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10 Jan 2008

TO: WOPR Team
Western Oregon Plan Revisions
P.O. Box 2965
Portland, OR 97208
Submitted via: orwopr@or.blm.gov (due to size limitation at www.daylightdecisions.com)

Subject: Oregon Wild comments on the Western Oregon Plan Revision DEIS

Dear BLM:

Please accept the following comments from Oregon Wild (formerly Oregon Natural Resources Council) concerning Western Oregon Plan Revision DEIS dated August 2007. Oregon Wild represents about 5,000 members who support our mission to protect and restore Oregon's wildlands, wildlife, and water as an enduring legacy. Our goal is to protect areas that remain relatively intact ecologically while striving to restore areas that have been degraded. This can be accomplished by strategically moving over-represented ecosystem elements (such as simplified young forests in logged and roaded areas) toward characteristics that are currently under-represented (such as complex older forests and roadless areas). The WOPR represents a dangerous revision of the Northwest Forest Plan that is directly contrary to our objectives.

The preferred alternative 2 involves:

- 143,400 acres of regeneration harvest in the first decade;
- 76,700 acres of thinning in the first decade;
- 1010 miles of new road construction in the first decade (610 miles permanent roads removing 3250 acres of land from permanent forest production)
- 36,500 acres of ground based yarding in the first decade;
- 54,600 acres of pre-commercial thinning in the first decade
- Old growth reserves 48% smaller than provided by the Northwest Forest Plan;
- No protection of spotted owl nests in the path of logging;
- Clearcutting of old growth with no retention of green trees or large sound snags, and limited retention of down wood;
- Salvage logging in reserves with inadequate retention of snags;

Oregon Wild WOPR DEIS Comments
Supplementary and Supporting Materials

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Mature And Old Growth Forests Must Be Protected

Regionally we are outside the natural range of variability for old forests.

Table 4.5-4. Overall distribution of forest age classes in western Washington and Oregon on National Forest and industrial forestland, 1997.

10-year class mid-point	Approximate Acreage (1,000 ac.)
5	2,300
15	2,200
25	1,500
35	1,600
45	1,800
55	1,500
65	950
75	700
85	550
95	410
105	410
115	350
125	400
135	300
145	290
155	230
165	240
175	230
185	195
195	170
200+	1,350
Total	**17,675**

Source: Curtis et al. (1998).

McShane, C., T. Hamer, H. Carter, G. Swartzman, V. Friesen, D. Ainley, R. Tressler, K. Nelson, A. Burger, L. Spear, T. Mohagen, R. Martin, L. Henkel, K. Prindle, C. Strong, and J. Keany. 2004. Evaluation report for the 5-year status review of the marbled murrelet in Washington, Oregon, and California. Unpublished report. EDAW, Inc. Seattle, Washington. Prepared for the U.S. Fish and Wildlife Service, Region 1. Portland, Oregon. (p 4-77).

There is a significant regional deficit of late-successional and old growth forests, and until that deficit is addressed the agency should focus on restoration instead of commodity extraction.

Before doing more regen harvest, the agency should address the backlog of needed young stand management. The older forests can wait, while the dense young stands, if not timely treated, can suffer potentially irreversible consequences (e.g., crown recession, instability, stand-level competitive stress).

Westside late-successional old-growth forests:

The 1994 Spotted Owl FSEIS concluded that the range of the spotted owl is so severely affected by logging and other landscape modifications, that it will take over 100 years to restore a functional interconnected late-successional old-growth ecosystem. Given that fact and the many species of terrestrial and aquatic species that are listed as threatened and endangered, the agencies should stop logging all mature and old-growth forest and shift their energy to restoration.

Since both the 2001 and 2004 S&M FEIS did not include an adequate range of alternatives, all logging of large trees should stop until an old-growth protection alternative is fully developed and considered.

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.

Figure 2 on page 3 of Appendix B of the Roseburg BLM's Cow Catcher Supplemental EA exposes the fallacy of the Northwest Forest Plan in a nutshell.

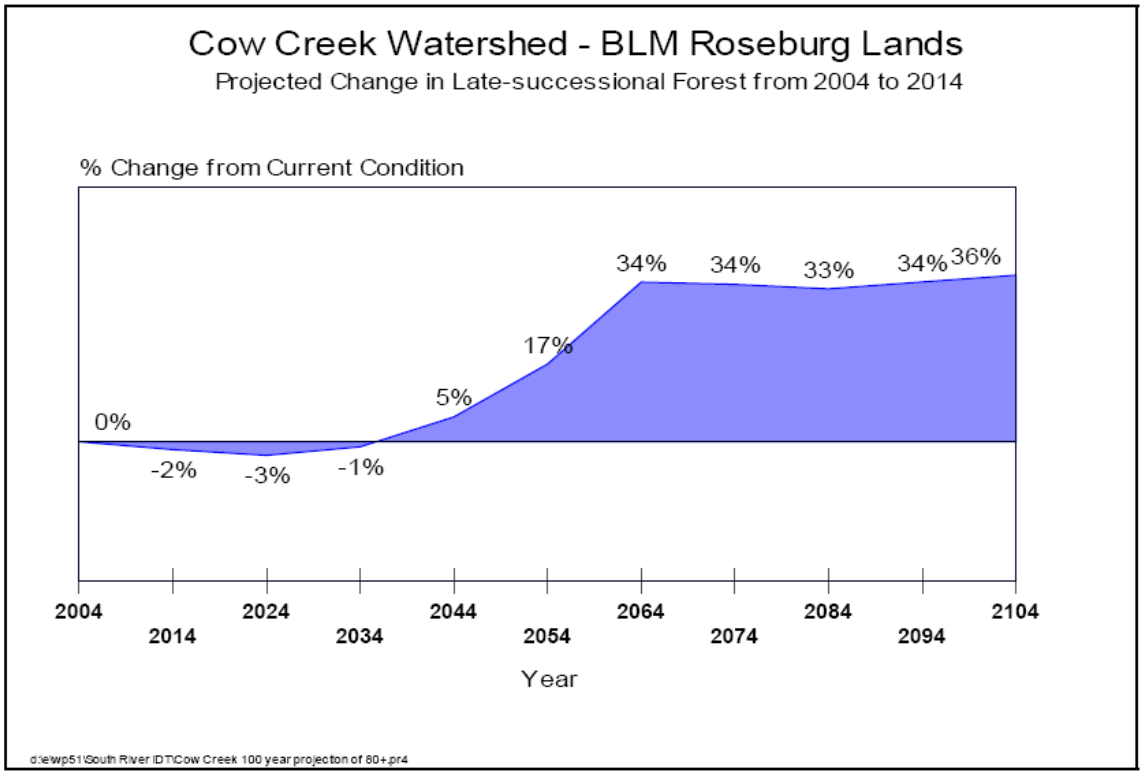

Figure 2

http://web.archive.org/web/20041211165302/http://www.or.blm.gov/roseburg/PDF/EAs/Cow-Catcher-Supplement.pdf After many decades of rampant clearcutting in what are now called "reserves," the agencies intend to keep cutting existing old-growth in the matrix. This chart shows that continued logging of old forest in the Matrix means that late successional habitat will not show net improvement for several more decades. In the Cow Creek watershed (as well as across the plan area), wildlife species that depend on late successional forest will not realize the benefits of the Northwest Forest Plan until 2034 or later. The agencies have already determined through the FEMAT process that late successional forest ecosystems are outside the range of natural variability, and several species are listed as Threatened, so the agencies should not be doing any more to push these degraded ecosystems farther from the historic norms. As clearly shown in Appendix B Figure 2, the agencies are doing just that for the next 30 years or more. It's well past time to stop logging old forest. Since the Northwest Forest Plan was approved in 1994, there is significant new information about new threats to the spotted owl, that the agencies must consider before proceeding to destroy more suitable habitat.

Why Mature Forests Must be Protected.

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

1. There is a serious region-scale deficit in mature and old-growth forest habitat. Over time, the Northwest Forest Plan seeks to re-establish 3.44 million acres of mature and old-growth forest (http://www.fs.fed.us/land/fm/oldgrow/oldgrow.htm). But by continuing to log mature forests we are significantly delaying this recovery. If we are going to make a timely recovery from that deficit, and give struggling species a

chance to survive the habitat bottleneck that we have created, we must protect mature forests so that they can become old-growth, and we must manage young forest so they can become mature.

