forest carbon storage in the western US by reducing future fire emissions? Front Ecol Environ 2011; doi:10.1890/110057 http://nnrg.org/files/CampbellJohn-65945.pdf; http://scholarsarchive.library.oregonstate.edu/xmlui/bitstream/handle/1957/26174/CampbellJohn.Forestry.CanFuelReductionTreatments.pdf. (Results suggest that the protection of one unit of C from wildfire combustion comes at the cost of removing three units of C in fuel treatments.)
- Mitchell, Harmon, O'Connell. 2009. Forest fuel reduction alters fire severity and long-term carbon storage in three Pacific Northwest ecosystems. Ecological Applications. 19(3), 2009, pp. 643–655. http://www.fs.fed.us/pnw/pubs/journals/pnw_2009_mitchell001.pdf.
- Reinhardt, Elizabeth, and Lisa Holsinger 2010. Effects of fuel treatments on carbon-disturbance relationships in forests of the northern Rocky Mountains. Forest Ecology and Management 259 (2010) 1427–1435. http://www.fs.fed.us/rm/pubs_other/rmrs_2010_reinhardt_e002.pdf ("Although wildfire emissions were reduced by fuel treatment, the fuel treatments themselves produced [carbon] emissions, and the untreated stands stored more carbon than the treated stands even after wildfire. … Our results show generally long recovery times …")
- Jim Cathcart, Alan A. Ager, Andrew McMahan, Mark Finney, and Brian Watt 2009. Carbon Benefits from Fuel Treatments. USDA Forest Service Proceedings RMRS-P-61. 2010.
- Law, B. & M.E. Harmon 2011. Forest sector carbon management, measurement and verification, and discussion of policy related to mitigation and adaptation of forests to climate change. Carbon Management 2011 2(1).
- Dina Fine Maron 2010. FORESTS: Researchers find carbon offsets aren't justified for removing understory (E&E Report 08/19/2010, reporting on the WESTCARB Project) https://pacificforest.org/pft-in-the-media-2010-climatewire-8-19-10.html.
- Restaino, Joseph C.; Peterson, David L. 2013. Wildfire and fuel treatment effects on forest carbon dynamics in the western United States. Forest Ecology and Management 303:46-60. http://www.fs.fed.us/pnw/pubs/journals/pnw_2013_restiano001.pdf ("… C costs associated with fuel treatments have can exceed the magnitude of C reduction in wildfire emissions, because a large percentage of biomass stored in forests (i.e., stem wood, branches, coarse woody debris) remains unconsumed, even in high-severity fires (Campbell et al., 2007; Mitchell et al., 2009). … Wildfire occurrence in a given area is uncertain and may never

interact with treated stands with reduced fire hazard, ostensibly negating expected C benefits from fuel treatments. Burn probabilities in treated stands in southern Oregon are less than 2%, so the probability that a treated stand encounters wildfire and creates C benefits is low (Ager et al., 2010).)"

- Goslee, K., Pearson, T., Grimland, S., Petrova, S., Walls, J., Brown, S., 2010. Final Report on WESTCARB Fuels Management Pilot Activities in Lake County, Oregon. California Energy Commission, PIER. CEC-500-XXXX-XXX; AND Pearson, T.R.H., Goslee, K., Brown, S., 2010. Emissions and Potential Emission Reductions from Hazardous Fuel Treatments in the WESTCARB Region. California Energy Commission, PIER. CEC-500-XXXX-XXX. (Summarized by Restaino & Peterson (2013) as follows: "Pearson et al. (2010) and Goslee et al. (2010) developed methodologies to evaluate C dynamics associated with fuel treatment projects in low to mid-elevation forest in northern California and Oregon. The authors, with consultation from teams of scientists, quantify C storage and release within the context of a six-point conceptual framework: annual fire risk, treatment emissions, fire emissions, forest growth and re-growth, re-treatment, and the shadow effect (i.e., treatment effect outside the treated area). Results indicate that the mean annual probability of wildfire for the study region is less than 0.76%/year, and treatments reduce C stocks by an average of 19%. Where timber is removed, 30% of extracted biomass is stored in long-lasting wood products. Wildfire emissions in treated stands, quantified with the Fuel Characteristic Classification System, are reduced by 6% relative to untreated stands. Growth estimates for a 60-year simulation horizon, derived from FVS, indicate that in the absence of wildfire, untreated stands sequester 17% more C than treated stands. However, in simulations that include wildfire, treated stands sequester 63% more C than untreated stands. The shadow effect is unlikely to be large enough to affect net GHG emissions. In summary, initial reductions in C stocks (e.g., thinning), combined with low annual probability of wildfire, preclude C benefits associated with fuel treatments, even if harvest residues are used for biomass energy.")
- Chiono, Lindsay 2011. Balancing the Carbon Costs and Benefits of Fuels Management. Research Synthesis for Resource Managers. Joint Fire Science Program Knowledge Exchange. https://static.squarespace.com/static/50083efce4b0c6fedbca9def/t/51632bf8e4b00b25a8fa21d3/1365453816037/CFSC_Chiono_Carbon_and_Fuel_Mngmt.pdf ("[T]he net carbon impact of fuel treatments is further complicated by the probabilistic nature of wildfire occurrence and the impermanence of post-treatment stand conditions … [T]reatment activities produce an immediate carbon emission while future wildfire emissions are uncertain … Depending on the intensity of treatment, the quantity of carbon removed may be substantial enough to negate gains from avoided wildfire emissions. … cumulative emissions from fuels reduction activities repeated in order to maintain low hazard conditions over time can overwhelm avoided wildfire emissions, resulting in a net carbon loss.")

