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RE: Calapooia Scoping Comments

Please consider the following comments of Cascadia Wildlands regarding the Calapooia project, located in the Sweet Home District of the Willamette National Forest. The project proposes 1,132 acres of logging, decommissioning of five miles of road, three miles of temporary road construction, and installation of a gate on road 2820 and day-use only corridor on the Upper Calapooia River.

Our primary interests in this project are, first, ensuring that ecosystems are protected, and second, exploring opportunities for meaningful ecosystem restoration.

Public Information

We very much appreciate the project story map. This sort of accessible information is a great asset to facilitate meaningful public participation.

Our organizations place a very high value on agencies providing accurate, timely, and useful information to the public. Our obligation in return is to provide the agency with meaningful and useful feedback. We hope this project can be a model of the value of the NEPA process.

Purpose and Need

The scoping notice identifies three purposes of the project, (1) contribute timber to local economies, (2) enhance forest health, vigor, species diversity and structural complexity, and (3) identify the minimum road system.

The timber-related purpose should be evaluated with more sophistication than a simple volumetric measure. Accessibility for smaller operators and local mills, economic feasibility of unit configurations and silvicultural prescriptions, and realistic evaluation of the impact this additional volume has on the local economy are critical factors that should be considered.

The second purpose, as stated, could mean a lot of different things to different people. It will be important that the purpose statement be very clear, and that it incorporates the best available scientific knowledge regarding forest ecosystem dynamics. For example, it is a common mistake to presume that the best forest is always the one that is growing biomass as quickly as it possibly can. That may be "best" in terms of crop farming, but certainly not for wildlife species like woodpeckers or spotted owls. The tools and metrics of forestry tend to bias in the simplistic faster-and-bigger-is-better direction because most of them were developed in a tree-farming context. The Forest Service perspective required here though is much more holistic and requires balancing of multiple values over time.

We notice that the project story map contains slightly different language for this purpose, adding "and promote resiliency to disturbances such as drought, insects and diseases." Please be sure to fully incorporate an ecosystem approach, and be as specific and precise as possible when identifying actions to achieve that second purpose. The project storymap, somewhat understandably, presents an over-simplistic characterization of these complex factors. We expect that the ID Team will carefully prepare the project purpose and that the analysis addresses these important issues specifically.

In some situations the timber production and forest health objectives are in conflict. In those situations, we do not think it is appropriate that matrix objectives for timber production should trump ecological restoration objectives. This is true because there is significant new information undermining the reasons behind matrix objectives. As explained in more detail below: barred owls are occupying tens of thousands of acres of suitable spotted owl habitat that the NWFP assumed would be available to spotted owls; the wood products industry does not stabilize local communities, rather it tends to have a destabilizing influence; climate change mitigation goals require that we take very opportunity to maintain and increase carbon storage in forests; climate change adaptation goals require that we hang onto the existing mature forests that we have because it may be more difficult to retain and replace them as the climate changes; logging has a greater adverse impact of dead wood habitat than previously recognized because dead wood standards are out-of-date and more green trees need to be retained to meet the long-term needs of wildlife, etc.

If project objectives are not clear, it is difficult to monitor and evaluate success and failure. The agency should be more explicit in describing the ecological goals they are seeking and the trade-offs inherent in reaching those goals.

… as ecologist Robert Lackey describes, there is no universal definition of ecosystem health, yet many environmental policy issues are based on the idea of restoring or improving the health of ecosystems. Lackey calls ecosystem health a "value-based ecological concept" based on subjective assumptions that "masquerade as science." Ecosystems have no preferences; people do.

Regan, S. 2016. . ENVIRONMENTALISM WITHOUT ROMANCE - Science alone cannot resolve most environmental issues. PERC Report: Volume 35, No.1, Summer 2016 http://www.perc.org/articles/environmentalism-without-romance. In many cases, logging will reduce dead wood habitat complexity/diversity/health in favor of green tree habitat complexity/diversity/health. Or trading off costs and benefits in one time period for costs and

benefits in another time period, with no clear acknowledgement of the time-value of costs/benefits. Natural mortality events, such as mixed-severity fire, lacks the trade-offs between live and dead trees because it would leave behind an abundance of both green trees AS WELL AS snags and down trees. The NEPA analysis must recognize that natural processes are still in operation, so human intervention may not be necessary. See, for instance, 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 paper discusses natural forces that tend to diversify young stands. These forces are even more prevalent in mature forests.

The scoping notice says over-stocked stands are susceptible to drought, insects, and disease. These natural processes should be viewed as solutions, not problems. Some trees die and others survive and thrive, that creates a desired mix of live and dead trees serving a wide variety of habitat needs. Logging will emphasize live trees, sacrificing dead trees, and providing a less complete suite of benefits for diverse wildlife.

If mortality is so bad, the FS should count logging mortality as a negative effect too. How many trees will die from logging versus natural processes? Why is logging mortality better than natural mortality? Commercial logging is demonstrably worse than natural mortality because it involves significant disturbance of soil and non-target vegetation, AND it removed the valuable habitat elements (both live and dead) represented by the trees that are being removed.

Thank you for including the minimum road system as a direct project purpose. This will enable the project to take a comprehensive view of the project area transportation system, identify management gaps and restoration opportunities. This is a major need on the Forest and a worthwhile objective. As a general rule, we are most concerned with obliterating or closing roads that are causing ecosystem damage, see benefits from having far fewer roads on the landscape, and also support public access to public lands. Gated roads are, generally speaking, the worst of all worlds in this respect.

Logging Older Stands

We are delighted to see that this project does not propose any commercial harvest in stands more than 80 years old. Our organizations strongly support that approach, and commend the agency for focusing its efforts here on younger plantation thinning.

Oregon Wild and Cascadia Wildlands continue to support careful variable thinning of dense young plantations that are accessible from existing roads. We support this work because even though there are some trade-offs, the ecological benefits of thinning young stands typically outweigh the ecological harms. We continue to have concerns with logging mature forests over 80 years old because as stands mature, there ecological harms of logging increase, and the ecological benefits decrease, which means the ecological harms outweigh any alleged ecological benefits. This is explained in detail below and in Heiken, Doug. 2009. The Case for Protecting Both Old Growth and Mature Forests, Version 1.8. Oregon Wild. https://www.dropbox.com/s/4s0825a7t6fq7zu/Mature%20Forests%2C%20Heiken%2C%20v%201.8.pdf?dl=0.

Logging Fire-Regenerated Stands

Logging in natural stands is typically not necessary unless there are very specific and clearly defined restoration need that can be met without significant trade-offs of other important values. It will be useful to bring trade-offs to light as this process moved forward.

It would be a mistake to assume that fire-regenerated stands operate in the same way as old clearcuts. The differences are significant enough that they should be treated and analyzed differently.

As a general rule, wildfire is well-understood to provide necessary ecological services. The Forest Service, in its calmer moments, understands this very well. The operating assumption then should be that fire-regenerated stands are healthy. Please focus efforts elsewhere.

Fire suppression has made recently-burned fire-regenerated stands a relative rarity. Even with more recent restoration of fire to the landscape, there is a roughly 100-year lull across the forest of these kinds of fire-regenerated stands. Those unique values should be conserved.

Not all forests come from stand-replacing high-intensity fire, so it is important that fire history be evaluated specifically at a site-specific level. Assigning all units precise stand ages can be misleading where some of them actually are precise, while others are guesses and averages of multi-aged, dynamic native forests.

Logging for forest health and vigor

Health and vigor are not ecologically based goals for forest management. Foresters are unfortunately trained to view forests as tree farms and manage for health and vigor of trees and stands, instead of managing for the whole ecosystem that includes a balance of tree growth and mortality. Managing stands for health and vigor has serious trade-offs. Many wildlife actually depend on dead and dying trees, and for many decades forests across the landscape have been managed with a goal to suppress these natural and beneficial forest attributes. Stands that foresters view as lacking health and vigor are often just experiencing natural mortality events that (i) thin the forest for free, (ii) eventually increase health and vigor of surviving trees, and (iii) retain and recruit high quality habitat components from dead and dying trees. Logging sacrifices the dead wood element and makes the forest less healthy because it has too much vigor and not enough decadence. The DEIS does not fully address this reasonable opposing viewpoint. 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]

If project objectives are not clear, it is difficult to monitor and evaluate success and failure. The agency should be more explicit in describing the ecological goals they are seeking and the trade-offs inherent in reaching those goals.

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Logging to Create Early Seral Habitat

Logging to create early seral habitat is a controversial approach that is probably not warranted. Please take a hard look at both (1) the need to create early seral habitat in this location, and (2) the effects and effectiveness of silvicultural techniques designed to do it.

Need

It is not apparent that there is a need to create more early seral habitat on the forest. Wildfire and aggressive clearcutting seem to provide enough early seral habitat. Last year was a big fire year on the Willamette, and with climate change and natural patterns more is certain to burn in the future.

Regen harvest to create early seral forest is not needed

To evaluate the "need" for early seral habitat, the Forest Service should be looking at the bigger picture instead of just looking at the South Santiam Watershed. There are many places where there is an over-abundance of early seral habitat (e.g., private lands, the Sisters Ranger District). Places like the South Santiam currently serve different habitat priorities in the grand scheme.

Logging proponents say that regen harvest of mature 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.
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> ...
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> 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.

BLM's analysis for the 2015 RMP Revisions DEIS (Vol 1, pp 182-183) indicates that the "current condition" shows no shortage of "early seral forest" across 1.3 million acres of dry Douglas fir forests. ("Currently, the Douglas-fir/dry vegetation type has a slight overabundance of early seral and a substantial overabundance of mid-seral closed forest") The biggest shortage is late seral forest types. The agencies' main focus should remain transitioning over-abundant mid-seral stands to help mitigate the persistent deficit of late-seral stands.

http://www.blm.gov/or/plans/rmpswesternoregon/files/draft/RMP_EIS_Volume1_pg_173-235.pdf And, there is already too much early seral in the Oregon Coast Range. 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].)

Furthermore, 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. 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.

Oregon Wild's scoping 2011 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.
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> 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 NF;

(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.

We continue to think that conserving mature forests is more important than creating early seral forests. Efforts to artificially enhance early seral 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/geograph

y/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.

Waring & Coops (2015) explained that we can expect more fire as a result of climate change.

> Wildland fires can be expected to establish new landscape patterns over time, while correcting the "fire deficit" created following a century of fire exclusion (Marlon et al. 2012; North et al. 2015). The patterns are not expected to attain stability, however, because projected temperature increases, derived from 11 climate models, are expected to result in an increase in total cloud-to-ground lightning flashes of 12 % ± 5 % per degree Celsius of global warming, equivalent to a 50 % increase over the rest of this century for the contiguous United States (Romps et al. 2014).

Richard H. Waring, Nicholas C. Coops. 2015. Predicting large wildfires across western North America by modeling seasonal variation in soil water balance. Climatic Change. March 2016, Volume 135, Issue 2, pp 325–339. http://link.springer.com/article/10.1007/s10584-015-1569-x. See also, Jennifer R. Marlon, Patrick J. Bartlein, Daniel G. Gavin, Colin J. Long, R. Scott Anderson, Christy E. Briles, Kendrick J. Brown, Daniele Colombaroli, Douglas J. Hallett, Mitchell J. Power, Elizabeth A. Scharf, and Megan K. Walsh. Long-term perspective on wildfires in the western USA. PNAS, February 14, 2012 DOI: 10.1073/pnas.1112839109. http://www.pnas.org/content/109/9/E535.full.pdf ("Biomass burning in the western United States has remained in dynamic equilibrium with climate at least since 500 CE to the 1800s CE. Burning generally increased when temperatures and drought area increased, and decreased when temperatures and drought declined. … Against the backdrop of climatic and ecological processes, human activities had a marked impact on biomass burning after the late 1800s. … The data do suggest however that even modest increases in temperature and drought (relative to those being projected for the 21st century) are able to perturb the level of biomass burning as much as large-scale industrialized human impacts on fire. … Since the mid 1800s, the trend in fire activity has strongly diverged from the trend predicted by climate alone and current levels of fire activity are clearly out of equilibrium with contemporary climate conditions. The divergence in fire and climate since the mid 1800s CE has created a fire deficit in the West that is jointly attributable to human activities and climate change … Although the current rate of biomass burning is not unusual (even allowing for post-1980 CE increases in burning such as in ref. 3), it is clearly out of equilibrium with the current climate. Our long-term perspective shows that the magnitude of the 20th century fire decline, while large, was matched by "natural" fire reduction during cold, moist intervals in the past (e.g., LIA). Current fire exclusion and suppression however, is taking place under conditions that are warmer and drier than those that occurred during the MCA, which calls into question their long-term efficacy.")

Effectiveness and Effects

We have not seen good evidence that logging actually can replicate the kind of early seral habitats that are created by high-intensity wildfire. There are dramatic differences in effects to soil, snags and dead wood.

We urge the FS to consider alternative ways to avoid and minimize the trade-offs involved in creating new early seral from exiting mid- or late-seral stands. Early seral habitat can be enhanced through a variety of means that do not require sacrificing mature forests. Existing early seral habitat in very young plantations can be heavily thinned to increase the persistence of early seral conditions. Early seral habitat can be enhance if fires on federal land can be managed differently (before, during, and after fire). Forest practices on non-federal lands can be adjusted to enhance early seral values (e.g., retention of more live and dead wood, less dense replanting, reduced herbicide use). The FS can embed patches early seral habitat (e.g., small structure-rich gaps) within young stand thinning prescriptions. The FS also needs to recognize the contradiction when managing for both early seral habitat and fuel reduction, because early seral habitat is a more hazardous fuel condition compared to stands of tall trees that hold most of the fuel high above the ground and out of the way of the flames. Science also shows that canopy reduction increases fire hazard by making the stand hotter, dryer, and windier, and stimulating the growth of future ladder fuels.

The purpose and need for regen logging to create early seral habitat is based on the idea of mimicking mixed severity fire. This does not make sense because logging is a poor surrogate for natural disturbance.

Regen logging does not mimic natural disturbance because it removes the vast majority of the habitat structure, such as snags and large down wood, that early seral wildlife depend on. Eighty five percent of vertebrates tied to edges and early seral forest in the western Cascades need dead wood. C. Friesen 2010. Early Seral Forests – A Conservation Conundrum. http://www.ecoshare.info/uploads/ccamp/Early-Seral-Forest-Friesen.ppt; http://ecoshare.info/projects/central-cascade-adaptive-management-partnership/synthesis-papers-tools/

"Key attributes" of high quality early seral habitat include "exceptionally high quantities of large dead wood," a condition that is not provided by commercial timber harvest that exports the vast majority of wood from the site. "[P]rompt reforestation and few legacies is unlikely to approximate the role of naturally generated early-seral conditions" M.E. Swanson Mark E. Swanson, Nichole M. Studevant, John L. Campbell, Daniel C. Donato. 2014. Biological associates of early-seral pre-forest in the Pacific Northwest. Forest Ecology and Management 324 (2014) 160–171. http://www.sierraforestlegacy.org/Resources/Conservation/Biodiversity/BD-Swanson-etal-EarlySeral2014.pdf.

The agency must avoid any suggestion that natural disturbance reset stand age to zero, or that regen logging mimics stand replacing disturbance. This is an oversimplification of forest ecology. First of all, forests are products of their history. There really is no such thing as a zero-aged stand, because every forest is a product of disturbance while retaining some memory of its past in the form of legacy structures; surviving organism; onsite and nearby seed banks, seed

sources, mycorrhizal inoculum, spores, and propagules, that are genetically "family" to the disturbed forest, etc. If the agency treats disturbed forests as a "blank slate" with no history, then they will effectively be erasing their history and their ecological memory.

Natural disturbance recruits large amounts of dead wood that provide valuable habitat for diverse wildlife. Of the many wildlife species that use early seral forest, 85% use dead wood at some life stage. Friesen, C.A. 2007. Early Seral Forest: A conservation Conundrumn. http://www.ecoshare.info/uploads/ccamp/Early-Seral-Forest-Friesen.ppt Unfortuately, regen harvest removes virtually all of the most valuable large wood depriving wildlife of the rich structural complexity they would normally enjoy after a natural disturbance.

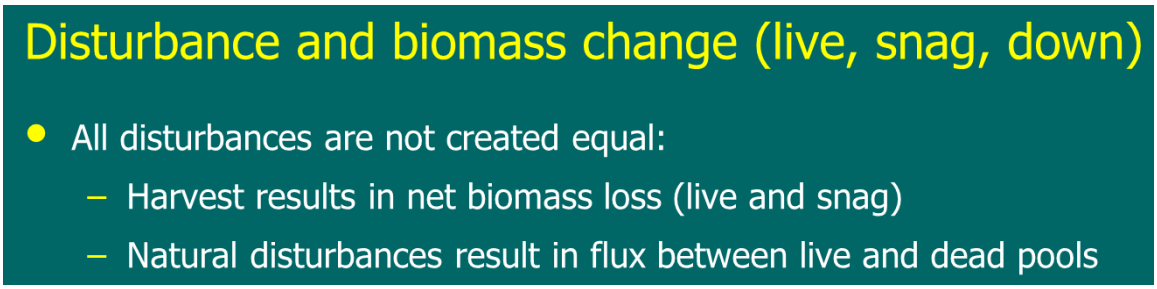
> The presence of coarse woody debris is critical for biodiversity conservation. … In general, post-fire forest ecosystems include the presence of large numbers of snags and downed woody debris. This dead material provides important habitat elements for many species of plants and animals, while also storing a great deal of carbon (MacDonald 1993; Fleming and Freedman 1998; Freedman et al. 1996). Clearcut harvesting of natural forests results in the removal of most of the aboveground woody biomass from the site because trees are the commodity being harvested. … Because clearcut harvesting concentrates on the removal of biomass, it fails to produce large-dimension snags and coarse-woody debris in intensively managed forests, … Although both harvesting and wildfire kills trees, only fire leaves them as dead standing biomass. … The fire-killed snags and woody debris cast partial shade, which ameliorates the surface microclimate and may enhance the survival of pine seedlings (Fraser and Farrar 1953; Cayford and McRae 1983; Carleton and MacLellan 1994). … Some studies have suggested that the cover and richness of the understorey vegetation of a natural forest may never fully recover from clearcutting. … Wildfires reduce the presence of some hosts that assist the spread of pests and pathogens while clearcutting may promote them. … [E]xclusion of fire from such ecosystems, along with forestry practices that leaves young infected trees in the residual stand, leads to increased abundance of this parasite. In contrast, fire eliminates Dwarf mistletoe. … Numerous studies have determined the potential removals of nutrients with conventional and whole-tree clearcuts … The data show that clearcutting removes large amounts of biomass and nutrients from the site, and that these are equivalent to a substantial fraction of the site capita of these materials. … During a wildfire, biomass capital of the stand is lost by combustion, as is that of nitrogen through the oxidation of organic compounds and the release of gaseous NO and NH3. In intense wildfires these losses of biomass and nitrogen can be comparable in magnitude to what would be removed by the clearcutting of comparable stands. Unlike wildfire, however, clearcutting also removes large amounts of phosphorus, potassium, calcium, and magnesium contained in the tree biomass; these materials are mostly conserved *in situ* during a wildfire. … Clearcut harvesting with heavy equipment can cause severe soil compaction along skidding lanes and it can also disrupt soil profiles by churning … Permanent roads are not generally associated with wildfire management or suppression (although temporary access routes may be constructed while fighting some wildfires). An extensive road network is, however, necessary for timber

> harvesting and subsequent stand management. Roads affect biodiversity in many ways. Roads directly remove natural habitat, alter drainage and stream dynamics, cause erosion, introduce edge effects, fragment contiguous ecosystems, alter species movements, and act as corridors for the introduction of non-native species …. Road density is a useful indicator of ecological threat … [I]t is erroneous to assume that forest harvesting plays the same ecological role as wildfire.