2. The transition from mature forest to old growth is a process that takes time and varies depending on factors such as location and species and disturbance events. In a mature forest, all the ingredients are there to make old growth (e.g., large trees) and the scientists agree that these forests need protection to help meet the current old-growth forest deficit.
3. The architects of the Northwest Forest Plan found that many of our best large intact forest landscapes are mature forests, not old-growth. Some large forest fires burned westside forests between 1840 and 1910 and many such areas were skipped over by the timber harvest planners because they were more intent on converting the very old forests to tree plantations. These former fire areas, now mature forests, offer some of our best hopes of recreating large blocks of intact older forest.
4. Cutting mature forests is not needed for ecological reasons. These forests are already exhibiting the characteristics that provide excellent habitat and they continue to develop and improve without human intervention. As recognized in the Northwest Forest Plan standards and guidelines for Late Successional Reserves, stands over 80 years old do not need to be manipulated to become old-growth. All the ingredients are there, they just need time.
5. Mature forests provide essential habitat for the species we are most concerned with such as: spotted owl, marbled murrelet, Pacific salmon, and most of the "survey and manage" species.
6. Protecting mature and old-growth forest leads to a real ecological solution, while protecting only old-growth is merely a partial solution to an ecological problem that is bigger than just old-growth.
7. Cutting mature forest will remain controversial and socially unacceptable. If we seek to resolve conflict over management of older forests, protecting the old-growth while leaving mature forests unprotected would be only half a solution and would lead to more conflict. Shifting to a restoration paradigm gets everyone at the table working toward the same goal.
8. If mature forest is left unprotected, some members of the environmental community will distrust the agencies and oppose them on many fronts.
9. Leaving mature forests unprotected would leave substantial areas of roadless lands subject to future conflict. Many westside roadless areas may not qualify as old-growth, but still provide important values as roadless and mature forests.
10. Complicated environmental analysis will be required for logging mature forests compared to thinning plantations. Wildlife surveys will be needed. Environmental Impact Statements will more often be needed instead of abbreviated Environmental Assessments. Formal consultation under the Endangered Species Act will more often be triggered.

11. We do not need to log mature forest to provide jobs. Less than 2% of the jobs in Washington and Oregon are in the lumber and wood products sectors, and only a small fraction of those are on federal land and only a fraction of those are related to mature forest logging. Many more environmentally benign jobs are available in restoring roads, streams, thinning young plantations, and managing fire and recreation.
12. We do not need to log mature forest to prop up the economy. The NW economy has greatly diversified in the last decade. Our economy typically creates more new jobs every year than exist in the entire lumber and wood products sectors.
13. We do not need to log mature forest to prop up the timber industry. Less than 10% of the logging in Oregon and Washington in recent years has been on federal lands. Only a fraction of that is mature forest. Much more environmentally benign and socially acceptable timber can be derived from thinning young plantations or small diameter fuel reduction where it is appropriate.
14. Since managing these stands is not "needed" for any ecological reason or any economic or social reason, what would be the objective?
15. Standing in a mature forest, once gets the distinct feeling that "this beautiful place should not be destroyed by logging."

Manage within the Natural or Historic Range of Variability

The agency usually interprets it's multiple-use mandate to mean it has a duty to "get the cut out" and contribute wood products to the nation. However, long after the Multiple-Use Sustained-Yield Act was passed, Congress passed National Environmental Policy Act which added an environmental consideration to everything the agency does. The CEQ regulations specifically require that "Each agency shall interpret the provisions of the Act as a supplement to its existing authority and as a mandate to view traditional policies and missions in the light of the Act's national environmental objectives." 40 CFR 1500.6. This should help the agency adopt and implement the objective of managing toward the "natural range of variability" not just in terms of seral stages, but in the fullest spectrum of ecological structures, functions, and processes. Under this view, it makes no sense to conduct regen harvest, salvage, or capture mortality from mature forests when there is still variable density thinning to do in dense young stands, and it makes no sense to remove fire-tolerant trees larger than 15-18 inches dbh (or "capture mortality" from these and larger sizes classes), when there are fire-intolerant trees smaller than 12" dbh that need to be removed from fire suppressed stands near existing roads.

> Swanson et al. (1994) contend that managing an ecosystem within its range of variability is appropriate to maintain diverse, resilient, productive, and healthy ecosystems for viable populations of native species. Using the historical range of variability, they believe, is the most scientifically defensible way to meet society's objective of sustaining habitat.

Patrick Daigle and Rick Dawson, Extension Note 07; Management Concepts for Landscape Ecology (Part 1 of 7). October 1996.
http://www.for.gov.bc.ca/hfd/pubs/docs/en/en07.pdf; citing Swanson, F. J.; Jones, J. A.;

Wallin, D. O.; Cissel, J. H. 1994. Natural variability--implications for ecosystem management. In: Jensen, M. E.; Bourgeron, P. S., tech. eds. Eastside Forest Ecosystem Health Assessment--Volume II: Ecosystem management: principles and applications. Gen. Tech. Rep. PNW-GTR-318. Portland, OR: U.S. Dept. of Agriculture, Forest Service, Pacific Northwest Research Station: pp 89-106.

> A coarse-filter approach to manage biodiversity at the landscape level should:
> • protect old growth and other biologically important ecosystems; and
> • maintain a range of seral stages (Steventon 1994).
> . . . This ecosystem management approach assumes that deviations from the natural distribution of seral stages will increase the risk to biodiversity, whereas less change will decrease the risk.

Susan Bannerman, Extension Note 18; Seral Stages across Forested Landscapes: Relationships to Biodiversity (Part 7 of 7), April 1998, http://www.for.gov.bc.ca/hfd/pubs/Docs/En/En18.pdf

> Stewardship of aquatic resources has the highest likelihood of protecting biological diversity and productivity when land use activities do not substantially alter the natural disturbance regime to which these organisms are adapted (Swanson et al. in press).

FEMAT V-29.

> Province, river basin, and individual watershed analyses will provide the baseline information and define the range of natural variability. The range of natural variability thus implicitly defines the context of the "natural" disturbance regime from which decisions will be made. Decision makers will use the information developed during these analyses to decide if proposed or existing management actions meet Aquatic Conservation Strategy objectives. . . .

FSEIS Appendix B-83

Using a model based on historic fire size and historic fire frequency Wimberly 2000 estimated the mean percentage of old growth and late successional forest in the Oregon coast range during the last 3000 years.

> At the late-successional reserve scale, variability was so high that any amount of old growth from 0 to 100% might be considered historically probable. . . . Under a disturbance regime of large, relatively infrequent fires, a range of historic variability may be definable only for relatively large areas.

Michael C. Wimberly, Thomas A. Spies, Colin J. Long, and Cathy Whitlock; "Simulating Historical Variability in the Amount of Old Forests in the Oregon Coast Range," Conservation Biology, Pages 167-180, Volume 14, No. 1, February 2000; http://www.fs.fed.us/pnw/pubs/journals/0010.pdf. At the province scale, the mean percentage of old growth in the Oregon Coast Range was estimated at between 39 and 55

percent. The mean percent of late successional forest showed less variation at between 66 to 76 percent. The authors also noted that currently

> the entire Coast Range province contains approximately 5% old growth and 11% late successional forests. These estimates fall far below the 5% quantiles for percent old growth and percent late successional forest modeled at the province scale. . . . Current levels of old growth and late successional forests are so low that even halving the natural fire rotation or doubling the mean fire size would not bring them within the estimated provincial-scale ranges of historical variability.

A century of human influence punctuated by several decades of aggressive and irresponsible clearcutting and development have pushed forest ecosystems far outside the natural range of variability. Numerous species in our forests and streams qualify for listing under the Endangered Species Act or have recognized concerns for persistence. To be consistent with the Northwest Forest Plan and to help recover at-risk species, all future management actions must be designed to move forest and stream ecosystems towards the middle of the range of variability, and must NOT push ecosystems further toward the extremes. All regen harvest, salvage harvest, and road building will move forests in the wrong direction further toward the extremes. Thinning young plantations to create complexity and diversity and encourage decadence would move forest ecosystems in the right direction.

Recent research covering the Oregon Coast Range (but likely applicable to all conifer forests in Western Oregon) shows, "The majority of the landscape historically contained 500-700 Mg/ha of live wood and 50-200 Mg/ha of dead wood. The current dead wood condition is outside HRV. Stands with very low dead wood are currently dominant but rarely occurred historically." Nonaka, Etsuko, Spies, Thomas, Wimberly, Michael, Ohmann, Janet. 2004. ***Historical range of variability in biomass dynamics and stand disturbance history: A simulation approach***.
http://abstracts.co.allenpress.com/pweb/esa2004/document/?ID=35104
NONAKA, ETSUKO AND THOMAS A. SPIES. 2005. HISTORICAL RANGE OF VARIABILITY IN LANDSCAPE STRUCTURE: A SIMULATION STUDY IN OREGON, USA Ecological Applications, 15(5), 2005, pp. 1727–1746.
http://www.cabnr.unr.edu/weisberg/NonakaSpies2005.pdf
http://www.fsl.orst.edu/clams/download/pubs/2005EA_nonaka_spies.pdf