See Campbell, Harmon & Mitchell 2011.

Abstract

It has been suggested that thinning trees and other fuel-reduction practices aimed at reducing the probability of high-severity forest fire are consistent with efforts to keep carbon (C) sequestered in terrestrial pools, and that such practices should therefore be rewarded rather than penalized in C-accounting schemes. By evaluating how fuel treatments, wildfire, and their interactions affect forest C stocks across a wide range of spatial and temporal scales, we

conclude that this is extremely unlikely. Our review reveals high C losses associated with fuel treatment, only modest differences in the combustive losses associated with high-severity fire and the low-severity fire that fuel treatment is meant to encourage, and a low likelihood that treated forests will be exposed to fire. Although fuel-reduction treatments may be necessary to restore historical functionality to firesuppressed ecosystems, we found little credible evidence that such efforts have the added benefit of increasing terrestrial C stocks.

...

In a nutshell:

• Carbon (C) losses incurred with fuel removal generally exceed what is protected from combustion should the treated area burn

• Even among fire-prone forests, one must treat about ten locations to influence future fire behavior in a single location

• Over multiple fire cycles, forests that burn less often store more C than forests that burn more often

• Only when treatments change the equilibrium between growth and mortality can they alter long-term C storage

…

Conclusions

Across a range of treatment intensities, the amount of C removed in treatment was typically three times that saved by altering fire behavior.

…

the protection of one hectare of forest from wildfire required the treatment of 10 hectares, owing not to the low efficacy of treatment but rather to the rarity of severe wildfire event.

…

Long-term simulations of forest growth, decomposition, and combustion illustrate how, despite a negative feedback between fire frequency and fuel-driven severity, a regime of low-frequency, high-severity fire stores more carbon over time than a regime of high-frequency, low-severity fire.

John L Campbell, Mark E Harmon, and Stephen R Mitchell. 2011. Can fuel-reduction treatments really increase forest carbon storage in the western US by reducing future fire emissions? Front Ecol Environ 2011; doi:10.1890/110057 http://scholarsarchive.library.oregonstate.edu/xmlui/bitstream/handle/1957/26174/CampbellJohn.Forestry.CanFuelReductionTreatments.pdf It is important to recognize that "the equilibrium between growth and mortality" must consider all forms of mortality, not just that caused by fire, but also mortality caused by logging.

Restaino & Peterson (2013) conducted a literature review of this issue and reported:

> "All studies agree unequivocally that untreated stands release more emissions to the atmosphere during wildfire than treated stands…. However, most studies in this review include assumptions of future wildfire frequency and probability that skew long-term trade-off analyses by overestimating the ability of fuel treatments to reduce wildfire emissions over long time scales. For example, fuel treatments have a finite life