D.J. McRae, L.C. Duchesne, B. Freedman, T.J. Lynham, and S. Woodley, 2001. Comparisons between wildfire and forest harvesting and their implications in forest management. Environ. Rev. 9. 223-260 (2001); DOI: 10.1139/er-9-4-223

Modelling by Harris (2000) suggests that 12 or more green trees need to be retained during regen harvest for every snag we want to recruit at any given time during the rotation. Harris, R.B. 2000. Estimating large snag recruitment needs in regeneration timber harvests. Western Journal of Applied Forestry. 15: 140-146.

http://www.cas.umt.edu/facultydatabase/FILES_Faculty/1152/Harris%202000%20LargeSnagRecruitment%20Western%20J.%20Appl.%20For.pdf. This paper also highlights the concern that without numerical guides, managers could erroneously assume that they are maintaining adequate numbers of snags across the landscape even though they are retaining too few green trees to achieve that goal.



Ohmann, JL, MJ Gregory, HM Roberts, RE Kennedy, Z Yang, J Braaten, SL Powell, WB Cohen, V Kane, J Lutz. 2012. Mapping change in live and dead forest biomass with Landsat time-series, remeasured plots, and nearest-neighbor imputation. ForestSat 2012: Corvallis, OR; September 2012.
http://lemma.forestry.oregonstate.edu/export/presentations/ohmann_etal_2012_forestsat.pps

> Although many existing silvicultural systems have been designed to mimic stand-scale natural disturbances, McRae et al. (2001) and Palik et al. (2002) remind us that natural disturbances are inherently different from those of silviculture. One difference, of course, relates to the amount of carbon removed from the site when harvesting a forest. Removals tend to be much greater with harvesting than for fire, for example. Fire tends to create a complex mosaic of forest types and ages on the landscape. Forest harvesting, as commonly practiced, tends to simplify forest composition and structure.

Crow, T.R. and A.J. Perera. 2004. Emulating natural landscape disturbance in forest management – an introduction. Landscape Ecology 19: 231-233. http://www.firescience.gov/projects/01-1-3-43/project/01-1-3-43_01_1_3_43_Deliverable_02.pdf

> In terms of sedimentation, it is the forest roads that may have the most significant impact because of the constant source of sediment they can provide over the life time of the road network.When all attributes are considered it appears that [clearcutting] does not emulate wildfire and may have a more detrimental impact on headwater systems in both the short and long-term. … Overall, the results suggest that harvesting does not emulate wildfire, particularly [clearcutting]. … It is important for forest managers to consider the complex affects that harvest treatments can have on headwater systems if they are going to successfully practice ecosystem management and achieve sustainable forest management. It is also important for managers to understand that there are many other attributes to be considered. In particular, the ability of harvest treatments to emulate wildfire in regards to peak flows, organic matter inputs, large woody debris recruitment, channel morphology, and stream biota response. Due to the inability to statistically analyse these attributes they were not incorporated into the scope of this paper.

Nitschke C.R. 2005. Does forest harvesting emulate fire disturbance? A comparison of effects on selected attributes in coniferous-dominated headwater systems. Forest Ecology and Management 214 (2005) 305–319. http://www.sierraforestlegacy.org/Resources/Conservation/FireForestEcology/FireScienceResearch/FuelsManagement/FM-Nitschke05.pdf

> From a wildlife perspective, stand-replacing fires and timber harvesting both represent major disturbances which significantly alter habitats … Despite their similarities, fire and logging differ in several of the habitat conditions they procure for wildlife. Wildfires, especially when severe, generate large amounts of standing (eventually downed) dead trees including large ones which represent an important habitat and food source for many wildlife species (Drapeau et al. 2002; Pedlar et al. 2002). … [T]he spatial variability of fire severity creates various amounts of green or mixed-severity stands over the burned landscape (e.g., Kafka, Gauthier, and Bergeron 2001; Smyth et al. 2005), which represent important refuge sites for some wildlife species (Norton and Hannon 1997; Tittler and Hannon 2000; Lance and Phinney 2001; Tittler, Hannon, and Norton 2001). Contrarily, clearcut harvesting removes most of the large live trees, leaves few standing deadwood, and retains variable amounts of non-commercial trees and understory vegetation. … All studies directly comparing bird assemblages in burned and harvested stands reported an important divergence in bird assemblages, especially for the first years following disturbance (Hutto 1995; Schulte and Niemi 1998; Hobson and Schieck 1999; Imbeau, Savard, and Gagnon 1999; Schieck and Hobson 2000; Morissette et al. 2002; Simon, Schwab, and Otto 2002). One of the most striking differences lies in the abundance of the snag-associated guild in post-fire stands. … [H]igh snag densities are clearly missing in harvested stands (Schulte and Niemi 1998; Pedlar et al. 2002; Simon,

Schwab, and Otto 2002). Concordantly, Imbeau, Savard, and Gagnon (1999) found no resident and cavity-nesting species in recent clearcuts, where little retention (green or dead trees) has been left on site. Similarly, Hobson and Schieck (1999) found very distinct assemblages between burned and harvested forests, a difference that was partly explained by the dominance of several snag-associated species. These major differences in the abundance of snag-associated species are of particular importance considering that several of these have been identified as the most sensitive to the long-term effects of forestry (Imbeau, Mönkkönen, and Desrochers 2001). … The magnitude of the initial divergence and eventual convergence in bird communities between fire and harvesting may greatly depend on the level of residual vegetation (Schieck and Hobson 2000). Schieck and Hobson (2000) found that bird assemblages from larger patches within disturbed stands supported more species from older forests than smaller ones. In contrast, bird communities from smaller patches (within cut blocks vs. burned stands) mainly reflected the surrounding post-disturbance communities, therefore showing the same initial divergence in bird assemblages between post-fire and post-harvest stands reported by Hobson and Schieck (1999). Nonetheless, over time these small patch communities also became more similar to those inhabiting mature fire origin forests and hence converged as succession proceeded (although some differences still persisted up to 60 years after disturbance). … Early after disturbance, most stand-level attributes differ between harvesting and wildfire. Structurally, young post-fire stands are characterized by more snags and less downed woody debris than young post-harvest stands. … Biodiversity elements significantly differ between burned and logged sites. Early after disturbance, significant differences in understory vascular and non-vascular community composition are commonly reported. Faunal assemblages, be they mammals, invertebrates, or birds, all seem to respond differently initially to harvesting- and wildfire-induced disturbances. … At the stand scale, while most forest attributes are different early after disturbance between burned and logged stands, the majority of these converge a few decades after fire. A few exceptions are to be noted, though. … [W]hile faunal communities do become less different as time passes, late in succession some species present in burned stands are either significantly less abundant or absent in similarly aged logged stands. … Post-fire salvage logging affects ecological processes, biological legacies, and the abundance of species commonly encountered only after fire. Removal of fire-killed trees can affect tree regeneration, understory composition, the abundance and distribution of dead wood, wildlife habitat, and soil properties. … At the landscape scale, the most important difference between fire and harvesting regimes is the distribution of stand age classes. The proportion of stands older than the rotation period (usually 100 yrs) tends toward zero under a fully regulated harvesting regime, while it is around 37% under a fire regime of similar rotation period. This results in a significant loss of over-mature forests in managed landscapes, potentially affecting organisms that are often associated with such stands.

NCASI. 2006. Similarities and differences between harvesting- and wildfire-induced disturbances in fire-mediated Canadian landscapes. Technical Bulletin No. 924. Research

Triangle Park, N.C.: National Council for Air and Stream Improvement, Inc. http://landscape.zoology.wisc.edu/People/Simard/NCASI924.pdf

Many bird species benefit from fire that leaves a rich mix of plants and complex structure of snags and dead wood, but regen harvest removes the complex structure and truncates the early seral vegetation by planting conifers. The quality of habitat that results after fire often depends on the successional stage of the forest pre-disturbance, because much of this structure is carried over after the fire into the future forest. Logging removes most of the trees and with it the structural legacies that bind the past and future forests. Dick Hutto said:

> In a new paper, we show that fire effects cannot be accurately assessed through a simple comparison of recently burned and unburned forest plots. This is because the same species that show negative responses through simplistic comparisons of burned and unburned forests reveal strong POSITIVE responses to more restricted combinations of successional stage and fire severity. With 10 years of post-fire data, we show that the majority of bird species (60%) benefit from fire (as evidenced by greater abundances in burned forest patches belonging to a particular successional stage/fire severity combination than in forest patches that have been long unburned). With data from even longer times-since-fire (say, 15, 20, or 30 years after fire), the percentage of species that clearly benefit from fire is probably closer to 80%!

Describing Richard L. Hutto, and David A. Patterson 2016. Positive effects of fire on birds may appear only under narrow combinations of fire severity and time-since-fire. International Journal of Wildland Fire. http://dx.doi.org/10.1071/WF15228

Regen harvest (and associated roads) on slopes above streams also increases landslide risk and modifies the composition of future landslides to increase adverse sediment and decrease beneficial wood recruitment.

> NATURAL landslides are important sources of wood and sediment for salmon
>
> 1. Provide 60% of wood source in coastal systems
> 2. Provide diverse stream structures
>
> …
>
> 2. Landslides from roads and management are DIFFERENT than natural slides in that those road-related types contribute excessive sediment and relatively low amounts of essential large wood to streams
> 3. Need to manage for quality, NATURAL landslides

Gordie Reeves 2017. Climate Modeling Results. Elk River Watershed Restoration Planning Project Public Presentation Notes. Port Orford, February 02, 2017 http://a123.g.akamai.net/7/123/11558/abc123/forestservic.download.akamai.com/11558/www/nepa/105036_FSPLT3_3949335.pdf

Regeneration logging (by whatever name) should be avoided due to adverse effects

Please avoid creating large clearings and planting. This will create dense homogeneous fuels conditions close to the ground. This is more hazardous than retaining taller trees that hold most of the fuel high off the ground. Retaining dense tree canopy also helps maintain a cool-moist-less-windy microclimate that is more favorable to low or moderate fire, and also helps suppress the growth of future surface and ladder fuels. "Large blocks of old-growth forests – rather than large contiguous blocks of young growth or highly simplified forests – are the best scenario for reducing catastrophic wildfire." 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.

Dense young plantations are more susceptible to severe fire effects than unmanaged older forests (DellaSala et al. 1995, Weatherspoon & Skinner 1995). The increased susceptibility of plantations to severe fire is due to:

- Structural characteristics that promote high heat energy output by fire (Sapsis & Brandow 1997).
- Warm, windy and dry microclimates compared to what would exist in an unlogged burned forest that possessed more structural diversity and ground shading (Countryman 1955, van Wagtendonk 1996).
- Accumulations of large volumes of fine logging slash on the ground surface (Weatherspoon & Skinner 1995).

In a study of fire severity in northwest California, researchers found that tree plantations of any age were "more receptive to combustion" than other forests (Odion et al., 2004). Perry (1995) suggested that once even-age tree plantations are established on a proportion of forest landscape, "the potential exists for a self-reinforcing cycle of catastrophic fires." Extensive networks of roads constructed to facilitate logging and planting also increase the risk of human-caused ignitions during hot, dry conditions (USDA 2000).[1]

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[1] Countryman, C.M. 1955. Old-growth conversion also converts fire climate. Fire Control Notes 17(4): 15-19.

Frost, E.J. and R. Sweeny. 2000. Fire Regimes, Fire History and Forest Conditions in the Klamath-Siskiyou Region: An Overview and Synthesis of Knowledge. Available at: http://www.mkwc.org/publications/fireandfuels/firestudies/Fire%20Regimes,%20Fire%20History%20and%20Forest%20Conditions%20in%20the%20Klamath-Siskiyou%20Region.pdf

Harma K. and P. Morrison. 2003. Analysis of Vegetation Mortality and Prior Landscape Condition, 2002 Biscuit Fire Complex. Pacific Biodiversity Institute. Winthrop, WA. 25 p.

Ingalsbee, T. 1997. Fires burn hotter in tree farms. Headwaters Forest News 7(2): 10-11.

DellaSala, D.A., D.M. Olson, S.E. Barth, S.L. Crane and S.A. Primm. 1995. Forest health: moving beyond rhetoric to restore healthy landscapes in the inland northwest. Wildlife Society Bulletin 23(3): 346-356.

Two fires in 2002 on the Umpqua National Forest were evaluated for their effect on the forest. Excerpts from the March 2003 Wildfire Effects Evaluation Project by the Umpqua N.F. make clear the impact of creating more tree plantations:

> "Plantations had a tendency to increase the rate of fire spread and increased the overall area of stand-replacement fire effects by spreading to neighboring stands." Page 4
>
> "Fire burned most plantations with high intensity and spread rapidly through the canopy of these young stands." Page 20.
>
> "Plantation mortality is disproportionately high compared to the total area that plantations occupied within the fire perimeter. Page 26-27.
>
> "Crown fire spreads readily through these young stands: rates of fire spread can be high, and significant areas or mortality can occur in and adjacent to these stands." Page 32.

Finally, the report says that the fire behavior in forest that had not been converted to tree farms was normal. "The pattern of mortality in the unmanaged forest resembles historic stand-replacement patch size and shape." Page 64. Umpqua NF. Wildfire Effects Evaluation Project. March 2013. http://web.archive.org/web/20041118062947/http://www.fs.fed.us/r6/umpqua/publications/weep/weep.html.

The 2013 BAER Report for the Douglas Complex Fires in SW Oregon said "While the severity varied throughout the fire area, young timber plantations carried the fire while older stands tended to be more resistant. This is mostly due young timber plantations having a high density

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Martinson, E., Omi, P.N., and Shepperd W., 2003. Fire behavior, fuel treatments, and fire suppression on the Hayman Fire, Part 3 Effects of fuel treatments on fire severity. Hayman Fire Case Study, pp. 96-126, USFS Rocky Mountain Research Station Gen. Tech. Rep. RMRS-GTR-114. Ogden, UT. http://www.treesearch.fs.fed.us/pubs/28718

Odion, D.C., E.J. Frost, J.R. Strittholt, H. Jiang, D.A. DellaSala and M.A. Moritz. 2004. Patterns of fire severity and forest conditions in the western Klamath Mountains, California. Conservation Biology 18(4): 927-936. http://www.landsinfo.org/ecosystem_defense/Science_Documents/Odion%20et%20al%202004%20Con%20Bio%20--%20Patterns%20of%20fire%20severity%20%26%20forest%20conditions%20in%20the%20western%20Klamath%20Mtns.pdf

Sapsis, D.B. and C. Brandow. 1997. Turning plantations into healthy, fire resistant forests: Outlook for the Granite Burn. California Dept. of Forestry and Fire Protection, Fire and Resource Assessment Program. Available at: http://frap.cdf.ca.gov/projects/granite_burn/gb.html

USDA Forest Service 2000. Final Environmental Impact Statement, Roadless Area Conservation. Vol. 1. Washington, D.C.

_____1994. Final Environmental Impact Statement, Land and Resource Management Plan. Klamath N.F. Yreka, CA.

Weatherspoon, C.P. 1996. Fire-silviculture relationships in Sierra forests. In: Status of the Sierra Nevada: Sierra Nevada Ecosystem Project Final Report to Congress, Vol. II. Wildland Resources Center Report No. 37. Center for Water and Wildland Resources. Univ. of California, Davis.

of ground fuels." HSG9 – Douglas Complex Fire Burned Area Emergency Rehabilitation Plan. BLM Douglas Complex BAER Team. Sept 5, 2013. (p 12).

Basically, a beneficial surface fire is unlikely to occur in a dense young plantation because the fuel is too close to the ground. The fuel conditions in dense young plantations set the stage for fast moving stand-replacing fire. If a "good fire" were to occur in adjacent mature forest areas, fire suppression would almost certainly be required to prevent destruction of the plantation, even though the fire might otherwise be allowed to burn beneficially through the older stands. This is an often unaccounted for "cost" of regeneration harvest.

The number and distribution of plantations resulting from industrial timber management likely has altered fire behavior and effects at both stand and landscape scales (Hann et al. 1997, Huff et al. 1995).[2] Perry (1995) suggests that the existence of a threshold proportion of highly combustible even-age tree patches on a forest landscape creates the potential for "a self-reinforcing cycle of catastrophic fires." In addition, most plantations occur next to roads that spread invasive and exotic plants (DellaSala & Frost 2001) and increase the risk of human-caused ignitions during hot, dry conditions (USDA 2000).

The March 2003 Wildfire Effects Evaluation Project for the Umpqua National Forest clearly documents this disproportionate fire intensity of young managed vs. mature unmanaged stands. ("The young vegetation, including plantations, experienced a disproportionately high amount of stand replacement mortality caused by crown fires as compared to older, unmanaged forests. … Plantations had a tendency to increase the rate of fire spread and increased the overall area of stand replacement fire effects by spreading to neighboring stands." p 4 "This early seral vegetation pattern, and the types and arrangement of fuels present, increased the fire's rate of spread and the area of stand replacement fire effects." p 64.)
http://web.archive.org/web/20041118062947/http://www.fs.fed.us/r6/umpqua/publications/weep/weep.html.

In the 1970s, Judge Burns recognized that regen harvest increases fire hazard. This was a class action case brought on behalf of Portland residents seeking to protect the Bull Run municipal watershed on the Mt Hood NF by enforcing a unique anti-trespassing law, but the judge's findings with respect to the hazards associated with regen harvest and roads are instructive.

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[2] Hann, W.J., et al. 1997. Landscape dynamics of the Basin. Pp. 337-1,055 in: Quigley, T.M. and S.J. Arbelbide (eds.). An assessment of ecosystem components in the Interior Columbia Basin and portions of the Klamath and Great Basins: Volume II. USDA For. Serv. Pac. Nor. Res. Sta. Gen. Tech. Rep. PNW-GTR-405. Portland, OR.