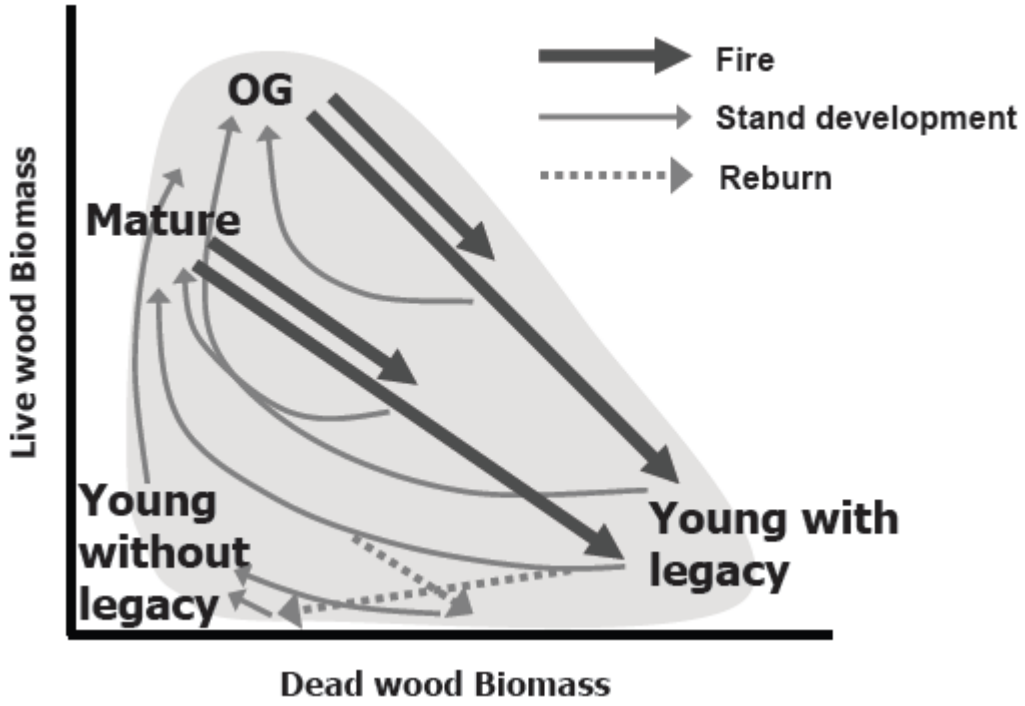

Figure 3.2: Dynamics of live and dead wood biomass in response to different fire severities and frequencies. The thick arrows are fire events, and the short ones are moderate-severity fires, which do not convert all live wood biomass into deadwood. The dotted arrows indicate repeated burns, which returned to the stand when live biomass has not been well developed. The thin arrows indicate stand development over time. "Young with legacy" refers to young stands (< 80 yrs) with high amounts of deadwood, and "young without legacy" refers to young stands with relatively small amounts of deadwood because of reburns. The shaded area conceptually indicates all possible range of pathways under the fire regime and forest growth. Under the historical fire regime, the shaded area can be considered as the HRV of biomass dynamics. Mature = mature forests (80-200 yrs). OG = old-growth forests (> 200 yrs). [from Etsuko Nonaka's MS Thesis: CHAPTER 3: HISTORICAL RANGE OF VARIABILITY (HRV) IN LIVE AND DEAD WOOD BIOMASS: A SIMULATION STUDY IN THE COAST RANGE OF OREGON, USA]

The following tables show <u>Abundance of forest types with various combinations of live and dead wood relative to historic mean values derived from multiple 1,000 year simulations.</u> Based on Table 3.4 *in* Nonaka, E, Spies, TA, Wimberly, MC, and Ohmann, JL. Historical range of variability (HRV) in live and deadwood biomass: a simulation study in the Coast Range of Oregon, USA.

live wood biomass	very high		mature and old-growth forests with abundant live biomass and some dead wood			
	high					

<table>
<tr><td rowspan="5"></td><td>moderate high</td><td></td><td colspan="2">are <u>significantly below</u> the historic mean</td><td colspan="2" rowspan="4">unsalvaged disturbances with abundant dead wood are well <u>below</u> the historic mean</td><td></td></tr>
<tr><td>moderate</td><td colspan="3" rowspan="3">clearcuts and post-fire salvage result in young forests with little dead wood. This type was rare historically but now <u>significantly above</u> the historic mean</td><td></td></tr>
<tr><td>low</td><td></td></tr>
<tr><td>very low</td><td></td></tr>
<tr><td></td><td>very low</td><td>low</td><td>moderate</td><td>moderate high</td><td>high</td><td>very high</td></tr>
<tr><td></td><td></td><td colspan="6">dead wood biomass</td></tr>
</table>

<u>Here is the same chart showing magnitude of the departure from historic mean. Each + or - represents a deviation from the mean of 1% of the landscape</u>).

live wood biomass	very high		- - -	- -			
	high		- -	- - -			
	moderate high	+	- - - - -	-	- - -	-	
	moderate	+++++ ++++	++	+	-	-	
	low	+++++ ++++ +++++ +++++	+++ +++	++	-	-	
	very low	+++++ +++++ +++++ +++++ +++++	+++++ +++++	+++	- -	- -	- -
		very low	low	moderate	moderate high	high	very high
	dead wood biomass						

This chart highlights the finding in the Windjammer EA, where the Siuslaw NF noted that at least six times more coarse wood carries over from old-growth forests after wildfire compared to timber harvest, and the CWD left after logging is smaller and decays faster (*citing* Spies & Cline 1988)[1]. Regen harvest and salvage harvest are inexcusable in this day and age because they will only create more of the young legacy-deprived forest types that are already far in excess of natural range of variability, while reducing both old and young legacy-rich forest types that are far below natural range of variability.

> Setting targets for maintaining the natural diversity of ecosystems requires identifying the thresholds at which disturbance greater than the natural range results in detrimental change. The scientific search for such thresholds is relatively new; and, because of time lags, it takes a while for the harmful impacts of habitat change to become apparent. Consequently, empirical evidence of thresholds is restricted to a limited number of ecosystems. In a small number of landscape-level studies, habitat thresholds in temperate and boreal forests range between 10% and 80%, occurring most frequently between about 30% and 70%. Simulation modelling produces similar results: in a theoretical landscape, habitat patches start to become isolated at 30% habitat loss and all patches are isolated at 70% loss.21 Accordingly, the target for old growth maintenance is at least 70% of the natural proportion—the natural proportion being the mean of the natural range (Table 1). This target applies to the subregional level [500,000 to 5,000,000 ha]. Less stringent versions apply to landscape and watershed levels. ... Accordingly, the old growth target at landscape level is 50% of the natural proportion, provided the average across all landscapes is 70% (the subregional target); and at watershed level 30%, provided the average across all watersheds is 50% (the landscape target).

Robert Prescott Allen. Coast Information Team Review Report. January 2005. http://www.citbc.org/c-citreview-jan05.pdf

Manage within the historic range of variability with restoration efforts that increase under-represented elements and reduce over-represented elements.

- Existing intact habitats should be protected, while restoration focuses on areas that have been degraded by past management. The agency should defer logging in the stands older than 80 years, because these areas are relatively more intact, and because older stands do not respond as well to thinning, making the younger stands with greater expectations of thinning response a much higher priority,
- Roads are an "alien" structure in our watersheds and though they are a necessary evil, management efforts must reduce the over-built road system to the bare minimum. Riparian roads that separate streams from their flood plains and or separate them from sources of large woody debris should be the very high priority

[1] Spies, T. A., and S. P. Cline. 1988. Coarse woody debris in forests and plantations of coastal Oregon. Pp. 5-23 in: C. Maser, R. F. Tarrant, J. M. Trappe, and J. F. Franklin, ed. From the forest to the sea: a story of fallen trees. Gen. Tech. Rpt. PNW- GTR-229. USDA Forest Service, Portland OR. http://www.fs.fed.us/pnw/pubs/229chpt1.pdf

for removal. Mid-slope roads that cross streams and steep slopes are also a high priority because they are likely to disrupt the natural movement of sediment and large woody debris and deprive streams of this vital material.

- Most mature and old-growth forest habitat historically occurred in large habitat patches which are currently greatly under-represented relative to the historical condition, so existing unroaded areas should be protected, while road closures are designed and prioritized to recreate more of the large intact habitat blocks.
- Dense young stands with little structural retention (e.g. stands resulting form past clearcutting and densely replanted) are vastly over-represented relative to the historical condition. Management should focus on thinning stands that are accessible from existing roads. Thinning should always use variable retention techniques that create a variety of microhabitats and habitat gradients within and between stands. Unthinned "skips" provide important refugia and centers for dispersal for post-thinning recovery. Heavily thinned "gaps" provide important landscape scale diversity. Skips should generally be much larger than the gaps.
- Stands that were artificially planted following logging often have one or a few species (such as Douglas fir) that are over-represented. Restoration thinning will require that tree species other than Douglas fir be retained as much as possible, especially large specimens. Certain trees such as Pacific yew, western redcedar, (and Sitka spruce in some areas) are under-represented and need to be planted or otherwise encouraged. Tall shrubs and other understory plants are underrepresented in dense plantations and will be helped by appropriate variable density thinning.
- Snags and dead wood habitat are critical components of healthy forests and provide not only essential habitat for a wide range of fish & wildlife, but they also provide essential functions related to soil stability and soil formation, nutrient cycling, and hydrology that are intimately tied to the very productivity of the forest. Dead wood is also far under-represented relative to the historical condition, so all future activities must manage for, not against, "decadence." This can include leaving existing snags and down wood, selectively killing some live trees, and retaining some extra live trees on site for future recruitment of dead wood.
- Healthy streams are also under-represented. Restoring connectivity and functionality to the stream network will include: restoring instream flows; removing road culverts and other non-native structures that block passage of aquatic organisms as well as blocking delivery of beneficial sediment and large wood structure to streams; restoring stream-side vegetation structure; and restoring natural processes such as floods and structure-rich landslides.