expectancy, and fire hazard increases over time as fuels accumulate in treated areas. Repetition and maintenance of fuel treatments are necessary in order to effectively maintain reduced fire hazard over time (Peterson et al., 2005; Johnson et al., 2007, 2011) and thus must be included in analyses of long-term C storage. Although Rhodes and Baker (2008) suggest that 2.0–4.2% of areas treated to reduce surface fuels are likely to encounter wildfires that would otherwise be high or moderate-high severity without treatment, most studies assume future wildfire probability of 100%, reporting inferences that essentially detail a ''best-case scenario'' for wildfire missions mitigation. Annual probability of wildfire in dry temperate forests for a given stand is approximately 1% (Ager et al., 2010; Pearson et al., 2010; Campbell et al., 2011). … To benefit total ecosystem C storage, the removal and release of C through fuel treatments must not exceed the expected reductions in wildfire emissions. Substantial treatment costs through timber harvest, prescribed fire, and milling waste exceed observed and simulated reductions in wildfire emissions. … The ability of fuel treatments to mitigate future fire behavior and move forest structure to a more fire-resistant condition is well documented. However, C costs associated with fuel treatments have can exceed the magnitude of C reduction in wildfire emissions, because a large percentage of biomass stored in forests (i.e., stem wood, branches, coarse woody debris) remains unconsumed, even in high-severity fires (Campbell et al., 2007; Mitchell et al., 2009). … Wildfire occurrence in a given area is uncertain and may never interact with treated stands with reduced fire hazard, ostensibly negating expected C benefits from fuel treatments. Burn probabilities in treated stands in southern Oregon are less than 2%, so the probability that a treated stand encounters wildfire and creates C benefits is low (Ager et al., 2010).)

Restaino, Joseph C.; Peterson, David L. 2013. Wildfire and fuel treatment effects on forest carbon dynamics in the western United States. Forest Ecology and Management 303:46-60. http://www.fs.fed.us/pnw/pubs/journals/pnw_2013_restiano001.pdf

Toward Better NEPA Analysis of Climate Effects

The Forest Service is now on record in the New York Times stating that carbon consequences of forest management are relevant to project-level decision-making:

… occasionally, when tour groups come through, someone will ask what role the trees might play as the nation addresses global warming. After all, forests soak up carbon dioxide as they grow. "We've always said that's outside the scope of this project," said Michael Keown,... "But those days have come and gone."WILLIAM YARDLEY 2009. Protecting the Forests, and Hoping for Payback. The New York Times November 29, 2009. http://www.nytimes.com/2009/11/29/science/earth/29trees.html. The Forest Service's Dave Cleaves said "Forests serve an important role in sequestering or removing carbon dioxide from the atmosphere and today, their role is even more important because of climate change. … Forests are the solution to absorbing carbon dioxide from the atmosphere and regulating temperatures. We must take an active role in keeping, planting and respecting forests for all they provide for us such as carbon, wood, flood control, wildlife habitat, and all the rest." [FS newsletter] Engaging a Climate Ready Agency from Dave Cleaves, Forest Service Climate Change Advisor. April 30, 2013. http://www.fs.fed.us/climatechange/updates/April%202013%20Climate%20Update%20.pdf.

What does adequate NEPA analysis look like? http://web.law.columbia.edu/climate-

change/resources/nepa-and-state-nepa-eis-resource-center#Federal Guidelines. The Forest Service has started to answer that question:

> "In recognizing agency responsibility to consider climate change, the responsible official can cite the Forest Service mission to 'sustain the health, diversity, and productivity of the Nation's forests and grasslands to meet the needs of present and future generations' and state how their decision considered climate change issues.
>
> … Climate change effects include the effects of agency action on global climate change and the effects of climate change on a proposed project.
>
> … Scoping is useful to determine if climate change issues are specifically related to the proposed action. Refrain from prematurely dismissing climate change issues as "outside the scope" of the analysis and use the interdisciplinary team and other sources to identify potential cause-effect relationships (if they exist) between the proposal and climate change.
>
> … Alternatives may include mitigation measures to reduce GHG emissions, affect carbon cycling, or enhance adaptive capacity.
>
> … Many proposed projects and programs will emit greenhouse gases (direct effect) and, thus, contribute to the global concentration of greenhouse gases that affect climate (indirect effect). Quantifying greenhouse gases emitted and/or sequestered may help choose between alternatives based on relative direct effects trade-offs. Forest Service decisions having the potential to emit or sequester more greenhouse gases; … may be best informed by quantitative analyses.
>
> … Qualitative effects disclosure for a project's impacts on GHG emissions and carbon sequestration should be couched in the ecosystem's role in the carbon cycle. … Forests play a major role in the carbon cycle.
>
> … It may be appropriate for the decision document rationale to include some indication of how climate change considerations (if any) were weighed during decisionmaking. These statements should reference relevant NEPA documents, assessments, and science to substantiate findings.
>
> … [W]hen responding to comments about climate change [the agency may] 1. Modify alternatives including the proposed action. 2. Develop and evaluate alternatives not previously given serious consideration by the Agency. 3. Supplement, improve, or modify the analysis. 4. Make factual corrections. 5. Explain why the comments do not warrant further agency response …"