Huff, M.H., R.D. Ottmar, E. Alvarado, R.E. Vihnanek, J.F. Lehmkuhl, P.F. Hessburg, and R.L Everett. 1995. Historical and current landscapes in eastern Oregon and Washington. Part II: Linking vegetation characteristics to potential fire behavior and related smoke production. USDA For. Serv. Pac. Nor. For. and

Ran. Exp. Sta. Gen. Tech. Rep. PNW-GTR-335. Portland, OR.

> Logging cannot be said to reduce the risk of fire: it cannot affect the incidence of lightning and it raises rather than lowers the risk of man-caused fires. …
>
> Logging may, however, have an effect on fire hazard.... What is important here is to decide whether the largescale, commercialized, sustained-yield logging program presently carried on by the Forest Service in fact reduces the hazard of fire. The uncomplicated truth is that slash from logging is not removed, the present program annually increases rather than decreases the fuel load, and does so in the types of fuel that are most dangerous as precursors to a crown fire. … Slash from old growth forests 'nearly always results in an extreme rate of spread and resistance to control. The potential for disastrous fires is high in the latter case unless the slash is disposed of immediately.' …
>
> Unfortunately, 'logging residue is not being abated--it is accumulating.' …Even the slash-burned acres may have high ground fuel levels because slash burning does not remove all the fuel. The sustained-yield commercial logging program conducted in Bull Run adds to rather than decreases the fuel levels: to say that large-scale commercial logging increases, rather than diminishes, protection of the forest from fires is to say that black is white.
>
> … [T]he road system which has been constructed since 1958 has not been the system which would have been built if intended primarily for fire fighting and control purposes. The road system largely represents roads to timber--not roads to fires. … The roads were primarily for logging, and only incidentally for fires.
>
> Under the Forest Service's theory, to protect the water and the forest, it has to build roads to fight fires; it has to sell timber--lots of it--to get the roads built. Ergo, large-scale timber sales protect the forest. This may or may not be good logic, given the pitfalls of the federal budget process. But my duty is not to evaluate the logic, but rather to evaluate the law. Good logic or not, I hold this theory is not good law, in light of s 1862.
>
> …[R]oads are not themselves particularly useful in fighting the catastrophic or crown fire. Only nature will suppress such a fire.

Miller v. Mallery, 410 F.Supp. 1283, 1294-1296 (D. Or 1976).

Bradley et al (2016) found that dry forests that are unprotected and most likely to be logged, are also those most likely to experience severe fire.

> Abstract
>
> There is a widespread view among land managers and others that the protected status of many forestlands in the western United States corresponds with higher fire severity levels due to historical restrictions on logging that contribute to greater amounts of biomass and fuel loading in less intensively managed areas, particularly after decades of fire suppression. This view has led to recent proposals—both administrative and legislative—to reduce or eliminate forest protections and increase some forms of

logging based on the belief that restrictions on active management have increased fire severity. We investigated the relationship between protected status and fire severity using the Random Forests algorithm applied to 1500 fires affecting 9.5 million hectares between 1984 and 2014 in pine (Pinus ponderosa, Pinus jeffreyi) and mixed-conifer forests of western United States, accounting for key topographic and climate variables.

We found forests with higher levels of protection had lower severity values even though they are generally identified as having the highest overall levels of biomass and fuel loading. Our results suggest a need to reconsider current overly simplistic assumptions about the relationship between forest protection and fire severity in fire management and policy.

Curtis M. Bradley, Chad T. Hanson, Dominick A. DellaSala. 2016.

Does increased forest protection correspond to higher fire severity in frequent-fire forests of the western United States? Ecosphere, Volume 7, Issue 10. October 2016. http://onlinelibrary.wiley.com/doi/10.1002/ecs2.1492/full

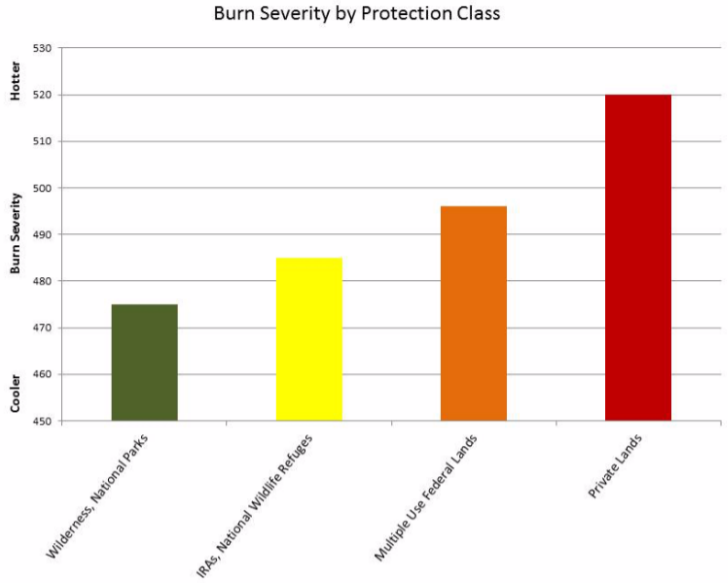

Chart 2. Burn severity (cool to hot fires) classes arranged by land-use categories from maximum protection (parks, wilderness) to minimal (private lands). Fire severity was assessed from the Monitoring Trends in Burn Severity project (http://www.mtbs.gov) managed by USDA and USDI. Fire severity data in acres burned and severity classes were available from 1984 to 2014 and analyzed for 1,500 fires affecting ~24 million acres burning in mixed-conifer and pine forests of 11 western states using GIS and robust statistical analyses (Bradley et al. 2016). The chart reflects average burn severities for land categories.

Chart 2 From: Testimony of Dr. Dominick A. DellaSala, Chief Scientist, Geos Institute, Ashland Oregon, Before the U.S. House of Representatives Natural Resources Committee, Subcommittee on Oversight and Investigations, September 27, 2017, Oversight Hearing

"Exploring Solutions to Reduce Risks of Catastrophic Wildfire and Improve Resilience of National Forests."

Cultural History, Tribal consultation and traditional ecological knowledge

We expect you to consult directly with Tribes regarding cultural resources that might be disturbed by the action, as well as regarding indigenous practices related to wildfire on this specific landscape. Most fundamentally this is commanded at moral and legal levels by respect for basic human rights and sovereignty. Tribes can and will assert their rights for themselves. As citizens of this government, we insist you fulfill those obligations meaningfully.

In terms of the NEPA analysis and good project planning, we are confident that this project could be improved with the benefit of traditional ecological knowledge, so encourage the agency to proactively seek to discover and apply it where appropriate. In doing so we specifically want to recognize the primary necessity of respecting tribal sovereignty and culture, which in many situations requires confidentiality and other methods of consultation outside of the NEPA process. Our point is that, as stewards of this land, there is an obligation to seek to apply the best-available information, and on a project such as this a lot of that is traditional knowledge.

Spotted Owl

Please take a hard look at effects to the Northern Spotted Owl, including the appropriate consultation under the Endangered Species Act.

Harm to NSO habitat should be avoided.

There is no compelling justification for removing or downgrading suitable nesting, roosting, foraging habitat for the threatened northern spotted owl. There is no valid programmatic NEPA analysis to support further removal or downgrading of owl habitat. Since the Northwest Forest Plan was adopted in 1994 there is significant new information, such as the barred owl which has invaded the entire range of the spotted owl and now occupies and territorially defends tens of thousands of acres of suitable habitat making in unavailable for spotted owls (as was assumed in the existing programmatic NEPA analysis). Core assumptions in the NEPA analysis supporting the LRMP (as amended) are outdated so the FS cannot rely on that analysis to conduct further damage to northern spotted owl habitat.

If commercial activities are considered that would impact on NSO habitat, then several important analyses would need to be completed. Simply tiering to the outdated Forest Plan EIS is not adequate.

Logging suitable habitat will increase adverse competitive interactions with barred owls.

The barred owl is dramatically increasing in numbers throughout the range of the spotted owl and causing Competition and displacement of the spotted owl. The Northwest Forest Plan does not account for the effects of barred owls which compete with spotted owls and exclude spotted owls from otherwise suitable habitat. The barred owl is barely mentioned in the 1994

SEIS. The invasion of the barred owl undermines a critical assumption underlying the Northwest Forest Plan - that all *suitable* owl habitat is *available* to spotted owls. Tens of thousands of acres old forest owl habitat (which was in short supply before the barred owl arrived) are now occupied and defended by barred owls to the exclusion of spotted owls. The logical response now is to protect and restore more habitat to reach spotted owl population goals. **Implications:** Based on well-established species/area relationships the agencies need to protect more suitable owl habitat is needed to ensure that these two owl species can co-exist, and to decrease the likelihood of competitive exclusion. This is corroborated by FWS' Final Recovery Plan for the Northern Spotted Owl, which recommends protection of "substantially all of the older and more structurally complex multi-layered conifer forest" outside of reserves (as well as on non-federal lands). "These forests are characterized as having large diameter trees, high amounts of canopy cover, and decadence components such as broken-topped live trees, mistletoe, cavities, large snags, and fallen trees." See Recovery Action 32. This recovery action is intended to reduce competitive pressures between spotted and barred owls, but unfortunately RA 32 only applies to a subset of all the suitable habitat that could be conserved to further co-existence between the two competing owls, and an analysis has not been done to show *how much* additional habitat needs to be protected to ensure recovery of the spotted owl, and the USFS and BLM have not taken steps to amend their LRMPs to implement this recovery plan element. More on the barred owl below.

Barred owls are larger and more aggressive than spotted owls, pushing the spotted owls from their nesting areas, their habitat and prey preferences appear to overlap with the spotted owl, and they can interbreed with unknown consequences. Barred owl numbers are clearly increasing (yet the methods used to detect them may vastly underestimate their numbers).

This is not just a hypothetical concern. According to recent monitoring of barred owl on the Willamette National Forest—

> "The percentage of sites containing at least a single barred owl (*Strix varia*) increased dramatically between 2000 and 2001; the high level of barred owl responses continued into 2002 as well (Figure 5)... it is important to note that our survey methods are not designed to locate barred owls.... The data do suggest, however, that barred owls are becoming increasingly common in the study area and several pairs of spotted owls have been either displaced or are inhibited from responding to our surveys as a result. In addition, a second hybrid owl was located on the study area in the Horse Creek LSR."
>
> [Figure 5 referenced above shows that barred owl singles jumped from an average of about 4 % of sites in 1988-2000, to 15% of sites in 2001 and 2002.]

ANNUAL RESEARCH REPORT. FY 2002. 5 December 2002. Title: The Ecology of Northern Spotted Owls (*Strix occidentalis caurina*) on the Willamette National Forest, Oregon: Habitat Use and Demography. Principal Investigator: Dr. Robert Anthony (Demography-RWU 4203). http://web.archive.org/web/20041016103942/http://www.reo.gov/monitoring/nso/reports/HJA2002-annual-report.pdf

Anthony, Forsman, Franklin et al. 2004. Draft "Status And Trends In Demography Of Northern Spotted Owls, 1985-2003. Interagency Regional Monitoring Program (April 30, 2004) says:

> There also was evidence that populations on the RAI, OLY, COA, and HJA study areas were decreasing also. … Of the 8 monitoring areas, there was evidence that populations were declining on CLE, COA and HJA based on 95% confidence intervals that did not overlap 1.0 or barely included 1.0. (p 47)
>
> … there was strong evidence that populations on the CLE, WEN, OLY, RAI, WSR, HJA, COA, and SIM study areas declined during the study (Fig. 11a-c). Estimated declines on the CLE, WEN, RAI, and WSR study areas were substantial over the last decade where population sizes were only 40-60% of the initial populations. Declines on the OLY, HJA, COA, and SIM study areas were not as great but are noteworthy; population sizes in 2002 were approximately 70-80% of the initial populations on those areas. The decline in the population on HJA appeared to occur during 1993 and 1999,… (p 50)
>
> …during the study, and populations on the OLY, HJA, COA, and SIM study areas had declined by about 20-30%. (p 59)

The Elliott State Forest had a spotted owl population study completed in the summer of 2003. Only 11 pairs of owls were found (down by 50% from 1993). NONE of the owls produced young last year, and for the first time in the public record, barred owls were found in the Elliott Forest, at eight spotted owl sites. Four of the new barred owl sites no longer have spotted owls.

The impact of the barred owl on the spotted owl was barely considered when the Northwest Forest Plan was approved in 1994. One of the implications of barred owls competition and the overall decline of the spotted owl is that the agencies may need to protect all the remaining mature and old growth forest habitat in order to increase the chances that spotted owls and barred owls can co-exist. In order to retain options while this issue is being sorted out the agency must consider protecting all remaining old forest. When we are losing population "sinks," conserving the remaining population "sources" become even more important.

Reliance on spotted owl habitat models is now quite suspect, because any acre of suitable spotted owl habitat could be occupied by barred owls and effectively unavailable to spotted owls, so any spotted owl habitat model that assumed anywhere near full occupancy of suitable acres is effectively invalid and should not be relied upon for NEPA or ESA consultation, that is until a model is developed that can confidently predict whether a given area of suitable habitat is more likely to be occupied by spotted owl vs barred owl. Right now we are not anywhere close to that level of confidence.

Fuel Reduction objectives conflict with owl habitat objectives

Please take a hard look at conflicts between fuel reduction and owl habitat objectives. Under the false premises of the Healthy Forest Restoration Act, the USFS and BLM are aggressively logging owl habitat to save it from fire. Fuel reduction efforts adversely affect spotted owl habitat characteristics. "Research conducted within and adjacent to the South Cascades LSR network indicates that spotted owls avoid suitable NRF that has been 'degraded'. This effect

appears to last for decades." South Cascades LSR Assessment. Scientific support is lacking for fuel reduction logging to benefit species like spotted owls that prefer to live in dense forests - a fuel rich environment. *Surface fuels* provide habitat for owl prey; *ladder fuels* provide owl roosting sites; and *canopy fuels* provide owl nesting habitat; thus, fuel reduction treatments in owl habitat will almost unavoidably degrade or downgrade some existing owl habitat (or put that habitat at greater risk of fire or barred owl invasion). This means that the remaining owl habitat throughout the owls range becomes more important than previously considered in any programmatic NEPA document. For more information, see Heiken, D. 2010. Log it to save it? The search for an ecological rationale for fuel reduction logging in Spotted Owl habitat. Oregon Wild. v 1.0. May 2010. https://www.dropbox.com/s/pi15rap4nvwxhtt/Heiken_Log_it_to_save_it_v.1.0.pdf?dl=0. The authors of the Northwest Forest Plan expected that 80% of the reserves will become late successional habitat after a period of restoration and recovery.[3] In addition, "[m]eeting the habitat needs of the owl will probably require maintaining a higher proportion of dense, multilayered, old-growth forests than would have occurred historically in many of the dry provinces."[4] However, recent "Science Findings" from PNW Research reveals that in the dry provinces, "requiring landscape treatments to earn a profit negatively impacted both habitat and fire objectives" and fuel reduction objectives are only compatible with owl habitat objectives, if the owl habitat objective is maintained at 40% (half the target of the NWFP). PNW Research Station. 2006. Seeing The Bigger Picture: Landscape Silviculture May Offer Compatible Solutions To Conflicting Objectives. Science Findings. July 2006. http://www.fs.fed.us/pnw/sciencef/scifi85.pdf. **Implications:** The agencies should re-evaluate whether logging in reserves and in owl habitat is compatible with spotted owl conservation; whether the 40% suitable habitat threshold is sufficient to maintain viable populations of owls in the dry provinces, and whether the reserve system should be expanded to ensure that a 40% slice of a bigger pie might better ensure recovery of the owl.

Please address the potential effect of climate change on Owls and fire

This analysis should be done in terms of longer fire seasons; larger and more intense fires; increased tree mortality from fire, insects, and drought stress, consequently altered regional vegetation patterns and climate patterns; and maybe most significantly, *uncertainty whether suitable habitat can be regrown from altered young stands in an altered climate regime*. Climate change also brings uncertainty in terms of the frequency and duration of inclement weather during the owl breeding season. Franklin et al. (2000) observed that spotted owl populations could decline due solely to weather effects.[5] **Implications**: Uncertainty in the

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[3] FEMAT p IV-55.

[4] Spies, Thomas A.; Hemstrom, Miles A.; Youngblood, Andrew; Hummel, Susan. 2006. Conserving old-growth forest diversity in disturbance-prone landscapes. Conservation Biology. 20(2): 351-362. http://www.fs.fed.us/pnw/pubs/journals/pnw_2006_spies001.pdf.

[5] Franklin AB, Anderson DR, Gutierrez RJ, Burnham KP (2000) Climate, habitat quality, and fitness in northern spotted owl populations in northwestern California. Ecol Monogr

weather creates uncertainty for the owl. This uncertainty can be mitigated by maintaining a larger population which is more resilient to climatic variations. Under a new climate regime, the average age of forests will likely decline, forest establishment will likely become more difficult; we may not be able to regrow new owl habitat in the reserves as assumed in the NW Forest Plan. Existing old forests are relatively resilient to climate change. It is risky to be conducting regen harvest and expect to be able grow new owl habitat in the reserves under an uncertain climate regime. Global climate change also affects local and regional weather. Spotted owl are known to be sensitive to cold and rain during the nesting season. If inclement weather increases during nesting season, spotted owl nesting success will likely be adversely affected. Dense forests provide owls more protection from inclement weather. "*Given that natural resource managers cannot control climate variation and barred owls are likely to persist and increase in the range of the northern spotted owl, maintaining sufficient high quality habitat on the landscape remains the most important management strategy for the conservation of this subspecies."* http://www.naturaloregon.org/2010/08/03/osu-climate-change-may-be-hurting-the-spotted-owl-in-oregon/;.

Please address the effects of BLM RMP Revisions that weaken the regional reserve network

The success of the entire Northwest Forest Plan is premised on the existence of the network of reserves that span the landscape from BLM to Forest Service lands. BLM has revised its six RMPs in western Oregon to significantly modify and reduce large block reserves, riparian reserves, and mitigations for logging. Increased logging will cause further loss of suitable habitat and will have long-term consequences. It is arbitrary and capricious to allow implementation of a plan premised on the existence of reserves if those reserves are going away.[6] One of the biggest problems with the RMP Revisions relates to reduced protection for

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70:539–590. See also, DISSERTATION OF Elizabeth M. Glenn. 2009. Local Weather, Regional Climate, and Population Dynamics of Northern Spotted Owls in Washington and Oregon. http://ir.library.oregonstate.edu/jspui/bitstream/1957/11326/1/EGlennDisseration2009.pdf. http://www.naturaloregon.org/2010/08/03/osu-climate-change-may-be-hurting-the-spotted-owl-in-oregon/ ("Climate change models predict Oregon and the Pacific Northwest will experience warmer and drier summers, as well as warmer and wetter winters, because of global warming. Lead researcher Betsy Glenn says both of those trends make it harder spotted owls to survive, but in different ways.