Don't Abuse the Historic Range of Variability Concept.

The NEPA document repeatedly invokes the concept of "historic range of variability" (HRV) to justify industrial intervention such as logging and roading. However, the HRV concept is meaningless unless a scale is specified (preferably both a temporal and spatial scale). The scale of determining the historic range of variability is critical. At small scales, the amount of old forest varied from zero to 100 percent depending on how recently the site was disturbed by intense fire, flood, volcanism, etc. HRV at this scale is

meaningless and must never be used as an excuse to destroy old forests. But at very large scales, such as the Interior Columbia Basin, the condition of vegetation is a mosaic that reflects the effects of fires and other disturbances. At these large scale, the historic range of variability begins to approach the amounts of young and old forest expected based on the fire return interval for stand replacing fires.

In the Northwest Forest Plan area and the Interior Columbia Basin, the amount of old forest, large trees and large snags are far below the historic range of variability. If we look only at the 5th field watershed scale we will miss this larger pattern of loss of old forest structure. Those few watersheds that are at or above HRV should be managed and conserved to compensate for the many watersheds that are below HRV.

All HRV references in the NEPA document must be clarified to specify a geographic and temporal scale and note what whether the same parameter is within the HRV at the more meaningful regional scale.

Furthermore, the agencies must avoid managing for a snap-shot in time, such as when Europeans arrived. HRV must be described as a range of values, not just a single midpoint value. Any single-value representation of HRV represents by necessity a static world, which we know to be false. A few examples will help clarify:

1. Fire return interval should not be reported as merely a mean value and landscape exceeding that mean should not be considered outside the natural range of variability. Instead fire return interval should be reported as a histogram of fire return values for a particular landscape. See Baker, William. 1994. Restoration of Landscape Structure Altered by Fire Suppression. Conservation Biology. vol 8, no. 3, Sept. 1994. The mean fire return value will likely be one of the high bars on the histogram, but presenting fire return interval as a histogram clearly shows that fire return intervals both shorter and longer than the mean were part of the natural range of variability and should not necessarily be considered abnormal.
2. Snag and dead wood values should not be presented as simple average values measured across a wide range of sites and seral conditions. Snag and dead wood values are highly variable across space and time, so this variability should be disclosed and not hidden. While average number of snags and down wood tend to be low, high values are expected after fire or other disturbances. Management activities must be viewed as disturbance events, and as such they should attempt to emulate the natural pattern by retaining much higher levels than average levels of snags and dead wood. The NEPA analysis should at a minimum disclose the expected values of dead and down wood over time in stands subject to a natural disturbance regime and compare those values to the expected snag and dead wood values under the proposed management regime.

The speakers at the January 2005 workshop on "Using Past Ecological Conditions" emphasized a few things that the project team should consider:

1. always specify the temporal and geographic scales;
2. choose scales of analysis that elucidate meaningful system properties; (don't be devious by choosing scales that justify predetermined action)

3. specify whether climate variability is being accounted for;
4. consider the probability of various values within the range of variability; specify the expected frequency distribution for values within the historic range of variability; recognize that systems spend more time near the mid-point of the range of variability and much less time near the extremes of the range of variability;
5. restore both structures and the processes that ultimately create and sustain them;
6. state assumptions and limitations;
7. describe consequences of types and degree of deviation from the historic range of variability;
8. account for exotic species (e.g. brook trout, false brome) and exotic structures (e.g., roads and culverts).

The courts demand an honest account of HRV and how it is used in the decision-making process:

> … Although treatment may be designed to restore old growth to "historic conditions," [plaintiff] points out this can be a misleading concept: for example, information regarding historic conditions is incomplete; altering particular sections of forest in order to achieve "historic" conditions may not make sense when the forest as a whole has already been fundamentally changed; many variables can affect treatment outcomes; and the treatment process is qualitatively different from the "natural" or "historic" processes it is intended to mimic.
>
> …Here, the Service is not simply maintaining the amount of old-growth habitat necessary to support old-growth dependent species — it is altering the composition of old-growth habitat through an invasive process.

Ecology Center v. Austin (9th Circ 2005)
http://www.ca9.uscourts.gov/ca9/newopinions.nsf/AD80E02F50359F82882570D0007C6849/$file/0335995.pdf

Taken in proper context the range of natural variability is probably wider than currently recognized. Consider for example: Prichard, Gedalof, and Peterson. A 10,000-year record of fire and vegetation history in the North Cascades Range, Washington, USA. Symposium: Mixed Severity Fire Regimes: Ecology and Management. Spokane, WA. USA. November 2004.
http://emmps.wsu.edu/fire/secondary/SYMPOSIUM.html#Abstracts/Prichard.html

> ABSTRACT
> Mixed severity fire regimes are widespread throughout the Cascade Range, but few studies on the dynamics of fire and vegetation have been conducted in these systems. We reconstructed the long-term history of fire and vegetation at a montain forest site in the North Cascade Range. Lake sediment charcoal and fossilized conifer needle records, sampled at the same high resolution, were used to establish vegetation and fire histories. During the early Holocene (>10,500 to c. 7700 calibrated years before present (cal yr BP)), climate was likely warm and dry, and forests were dominated by lodgepole pine with Douglas-fir, subalpine fir and western white pine as stand associates. During the mid Holocene (c. 7700 to

c. 5200 cal yr BP), regional climate gradually shifted to cooler and moister conditions. Lodgepole pine became uncommon and Douglas-fir and western white pine were dominant. Shade tolerant species including western hemlock and western red cedar first appeared at the beginning of the late Holocene (5200 cal yr BP to present). Alaska yellow cedar appeared most recently at 2000 years BP. The present forest assemblage contains the greatest tree diversity of any time throughout the Holocene record. Although climate and vegetation clearly varied over the Holocene record, fire frequency did not significantly change over millennial time scales. The high variability in fire return intervals throughout the Holocene is notable in our record and suggests that mean fire return intervals estimated from tree-ring reconstructions do not represent the variability in historic fire frequencies and should be treated with caution.

Future range of variability.

The agency should consider the possibility that the future range of variability is different than the historic range of variability. In other words, we raise the significant possibility that CO2 enrichment, plus cessation of native burning and continuation of fire suppression, plus climate change (different spatial and temporal patterns of wet/dry ad warm/cold) has resulted in a different range of future possibilities relative to the past? The historic range of variability is still a useful point of reference but may be an unattainable goal. How should the agency respond? We suggest that the agency needs to tolerate more dense stands while maintaining enough variability so that disturbances are controlled by discontinuities (e.g. disturbance is not overly contagious), then make sure that post-disturbance landscapes retain structural legacies and are allowed to recover their complexity.

Some are saying that Global Warming May Warrant New Approaches To Ecosystem Restoration[2], but few are offering concrete ideas on how to adapt management to account for climate change.

We should recognize that forests have ecological inertia that will help them persistent through small ranges of climate variability but that large scale climate variation is on the horizon and over long time frames stand replacing disturbance is inevitable. Such stand replacing disturbances may bring on a phase transition that may divert the trajectory of the vegetation into a new attractor basin (e.g. hardwoods or shrub fields).

The stand replacing disturbance could be either fire or regen harvest, so we could choose to delay the phase transition by NOT conducting regen harvest. It might also be persuasively argued that thinning in some cases actually make forests more resilient to disturbance and forestall the phase transition.

This all assumes that we prefer forests over the alternatives, which may be placing human values on the question, but it would be best to think of it as helping all the forest dwelling

[2] http://www.sciencedaily.com/releases/2006/06/060615082745.htm

critters persist a little longer before they face ever more pressure from human caused climate change.