USDA Forest Service. 2009. Climate Change Considerations in Project Level NEPA Analysis. January 13, 2009. http://www.fs.fed.us/emc/nepa/climate_change/includes/cc_nepa_guidance.pdf. http://www.fs.fed.us/emc/nepa/climate_change/includes/cc_cover_letter.pdf. Note this document has some serious shortcomings. It completely misses the contribution of logging to GHG emissions and it fails to recognize the useful role of NEPA's requirement for cumulative impacts analysis to address the programmatic effects of the agencies' forest management programs. The project-level effects of logging must be linked to the cumulative global effects of climate change through a credible cumulative effects analysis. The Forest Service's assertion that "Because the context of individual projects and their effects cannot be meaningfully evaluated globally to

inform individual project decisions, it is not possible and it is not expected that climate change effects can be found to be 'significant' under NEPA and therefore require EIS preparation." Is absurd and erroneous. Recognizing the significant global impact of collective project-level actions, it is clear that a programmatic EIS is needed and a project-level FONSIs are inappropriate until one is done.

The following is an excerpt from Ron Bass's presentation, "NEPA and Climate Change: What Constitutes a Hard Look?"

> The recommended 10-step approach takes into consideration the existing provisions of the NEPA regulations, recent court decisions, and various state programs. The steps conform to the main elements of a NEPA document.
>
> **Affected Environment**
> Step 1 – Describe the existing global context in which climate change impacts are occurring and are expected to continue to occur in the future.
> Step 2 – Summarize any relevant state laws that address climate change.
> Step 3 – Describe any relevant national, statewide, and regional GHG inventories to which the project will contribute.
>
> **Environmental Consequences**
> Step 4 – Quantify the project's direct and indirect GHG emissions.
> Step 5 – Convert the GHG emissions into carbon equivalents using an established "carbon calculator."
> Step 6 – Discuss whether the project would enhance or impede the attainment of applicable state GHG reduction.
> Step 7 – Describe the cumulative global climate change impacts to which the proposed action would contribute, i.e., the impacts of the project on climate change. (This may use the same information as in Step 1.)
> Step 8 – Describe how the impacts of global climate change could manifest themselves in the geographic area in which the project is proposed, and therefore potentially affect the project, i.e., the impacts of climate change on the project (e.g., sea level rise could affect a coastal project).
>
> **Alternatives**
> Step 9 – Include alternatives that would meet the project objectives but would also reduce GHG emissions.
>
> **Mitigation Measures**
> Step 10 – Identify mitigation measures that would reduce GHG emissions, including both project design or operational changes and potential compensatory mitigation (e.g., carbon offsets).

DOE 2009. NEPA and Climate Change: "Don't Do Nothing" NEPA Lessons Learned - Quarterly Report. June 1, 2009. http://energy.gov/sites/prod/files/LLQR-2009-Q2.pdf *citing* Ron Bass 2008. Evaluating Greenhouse Gases and Climate Change Impacts Under NEPA: Ten Steps to Taking a Hard Look. ICF/Jones & Stokes. Impact Report Nov. 2008. http://www.icfi.com/insights/white-papers/2008/evaluating-greenhouse-gases-and-climate-change-impacts-under-nepa-ten-steps-to-taking-a-hard-look.

NEPA's requirement to take a "hard look" requires the agency to consider the effects of logging-related GHG emissions. This includes:

- **Disclose whether the cumulative effects of logging-related GHG emissions are consistent with emissions reduction goals established by state or federal government or international agreements**. In 2007, the Oregon legislature passed HB 3543 that codifies Governor Kulongoski's greenhouse gas reduction goals: namely, by 2010 to begin to reduce greenhouse gas emissions, by 2020 to achieve greenhouse gas levels 10% less than 1990 levels and by 2050 to achieve greenhouse gas levels 75% below 1990 levels. ORS § 468A.205. The agency should also strive to harmonize with State of Oregon statewide land-use planning goals (adopted in administrative rules) that prohibit land use activities that exceed the "carrying capacity" of air and water resources. OAR 660-015-0000(5) - (6). The Department of Land Conservation and Development (DLCD) defines "carrying capacity" as a "Level of use which can be accommodated and continued without irreversible impairment of natural resources productivity, the ecosystem and the quality of air, land, and water resources." There is a large body of science indicating that we are already beyond the level of CO2 in our atmosphere that can be described as safe or reversible.