* Unusually dry summers reduce the food supply for spotted owls. That's when you're mostly likely to see big declines in the numbers of northern flying squirrels and other small mammals that spotted owls like to eat. Glenn says less food means lower survival rates for adults and owls won't expand into areas when there's not enough to eat.

* If the spring time nesting season is colder and wetter than normal, Glenn says it hurts the survival chances of owl fledglings.")

[6] The BLM Planning Handbook 1601-1 provides, "During the amendment or revision process, the BLM should review all proposed implementation actions through the NEPA process

streams that were intended to benefit spotted owl demography and dispersal. New information now indicates that complex riparian forests are one of the places that spotted owls and barred owls are more tolerant of each other so conservation of these areas is more important than ever. See Wiens, D.J. 2012. Dietary Overlap between Northern Spotted Owls and Barred Owls in Western Oregon, *workshop* What's for Dinner: Spotted Owl Prey 2012 http://ecoshare.info/projects/central-cascade-adaptive-management-partnership/workshops/spotted-owl/; http://ecoshare.info/wp-content/uploads/2012/08/Barred-compared-to-spotted-Owl-diets.ppt. **Implications:** Although the WOPR has been withdrawn by the Secretary of Interior, the timber industry has sued to reinstate the WOPR, and a federal judge has questioned the process used by the Secretary to withdraw the RODs. If there is a chance that NWFP reserves on BLM lands will no longer be protected as part of the interagency reserve strategy, then all remaining suitable habitat must be protected to retain options for the conservation of the Threatened spotted owl, marbled murrelet, and SONC Coho salmon. The spotted owl cumulative effects analysis in the 1994 SEIS is no longer valid and must be reconsidered at the regional scale. No project-level NEPA document can rely on the 1994 effects analysis because the publication of the WOPR NOI, FEIS, and RODs means that elimination of the reserves is a "reasonably foreseeable" action.

Please address new information indicating that spotted owl dispersal habitat should be managed for "at least 80%" canopy cover.

See Stan G. Sovern, Eric D. Forsman, Katie M. Dugger, Margaret Taylor. 2015. Roosting Habitat Use and Selection By Northern Spotted Owls During Natal Dispersal. The Journal of Wildlife Management 79(2):254–262; 2015; DOI: 10.1002/jwmg.834. ("**Roost Site Selection**. In contrast to the assumption that stands with relatively open canopies provide suitable dispersal habitat for spotted owls, our results suggest that dispersing juveniles selected stands for roosting that had relatively high canopy closure (x = 66 ± 2%). … Two hypotheses could explain why dispersing owls selected closed-canopy stands. First, several researchers (Barrows 1981, Forsman et al. 1984, Weathers et al. 2001) have shown that temperature and precipitation appear to influence selection for roost trees and attributes within a roost tree, such as perch height and percent overhead cover. … Second, juvenile northern spotted owls may have selected for closed-canopy forest because their preferred prey were most abundant … **Landscape Scale Selection**. … [O]ur mean estimate of canopy closure from plots at roosts (66%), which was likely an underestimate of canopy cover, was considerably higher than the minimum values recommended by Thomas et al. (1990) [i.e. 50-11-40]. …**Management**

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to determine whether approval of a proposed action would harm resource values so as to limit the choice of reasonable alternative actions relative to the land use plan decisions being reexamined. Even though the current land use plan may allow an action, the BLM manager has the discretion to defer or modify proposed implementation-level

actions and require appropriate conditions of approval, stipulations, relocations, or redesigns to reduce the effect of the action on the values being considered through the amendment or revision process."

Implications. … Based on our study, we recommend that managers should pursue a strategy that exceeds the canopy cover guidelines recommended by Thomas et al. (1990) when managing dispersal habitat for spotted owls. Based on our estimate of mean canopy closure (66%), and our estimate of mean canopy cover from overlaying a dot grid on the same areas (approx. 14% larger), we recommend that the target for canopy cover in stands managed for dispersing spotted owls should be at least 80%.")

The agencies can no longer rely on the 1994 Northwest Forest Plan FSEIS because there is significant new information that could alter the results of the previous analysis. "[A]n agency preparing a SEIS cannot simply rest on the previous EIS or SEIS if there is new information that may alter the environmental analysis. 'The agency must be alert to new information that may alter the results of its original environmental analysis....'" Friends of the Clearwater v. Dombeck, 222 F.3d 552, 557 (9th Cir. 2000). NWEA vs. Mark Rey, W.D. Washington. No. C04-844P. Judge Marsha Pechman, Aug 1, 2005.

The agency must do more than blindly rely on an biological opinion or the 5-year status review. Unless a document has gone through the NEPA process itself, a "non-NEPA document…cannot satisfy a federal agency's obligations under NEPA." South Fork Band Council of Western Shoshone of Nevada v. U.S. Dept. of Interior, 588 F.3d 718, 726 (9th Cir. 2009). Judge King's August 2006 decision in ONRC Action v. US Forest Service makes clear that the agency must carefully consider and explain the potential relevance and significance of new information on the spotted owl within the context of the timber sale under consideration. Merely

> "including documents in the administrative record, without analyzing them in the context of their bearing on the proposed action, does not satisfy the requirement that the agency make a reasoned decision based on its evaluation of the significance or lack of significance of the new information. … Additional documentation or data in the record does not cure the unreasonableness of the Forest Service's Review & Analysis on this issue unless it is incorporated into a careful analysis and explanation"

ONRC Action v. US Forest Service. Civil No. 03-613-KI. US District Court for the District of Oregon. Opinion and Order; August 9, 2006.

In view of heightened concern for the future status of the spotted owl caused by continued habit loss from logging and fires, barred owl competition, West Nile Virus, Sudden Oak Death syndrome, and global climate change, all remaining suitable habitat should be protected. Jerry Franklin's summarized the "findings" of the Northern Spotted Owl Status Review scientific review panel as follows:

> The implications of the scientific findings with regards to conservation strategies.
> ...
> ... in view of current uncertainties, such as the eventual outcome of the Spotted Owl/Barred Owl competition, West Nile Virus, and Sudden Oak Death, and whatever else comes along -- such as global change and other kinds of introductions -- existing suitable habitat could be important to the persistence of the Northern Spotted Owl. [repeated with emphasis] Existing suitable habitat could be important to the persistence of the Northern Spotted Owl, i.e., risk to Northern Spotted Owl may increase if

additional suitable habitat is removed. It is not clear where the Spotted Owl may find the refuge or refuges from new threats within existing suitable habitat. Barred Owl intrusions do not negate the need for structurally complex forest habitat to sustain Northern Spotted Owl based on existing knowledge.

U.S. FISH & WILDLIFE SERVICE SCIENTIFIC REVIEW PANEL FOR THE NORTHERN SPOTTED OWL. June 22, 2004 PUBLIC HEARING. WASHINGTON STATE UNIVERSITY, VANCOUVER CAMPUS. TRANSCRIPT OF PROCEEDINGS, page 121. https://web.archive.org/web/20060927181458/http://www.sei.org/owl/meetings/minutes/minutes062204.pdf.

A recent presentation by the FWS to the Willamette Province Advisory Committee discussed the following "implications" of the 5-year status review:

"Does the new information trigger reinitiation?"

"What are the management implications to NWFP and agency projects?"

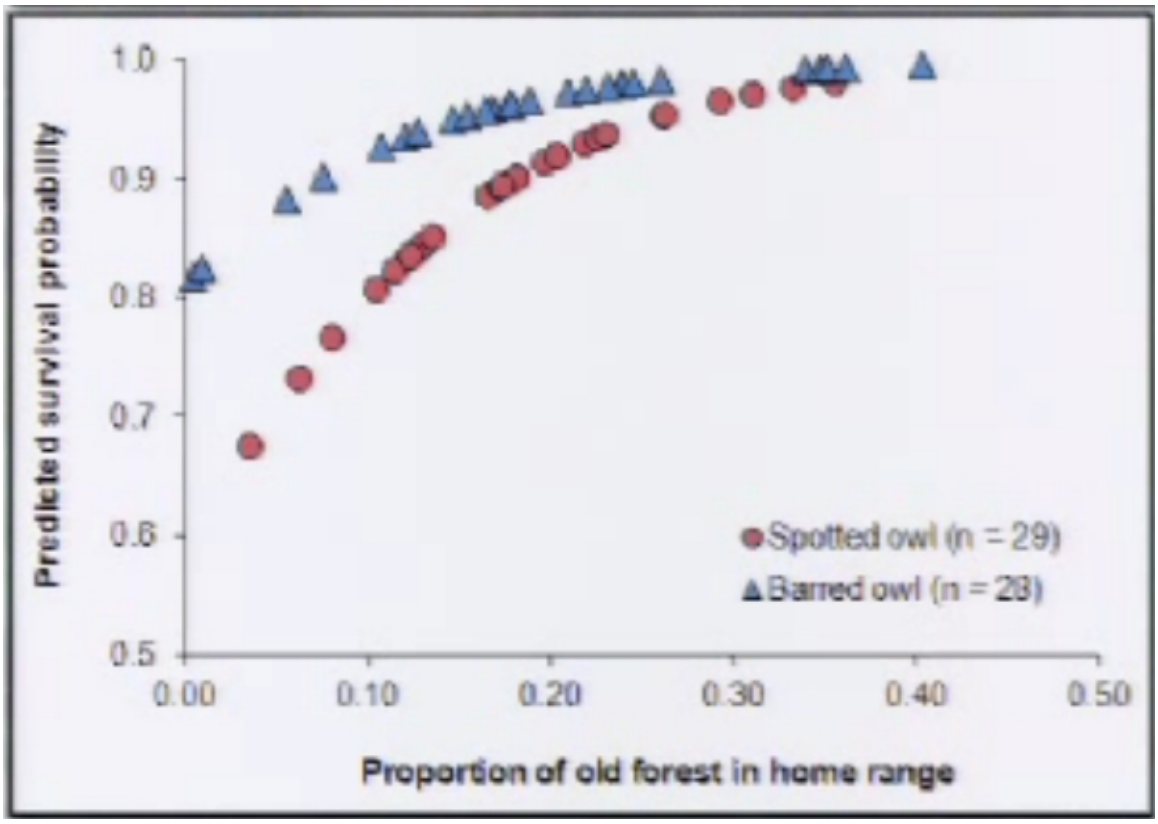
"Protect more habitat … that produces benefits?"

"Do OR and CA populations become more important … protect them more?"

"Re-evaluate conservation needs?"

Jim Thrailkill FWS Presentation to the Willamette PAC. December 9, 2004. An EIS is needed to determine whether the effects of further logging of mature and old-growth forests may be significant.

A recent telemetry study showed that in fragmented landscapes barred owls have a survival advantage relative to spotted owls, but that survival advantage diminishes in landscapes with a higher proportion of older forest. In other words, conservation of mature & old-growth forest should be favored because spotted owls are able to compete nearly equally with barred owls in landscapes with a high proportion of old forest.



See Wiens, D. 2012. Presentation to The Wildlife Society. http://tws.sclivelearningcenter.com/index.aspx?PID=6893&SID=163551 (at 1:12).

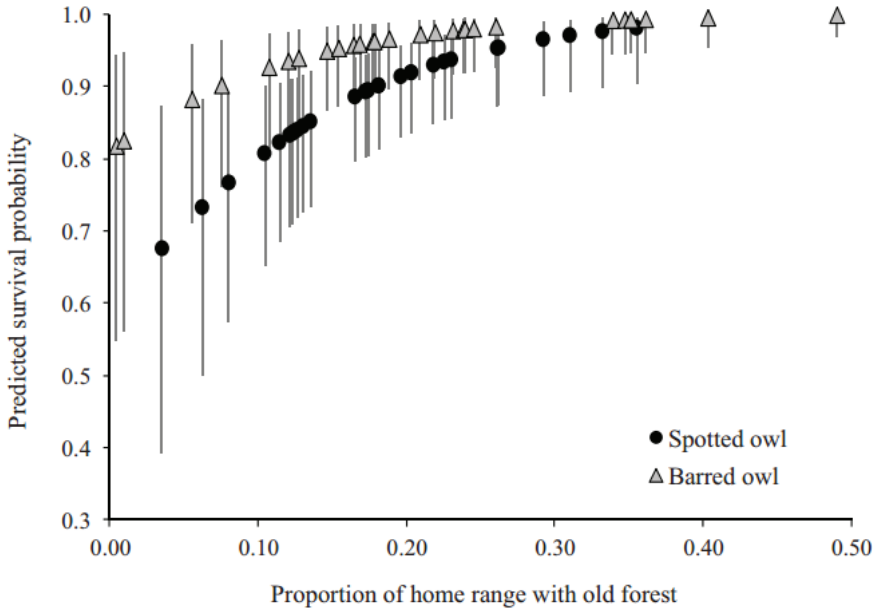


Figure 13. Predicted relationship between mean proportion of old conifer forest within the home range and seasonal (6-month) survival probabilities of radio-marked northern spotted owls ($n = 29$) and barred owls ($n = 28$) in western Oregon, USA, 2007–2009. We calculated point estimates with 95% confidence intervals at observed mean values for each individual under the best-supported model of survival, which included the additive effects of species and proportion of old conifer forest within the home range.

Wiens, J.D., Anthony, R.G., and E.D. Forsman. 2014: Competitive Interactions and Resource Partitioning Between Northern Spotted Owls and Barred Owls in Western Oregon. Wildlife Monographs 185:1–50; 2014; DOI: 10.1002/wmon.1009. https://ir.library.oregonstate.edu/xmlui/bitstream/handle/1957/48214/AnthonyRobertFisheriesWildlifeCompetitiveInteractions.pdf

David Wiens has conducted the most thorough research on the influence of barred owls on spotted owls and concluded -

Conservation Implications

- Results emphasize the importance of old conifer forest and moist streamside habitats to resource partitioning.
- Additional loss of older forest can further constrain both species to a common set of limiting resources, thereby increasing competitive pressure

Wiens, D.J. 2012. Dietary Overlap between Northern Spotted Owls and Barred Owls in Western Oregon, *workshop* What's for Dinner: Spotted Owl Prey 2012 http://ecoshare.info/projects/central-cascade-adaptive-management-partnership/workshops/spotted-owl/; http://ecoshare.info/wp-content/uploads/2012/08/Barred-compared-to-spotted-Owl-diets.ppt

The final Recovery Plan for the Northern Spotted Owl has partially addressed the barred owl issue by adopting Recovery Action 32 which urges the FS and BLM to "Maintain substantially all of the older and more structurally complex multi-layered conifer forests on Federal lands outside of MOCAs…" based on the idea that "protecting these forests will not further exacerbate competitive interactions between spotted owls and barred owls as would occur if the amount of shared resources were decreased." (FRP p 34). The revised critical habitat for the northern spotted owl was also expanded to "… increase the likelihood that spotted owls would be able to persist in areas where barred owls are also present. … [A]dditional critical habitat may allow for coexistence of the two species, potentially reducing competition (Dugger et al. 2011; Forsman et al. 2011)." FWS 2012. CHU draft EA, p 53, 62. http://www.fws.gov/oregonfwo/Species/Data/NorthernSpottedOwl/Documents/CH_DRAFTEnvAssmnt_6.1.12.pdf. In considering this recommendation the agencies must prepare NEPA analysis which considers the full potential of suitable habitat quantity and quality and its mediating influence on the interactions between spotted owls and barred owls. Maintaining a subset of suitable habitat as recommended by the recovery plan is one option, but the agencies must consider the full benefits of protecting all suitable habitat, not just a subset, and providing additional mitigation in matrix areas such as managing the matrix to enhance habitat for owl prey species. The recovery plan is not a NEPA document and FWS was not required to consider all reasonable alternatives. Action agencies like the FS and BLM on the other hand are required to fully consider alternatives. It would be wise to do so at a range-wide level, but until that is done, the agencies should not adversely modify any suitable habitat. Protection of additional suitable habitat in order to reduce competitive interactions between the two owls is now a recognized tool in the toolbox and represents significant new information about *any* proposal to modify suitable habitat regardless of how far the planning process may have proceeded.

A 2010 Draft report "Population Demography of Northern Spotted Owls" corroborates the need to protect more than just the highest quality spotted owl habitat as contemplated in the draft Recovery Action 32.

> We also found a negative relationship between recruitment rates and the presence of Barred Owls and a positive relationship between recruitment and the amount of suitable owl habitat in the study areas. Recruitment was higher on federal lands where the amount of suitable owl habitat was generally highest. [p 96] …
>
> While our observational results do not demonstrate cause-effect relationships, they provide support for the hypothesis that the invasion of the range of the Spotted Owl by Barred Owls is at least partly the cause for the continued decline of Spotted Owls on federal lands. Our results also suggest that Barred Owl encroachment into western forests may make it difficult to insure the continued persistence of Northern Spotted Owls (see also Olson et al. 2004). The fact that Barred Owls are increasing and becoming an escalating threat to the persistence of Spotted Owls does not diminish the importance of habitat conservation for Spotted Owls and their prey. In fact, the existence of a new and potential competitor like the Barred Owl makes the protection of habitat even more important, since any loss of habitat will likely

increase competitive pressure and result in further reductions in Spotted Owl populations (Horn and MacArthur 1972, Olson et al. 2004, Carrete et al. 2005). [pp 97-98] …

Our results and those of others referenced above consistently identify loss of habitat and Barred Owls as important stressors on populations of Northern spotted Owls. In view of the continued decline of Spotted Owls in most study areas, it would be wise to **preserve as much high quality habitat in late-successional forests for Spotted Owls as possible**, distributed over as large an area as possible. This recommendation is comparable to one of the recovery goals in the final recovery plan for the Northern Spotted Owl (USDI Fish and Wildlife Service 2008), but **we believe that a more inclusive definition of high quality habitat is needed** than the rather vague definition provided in the 2008 recovery plan. Much of the habitat occupied by Northern Spotted Owls and their prey does not fit the classical definition of "old-growth" as defined by Franklin and Spies (1991), and a narrow definition of habitat based on the Franklin and Spies criteria would exclude many areas currently occupied by Northern Spotted Owls. [p 99]...

Eric D. Forsman, Robert G. Anthony, Katie M. Dugger, Elizabeth M. Glenn, Alan B. Franklin, Gary C. White, Carl J. Schwarz, Kenneth P. Burnham, David R. Anderson, James D. Nichols, James E. Hines, Joseph B. Lint, Raymond J. Davis, Steven H. Ackers, Lawrence S. Andrews, Brian L. Biswell, Peter C. Carlson, Lowell V. Diller, Scott A.Gremel, Dale R. Herter, J. Mark Higley, Robert B. Horn, Janice A. Reid, Jeremy Rockweit, Jim Schaberl, Thomas J. Snetsinger, and Stan G. Sovern. "Population Demography of Northern Spotted Owls." DRAFT COPY 17 December 2010. This draft manuscript is in press at the University of California Press with a projected publication date of July 2011. It will be No. 40 in Studies In Avian Biology, which is published by the Cooper Ornithological Society. http://www.reo.gov/monitoring/reports/nso/FORSMANetal_draft_17_Dec_2010.pdf.