Maintaining biodiversity enhances forest health

> Chickadees, nuthatches and warblers foraging their way through forests have been shown to spur the growth of pine trees in the West by as much as one-third, according to a new University of Colorado at Boulder study.
>
> The study showed birds removed various species of beetles, caterpillars, ants and aphids from tree branches, increasing the vigor of the trees, said study author Kailen Mooney.
> …
> "The study indicates that pine canopies are very complex systems with an unexpected level of biodiversity," said Mooney. "Forest managers really need to look at the big picture of ecosystems and not just focus on trees when implementing regulations aimed at encouraging the growth of healthy forests."
>
> The study also has implications for large areas of the West ravaged by forest fires in recent years, he said. A number of once formidable stands of mature ponderosa have been burned and logged and subsequently replaced by smaller pines that offer limited breeding opportunities for cavity-nesting birds like chickadees and nuthatches, which nest and lay their eggs in the holes of large trees and dead snags.
>
> "This is a very rigorous study that essentially shows that even modest little birds like chickadees and nuthatches can help improve the heath of the trees, which are the monarchs of the forest," said CU-Boulder biology Professor Yan Linhart.
> …
> By removing insects, the birds indirectly altered the terpene composition of pine tissues, said Linhart. The alteration of terpene "flavor" can have wide ranging effects, since terpenes influence decisions that creatures like bark beetles, porcupines and squirrels make when deciding which trees to eat, said Linhart.
>
> "Terpenes act a bit like an immune system by essentially fending off attacks by birds and mammals," said Linhart. "One of the fascinating results of this study is that birds affect how this immune system functions."
>
> The study also showed that chickadees and nuthatches disrupt a mutually beneficial relationship ants have with aphids, which feed on plant tissue known as phloem sap that carries nutrients through the tree, Mooney said. While some ant species "tend" aphid colonies -- protecting them from predators in exchange for their carbohydrate-high "honeydew" secretions - feeding activity by birds can disrupt this relationship, triggering aphid population decreases and increases in tree growth.

"These ponderosa forests have very complex food chains," Linhart said. "In essence the nuthatches and chickadees act as tree protectors, keeping check the insects that can have deleterious effects on forest vigor."

The birds in the study included the mountain chickadee, the red-breasted nuthatch, the pygmy nuthatch and the yellow-rumped warbler. All but the warbler are year-round residents of ponderosa pine forests in Colorado.

Chickadee, Nuthatch Presence In Conifers Increases Tree Growth, Says CU-Boulder Study. Aug. 1, 2007. http://www.colorado.edu/news/releases/2007/282.html

Forest insects and diseases help regulate a healthy forest.

The NEPA document failed to consider the beneficial effects of insects and disease, for example: the value of mistletoe brooms as wildlife structures; the value of root rot in creating pockets of down woody debris, enhancing biodiversity, and creating gaps with complex canopy architecture; the value of bark beetles as food sources for diverse wildlife and as vectors of sapwood decay fungi rendering the tree more suitable for wildlife habitation.

The massive insect epidemics that have plagued Pacific Northwest forests in recent years are mostly a reflection of poor forest health conditions, overcrowding, overuse of chemicals, fire suppression and introduction of monocultures or non-native species, a new report concludes.

Beyond that, these insect attacks are actually nature's mechanism to help restore forest health on a long-term basis and in many cases should be allowed to run their course, according to Oregon State University scientists in a new study published this week in the journal Conservation Biology In Practice.

Native insects work to thin trees, control crowding, reduce stress and lessen competition for water and nutrients, the researchers found. Some levels of insect herbivory, or plant-eating, may even be good for trees and forests, and in the long run produce as much or more tree growth.

"There is now evidence that in many cases forests are more healthy after an insect outbreak," said Tim Schowalter, an OSU professor of entomology. "The traditional view still is that forest insects are destructive, but we need a revolution in this way of thinking. The fact is we will never resolve our problems with catastrophic fires or insect epidemics until we restore forest health, and in this battle insects may well be our ally, not our enemy."

Historically, Schowalter said, destructive forest insects such as the mountain pine beetle or tussock moth were native to Pacific Northwest forests and served an essential role in keeping them healthy. When trees became too crowded the insects would eliminate weaker trees and reduce competition. But since the beetles' reproductive pheromones only carried effectively about 15-20 feet,

naturally open stands of mature pines were protected against widespread outbreaks.

In these same forests today, fire suppression has allowed shade-tolerant, fire-intolerant species to crowd the understory, create an entire forest stressed for water and nutrients, and beetles can skip from one weak tree to another across entire stands. But the solution in cases such as this, Schowalter said, is to address the fundamental issue of overcrowding through forest thinning, controlled fire and insect attack, allowing the pine beetles to actually help in the long-term process of restoring forest health.

It now appears that insects, which are the most abundant and diverse animals on Earth, are anything but destructive pests. Rather, they are major architects of the plant world in both structure and function, and in natural balance help to maintain healthy and productive forest ecosystems.

According to the new report, insects can influence their environment in five key ways:

· Insects aid decomposition, stimulate the breakdown of organic materials, enhance soil fertility and plant growth, burrow in soils and increase its porosity and water-holding capacity.

· Insects are herbivores that eat plants, influencing where they can grow. Sometimes they kill trees and other plants to reduce competition, and many times feed on trees without killing them in ways that actually improve the health and long-term growth of trees and forests.

· Insects are a key food source for vertebrates and other animals, and play a major role in the food chain.

· Insect are dispersal agents to carry seeds, fungal spores, and even other invertebrates from one place to another.

· Insects are pollinators, and in this role also help control the movement of plant species.

Through this multiplicity of roles, forest insects can help to control plant succession, dictate which plants will be allowed to grow or thrive in particular areas, and generally invigorate plant communities, the report said. Studies suggest herbivory levels as high as 40-50 percent make little or no difference to plant growth and survival, and this type of moderate herbivory clearly should not be "fought" with costly controls. Wood production in western U.S. pine forests reached or exceeded pre-attack levels 10-15 years following mountain pine beetle outbreaks, research has shown, and the more an individual Douglas-fir tree is defoliated by the tussock moth, the more it compensates afterwards with increased

growth, given sufficient resources. The herbivory may alleviate drought stress by reducing a tree's demand for water, and also encourage more competitive interactions between plant species that ultimately work to the benefit of the tree.

Insects may be so important to soil fertility that they may be a better barometer of forest ecosystem health than the larger trees or animals which live there, researchers say. In natural forest communities there are more than 200 species of arthropods and more than 200,000 individuals in a square meter of soil, and the numbers of these arthropods can tell more than chemical tests about soil concerns such as compaction and nutrient cycling. A study by another OSU researcher showed residual impacts on soil invertebrate populations from a site that had been clearcut and slash burned 40 years earlier.

In their natural role, insects are usually helpful to the forest and rarely cause large epidemics.

"When you have a highly destructive insect epidemic, what that really should be telling us is not that we have an insect problem, but that we have a forest health problem," Schowalter said. "It's monocultures and fire suppression that cause insects to become nuisances. The pests that plague us are all too often of our own making."

As these systems become more fully understood, Schowalter said, it should be possible to work with insects, rather than against them, to produce new solutions to maximize the yield of forest commodities while achieving conservation goals and healthier ecosystems.

"It's really simple on one level," Schowalter said. "We have to pay more than lip service to the balance of nature."

http://www.sciencedaily.com/releases/2001/10/011030230203.htm

See also:

- Insect Ecology - An Ecosystem Approach Edited by Timothy D. Schowalter Academic Press. 2000. and Schowalter, TD and J. Withgott. 2001.
- Rethinking insects: What would an ecosystem approach look like? Conservation Biology In Practice 2(4): 11-16.
- Waldbruaer, Gilbert. 2003. What Good are Bugs? Insects in the Web of Life. Harvard University Press. Cambridge, MA. 316 pp.

Another interesting example, though anecdotal, is from Yellowstone National Park where researchers noted after the 3,400 hectare 1994 Robinson fire that beetle-killed lodgepole pine (self-thinned to lower density) experienced significantly lower fire severity compared to adjacent burned areas.
http://www.fs.fed.us/projects/documents/Omi_pollet_2002_thinning_effects.htm

Recognize the Many Values of Snags, Decayed Wood And Associated Functions And Species

In a dynamic ecosystem life may be fleeting but the snags and logs that survive disturbance provide very critical temporal links from one stand to the next. Under natural conditions, a forest hands down a large legacy of living and dead material from one stand to another even after an intense disturbance. Even non-stand-replacing disturbance creates pulses of dead material that are critical for forest ecosystems. See

1. Franklin, J.F., Lindenmayer, D., MacMahon, J.A., McKee, A., Magnuson, J., Perry, D.A., Waide, R., and Foster, D. 2000. Threads of Continuity. Conservation Biology in Practice. [Malden, MA] Blackwell Science, Inc. 1(1) pp9-16.
2. William F. Laudenslayer, Jr., Patrick J. Shea, Bradley E. Valentine, C. Phillip Weatherspoon, and Thomas E. Lisle *Technical Coordinators*. Proceedings of the Symposium on the Ecology and Management of Dead Wood in Western Forests. PSW-GTR-181. http://www.fs.fed.us/psw/publications/documents/gtr-181/
3. Lofroth, Eric. 1998. The dead wood cycle. In: Conservation biology principles for forested landscapes. Edited by J. Voller and S. Harrison. UBC Press, Vancouver, B.C. pp. 185-214. 243 p. http://www.for.gov.bc.ca/hre/deadwood/DTrol.htm
4. 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://www.nwhi.org/inc/data/GISdata/docs/chapter24.pdf
5. Stevens, Victoria. 1997. The ecological role of coarse woody debris: an overview of the ecological importance of CWD in B.C. forests. Res. Br., B.C. Min. For., Victoria, B.C. Work. Pap. 30/1997. http://www.for.gov.bc.ca/hfd/pubs/docs/Wp/Wp30.pdf

The Forest Service even has a public education program called "Animal Inn" intended to inform the public of the value of dead wood, unfortunately the agencies still don't fully recognize these values:

> Nearly a third of all forest creatures depend on standing dead or fallen trees for their survival. ANIMAL INNS provide shelter, nest sites, and feeding areas for over 1200 species of birds, mammals, amphibians, and reptiles; over 60% of which feed on insects. These insect-eating species act as natural biological regulators to dampen the effects of insect outbreaks in forested lands, thereby performing an important ecosystem function. Fish benefit from trees that have fallen into stream channels.

http://www.fs.fed.us/r6/nr/wildlife/animalinn/basicneed.htm

Felling and removal of large trees, whether they are alive or dead, removes large material that is normally handed down from one stand to the next. The loss of this material has serious adverse consequences for wildlife, hydrology, soil, etc. These legacies are often described as "lifeboats" that allow species to persist in post-disturbance forests and/or return more rapidly to post-disturbance forests. Given cumulative loss of habitat and ecological functions over the last century, how many lifeboats can we take off the ship

when threatened and endangered species and sensitive species are at stake? The NEPA analysis must account for all the values provided by snags and down wood and the effect of removing these legacy structures.