"In November 2014, in a historic joint announcement with China, President Obama laid out an ambitious but achievable target to reduce greenhouse gas emissions in the United States in the range of 26 to 28 percent below 2005 levels by 2025." https://www.whitehouse.gov/climate-change; https://www.whitehouse.gov/the-press-office/2014/11/11/fact-sheet-us-china-joint-announcement-climate-change-and-clean-energy-c

On June 25, 2013, President Obama released his Climate Action Plan which includes forest conservation among the "first pillar"[20] of efforts to reduce emissions, saying: "Preserving the Role of Forests in Mitigating Climate Change: America's forests play a critical role in addressing carbon pollution, removing nearly 12 percent of total U.S. greenhouse gas emissions each year. … Conservation and sustainable management can help to ensure our forests continue to remove carbon from the atmosphere … " http://www.whitehouse.gov/sites/default/files/image/president27sclimateactionplan.pdf "[A]dvancing efforts to protect our forests" is also mentioned in the 6th U.S. Climate Action Report under the United Nations Framework Convention on Climate Change (UNFCCC). The agency should advance this national climate goal by conserving public forests. Carbon emissions from logging public lands directly conflict with this important national goal and indicate potential significant impacts requiring an EIS.

Logging related GHG emissions (and forgone opportunities for increased storage of carbon in forests) will conflict with these state, federal and international GHG reduction goals.

- **Disclose the social cost of carbon as a proxy for the impacts of GHG emissions**. GHG emissions from logging (and other land management activities) impose significant costs on society, such as the cost of damage caused by climate change and the costs of adapting to climate change and the cost of sequestering carbon to mitigate emissions. CEQ's draft guidance on NEPA and Climate Change recognizes that the social cost of carbon

[20] U.S. Dept of State 2013. draft 6th Climate Action Report http://www.state.gov/e/oes/climate/ccreport2014/index.htm (page 12).

("SCC") is a "harmonized, interagency metric that can provide decisionmakers and the public with some context for meaningful NEPA review." 79 Fed. Reg. 77802, 77827. "The SCC estimates the benefit to be achieved, expressed in monetary value, by avoiding the damage caused by each additional metric ton (tonne) of carbon dioxide (CO2) put into the atmosphere. Ruth Greenspan and Dianne Callan, World Resources Institute, More than Meets the Eye: The Social Cost of Carbon in U.S Climate Policy, in Plain English (July 2011) at 1. The NEPA analysis should carefully disclose these social costs. The express purpose of SCC analysis is to provide an apples-to-apples basis for comparing a project's economic benefits with GHG pollution impacts (costs). Where SCC is not completed, these impacts (costs) are hidden from the public and, in fact, often "paid for" by the broader environment and public in the form of degraded ecological resiliency, public health impacts, and more.

The agency must recognize that the federal estimate of SCC likely underestimates—perhaps significantly—the climate impacts of GHG pollution. As the U.S. Environmental Protection Agency has concluded:

> given current modeling and data limitations, [the federal SCC values] do[] not include all important damages. As noted by the IPCC Fourth Assessment Report, it is "very likely that [SCC] underestimates" the damages. The models used to develop SCC estimates, known as integrated assessment models, do not currently include all of the important physical, ecological, and economic impacts of climate change recognized in the climate change literature because of a lack of precise information on the nature of damages and because the science incorporated into these models naturally lags behind the most recent research.

EPA, The Social Cost of Carbon, http://www.epa.gov/climatechange/EPAactivities/economics/scc.html.

> Agencies seeking to incorporate climate change considerations in rules and regulations often rely on a cost-benefit analysis, weighing the cost of curbing emissions against the expected damages from every ton of carbon dioxide (CO2) that goes into the atmosphere — a value known as the "social cost of carbon" (SCC). … While no definite SCC has been set so far, an interagency working group has endorsed a "central" estimate of $21 per ton of CO2 in 2010, or roughly 20 cents per gallon of gasoline — far too small a price incentive to prompt substantive mitigation measures.
>
> …
>
> In the United Kingdom, which started estimating prices for carbon emissions several years ago, the government's latest calculation is a range of $41 – $124 per ton of CO2, with a central case of $83. An expanded calculation of carbon prices for the United States should at least explore prices in this range …

Frank Ackerman, Elizabeth A. Stanton. 2010. The Social Cost of Carbon - A Report for the Economics for Equity and the Environment Network. April 1, 2010. http://www.e3network.org/papers/SocialCostOfCarbon_SEI_20100401.pdf.