A well-known axiom of the species-area relationship from island biogeography holds that as habitat area increases, the number of cohabiting species also increases. See especially, Part III - Competition in a Spatial World *in* Tilman, D. and P. Karieva, Eds. 1997. Spatial Ecology: The Role of Space in Population Dynamics and Interspecific Interactions. Monographs in Population Biology, Princeton University Press. 368 pp.

"The major causes of population and species extinction worldwide are habitat loss and interactions among species. … The most robust generalization that we can make about population extinction is that small populations face a particularly high risk of extinction. … [E]mpirical support for the extinction-proneness of small populations has been found practically wherever this issue has been examined. … The loss of habitat reduced population size …. Larger habitat patches have larger expected population sizes than smaller patches. Therefore, other things being equal, we could expect large habitat patches to have populations with a lower risk of extinction than populations in small patches. … More generally, the relationship between patch size and extinction risk provides a key rule of thumb for conservation: other things being equal it is better to conserve a large than a small patch of habitat or to preserve as much of a particular patch as possible. … [T]here are likely to be many complementary reasons why large patches have populations with low risk of extinction. "

Oscar E. Gaggiotti and Ilkka Hanski. 2004. Chapter 14 - Mechanisms of Population Extinction. *In* Ecology, Genetics, and Evolution of Metapopulations. Elsevier. 2004. http://web.archive.org/web/20070612211945/http://www.eeb.cornell.edu/sdv2/Readings/Gaggiotti&Hanski.pdf

The effects of habitat availability on competing species was explored by expert wildlife population modelers who found —

> The territorial occupancy model developed by Lande (1987), extended here to include two competing species, represents a useful tool for evaluating how equilibrium breeding numbers could be affected by changes in habitat availability, demographic parameters, dispersal behavior and interspecific competition … Its application shows that **increases in the exclusive suitable habitat of each species is the best option to maintain viable populations of territorial competitors** in a same area, given that it reduces competition for territories. Increases in habitat overlap by reducing the exclusive habitat available for one species strongly affected the outcome of competition, resulting in extinction of the species for which exclusive habitat had been eliminated.

Martina Carrete, Jose´ A. Sa´nchez-Zapata, Jose´ F. Calvo and Russell Lande. Demography and habitat availability in territorial occupancy of two competing species. OIKOS 108: 125-136, 2005 http://www.ebd.csic.es/carnivoros/personal/carrete/martina/recursos/13.%20carrete%20et%20al%20%282005%29%20oikos%20108-125.pdf.

From these ecological foundations, one can see that the barred owl, by invading, occupying suitable habitat and excluding spotted owls, has reduced the effective size of the reserves that were established in 1994, and thereby reduces the potential population of spotted owls. Extinction risk is increased by this loss of habitat and smaller population. If we provide more suitable habitat, the population potential increases, and the risk of extinction decreases. The most rational way to respond is to protect remaining suitable habitat, expand and restore the reserve system to provide more suitable habitat to increase the likelihood that the two owl species can co-exist.[7]

This view is corroborated by owl biologist David Wiens who was interviewed on the Lehrer NewsHour. He said: "The more habitat you protect, the more you're going to alleviate the competitive pressure between the species. Rather than reducing it and increasing the competitive pressure between these two species, we need to provide as much habitat as possible for them." DAVID WIENS. NewsHour interview. "Biologists Struggle to Save the Spotted Owl." December 18, 2007. http://www.pbs.org/newshour/bb/science/july-dec07/owl_12-18.html. Robert Anthony agrees, "If you start cutting habitat for either bird, you just increase

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[7] Put another way, when threatened with extinction, "the best defense is a strong offense" that is, species are more likely to persist if they have a large, well-distributed population size and if we minimize all manageable threats. Dunham, Jason. 2008. Bull trout habitat requirements and factors most at risk from climate change. http://www.fs.fed.us/rm/boise/AWAE/projects/bull_trout/bt_Dunham.html

competitive pressure." Welch, Craig. 2009. The Spotted Owl's New Nemesis. Smithsonian Magazine. January 2009. http://www.smithsonianmag.com/science-nature/The-Spotted-Owls-New-Nemesis.html?c=y&page=2 And in the same article Eric Forsman added "You could shoot barred owls until you're blue in the face," he said. "But unless you're willing to do it forever, it's just not going to work."

The book "Signs of Life: How Complexity Pervades Biology" by Sole and Goodwin has an interesting discussion that immediately brings to mind the barred owl/spotted owl issue. Chapter 7 of the book describes work being done by a Japanese researcher named Kaneko who developed and explored a modeling concept called "coupled map lattices." The lesson from these models is that when habitat is abundant, competing species operate within the "coexistence regime" but when habitat becomes scarce the model switches to a new attractor and operates in the "exclusion regime." This model strongly supports the idea that retaining more habitat increases the likelihood that spotted and barred owls can coexist, and if we eliminate reserves or continue to log suitable habitat in the matrix, then barred owl may competitively exclude and extirpate the spotted owls. Similar results are demonstrated in resource competition models described by Tilman, Lehman, and Thompson. 1997. Plant diversity and ecosystem productivity: theoretical considerations. Proceedings of the National Academy of Sciences. 94:1857-1861. http://www.cedarcreek.umn.edu/biblio/fulltext/t1694.pdf. See also, Tilman, D. and P. Karieva, Eds. 1997. Spatial Ecology: The Role of Space in Population Dynamics and Interspecific Interactions. Monographs in Population Biology, Princeton University Press. 368 pp. and Valenti D., Fiasconaro A., Spagnolo B. Pattern formation and spatial correlation induced by the noise in two competing species http://arxiv.org/PS_cache/cond-mat/pdf/0401/0401424v1.pdf.

Red Tree Vole Surveys

Please take a hard look at habitat and presence of red tree voles. Surveys should be conducted to a standard that provides good information for the NEPA analysis— not merely the minimum general requirements from the Forest Plan. Older forest habitat with voles should be a priority for conservation.

Logging in Riparian Reserves

If logging is proposed in riparian reserves, then this would be a significant effect that requires a hard look under NEPA.

There are significant benefits to ACS Objectives from abundant dead wood throughout the riparian reserves, not just instream. The FS must not terminate its analysis of effects in riparian reserves at the stream edge. See Heiken, D. 2013. Riparian Reserves Provide Both Aquatic & Terrestrial Benefits - A Critical Review of Reeves, Pickard & Johnson (2013). https://www.dropbox.com/s/yc13jrg0ya93yht/Heiken%202013.%20Review%20of%20Reeves%20et%20al%20Riparian%20Proposal.pdf?dl=0

Riparian reserves are intended to protect numerous species that do not live *in* the stream, rather, they live in the stream-side forest extending hundreds of feet from the stream, but they still require a relatively cool-moist microclimate, complex forest structure, and abundant wood, and these species will be adversely affected by logging adjacent to narrower riparian reserves. This is

part of the reason the NWFP adopted a *buffer-on-the-buffer*, that is, an outer buffer of shade and cover to maintain suitable microclimate conditions for wildlife that live in the inner buffer. The EIS supporting the NWFP states:

> Riparian areas are widely considered to be important wildlife habitat. Cool air temperatures due to the presence of cool and turbulent surface waters, typically dense vegetative canopy cover, and their location in the lowest portions of watersheds combine to maintain a distinct microclimate along stream channels and in the adjacent riparian area. Maintaining the integrity of the vegetation in these areas is particularly important for riparian-dependent species of amphibians, arthropods, mammals, birds, and bats. Many species of amphibians, birds, and mammals use late-successional and old-growth riparian areas, including associated streams, ponds and wetlands, for reproducing, foraging, roosting, and as travel corridors (Table 3&4-11). The many wildlife species, along with lichens, mosses, vascular plants and mollusks, listed in Table 3&4-11 depend on diverse and complex riparian and aquatic habitats.
>
> …
>
> The principal factor influencing the outcomes for amphibians related to the width of Riparian Reserves.[1994 FSEIS pp 3&4 - 61, 3&4 - 81]

A key issue is whether narrow buffers are adequate to protect wildlife, such as amphibians, that may be associated with streams, but also venture away from the water. The NWFP adopted wider buffers in part because many amphibians live up to 900 feet from water. The 1993 SAT Report explained:

> The abundance of amphibians in Pacific Northwest forest and riparian zones is influenced by habitat conditions in riparian areas (Bury et al. 1991, Gomez 1992). Amphibians populations are generally found less than 900 feet from water sources (Nussbaum et al. 1983). Gomez (1992) found that rough-skinned newts, tailed frogs, and western redbacked salamanders were the most abundant species of herptafauna in upland and riparian areas along the Oregon Coast Range. These organisms were found up to 600 feet from streams but were most abundant within 300 feet. Many species have specific tolerance thresholds (e.g., temperature and moisture) microhabitat requirements (e.g., headwater seeps or talus slopes). Many also require downed wood, but may differ in types of wood (e.g., snag, bark on a log, or bark on the ground) or particular decay class of wood (refer to Chapter 5 more specific requirements of specific species). Alteration of microhabitat climate may influence the suitability of riparian conditions for riparian-dependent organisms.[1993 SAT Report, Chapter 5, p 461]

Narrow buffers that maintain microclimate at the stream center are unlikely to protect temperature-sensitive species that live hundreds of feet from streams.

Many riparian species rely on unimpeded successional processes that accumulate abundant dead wood *near* streams, but not necessarily *in* streams. Logging within and adjacent to riparian reserves will capture mortality, truncate wood recruitment processes, and deprive wildlife of the abundant dead wood they need. Likewise, reducing stream buffers and allowing clearcut edges directly abutting inner riparian buffers will eliminate one source of down wood that would otherwise fall into the buffer. Protecting an outer *buffer-on-the-buffer* helps maintain natural levels of wood recruitment at least within the inner buffer, though the outer buffer itself would still suffer from depleted dead wood levels due to edge effects.

The NWFP explicitly recognized the problem of reduced wood recruitment in narrow riparian buffers adjacent to logged sites. The 1993 FEMAT Report, an appendix to the EIS supporting the NWFP explained:

> Large wood on the ground is an important habitat component in riparian areas. Maintaining the integrity of the vegetation is particularly important for riparian-dependent organisms including amphibians, arthropods, mammals, birds, and bats (see appendix V-E for greater detail).
>
> …
>
> **Riparian Processes as a Function of Distance from Stream Channels**
>
> …
>
> **Large wood delivery to riparian areas**. Large downed logs are recruited into riparian areas from the riparian forests and from upslope forests. Similar to large wood delivery from riparian areas into streams, the effectiveness of upland forests to deliver large wood to the riparian area is naturally expected to decline at distances greater than approximately one tree height from the stand edge (Thomas et al.., 1993). Timber harvest adjacent to the riparian area creates an edge that eliminates one source of large wood. Thus, long-term levels of large wood may diminish in the riparian zone.[1993 FEMAT Report, pp V-25 - V-26]

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.

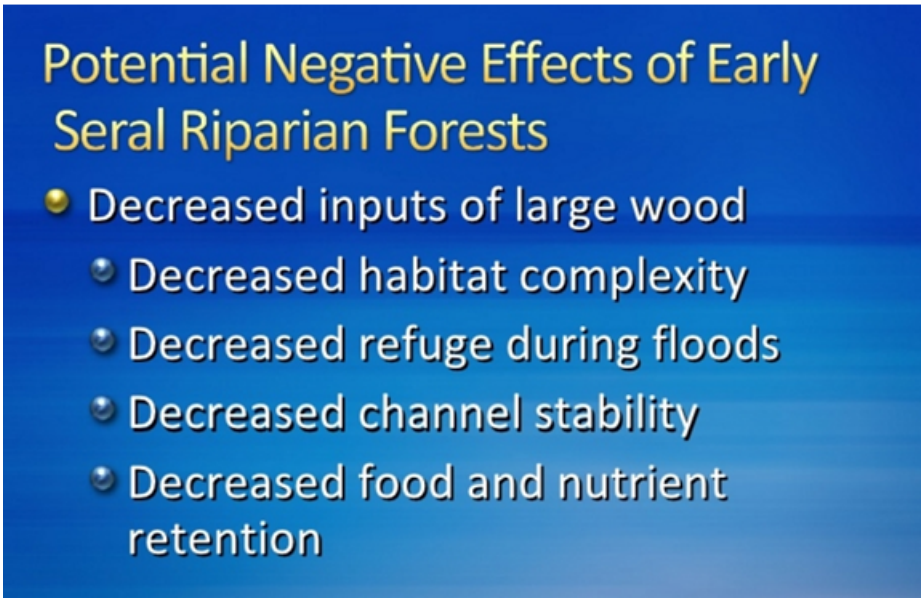
If the agency intends to log in riparian reserves to increase some nebulous goal like "vegetation diversity and complexity," then please explain why the biophysical indicators for the ACS objectives (set forth below) do not include any mention of vegetation diversity or complexity. See the Jazz Thinning Preliminary Analysis, 2011. http://bark-out.org/sites/default/files/bark-docs/Jazz_PA_0.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. BLM admits "The 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

Stan Gregory notes the following trade-offs associated with logging riparian reserves to enhance early seral vegetation:



Gregory, Stan 2010. What About Riparian Systems: Who Benefits From an Early Seral Forest Condition. Workshop - Early Seral Forest - We know we need it -- How do we get it? Presentation sponsored by the Central Cascades Adaptive Management Partnership and NW Oregon Ecology Group http://ecoshare.info/2010/07/06/what-about-riparian-systems-who-benefits-from-an-early-seral-forest-condition-gregory/

The Northwest Forest Plan Aquatic Conservation Strategy Objectives (1994 ROD p B-11) enumerates specific purposes for "Maintain[ing] and restor[ing] the species composition and structural diversity of plant communities in riparian areas and wetlands" that is -

> "to provide adequate summer and winter thermal regulation, nutrient filtering, appropriate rates of surface erosion, bank erosion, and channel migration and to supply amounts and distributions of coarse woody debris sufficient to sustain physical complexity and stability."

All these values are provided as well or better by unthinned riparian stands.

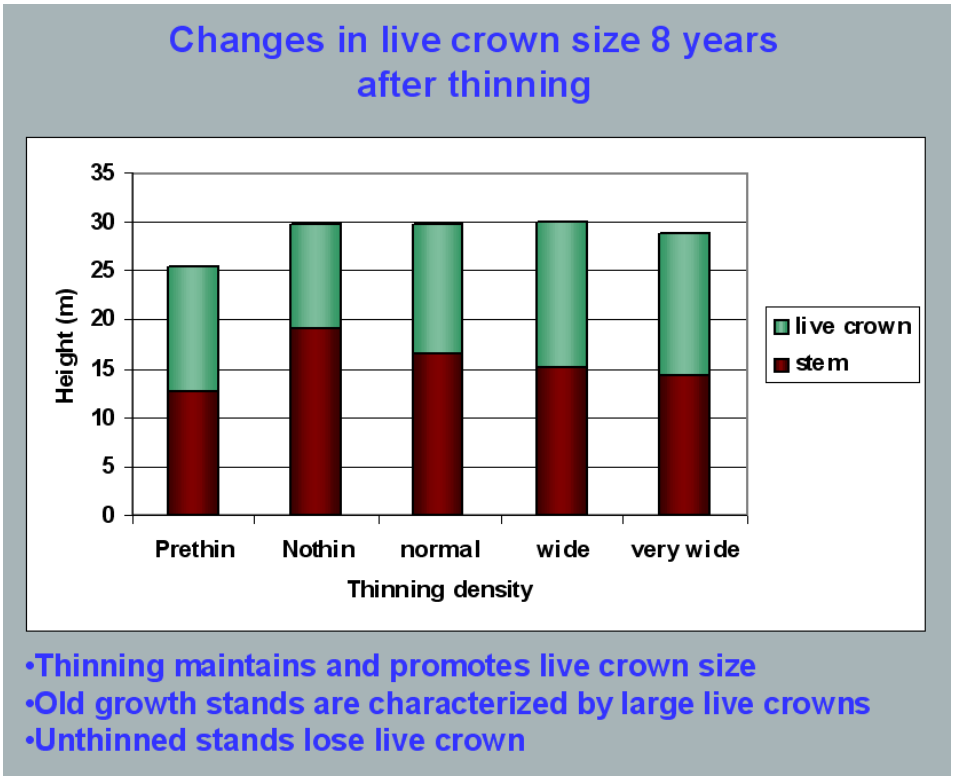
The effects of logging on dead wood are significant and long term, adversely affecting a core function of the reserves, while the purported benefits to vegetation diversity are minor and transitory, and affect secondary purposes of the reserves.

> **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 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."

It is also worth noting that where understories are well-stocked, midstory development can be enhanced by focusing on treating the understory itself rather than killing canopy trees.

> [R]esults show that individual understory trees can be selectively favored for increased growth into the midstory by being released from competing saplings in the understory cohort. …Our results suggest that understory release treatments can be used to target individual saplings for increased growth, thereby recruiting a shade tolerant midstory cohort and accelerating the development of vertical foliar connectivity and a multi-layered stand structure. Abundance of non-coniferous understory vegetation is also augmented by this treatment. … [Note] The extent to which released understory trees collectively form a cohesive midstory canopy stratum is dependent on the density and horizontal arrangement of those released individuals. … . Inducing spatial variability within the midstory tree cohort would emulate the finescale disturbances of natural stands that create gaps and patches.

Taylor, Andrew 2016. : Understory Vegetation Dynamics and Midstory Development Following Understory Release Treatments in Northwest Oregon Thinned Douglas-fir Stands. OSU MS Professional Paper.

Anderson (2007) looked at the effects of thinning in young Douglas fir forests and found -

> [T]hinning treatments … had little impact on the abundance, size, or diversity of understory vegetation. Disturbance resulted in short-term decreases in understory vegetation cover, particularly tall shrubs. However, within five years of treatment, understory vegetation abundance returned to approximate pretreatment condition. … The general lack of understory vegetation response to the thinning treatments was likely due to the inherent resistance and resilience of the plant communities to disturbance, as well as the low intensity of disturbance attributable to the treatments.