The NEPA analysis must recognize that mechanical treatments unavoidably reduce snag habit, if for no other reason than the habitual removal of snags for safety reasons. Even restoration thinning intended to accelerate development of large trees reduces mortality that is another key attribute of late successional forests.[3] In the Windjammer EA, the Siuslaw NF noted that at least six times more coarse wood carries over from old-growth forests after wildfire compared to timber harvest, and the CWD left after logging is smaller and decays faster (*citing* Spies & Cline 1988)[4]. Ohmann et al (1994) found that non-federal forestlands do not retain enough snags to support viable wildlife populations[5], so federal managers likely need to retain more snags on federal lands to compensate. Even when snag removal is not an intentional design feature of a project, hazard tree felling normally occurs in all treatment areas, plus a safety buffer around all treatment areas, plus a safety corridor along roads, and other work areas. Furthermore, non-federal lands are not managed for snag habitat. These are some of the reasons why Korol et al (2002) found that large snag habitat is below historic range of variability, and in the future would attain historic levels only in roadless and wilderness areas. Given the current extent of the road network and the historic extent of logging, the cumulative effects analysis must recognize the inherent conflict between "forest management" (past, present and future) and snags and all their values.

Bats, martens, woodpeckers, bears, amphibians, invertebrates, and many other species are dependant upon snags and down wood. Approximately 31% of the total bird fauna of this region use snags for nesting and denning, foraging, roosting, communicating, and as hunting and resting perches. (Raphael and White 1984), so the importance of dead wood as a habitat element cannot be over-stated. Snags and down wood also serve several crucial ecosystem functions related to site productivity, nutrient storage & cycling, hydrology, geomorphology, disturbance, and habitat (terrestrial, riparian and aquatic).

Current plan direction for protecting and providing snags and down wood tends to be focused on a small subset of the full spectrum of values provided by dead wood and does not ensure the continued operation of these ecosystem functions or meet the complete lifecycle needs of the many species associated with this unique and valuable habitat component. Please consider all the many values of snags and down wood presented in Rose, C.L., Marcot, B.G., Mellen, T.K., Ohmann, J.L., Waddell, K.L., Lindely, D.L., and

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[3] Mortality of Douglas-fir and hardwoods was higher in controls than in thinned units. Liane R. Davis, and Klaus J. Puettmann, Gabriel F. Tucker. 2007. Overstory Response to Alternative Thinning Treatments in Young Douglas-fir Forests of Western Oregon. Northwest Science 81(1). 2007.

[4] Spies, T. A., and S. P. Cline. 1988. Coarse woody debris in forests and plantations of coastal Oregon. Pp. 5-23 in: C. Maser, R. F. Tarrant, J. M. Trappe, and J. F. Franklin, ed. From the forest to the sea: a story of fallen trees. Gen. Tech. Rpt. PNW- GTR-229. USDA Forest Service, Portland OR. http://www.fs.fed.us/pnw/pubs/229chpt1.pdf

[5] Ohmann, McComb, & Zumrawi; SNAG ABUNDANCE FOR PRIMARY CAVITY-NESTING BIRDS ON NONFEDERAL FOREST LANDS IN OREGON AND WASHINGTON; *Wildl. Soc. Bull. 22:607-620,* 1994 http://www.fs.fed.us/pnw/pubs/journals/ohmann-snagabundance.pdf

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://www.nwhi.org/inc/data/GISdata/docs/chapter24.pdf

Introduction

Decaying wood has become a major conservation issue in managed forest ecosystems.[16, 64, 69a, 149, 201] Of particular interest to wildlife scientists, foresters, and managers are the roles of wood decay in the diversity and distribution of native fauna, and ecosystem processes. Numerous wildlife functions are attributed to decaying wood as a source of food, nutrients, and cover for organisms at numerous trophic levels.[231, 232, 234, 346, 369] Principles of long- term productivity and sustainable forestry include decaying wood as a key feature of productive and resilient ecosystems.[10, 229, 291, 293, 386] In addition to a growing appreciation of the aesthetic, spiritual, and recreational values of forests, society increasingly recognizes ecosystem services of forests as resource .capital. with tangible economic value to humansy, such as air and water quality, flood control, and climate modification.[15, 262, 290]

The ecological importance of decaying wood is especially evident in coniferous forests of the Pacific Northwest. In this region, the abundance of large decaying wood is a defining feature of forest ecosystems, and a key factor in ecosystem diversity and productivity.[127] … Large accumulations of decaying wood provide wildlife habitat and influence basic ecosystem processes such as soil development and productivity, nutrient immobilization and mineralization, and nitrogen fixation.[85, 115, 218, 233] …
…
Since the publication of Thomas et al.[369] and Brown,[48] new research has indicated that more snags and large down wood are needed to provide for the needs of fish, wildlife, and other ecosystem functions than was previously recommended by forest management guidelines in Washington and Oregon. For example, the density of cavity trees selected and used by cavity-nesters is higher than provided for in current management guidelines.[53, 102] …
…

Ecological Functions of Decaying Wood

…
Recent significant advancements have defined wildlife species-specific relationships with particular characteristics and components of decaying trees, both standing and fallen,[56, 95, 185, 284, 351, 373, 386, 402] and implications for management.[13, 68, 223, 226, 250, 327] …
…
Hollow trees larger than 20 inches (51 cm) in diameter at breast height (dbh) are the most valuable for denning, shelter, roosting, and hunting by a wide range of animals.[7], **…**
…

… In the Interior Columbia Basin, grand fir and western larch form the best hollow trees for wildlife uses. …

…

Recent studies have provided valuable insight on wildlife uses of snags (dead trees).[21, 56, 314, 402] Snags provide essential habitat features for many wildlife species (Figure 6). The abundance of cavity-using species is directly related to the presence or absence of suitable cavity trees. Habitat suitability for cavity-users is influenced by the size (diameter and height), abundance, density, distribution, species, and decay characteristics of snags.[307] In addition, the structural condition of surrounding vegetation determines foraging opportunities.[402]

The Habitat Elements matrix on the CD-ROM with this book lists a total of 96 wildlife species associated with snags in forest (93 species) or grassland /shrubland (47 species) environments. Most of these species use snags in both environments. In forests, this includes 4 amphibian, 63 bird, and 26 mammal species. Additionally, 51 wildlife species are associated with tree cavities, 45 with dead parts of live trees, 33 with remnant or legacy trees (which may have dead parts), 28 with hollow living trees, 21 with bark crevices, and 18 with trees having mistletoe or witch's brooms. Habitat uses include nesting, roosting, preening, foraging, perching, courtship, drumming, and hibernating (Figure 7).

Of the 93 wildlife species associated with snags in forest environments, 21 are associated with hard snags (Stages 1 and 2), 20 with moderately decayed snags (Stage 3), and 6 with soft snags (Stages 4-5) in the five-stage classification system. According to the matrixes,188 most snag-using wildlife species are associated with snags >14.2 inches (36 cm) diameter at breast height (dbh), and about a third of these species use snags >29.1 inches (74 cm) dbh.