In recent work, Nordhaus (2010) ran a an updated version of the regional integrated model of climate and the economy (RICE model).

> The model also calculates the path of carbon prices necessary to keep the increase in global mean temperature to 2 °C or less in an efficient manner. The carbon price for 2010 associated with that goal is estimated to be $59 per ton (at 2005 prices) …

William D. Nordhaus 2010. Economic aspects of global warming in a post-Copenhagen environment. PNAS June 29, 2010 vol. 107 no. 26 11721-11726. http://www.pnas.org/content/107/26/11721.full.pdf.

The 2006 "Stern Review" from the UK Treasury concluded that each ton of carbon dioxide emitted will cause $85 worth of damage to the world's economy. http://www.hm-treasury.gov.uk/independent_reviews/stern_review_economics_climate_change/sternreview_index.cfm. According to the Congressional Research Service, capturing and storing most of the carbon from coal as it is combusted costs between $43-89/ton of CO_2, and this price will likely increase after the many safety, environmental, and efficiency problems with CSS are fully accounted for. Parker, Folger & Stine. 2008. Capturing CO2 from Coal-Fired Power Plants: Challenges for a Comprehensive Strategy. CRS Report for Congress. http://www.fas.org/sgp/crs/misc/RL34621.pdf *citing* S. Julio Friedmann, Carbon Capture and Sequestration As a Major Greenhouse Gas Abatement Option (November 2007), p. 11. That's another good indication of the value of a storing a ton of carbon in forests.

Howard, P. 2014. OMITTED DAMAGES: What's Missing From the Social Cost of Carbon. http://costofcarbon.org/files/Omitted_Damages_Whats_Missing_From_the_Social_Cost_of_Carbon.pdf ("ABSTRACT: The 2013 Interagency Working Group on the Social Cost of Carbon (IWG) updated the U.S. social cost of carbon (SCC) for 2015 from a central value of $24 to $37 using three integrated assessment models (IAMs): DICE-2010, FUND 3.8, and PAGE09. The SCC is the additional economic damage caused by one ton of carbon dioxide. While some have questioned the increase in the SCC as too high, a thorough examination of the latest scientific and economic research shows that $37 should be viewed as a lower bound. This is because the studies available to estimate the SCC omit many climate impacts—effectively valuing them at zero. Where estimates are available for a given type of impact, they tend to include only a portion of potential harms. This paper represents the first attempt to systematically examine and document these omissions for the latest versions of the three IAMs used by the IWG, as well as earlier versions when they are used in calibrating the updated models. … [H]ot spot damages include[e] increases in forced migration, social and political conflict, and violence; weather variability and extreme weather events; and declining growth rates. A better accounting of catastrophic damages is also needed, as well as many other impacts.")

Laurie T. Johnson & Chris Hope, 2012. The social cost of carbon in U.S. regulatory impact analyses: an introduction and critique, J Environ Stud Sci. DOI 10.1007/s13412-012-0087-7.

http://www.springerlink.com/content/863287021p06m441/fulltext.pdf?MUD=MP ("We reestimate the values from the models (1) using a range of discount rates and methodologies considered more appropriate for the very long time horizons associated with climate change and (2) using a methodology that assigns "equity weights" to damages based upon relative income levels between regions—i.e., a dollar's worth of damages occurring in a poor region is given more weight than one occurring in a wealthy region. Under our alternative discount rate specifications, we find an SCC [social cost of carbon] 2.6 to over 12 times larger than the Working Group's central estimate of $21"…)

If the agency chooses to disclose the economic and other benefits of logging, they must also disclose the social costs. See *Sierra Club v. Sigler*, 695 F.2d 957, 979 (5th Cir. 1983), *Hughes River Watershed Conservancy v. Glickman*, 81 F.3d 437, 448 (4th Cir. 1996); *Columbia Basin Land Prot. Assn v. Schlesinger*, 643 F.2d 585, 594 (9th Cir. 1981).

Thank you for considering our organizations' scoping comments on the proposed Hwy 46 Project. We cannot stress enough how important this project is to our organizations. Please feel free to contact us with any questions or to receive any documents or studies cited herein.

Sincerely,

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