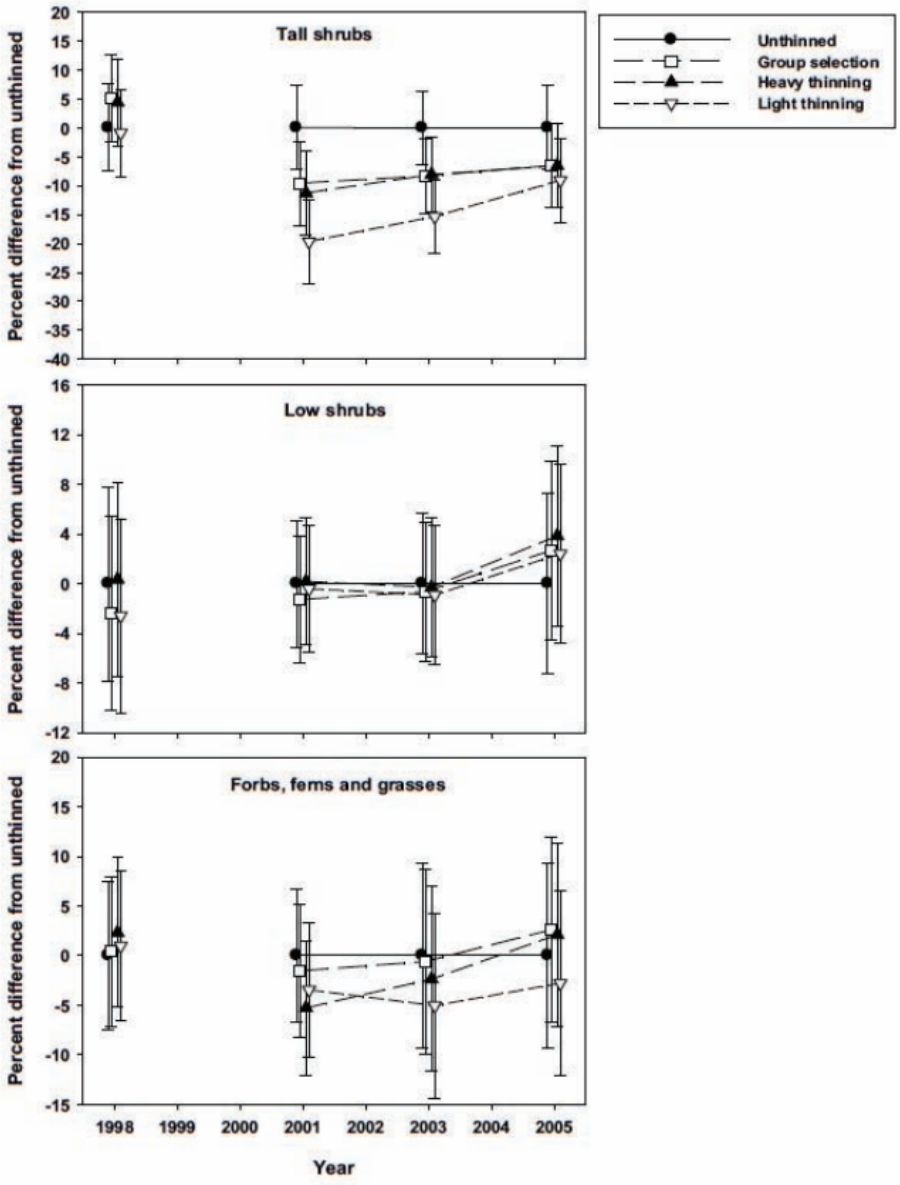


Figure 2 — Cover of tall shrubs, low shrubs, and forbs, ferns and grass vegetation strata by treatment expressed as a difference from the unthinned treatment. Error bars represent one standard error about the mean of n=four replications.

> [Four years after thinning] tall shrub cover that was approximately four to nine percent less than the unthinned treatment … [C]over by low shrub species was unchanged by the harvest activity … Forbs, ferns, and grasses [experienced] little difference in cover between thinned and unthinned stands. … [F]ollowing treatment, the mean number of species declined somewhat, [then] return[ed] to pretreatment levels… [T]he evenness component of diversity did not differ among treatments or vary over time …. [T]here was little evidence of substantial alterations of understory shrub and herbaceous vegetation. This lack of strong understory vegetation response in terms of composition, abundance, or size is consistent with several studies of thinning in Douglas-fir. In a recent review of seven operational-scale silviculture experiments, Wilson and Puettmann (2007) report that percent cover by shrubs and percent cover by herbs, one to seven years following thinning showed little difference across a wide range of residual basal area.

Paul D. Anderson 2007. Understory Vegetation Responses to Initial Thinning of Douglas-fir Plantations Undergoing Conversion to Uneven-Age Management. Proceedings of the 2007 National Silviculture Workshop. http://www.fs.fed.us/pnw/publications/gtr733/PNW_GTR_733_4.pdf This paper was published in: Deal, R.L., tech. ed. 2008. Integrated restoration of forested ecosystems to achieve multi-resource benefits: proceedings of the 2007 national silviculture workshop. Gen. Tech. Rep. PNW-GTR-733. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. 306 p.

> [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 (Forsman et al., 1984; Carey, 1995; North et 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; Beechie et 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

Don't make the mistake of assuming that thinning is always consistent with the ACS because it helps grow large trees faster. First, thinning captures mortality and actually delays recruitment of large wood. Second, the agencies often misinterpret the Northwest Forest Plan ROD by confusing accelerated attainment of ACS objectives with ACS compliance. The NWFP ROD actually says that silviculture in riparian reserves is generally prohibited, and allowed only "if needed to attain" ACS objectives, not (as implied by the EA) if needed to "accelerate" ACS objectives. This is a common "group-think" misinterpretation of the ACS. The appropriate evaluation is to ask "will ACS objectives eventually be met without intervention?" If the answer is "yes," then silviculture is technically not allowed. Confusion may stem from the fact that the ACS also has a "do not retard" standard, but this is separate from the "if needed" test, and is itself a criteria to limit active management, not an excuse to reject the no action alternative. The "do not retard" standard cannot be interpreted to require active management whenever and wherever it would accelerate attainment of ACS objectives. That would lead to all kinds of problems, such as cumulative impacts, unintended consequences, and sacrificing some aquatic objectives in the pursuit of others. Oregon Wild is not absolutely opposed to treatment of riparian reserves but we want to avoid the slippery slope of just assuming "it's all good" without careful analysis and justification.

Under the NWFP: "The risk has been shifted under the Aquatic Conservation Strategy because each project must meet the maintenance and restoration criteria by maintaining or restoring the physical and biological processes required by riparian-dependent resources within a watershed." 1994 FSEIS p 3&4 – 69. Clearly, this requires the FS to show there is a need for intervention.

The NEPA analysis must reflect accurate scientific analysis such as that presented by the NMFS:

> A strategy of thinning to accelerate the development of a few healthy, large-diameter trees does not translate into more large wood in streams. … Overall, an unthinned stand will produce a higher number of both live and dead trees across a range of diameter classes and will produce far more dead wood over a much longer time frame relative to a heavily thinned stand. … The tradeoff of getting a few more large standing live trees sooner at the expense of a continuous supply of both large and small trees over the long term period always needs to be considered.
>
> …
>
> Numerous studies suggest that all organic matter, including the various sizes of wood, has functional value in streams (and riparian areas), and that these functions vary with size (Bilby and Likens 1980, Beechie and Sibley 1997, Gurnell et al. 2002). Of particular

note is that large wood that cannot singly form pools will form pools in combination with other pieces of wood and other obstructions by forming "wood jams." Wood jams are common feature of natural streams of all sizes, and contain a distribution of wood sizes that, in concert, can form a semipermeable structure that can retain sediment (such as that used for spawning), nutrients and organic material, as well as form pools upstream and downstream of the obstruction (Bilby and Likens 1980, Bilby 1981, Bilby and Ward 1991).

…

Reid and Hilton (1998) found that 30% of the trees falling into streams were triggered by trees falling from farther upslope. More research on this subject is needed, but it speaks to the indirect importance of trees in the outer portion of the riparian zone for wood delivery to streams.

…

Managing for large instream wood also results in the creation of large riparian wood and large snags, both of which are beneficial to numerous species other than salmonids, such as cavity nesting birds and certain amphibians.

…

[NMFS's Northwest Fisheries Science Center's quantitative analysis of the East Alsea Landscape Management Project, Pollock, M.M.] (Appendix 1) suggests that typical riparian thinning regimes will result in a mature forest with fewer large diameter trees, fewer large diameter snags, and fewer large diameter pieces of wood on the riparian forest floor and in streams, relative to natural conditions. This largely stems from excessive thinning. In regards to stream habitat, many of the negative impacts created by the existing riparian thinning proposals could be largely avoided with wider no-thin buffers (e.g., see Appendix 1) and removing far fewer trees during thinning operations.

…

The exclusive use of the 24-inch/50-ft wood indicator by the USFS and BLM does not satisfy the requirement in 50 CFR 402.14 that both the action agency and NMFS use the best available scientific and commercial data, or (2) the requirement in 50 CFR 402.02 that the action agencies and NMFS analyze all effects of the proposed action … which would mean consideration of a broader range of sizes of wood.

…

Recommendations

- The USFS and BLM should include all sizes of wood in describing environmental baseline conditions and in analyzing the effects of its proposed actions, not just pieces of wood that are greater than 24 inches in diameter and greater than 50 ft in length.
- The USFS and BLM should adjust their tree diameter targets based on stream size. Databased curves are available for both functional-sized and key pieces of wood (e.g., Fox and Bolton 2007).

- The USFS and BLM should leave more thinned trees on the ground in riparian areas, particularly close to streams, on floodplains, and on steep sideslopes where some trees are likely to slide down into streams, than are required to meet wildlife needs.
- In order to better portray environmental baseline conditions and to understand the likely effects of thinning proposals, the USFS and BLM should develop stand data separately for riparian and upland forests.
- In order to insure adequate recruitment of conifer wood to streams, the USFS and BLM should measure riparian buffers from the outer edge of streamside hardwood forests, where present.
- The USFS and BLM should work with NMFS to develop reliable methods of wood recruitment modeling and procedures that could be used routinely in ESA section 7 consultations to promote decisions based on data instead of concepts and generalizations from the scientific literature.

…

Kratz, K.W. 2010. Response to April 1, 2010, Request by the Interagency Coordinating Subgroup for Position Paper to Support the February 23, 2010 Elevation of Two Northwest Forest Plan Issues to the Regional Executives. NOAA/NMFS July 23, 2010.

From Appendix 1 of the NMFS Memo quoted above:

> Thinning did accelerate the development of large diameter trees by about 20 years relative to the unthinned stand, but this benefit was short-lived because the higher number of trees in the unthinned stand allowed it to produce far more large diameter live and dead trees in the long run. A century after thinning, a 60 foot no cut buffer between a stream and the thinned forest provided 56% of the stream wood relative to an unthinned stand, while a 150 foot no cut buffer provided 91% of the stream wood relative to an unthinned stand. Our results suggest that the thinning regimes proposed by the Siuslaw National Forest will delay the development of key structural elements of forest and stream habitat by more than a century. The delay in stream habitat recovery can be minimized by creating a no cut buffer of 150 feet or more in width between streams and any forest thinning operations. Some of the delay in forest structure development caused by thinning might also be reduced by removing far fewer trees.
>
> …
>
> [Analysis based on a 37 year old Douglas-fir stand thinned to 55 TPA]
>
> **MORTALITY TREES** — … Trees in the thinned stand increased diameter rapidly, and in 20 years following thinning, had a greater number of > 18" diameter trees relative to the unthinned stand. However, from 30-100 years after thinning, the unthinned stand had more > 18" dbh trees, and by year 135 had over 5 [dead]TPA, compared to just 0.6 [dead]TPA in the thinned stand. Neither stand produced many trees > 24" dbh by year

135. The thinned stand produced slightly more > 24" [dead]TPA for each decade following thinning through year 115 (e.g. 0.5 v. 0.4 > 24" [dead]TPA at year 115), but by year 135 the unthinned stand was producing more large trees (0.7 v. 0.5 > 24" [dead]TPA). Further, at year 135, the trend of the > 24" dbh [dead]TPA in the unthinned stand was increasing, while in the thinned stand the > 24" dbh class had leveled off, suggesting that beyond year 135 the unthinned stand would continue to produce a greater number of large dead trees. … Comparison of the thinned and unthinned mortality curves graphically illustrates that thinning greatly reduced riparian tree mortality and thus reduces the potential for snags, forest wood and instream wood. It is noteworthy that the proposed thinning reduces tree mortality during the period of stand development when tree mortality and thus snag and wood loading, is at its' highest. For example, for an unthinned stand at age 135, about 50 years past peak mortality, will still be producing about 10 trees per acre per decade. In contrast, a thinned stand will have about 0.5 [dead]TPA for the same time period. … The 30 foot no cut buffer, which approximates what the Siuslaw National Forest proposed …, would provide less than 30% of the in stream wood relative to a 250 foot no cut buffer at year 135.

…

[T]he vast majority of stands likely grew at densities higher than 55 TPA, and there is no evidence that such low density conifer stands were found in riparian environments. For example, Poage and Tappeiner (2002) estimated growth rates from the stumps of 505 large diameter Douglas-fir on upland sites and concluded that at age 50, about 75% of them were growing at tree densities higher than 53 TPA Since riparian forests generally are more productive and have higher tree densities than upland forests (Pollock et al., in review), we expect that the occurrence of young, low density riparian stands would be even less than in upland environments.

…

Even if the uncut buffer is 150 feet wide and the thinning is confined to the outer 100 feet of the Riparian Reserve, a century after thinning, the recovery rate of instream wood will still be lowered by about 10%. This is a significant decrease for a program that is ostensibly designed to improve riparian function. We conclude that the thinning of riparian forests to the degree contemplated in the Siuslaw National Forest will delay creation of late successional forest structure by more than a century. … Thinning treatments may exist which will accelerate the

development of late successional forest structure in Riparian Reserves and that are consistent with the goals of the Northwest Forest Plan Aquatic Conservation Strategy, but they most assuredly will involve the removal of far fewer trees. … Future research should more comprehensively assess the conditions under which thinning accelerates or retards the development of key structural attributes of riparian forests.

Michael M. Pollock and co-authors to be determined. [*in review 2010*] Effects of Riparian Thinning on Development of Late-Successional Forest Structure in the Alsea Watershed, Oregon, USA. NOAA Fisheries, Northwest Fisheries Science Center, Seattle, Washington.

Consider extending the riparian buffers across ridgetops in order to provide interbasin connectivity for amphibians and other species. Science Findings, Issue 120 (February 2010) Linked in: Connecting riparian areas to support forest biodiversity, based on science by Kelly Burnett and Deanna Olson. http://www.fs.fed.us/pnw/sciencef/scifi120.pdf.

Recommendations related to thinning in riparian reserves must be reconsidered in light of new information showing that logging does NOT increase the recruitment of functional wood, and the minor increase in very large live trees comes at great cost in terms of a significant reduction in recruitment of functional wood in medium and large size classes (smaller than "very large.")

> [T]here are long-term habitat tradeoffs associated with different thinning intensities. Species that utilize large diameter live trees will benefit most from heavy thinning, whereas species that utilize large diameter deadwood will benefit most from light or no thinning. Because far more vertebrate species utilize large deadwood rather than large live trees, allowing riparian forests to naturally develop may result in the most rapid and sustained development of structural features important to most terrestrial and aquatic vertebrates.
>
> …
>
> Over the course of the simulation, the most intensively thinned stands produced a third as many mortality trees >30 cm (145vs. 461) and half as many mortality trees>50 cm (127vs. 250) relative to the unthinned stands (Figures 5a and 5b). In contrast, the heaviest thin produced slightly more mortality trees >100 cm, a cumulative average production of 42 mortality trees >100 cm for the heaviest thin, relative to 37 mortality trees>100 cm for the unthinned stands (Figure 5a).
>
> Relative to the no thin scenario, thinning reduced the mortality peak of boles in the 30-50 cm and 50-100 cm size classes that occurred 10-60 years posttreatment in the passively managed stands, with the reduction in mortality proportional to the intensity of the thin (Figure 4).
>
> In summary, thinning minimally increased the production of large diameter deadwood >100 cm, while causing substantial losses in deadwood 30- 50 cm and 50-100 cm diameter, with no acceleration in the production of these size classes (Figure 5). This suggests that the thinning regimes we examined are not an effective approach for increasing the abundance of ecologically functional deadwood. The no thin scenario

produced substantially more deadwood across a wide range of sizes useful to a variety of vertebrate species (Table 1).

…

Examination of Table 1 suggests that deadwood >30 cm diameter creates habitat that is used by many species, but that deadwood >50 cm provides even more habitat benefits, and that maximizing the production of deadwood>50 cm diameter may be a suitable management target if the goal is to benefit the most vertebrates. There were far fewer species that preferred live trees or deadwood >100 cm, , but larger diameter dead trees will take longer to decompose, extending the length of time that habitat benefits are provided.

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. This paper provides a nice graphic showing mortality recruitment per decade under various thinning scenarios and showing that no-treatment performs best:

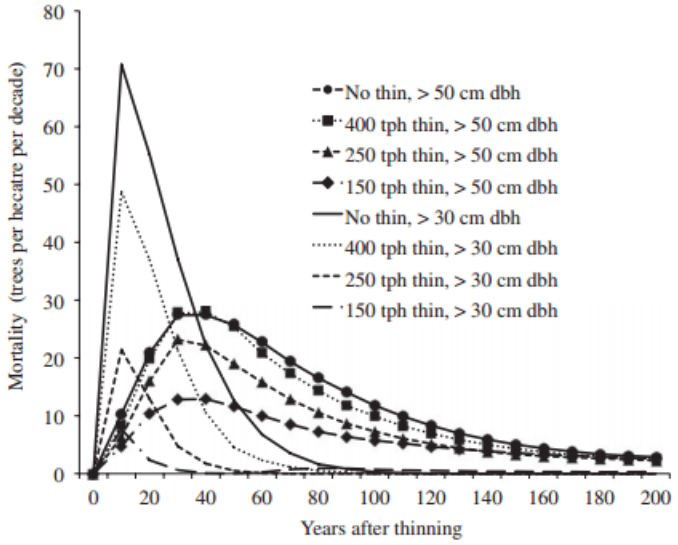


FIGURE 4. Graph Showing Projected Average Mortality Rates (number of trees dying per decade) of Trees >30 cm Diameter and Trees >50 cm Diameter, for each of the Four Simulated Treatments. The 10-year mortality rate of trees >100 cm diameter is low for all treatments throughout the length of the simulation and is not shown in the figure.

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. [Portions of this project are probably less dense and less in need of thinning, compared to the very dense, very young stands addressed in this report.]

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. [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: The appearance of a few "very large" trees in the decades after thinning comes with the loss of a much larger volume of "large functional" trees that were exported from the site before they were allowed to grow and recruit to the stream. 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.]

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 statement in #5 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.

The apparent dissonance between the fact that thinning reduces wood recruitment (#4), but also has the potential to increase production of the very large trees (#5) might be resolved by looking to the right mix of different treatments as suggested in #14 – with some riparian reaches left unthinned to provide for recruitment of large amounts of wood in a range of sizes, some areas thinned non-commercially, and some riparian patches thinned to produce those very large trees. Also, the statement in #10 that thinning can increase pool-forming wood depending on stream size, needs more explanation. Most riparian thinning occurs near small streams where small wood can be pool-forming.