This query of the Habitat Elements matrix illustrates the breadth of updated information about wildlife and snag habitat relations. Research results have expanded the number and variety of decaying wood categories over what was previously presented in Thomas[366] and Brown.[48]

…

. Down Woody Material (logs). Down wood affords a diversity of habitat functions for wildlife, including foraging sites, hiding and thermal cover, denning, nesting, travel corridors, and vantage points for predator avoidance.[56, 64, 230] Larger down wood (diameter and length) generally has more potential uses as wildlife habitat. Large diameter logs, especially hollow ones are used by vertebrates for hiding and denning structures.[214, 230] …

…

Long term Productivity

… Processes that sustain the long- term productivity of ecosystems have become the centerpiece of new directives in ecosystem management and sustainable forestry.[78, 229, 291, 320] Given the key role of decaying wood in long-term productivity of forest ecosystems in the Pacific Northwest,[122, 169, 261, 302] the topic

should remain of keen interest to scientists and managers during the coming decade.[149] … functions of decaying wood directly linked to long-term productivity, include[e] influences on the frequency and severity of disturbances such as fire, disease, and insect outbreaks.5, 6, 133, 137

Nutrient Cycling and Soil Fertility. Decaying wood has been likened to a savings account for nutrients and organic matter,[376] and has also been described as a short-term sink, but a long-term source of nutrients in forest ecosystems.[164] …

… Substantial amounts of nitrogen are returned to the soil from coarse wood inputs, yet even where annual rates of wood input are high, 4 to 15 times more nitrogen is returned to the forest floor from foliage than from large wood.[164] …

… The low nutrient content in wood, small mass of tree boles relative to foliar litterfall, and slow rates of wood decay suggest that large wood plays a minor role in forest nutrition.[18, 159, 162] After large scale disturbance such as fire and blowdown, however, the large nutrient pool stored in woody structures of trees (bole, branches, twigs, roots) becomes available to the regrowing forest. Large down wood may thus be an ample source of nutrients throughout secondary succession.[281]
…
Recent studies indicate that wood may release nutrients more rapidly than previously thought through a variety of decay mechanisms mediated by means other than microbial decomposers, i.e. fungal sporocarps, mycorrhizae and roots, leaching, fragmentation, and insects.[107, 158, 159, 162, 339, 405] …

Soil is the foundation of the forest ecosystem.[68, 348] … On the H. J. Andrews Experimental Forest of western Oregon, 20-30% of the soil volume consists of decaying wood dispersed throughout a matrix of litter and duff.[294] Because wood is a relatively inert substance, it may help to stabilize pools of organic matter in forests by slowing soil processes and buffering against rapid changes in soil chemistry. …
…
… Numerous studies have demonstrated that losses in soil productivity often are closely linked to losses in soil organic matter.[298]
…

Mass Wasting and Surface Erosion. … Large wood helps to anchor snowpacks, limit the extent of snow avalanches, and may even stabilize debris flows, depending on the depth of the unstable area.[125, 356, 358] … By covering soil surfaces and dissipating energy in flowing and splashing water, logs and other forms of coarse wood significantly reduce erosion.[357] Large trees lying along contours reduce erosion by forming a barrier to creeping and raveling soils, especially on steep terrain. Material deposited on the upslope side of fallen logs absorbs

moisture and creates favorable substrates for plants that stabilize soil and reduce runoff.[230]

Stand Regeneration and Ecosystem Succession. Decomposing wood serves as a superior seed bed for some plants because of accumulated nutrients and water, accelerated soil development, reduced erosion, and lower competition from mosses and herbs.[160, 376] In the Pacific Northwest, decaying wood influences forest succession by serving as nursery sites for shade-tolerant species such as western hemlock, the climax species in moist Douglas- fir habitat.[80, 123, 160, 163, 244] Wood that covers the forest floor also modifies plant establishment by inhibiting plant growth, and by altering physical, microclimatic, and biological properties of the underlying soil. For example, elevated levels of nitrogen fixation in *Ceanothus velutinus* and red alder[35, 88] have been reported under old logs.

Streams and Riparian Forests. Long-term productivity in streams and riparian areas is closely linked to nutrient inputs, to attributes of channel morphology, and to flow dynamics created by decaying wood.[144, 233, 360] …

Large wood is the principal factor determining the productivity of aquatic habitats in low- and mid-order forested streams.[262] Large wood stabilizes small streams by dissipating energy, protecting streambanks, regulating the distribution and temporal stability of fast-water erosional areas and slow-water depositional sites, shaping channel morphology by routing sediment and water, and by providing substrate for biological activity.361 The influence of large wood on energy dissipation in streams influences virtually all aspects of ecological processes in aquatic environments, and is responsible for much of the habitat diversity in stream and riparian ecosystems.[262, 376]

Key Ecological Functions of Wildlife Species Associated With Decaying Wood

…

Various symbiotic relations can be described for the 96 snag-associated species. Sixteen species are primary cavity excavators and 35 are secondary cavity users; 8 are primary burrow excavators and 11 are secondary burrow users; 5 are primary terrestrial runway excavators and 6 are secondary runway users. Nine snag-associated species create nesting or denning structures and 8 use created structures. Sixteen species might influence vertebrate population dynamics and 22 might influence invertebrate population dynamics. Snag-associated species also contribute to dispersal of other organisms including seeds and fruits (21 snag-associated wildlife species perform this function), invertebrates (8 species), plants (8 species), fungi (2 species), and lichens (1 species). Six snag-associated species can improve soil structure and aeration through digging, 2 species fragment standing wood, and 2 species fragment down wood. One snag-associated species creates snags, and at least 1 can alter vegetation structure and succession through herbivory.

…

… both snag- and down wood-associated wildlife more or less equally participate in dispersal of seeds and fruits (although the particular species they disperse may differ); however, snag- associated wildlife play a greater role in dispersal of invertebrates and plants, and down wood-associated wildlife play a greater role in dispersal of fungi and lichens. Down wood-associated species might contribute more to improving soil structure and aeration through digging, and to fragmenting wood. This is one example of the far greater differentiating power afforded by a well-constructed set of matrixes than was previously available in Thomas [366] and Brown.[48] …

…

Fire Suppression. In the eastern Cascades and through much of the intermountain area, extensive forest insect and disease problems have resulted from decades of fire suppression in combination with selective harvesting of pines.[177, 194, 236, 401, 403] An analysis of landscape dynamics in the Interior Columbia River Basin[302, 379] revealed that fire suppression resulted in a decreased abundance of large- diameter trees, and caused fuel accumulations that predisposed forests to stand-replacement fires**.** As mentioned previously, more intense fires not only consume more wood, but can inhibit wood decay by reducing nitrogen availability (and other elements) through volatilization and leaching, especially for wood in close association with the soil.[245] Wood decay in post- fire regenerating forests also may be exacerbated by a decline in symbiotic nitrogen-fixing plant species in stands subject to prolonged fire suppression.[169]

…

Management Considerations Management Ramifications of Snag and Down Wood Abundance

…

… The apparent dearth of large snags in Ponderosa pine may mean lower suitability for the 54 wildlife species associated with large snags (20+ in or 51+ cm dbh) in that wildlife habitat. Intensive forest management activities that have decreased the density of large snags in early forest successional stages (sapling/pole and small tree stages) may have had adverse impacts on the 61 associated wildlife species (Figure 12). Similarly, the lesser amount of large down wood in early forest successional stages may not provide as well for the 24 associated wildlife species. Such results suggest the continuing need for specific management guidelines to provide large standing and down dead wood in all successional stages.

…

Depletion of Large Wood. The loss of large wood structures has numerous potential impacts on ecological functions of forests, although available information is inadequate for a definitive assessment. The lack of large logs on steep slopes can decrease water percolation into soil, impair slope stability, accelerate soil erosion and sediment input to streams, and increase nutrient losses in litter.[164, 358, 359, 360, 361] Some data support a linkage between intensive management (especially depletion of decaying wood) and reduced forest biomass productivity, particularly on less productive sites. Lower productivity is attributed to nutrient losses from managed forests, reduced nutrient availability in older

stands, and decreased nutrient storage, particularly in the soil.[272, 383, 384] Depletion of soil organic matter has been cited as a primary factor contributing to declining forest productivity and biodiversity in the Pacific Northwest and elsewhere.[17, 137, 198, 199, 228, 292, 293, 298, 299]

…

Riparian Forests. … Far-reaching effects of the absence of large wood structures in streams include: 1) simplification of channel morphology, 2) increased bank erosion, 3) increased sediment export and decreased nutrient retention, 4) loss of habitats associated with diversity in cover, hydrologic patterns, and sediment retention.[33, 144, 262] In coastal environments and estuaries, the loss of large wood may disrupt trophic webs and alter coastal sediment dynamics.[233]

…

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.

We have also learned that managing forests with decay processes should be done as part of a broader management approach to stand development, with attention paid to retaining legacies of large trees and decaying wood from original or prior stands. Further lessons have been learned in the area of technical and operational developments; some of these are discussed below.