Thinning to produce very large wood in the distant future at the expense of more abundant wood recruited over time is not advised. The SAT Report, upon which the ACS is founded, was clear that continuous input of wood is important. “Riparian zones along larger channels need protection to limit bank erosion due to trampling, grazing, and compaction, to ensure an adequate and continuous supply of large wood to channels …” 1993 SAT Report. Ch 5, p 455. Commercial removal of pool forming wood creates a gap in the wood recruitment process and is inconsistent with the goal of continuous wood recruitment.

Transportation and Roads

Minimum Road System

As a purpose of this project is to identify the minimum road system, that analysis should take place in the NEPA document. Please take a hard look at and specifically address the 2015 Road Investment Strategy and travel analysis, incorporating relevant new information and circumstances.

Costs and Budget Effects

Please take a hard look at maintenance budgets and project impacts on them. The maintenance backlog is a long-standing problem all over the country, and it is reasonably foreseeable that

maintenance funding shortages will continue to be a major factor. The minimum road system in this context necessarily is one that can be maintained within current budgets.

A related but different analysis should be done to look at the impacts this project will have on transportation budget activities. If limited restoration dollars are spent in one place then that means they are not being spent in another— so it is critical to apply a rational system of priorities.

Aquatic effects of transportation system

Please take a hard look at the impacts of the existing and proposed road system on area watersheds. The best available information regarding (1) watershed condition, (2) road condition, and (3) road-stream connectivity should be brought to bear. We are concerned with negative effects including chronic sedimentation, blowouts, impeded passage at culverts, and interception of surface and ground-water flow.

Unroaded Areas

An important factor to consider in road system planning (as well as timber sale design) are potential effects to unroaded areas. The agency should not limit the analysis to inventoried roadless areas (>5,000 acres), but also identify and conserve unroaded areas as small as 1,000 acres.

. Recent scientific literature emphasizes the importance of unroaded areas greater than 1,000 acres as strongholds for the production of fish and other aquatic and terrestrial species, as well as sources of high quality water. Commercial logging and/or road building within large unroaded areas threatens these significant ecological values.

First, it is important to recognize that about 30% of inventoried roadless areas (IRA) nationwide are smaller than 5,000 acres. It is therefore likely that the diverse and significant values of IRAs can be found within many other unroaded areas between 1,000 and 5,000 acres that were simply not inventoried. NEPA requires that these values be recognized and the effects of logging and roads be carefully disclosed and considered. Martin, DeVelice, Brown. 2001. Landscape Analysis and Biodiversity Specialist Report. Forest Service Roadless Area Conservation FEIS. November 2000.
http://www.fs.usda.gov/Internet/FSE_DOCUMENTS/fsm8_035781.pdf

> Small areas are important for conserving biodiversity of species with small home ranges, species with special habitat needs, or for providing linkages between larger areas. … Of the more than 2,800 named inventoried roadless areas, about 70% of these areas are larger than 5,000 acres (USDA Forest Service 2000a).

Large unroaded areas are important simply due to the fact that they better represent the historic condition that species evolved with but they are now rare on the landscape due to human activities that have degraded and fragmented the majority of the landscape. The Northwest Forest Plan LSOG Effectiveness Monitoring Plan says that “perhaps 80 percent or more [of the historic late-successional old-growth forest] would probably have occurred as relatively large (greater than 1,000 acres) areas of connected forest.” Miles Hemstrom, Thomas Spies, Craig Palmer, Ross Kiester, John Teply, Phil McDonald, and Ralph Warbington; Late-

Successional and Old-Growth Forest Effectiveness Monitoring Plan for the Northwest Forest Plan, USFS General Technical Report PNW-GTR-438; December 1998; http://www.fs.fed.us/pnw/pubs/gtr_438.pdf. Currently, these 1,000 acre and larger patches are rare on the landscape.

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

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

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

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

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

WWF CBI 200x. Importance of Roadless Areas in Biodiversity Conservation: A Scientific Perspective - Executive Summary. http://magicalliance.org/download/ecological-importance-of-roadless-areas.pdf

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

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

Letter to President Clinton from 136 scientists (Dec. 10, 1997). https://docs.google.com/open?id=0B4L_-RD-MJwrRzhFcm5QcFR0MHM

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

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

Oct 24, 2013 Press release: EUROPEAN PARLIAMENT BACKS THE PROTECTION OF ROADFREE AREAS. http://kritonarsenis.gr/eng/actions/view/european-parliament-backs-the-protection. Federal land managers should recognize the tremendous carbon values in unroaded/unmanaged forests and avoid actions that would threaten these values.

Access

On the opposite side of the coin, effects to public access to public lands (and private access to private lands) need also to be carefully considered. As a general rule, a road with a gate is the worst of all worlds because it still causes most of the same resource damage, while providing

none of the positive access benefits. The proposed gate and travel restrictions should be carefully analyzed, and the available alternatives compared.

Please consider intermediate accessibility of existing and proposed roads. Roads could be turned into trails in such a way as to disconnect them from the hydrologic system, while still providing access for recreation, firefighting and administrative access.

One part of the minimum road system analysis will have to be identifying those roads where private rights of access (e.g. mining claims, private lands) are implicated. It would be helpful for those facilities to be identified specifically.

Dead Wood Analysis

Please take a hard look at effects to dead wood. It is especially important that this analysis use the best available information, and that it accounts for cumulative effects over landscapes and through time.

The DecAID tool in particular should be used with caution. 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.

The NEPA analysis should not rely on a snapshot, but instead focus on the *process* of creating snags (i.e., a process that requires lots of growing trees that are retained in the forest until they become snags). The most important effect of logging on snags, is NOT how many *snags* will be cut vs. retained, but how many *green trees* will be cut vs retained. To clearly and explicitly address the issue of "snag dynamics" the NEPA analysis 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).

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

> "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."

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

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%."[8] There is no reason to think that thinning in densely stocked forests elsewhere would be any different.

Dead wood in forests is thought to follow a U-shaped pattern over time "from the combined and lagged effects of legacy wood decay and the recruitment of new dead wood," (Harmon 1986, Hudiburg 2009) resulting in abundant dead wood legacies from the previous stand in young forests, less dead wood in middle-aged stands as the legacies decay, and more again in older stands as natural mortality processes manifest. If the goal is to restore high quality old forest habitat, the agencies must respect this dynamic by recognizing that dead wood

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

recruitment requires (1) “surplus” biomass and (2) it’s a process that takes time, so managers should ensure that middle-aged stands accumulate biomass and begin to recruit and accumulate snags and dead wood. The low of dead wood in middle aged stands is not universal or necessarily desirable, and since many young stands were deprived of the legacies they normally enjoy, it would be advisable to start accumulating snags and dead wood as soon as possible, not wait for mature stages.

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 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.

The Forest Service recognizes that

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

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

> Bull et al. (1997) states current direction for providing wildlife habitat on public forest lands does not reflect the new information available, which suggests that to fully meet the needs of wildlife, additional snags and habitat are required for foraging, denning, nesting, and roosting. Rose et al. (2001) suggests that calculation of numbers of snags required by woodpeckers based on assessing their "biological (population) potential" is a flawed technique (Rose et al. 2001) due to the fact that 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. There is general consensus that the biological potential model does not provide adequate nesting, roosting, or foraging structure for cavity excavating birds (Bull et al. 1997, Johnson and O'Neil 2001). This suggests the current direction of managing for 100 percent population levels of primary excavators may not represent the most current knowledge of managing for cavity nesters.

North Fork John Day RD, Umatilla NF. 2011. Mirage Vegetation Management Project EA, Appendix K – Terrestrial Wildlife Specialist Report. p K-45. http://a123.g.akamai.net/7/123/11558/abc123/forestservic.download.akamai.com/11558/www/nepa/53012_FSPLT2_055426.pdf.

> **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.

New science indicates that meeting the needs of cavity excavators need requires retaining far more snags than managers realize.

> … at-risk species, namely the black-backed and the white-headed woodpeckers, were nesting within burns that contained 86 to 96 percent of trees with unsuitably hard wood. This suggests that past studies that did not measure wood hardness counted many sites as available to cavity-excavating birds when actually they were unsuitable. "By not accounting for wood hardness, managers may be overestimating the amount of suitable habitat for cavity-excavating bird species, some of which are at risk," Lorenz says.
>
> In their study plots, the researchers did not find reliable visual cues to distinguish between suitable and unsuitable trees. Snag decay class was a poor indicator of internal wood properties—and this was not the first study to demonstrate that fact, although it

was the first study to do so in ornithology (past studies had been done by foresters and published in forestry journals).

"Currently, the best solution we can recommend is to provide large numbers of snags for the birds, which can be difficult without fire," Lorenz says. According to the researchers' calculations, if one of every 20 snags (approximately 4 percent) has suitable wood, and there are five to seven species of woodpeckers

nesting in a given patch, approximately 100 snags may be needed each year for nesting sites alone. This does not account for other nuances, like the fact that most species are territorial and will not tolerate close neighbors while nesting, or the fact that species like the black-backed woodpecker need more foraging

options. Overall, more snags are needed than other studies have previously recommended.

Vizcarra, Natasha 2017. Woodpecker Woes: The Right Tree Can Be Hard to Find. PNW Science Findings, Issue 199, August 2017. https://www.fs.fed.us/pnw/sciencef/scifi199.pdf. *citing* Lorenz, T.J.; Vierling, K.T.; Johnson, T.R.; Fischer, P.C. 2015. The role of wood hardness in limiting nest site selection in avian cavity excavators. Ecological Applications. 25: 1 016–1033. https://www.treesearch.fs.fed.us/pubs/49102.

There is evidence that retaining more than the minimum number of snags has significant benefits for cavity dependent species. Comparing two sites in Northern California, Blacks Mountain Experimental Forest (BMEF) with little past logging and lots of snags, and Goosenest Adaptive Management Area (GAMA) with lots of logging and fewer snags, the author's found "… three times as many snags (6.38/acre vs. 2.04/acre, respectively) … The use of snags by cavity-nesting bird species was dramatically different between the sites. Thirty-one cavity-nesting pairs from 10 species were detected at BMEF, while only one pair each of two species were detected at GAMA…. This fifteenfold difference is much greater than any measure of snags or cavities reported. …"

> We feel that forest managers may well be asking a misleading question. "Snags per acre" requirements implicitly assume an equilibrium condition and reflect only one ecological requirement for a given cavity-nesting species. … [C]onsideration of foraging habitat and other ecological requirements must be part of the "snags per acre" management considerations. This is an important, but somewhat daunting proposition, as potential cavity-nesting species are diverse, and each species likely has very different foraging ecologies, as well as other differences in habitat requirements. … [C]avity nesters at BMEF used larger snags on average … [T]he loss of large trees due to logging in eastside pine and other forests, over the past century has major implications for cavity-nesting birds. … [F]orest managers must have a sense of snag recruitment in relationship to snag fall, and the patterns and processes that underlie them, when addressing wildlife needs. … We view the understanding of these complexities to be of primary importance in forest management for wildlife.

Steve Zack, T. Luke George, and William F. Laudenslayer, Jr. 2002. Are There Snags in the System? Comparing Cavity Use among Nesting Birds in "Snag-rich" and "Snag-poor" Eastside

Pine Forests. USDA Forest Service Gen. Tech. Rep. PSW-GTR-181. http://www.fs.fed.us/psw/publications/documents/gtr-181/017_Zack.pdf.

Another recent science publication asked that the agencies salvage polices be brought up to date with current science.

Inadequacy of Current Snag Guidelines

Current snag-retention guidelines for most North American plant community types fall between 1 and 8 snags/ha. These guidelines emerged primarily from a consideration of the nesting requirements of cavity-nesting vertebrate species in the now classic Blue Mountains book (Thomas 1979). The retention of 8 snags/ha was judged to support 100% of the maximum population density of any of the woodpecker species that occur in the Blue Mountains area (Thomas 1979: Appendix 22). Bull et al. (1997) concluded that about 10 snags/ha in ponderosa pine and mixed-conifer forests should support viable populations of cavity-nesting birds. Thus, most current U.S. National Forest guidelines generally converge on the recommendation to retain 6–10 trees/ha, as do guidelines for Washington State, the Ontario Ministry of Natural Resources, the U.S. Army Corps of Engineers, and many other land management agencies.

It has been acknowledged that snag guidelines should be sensitive to forest type and forest age because "the wildlife species that use snags are influenced by the stage of forest succession in which the snag occurs" and by the breakdown stage of the snag (Thomas et al. 1979). Moreover, snag types, sizes, and densities vary significantly with vegetation type (Harris 1999; Harmon 2002; White et al. 2002). Therefore, it follows necessarily that the desired snag types and densities will differ with both plant community type and successional stage and that we need as great a variety of guidelines as there are community types and successional stages (Bull et al. 1997; Everett et al. 1999; Rose et al. 2001; Kotliar et al. 2002; Lehmkuhl et al. 2003). Unfortunately, we have generally failed to adjust snag-retention recommendations to specific forest age, and nowhere is that failure more serious than for those special plant community types that were ignored in the development of the generic guidelines—recently burned conifer forests. Such forests are characterized by uniquely high densities of snags (Angelstam & Mikusinski 1994; Hutto 1995; Agee 2002; Drapeau et al. 2002), and snag use by most woodpeckers in burned forests requires high snag densities because they nest in and feed from burned snags.

These facts have been overlooked in the development and implementation of meaningful snag-management guidelines. Indeed, these guidelines have generally converged toward an average of 6–7 trees/ha because that number was deemed more than adequate to meet the nesting requirements of cavity-nesting wildlife species (Thomas et al. 1979:69). Snag guidelines were not originally developed with an eye toward non-nesting uses of snags or from an attempt to mirror snag densities that typically occur on unmanaged reference stands. Snag guidelines are still much narrower than numerous authors have suggested they ought to be, and we currently run the risk of managing coarse woody debris with uniform standards across historically variable landscapes, which is entirely inappropriate. Instead, we should be managing for levels of

coarse woody debris that more accurately mirror levels characteristic of the natural disturbance regime (Agee 2002). Clearly, we need more data on what might constitute meaningful snag targets for all forest types and successional stages, and those targets should be set on the basis of reference conditions from natural post disturbance forests, not from managed forest stands and certainly not from consideration of only a single aspect of an organism's life history.

Newer guidelines that are appropriate for snag dependent species that occupy standing dead forests at the earliest stage of succession are beginning to trickle in (Saab & Dudley 1998; Haggard & Gaines 2001; Saab et al. 2002; Kotliar et al. 2002), and authors suggest that 200–300 snags/ha may better address the needs of wildlife in burned forests. The issue has yet to receive the serious management attention it deserves, but the comprehensive review of habitat needs of vertebrates in the Columbia River Basin (Wisdom et al. 2000) and the recently developed DecAID modeling effort in Washington and Oregon represent important efforts toward providing that kind of management guidance (Marcot et al. 2002).

Hutto, R.L., 2006. Toward Meaningful Snag-Management Guidelines for Postfire Salvage Logging in North American Conifer Forests. Conservation Biology Volume 20, No. 4, 984–993. http://web.archive.org/web/20090205212350/http://avianscience.dbs.umt.edu/documents/hutto_conbio_2006.pdf

> "In general, wildlife species that use dead wood for nesting, roosting, or foraging prefer larger diameter logs and snags (>20 inches). Although we tallied dead wood in this size class throughout Oregon, the estimated density may not be sufficient for some wildlife species. For example, inventory results show a mean of almost 3 snags per acre in this size class in western Oregon and 1 per acre in eastern Oregon. This may indicate that large-diameter snags are currently uncommon in Oregon habitat and that management may be necessary to produce a greater density of large snags."

Donnegan, Joseph; Campbell, Sally; Azuma, Dave, tech. eds. 2008. Oregon's forest resources, 2001–2005: five-year Forest Inventory and Analysis report. Gen. Tech. Rep. PNW-GTR-765. Portland, OR: U.S. Forest Service, Pacific Northwest Research Station. 186 p. http://www.fs.fed.us/pnw/publications/gtr765/pnw-gtr765b.pdf.

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.

New Information requires modification of Matrix Objectives

This project is based on part on the need to produce timber to meet Forest Plan objectives. There is a trade-off between ecological objectives and timber objectives, and new information indicates that these trade-offs are becoming more acute. Before sacrificing older forests in order to produce timber, the agency needs to carefully consider new information developed since the Northwest Forest Plan was adopted in 1994. Several significant new developments indicate a need to increase emphasis on conservation and restoration of more mature & old-growth forests, and reduced emphasis on Matrix objectives such as timber production from logging of mature & old-growth forests. Unfortunately, the agencies have not taken steps to account for new information and has failed to adjust Matrix objectives accordingly.

A few of the most important new issues include:

> (a) **Barred owls** — The threatened spotted owl faces a significant new threat in the form of the barred owl which has recently invaded the range of the spotted owl, uses and similar habitat, and uses many of the same food sources. Hundreds of thousands of acres of suitable owl habitat that were assumed in the NW Forest Plan to be available for spotted

owl nesting, roosting, and foraging are now occupied and defended by territorial barred owls to the exclusion of spotted owls. There is an urgent need to protect additional suitable owl habitat (and reduce the loss of existing habitat) in order to increase the likelihood that threatened spotted owls can coexist with newly invading barred owls instead of facing competitive exclusion. More habitat increases the chances that the two owls can co-exist. More discretion and more logging reduce the changes for co-existence and increase the chances for competitive exclusion/extirpation.

FWS has recommended protection of a subset of high quality owl habitat, but whether this subset of habitat is enough to ensure species recovery has never been tested and validated. The habitat modeling done as part of the spotted owl recovery planning process assume that the barred owl population would remain constant, but it is more realistic to expect that the barred owl population will continue to increase for some time. We are a long way from an effective rangewide barred owl control program, and if the program ever gets fully implemented, failure to maintain the program in perpetuity will likely lead to a rapidly resurgent population of barred owls. There are too many preconditions that undercut FWS' modeling assumptions and the effectiveness of relying on a subset of suitable habitat. Spotted owls would be safer if all suitable habitat were protected.

The FS is using RA32 to mitigate for the barred owl, but in reality all suitable habitat should be conserved. When the agency discovers that its plans are out of date and adopts new strategies, the agency must follow NEPA and NFMA procedures to amend its forest plan. *ONRC and HCPC v. Forsgren*, 252 F. Supp. 2d 1088 (D. Or. 2003) March 11, 2003. http://law.justia.com/cases/federal/district-courts/FSupp2/252/1088/2424683/ Here, RA 32 is a new strategy that the FS is using as a *de facto* plan amendment to justify logging suitable habitat. This is not allowed without following legal requirements.

(b) **Carbon storage** — Global climate change is a new and significant threat not only to imperiled species, but also whole forest ecosystems and human communities. To reduce the severity of global climate change requires, among other things, that the global carbon cycle be managed to store more carbon. Carbon-rich ecosystems like mature & old-growth forests of western Oregon present a tremendous opportunity to increase carbon storage and mitigate climate change.

Climate change is a new and significant reason to conserve forests and reduce logging. A science review will show that long-live d forests are a great place to store carbon, while wood products are relatively short-lived and not a good place to store carbon. Also, carbon can't be moved from the forest to durable wood products without causing significant GHG emissions. Alleged benefits of wood products substitution for steel and concrete are vastly over-estimated. All high biomass forests should be conserved, and many young forest should be allowed to grow.

(c) **Climate change** — A warmer world with more seasonal extremes of wet and dry also creates uncertainty about our ability to sustain older forests, and about whether we can recreate functional old forests starting from young, planted stands. If climate change brings increasing frequency and severity of drought and natural disturbance, it may be harder to

sustain existing older forests and harder to establish new forests and sustain them through long periods of forest succession required to reach habitat goals for imperiled species like spotted owls, marbled murrelet, and salmon. This highlights the old adage that "a bird in the hand is worth two in the bush." We should retain all the older forests that we currently have (and carefully nurture likely recruitment forests). Climate uncertainty alone represents an increased risk for spotted owl recovery.

Undisturbed ecosystems and late successional forests are more resistant and resilient to climate change. György Kröel-Dulay et al (2015). Increased sensitivity to climate change in disturbed ecosystems. Nature Communications, 2015; 6: 6682. http://web.ics.purdue.edu/~jsdukes/Kr%C3%B6el-DulayEtAl_NC_2015.pdf. Climate change is a huge new stress on ecosystems that are already stressed. We can help ecosystems better withstand climate change by reducing anthropogenic stress caused by logging, roads, grazing, etc. Climate change is expected to amplify the hydrologic cycle. This calls for increased protection of whole watersheds and especially streams buffers (and reducing road/stream interactions). There may be a need for modest reductions in tree density, but only in limited areas. For wildlife that depend on dense forest conditions (i.e., most of our threatened & endangered species), logging to reduce stress or reduce fire hazard will only make things worse. Wildlife are more threatened by the combined effects of logging plus fire, than by fire alone. See Heiken, D. 2010. Log it to save it? The search for an ecological rationale for fuel reduction logging in Spotted Owl habitat. Oregon Wild. v 1.0. May 2010. https://www.dropbox.com/s/pi15rap4nvwxhtt/Heiken_Log_it_to_save_it_v.1.0.pdf?dl=0

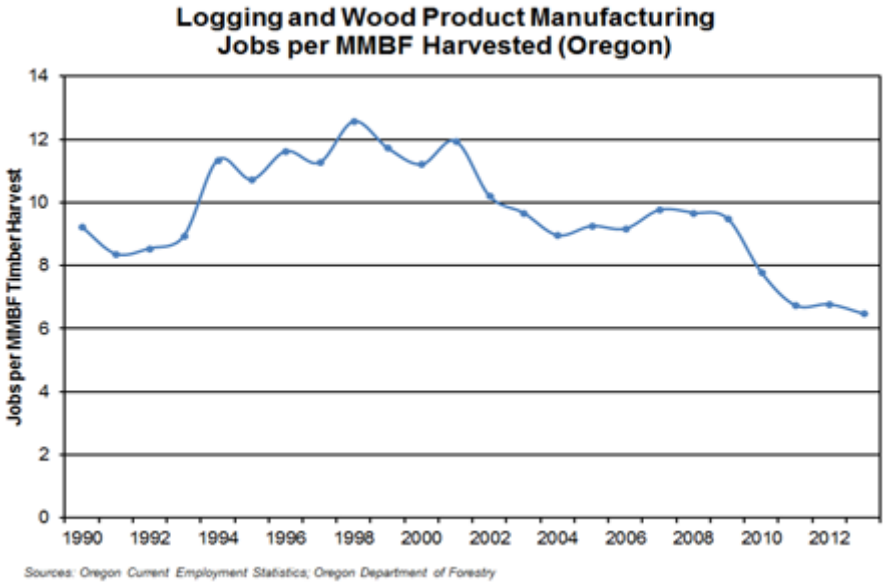
(d) **Dead wood standards** — Large accumulations of dead wood are essential for meeting objectives for fish & wildlife habitat, water quality, and carbon storage. Past and ongoing forest management has greatly reduced the prevalence of large snags and dead wood. Northwest Forest Plan standards for dead wood are based on an outdated "potential population" methodology which greatly underestimates the amount of snags and down logs needed to meet the needs of a variety of species associated with dead wood.[1] Forests are a dynamic system where the population of all live trees represent the recruitment pool for all dead trees, so if more dead trees are needed over time, that means more live trees need to be retained for long-term recruitment. Before conducting activities like commercial logging (especially regen logging) that will result in long-term reduction in recruitment of snags and dead wood, the agencies should follow NEPA procedures to amend their management plans, consider alternatives, and adopt new standards that assure objectives are met over time and across the landscape.

(e) **Complex early seral forest -** There is some concern that clearcuts on non-federal do not provide high quality habitat for wildlife that prefer complex early seral habitat with abundant legacies and diverse non-conifer vegetation. While this habitat may be under-represented, there are no listed species that depend on it because most of the species associated with ephemeral young forests tend to be mobile, generalist, and/or opportunistic. There are a wide variety of policy options for enhancing early seral that do not require that we sacrifice old forests. K. Norm Johnson, Debora L. Johnson. 2007. Policies to Encourage Diverse, Early Seral Forest in Oregon: What Might We

Do? http://ecoshare.info/2010/10/04/k-norman-johnson-policies-to-encourage-diverse-early-seral-forest-in-oregon-what-might-we-do/ Climate change is expected to increase the prevalence of early seral forests. Regen logging produces lower quality early seral. We should instead stop salvage logging.

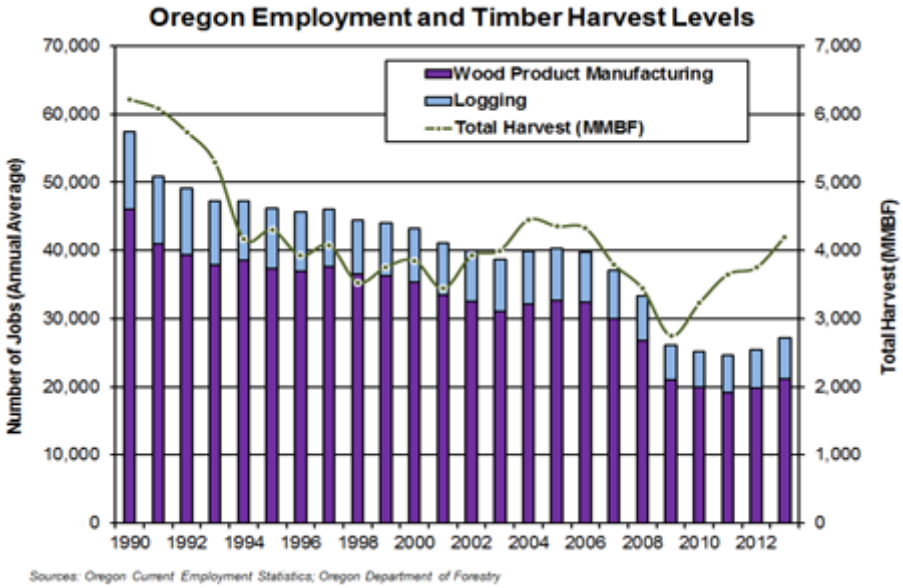
(f) *The PNW economy has changed*. At the NWFP tenth anniversary conference on April 13, 2004 in Portland, USFS PNW Regional Economist Richard Haynes said that the NW economy has "fundamentally changed" over the last ten years since the NWFP was approved. The changes include: growth and diversification of the overall economy so that the timber industry plays a much smaller role in the overall economy, structural changes in the timber industry both regionally and nationally so that few mills remain dependent upon federal old-growth log supply, and serious decline of the export market so the logs from private lands are now more available to domestic mills. This raises a significant issue about whether the NWFP should continue to log any more late-successional old-growth at all and take continued risks with population viability of late-successional old-growth dependent species. Changed economic circumstances represent significant new information and requires the agency to prepare an EIS to consider protecting all remaining mature and old-growth forests and shifting efforts toward restoration including thinning dense young plantations.

(g) **The economic and social benefits of logging are decreasing**. As recently as 2001, there were 12 jobs generated per million board feet cut. In 2012, that ratio had declined to 6.5 jobs per million board feet logged. (Oregon Employment Department, July 17, 2014).



https://www.qualityinfo.org/-/jobs-per-board-feet-of-timber-harvests-in-oregon;

Since 2010, timber harvest and jobs have become decoupled. There is no reason to think that increased timber harvest will result in increased employment.

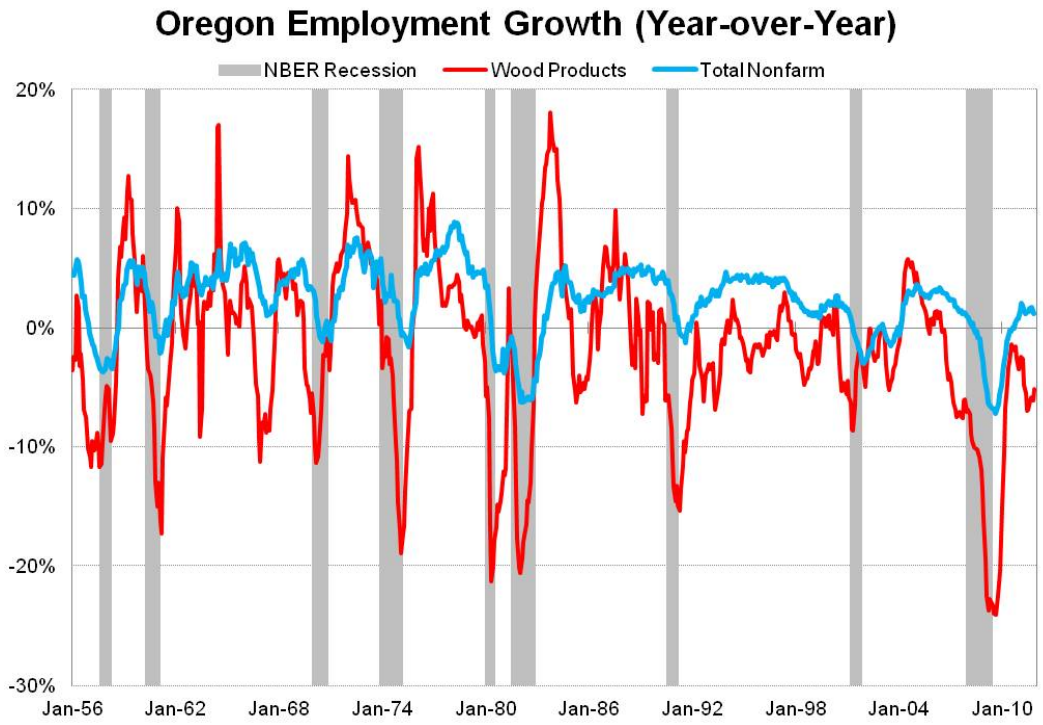


https://www.qualityinfo.org/-/jobs-per-board-feet-of-timber-harvests-in-oregon;

(h) **Producing timber from federal lands feeds an inherently volatile industry that perpetuates community instability.** There is significant new information indicating that the timber industry is inherently volatile so proving timber from federal lands causes community instability rather than community stability. BLM's 2015 Western Oregon Plan Revision DEIS (p 472) said:

> Over the long-term (1969-2007), timber-based industries nationally exhibited low or negative growth rates with high volatility compared with the United States economy as a whole, indicating that these industries tend to be inherently volatile. Increases in timber industry activity in the planning area could bring additional exposure to greater economic instability.

http://www.blm.gov/or/plans/rmpswesternoregon/deis.php BLM's DEIS acknowledges that the timber industry is far more volatile than other industries so boosting timber jobs does not necessarily translate to community stability. This new information requires a fundamental shift in thinking about the value of federal lands for timber production versus provision of public benefits that do contribute to community stability, such as: clean water, carbon storage and stabilizes the climate, biodiversity, diverse recreation opportunities, scenic values, etc.



Lehner, J. 2012. Historical Look at Oregon's Wood Product Industry. http://oregoneconomicanalysis.com/2012/01/23/historical-look-at-oregons-wood-product-industry/

Timber industry volatility would have its greatest effect in local communities that have the lowest levels of economic diversity, the greatest dependence on commodity production, and would therefore see the greatest fluctuations in jobs and income. The gain and loss of jobs caused by timber industry volatility would cause a variety of social problems related to job insecurity, depression, substance abuse, health care insecurity, domestic abuse, etc. which would in turn cause an increase in the demand for social services that are not adequately funded. If the Forest Service and BLM would emphasize development of less volatile economic sectors through provision of amenities instead of commodities, the social problems described above would be diminished and the demand for social services would be reduced.

All things being equal, a more diversified economy is a more stable economy. Oregon will always have a timber industry based on non-federal forest lands. The highest and best use of public forest lands, in terms of community stability, is to conserve the resources on those lands to provide a stable flow of ecosystem services such as clean water, carbon storage and recreation opportunities, that will help diversify the economy, and mitigate the economic instability caused by logging on non-federal lands.

(i) **"Sustained yield" is based on flawed science**. Sustained yield logging in the matrix is premised on the concept of a "regulated forest." As explained in the Days Creek – South Umpqua Harvest Plan EA "The key to achieving sustained yield is to establish a regulated

forest with the proper distribution of stand age and size classes so that over time, approximately equal periodic harvests of the desired size and quality are produced. A 'regulated forest' consists of tree sizes in approximately equal parts and age classes that correspond to the size classes. To achieve the desired age class distribution, it is necessary that the harvest type resets the age class or seral stage, i.e. a regeneration harvest of selected stands is necessary, including regeneration harvest of intermediate-age classes. Over time, regeneration harvests can transform or convert an irregular forest structure to a regulated one (Hennes et al., 1971)." Unfortunately, this is only possible on paper. In the real world, none of this is possible, especially if the agency wishes to meet other important objectives such as water quality, climate stability, health populations of fish & wildlife, etc. See Jack Ward Thomas 1997. The Instability of Stability, http://web.archive.org/web/20001201174000/http://coopext.cahe.wsu.edu/~pnrec97/thomas2.htm ("The vision that I was taught in school of the "regulated forest" and the resultant predictable outputs of commodities has turned out to have been a dream. … By now it is becoming obvious that this dream was built on the pillars of the seemingly boundless virgin forest and an ethic of manifest destiny coupled with hubris of being able to predict the response of nature and humans. This was coupled with an inflated sense of understanding of forested ecosystems and of human control. Perhaps it is time to recognize that such stability is not attainable in any western region except for relatively short periods of years or decades. … It is increasingly apparent that ecological processes are not as well understood nor as predictable as had been assumed by natural resource managers steeped in Clementsian ecological theory of orderly and predictable succession of plant communities from bare ground to a mature, steady state. … In summary, the timber supply from federal lands is one drought, one insect and disease outbreak, one severe fire season, one election, one budget, one successful appeal, one loss in court, one listing of a threatened or endangered species, one new piece of pertinent scientific information, one change in technology, one shift in public opinion, one new law, one loss of a currently available technological tool, one change in market, one shift in interest rates, et al, away from "stability" at all times. And, these changes do not come one at a time, they come in bunches like banannas [sic] and the bunches are always changing. So, stability in timber supply from the public lands is simply a myth, a dream that was never founded in reality. It is time to stop pretending."). See also: Donald Ludwig, Ray Hilborn, Carl Waters 1993. Uncertainty, Resource Exploitation, and Conservation: Lessons from History. Science, New Series, Vol. 260, No. 5104 (Apr. 2, 1993), pp. 17-36. http://www.waterboards.ca.gov/waterrights/water_issues/programs/bay_delta/deltaflow/docs/exhibits/swrcb/swrcb_ludwig1993.pdf

When we bring all these lines of evidence together one realizes that since the NWFP and the matrix land allocation was adopted there are many more reasons to protect forests and fewer reasons to log them. This needs to be considered in a new EIS. Since these significant new issues were not properly considered in the Northwest Forest Plan FEIS, the agency needs to address them in project level NEPA analyses. Since these significant new issues were not properly considered in the Northwest Forest Plan FEIS, the agency needs to address them here.

Preparation of new NEPA documents is a non-discretionary duty of all federal agencies. The CEQ regulations state that:

> (c) Agencies:
>
> (1) Shall prepare supplements to either draft or final environmental impact statements if:
>
> … (ii) There are significant new circumstances or information relevant to environmental concerns and bearing on the proposed action or its impacts.

40 CFR 1502.9(c). This duty applies to both EISs and EAs. ISC v. Alexander (9th Circ. 2000).

"A federal agency has a continuing duty to gather and evaluate new information relevant to the environmental impact of its actions.... [W]hen new information comes to light the agency must consider it, evaluate it, and make a reasoned determination whether it is of significance as to require formal NEPA procedures." *Warm Springs Dam Task Force v. Gribble*, 621 F.2d 1017, 1023-24 (9th Cir. 1980). "[T]he decision whether to prepare a supplemental EIS is similar to the decision whether to prepare an EIS in the first instance: If there remains 'major Federal actio[n]' to occur, and if the new information is sufficient to show that the remaining action will 'affec[t] the quality of the human environment' in a significant manner or to a significant extent not already considered, a supplemental EIS must be prepared." *Marsh v. ONRC*, 490 U.S. 360, 374, 109 S. Ct. 1851, 1859 (1989). While BLM is making decision to implement the regen harvest and mature forest thinning aspects of its RMP, it must first prepare a new or supplemental EIS to consider all the new information that has arisen over the last two decades. Most of the new information indicates that forest conservation is even more important than previously realized and that logging is less important than previously realized.

Similarly, under both NMFA and FLPMA, the agencies must "… prepare and maintain on a continuing basis an inventory of all public lands and their resources and other values … This inventory shall be kept current so as to reflect changes in conditions and to identify new and emerging resource and other values …" 43 USC 1711 (similar at 16 USC 1603). The resulting inventory shall be used in creating land use plans which are living documents, not a static end result. "The Secretary shall … develop, maintain, and when appropriate, revise land use plans …" 43 USC 1712 (similar at 16 USC 1604). These provisions, combined with NEPA's action-driven mandate for considering "new circumstances or information," and the multiple-use mandate to utilize resources in the combination that "best meet the present and future needs of the American people" (43 USC 1702, 16 USC 1601) create a non-discretionary duty to keep programmatic plans up to date.

The fact that LRMPs and RMPs are all 20 years old (and well beyond the expected life-span of the plans) just adds to the evidence indicating the need for reconsideration of the emphasis on timber production, when conservation is what's needed.

Thank you for thoughtfully considering these comments. Please include us in future project notices.

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