…

… Studies suggest that wood habitat structures function best for wildlife when they are broadly distributed as well as occurring in locally- dense clumps, such as with scattered snag or down wood patches. …

…
… A new modeling tool named DecAID is available to assist with this task. DecAID (as in .decayed. or .decay aid.) is a new Decayed Wood Advisory Model being developed to address some of the recent lessons learned.226, 247 DecAID is based on a thorough review of literature, available research and inventory data, and expert judgment. It broadens the paradigm for wildlife species and habitat assessment by considering the key ecological functions of wildlife (see below) as well as the ecosystem context of wood decay in terms of secondary effects on forest productivity, fire, pest insects, and diseases.
…
The manager will be able to use DecAID for advice on the following topics by first specifying wildlife habitat, structural stage, and statistical (confidence) level: 1) wildlife species associated with particular sizes and densities of snags and down wood, or, conversely, the sizes and densities required to meet specified wildlife management objectives, at three levels of confidence; 2) the array of key ecological functions of wildlife associated with decaying wood; 3) the recent-historic and current range of natural conditions of snags and fallen trees; 4) advice on fire risk assessment and mitigation; 5) advice on the roles of insects and diseases associated with various amounts of decaying wood; 6) and the influence of the abundance of decaying wood on ecosystem processes and productivity.
…
Management Tools and Opportunities
…
… In young stands, Franklin[122] recommends that management should:

1. Aggressively create stands of mixed composition to maintain habitat for a broad array of species (and to achieve diversity in quality and timing of nutrient inputs to streams).
2. Delay the process of early canopy closure (wide spacings, pre-commercial thinning etc.).
3. Provide for adequate amounts and a continuous supply of large wood, including snags and down logs, for maintaining structural diversity in forests and streams and maintaining all other ecosystem processes associated with wood.

The basic theme of these revisions of intensive forestry practices is to retain the higher levels of complexity found in natural forests, and in so doing, to protect processes and structures that retain future options for ecosystem management. …
…

> … Retention of snags provides numerous habitat benefits.[154, 239, 402] However, safety and liability issues associated with snag retention have posed an operational barrier to management objectives for structural retention. Two approaches useful in reducing hazards associated with snags are: 1) to cluster snags in patches rather than wide dispersal, and 2) to create snags from green trees after cutting.[122]

… Managers must also consider the temporal dimension to decaying wood, to ensure that sufficient snag and down wood densities are provided through time.
…

Live (Green) Tree Retention. Retention of living trees on cutover areas is one form of structural retention that can provide for future recruitment of snags and down wood …

> Green trees function as a refugium of biodiversity in forests. For example, many species of invertebrate fauna in soil, stem, and canopy habitats of old-growth forests do not disperse well, and thus, do not readily recolonize clear-cut areas.[207, 326] The same concept holds for many mycorrhizae-forming fungal species.[293] Added benefits of green tree retention include moderated microclimates of the cutover area, which may increase seedling survival, reduce additional losses of biodiversity on stressed sites,[293] and facilitate movement of organisms through cutover patches of the landscape. Green trees retained across harvest cycles can also be used to grow very large trees for either ecologic or economic goals. …

Green tree retention offers many benefits to wildlife. For example, the higher structural diversity in young stands that contain legacy trees from previous stands provides much improved habitat values to late successional species such as the northern spotted owl, as well as other vertebrates that use late-successional stands for some elements of their life history.[69, 122, 314] Such stands may provide wildlife habitat as early as age 70-80 years rather than 200-300 years, the approximate time interval required for old-growth conditions to develop after secondary succession. …
…

Summary of Management Recommendations

The information presented in this chapter emphasizes several properties of decaying wood in forest ecosystems: (1) each structure formed by decaying wood helps support a different functional web in the ecosystem; (2) no one decaying wood structure supports all functions equally; and (3) all decaying wood habitats together support the widest array of ecological functions and associated wildlife species. The CD-ROM with this book in combination with the DecAid model provides managers with a powerful tool that makes it possible to assess the degree of .full functionality. of ecosystems as supported by the various decaying wood structures, and which functions are strengthened, diminished, or lost through alternative silvicultural management practices.

Lessons for managers are:
…

2. Emphasize retention of wood legacies, and secondarily promote restoration where legacies are deficient to meet stated objectives. The decline of species associated with late-successional forest structures, as well as the

> prolonged time needed to produce wood legacies, suggests that it is both ecologically and economically advantageous to retain legacy structures across harvest cycles wherever possible, rather than attempt to restore structures that have been depleted. This is especially obvious for slow-growing tree species and very large wood structures. …
>
> …
>
> **Operational Considerations**
>
> …
>
> … OSHA revised the federal Logging Standard (29 CFR 1910.266) in 1995, to clarify its intent that danger trees may be avoided, rather than being removed or felled.[72a] A danger tree is any standing tree (live or dead) that poses a hazard to workers, from unstable conditions such as deterioration, damage, or lean. The revised rule allows some discretion in determining the hazard area around a danger tree, by ....allowing work to commence within two tree lengths of a marked danger tree, provided that the employer demonstrates that a shorter distance will not create a hazard for an employee..(OSHA Logging Preamble, Section V). Determining a safe working distance requires a case-by-case ....evaluation of various factors such as, but not limited to, the size of the danger tree, how secure it is, its condition, the slope of the work area, and the presence of other employees in the area. …
>
> …
>
> Concerns frequently arise where high public use creates a risk of third party liability. Considerations include the proximity of reserve trees to roads, trails, campgrounds, ski areas, and other recreation areas and public access points. Methods for addressing these concerns include signage and clear delineation of potential hazard areas, fencing and other barriers to discourage public access, snag height reduction and use of setbacks to minimize exposure.

Abundant Snags and Logs Help Meet Aquatic Objectives

Fisheries scientist, Peter Moyle said in the Sacramento Bee on May 16, 2006:

> Logging after fire reduces the ability of streams to support desirable aquatic life, including salmon and steelhead. When logging roads are put through burned areas, erosion increases and streams may become clogged with sediment, which covers gravel needed by fish for spawning. A heavily logged watershed can produce streams with increased peak flows and decreased summer flows, severely reducing fish populations.
>
> When large logs fall into streams, they stabilize banks and create complex habitat for fish and a host of other creatures. The logs function directly as cooling shade and cover and indirectly as hard surfaces that cause the scour pools in which most fish live. It is now standard practice when restoring salmon streams to haul in large logs to increase the ability of the stream to support large numbers of fish. Post-fire logging removes the very logs that sustain such streams, reducing their ability to support large fish populations for decades to come. It is important to leave not only large dead trees, but also those that have been damaged as well as

> the largest living trees, which often survive fires. Together, these trees provide the continuous supply of logs that a stream requires to replace those that have been moved downstream or rotted away.

New science indicates that in landslide prone landscapes almost half of instream wood comes from outside the riparian area (>90 meters from the stream). This indicates that the total watershed must be managed to meet the ACS objective of healthy streams.

Aquatic Conservation Strategy objective #5 requires the agency to "maintain and restore the sediment regime under which aquatic ecosystems evolved" including "the timing, volume, rate, and character of sediment input, storage, and transport." ACS Objective #8 calls for maintaining "distributions of coarse woody debris sufficient to sustain physical complexity and stability" The objectives require retention of abundant trees and wood especially large wood that provides long-lasting ecological services.

> **Mass Wasting and Surface Erosion.** … Large wood helps to anchor snowpacks, limit the extent of snow avalanches, and may even stabilize debris flows, depending on the depth of the unstable area … By covering soil surfaces and dissipating energy in flowing and splashing water, logs and other forms of coarse wood significantly reduce erosion. Large trees lying along contours reduce erosion by forming a barrier to creeping and raveling soils, especially on steep terrain. Material deposited on the upslope side of fallen logs absorbs moisture and creates favorable substrates for plants that stabilize soil and reduce runoff.

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://www.nwhi.org/inc/data/GISdata/docs/chapter24.pdf

> Salvage harvest yields responses (e.g., ground disturbance, woody debris removal, interruption of normal infiltration pathways, and acceleration of surface flows) that interact with the direct and indirect effects of fire to make these actions so potentially damaging. In addition, the negative effects extend many years beyond the actual time of salvage activities because the harvest of snags that normally fall and become incorporated into stream channels and forest floors over several decades or more (Lyon 1984). These wood inputs are important to create habitat, increase nutrients, and retard runoff and channel alteration during what is normally the most critical stage of stream and riparian recovery.

Minshall, G.W. 2003. Responses of stream benthic macroinvertebrates to fire. Forest ecology and management. 178: 155-161.
http://www.famu.org/mayfly/pubs/pub_m/pubminshallg2003p155.pdf

> Our results suggest that abundant wood plays a key role in moderating sediment flux from small basins following debris flow events. Debris flow events coincident with a lack of abundant wood, such as might occur following forest

> harvest, could lead to more episodic sediment flux to downstream, fish-bearing reaches.

Modeling Sediment And Wood Storage And Dynamics In Small Mountainous Watersheds; LANCASTER, Stephen, HAYES, Shannon K., and GRANT, Gordon E. http://gsa.confex.com/gsa/2002CD/finalprogram/abstract_34646.htm

> Historical stand structure results suggest that conservation of old trees is as important on sideslopes as in riparian forest and there is connectivity both in disturbance and structure across the riparian-sideslope ecotone.

Everett, Schellhaas, Ohlson, Spurbeck, Keenum; 2001; Continuity in Fire Regimes Between Riparian and Adjacent Sideslopes in the Douglas-fir Forest Series; http://www.srs.fs.usda.gov/pubs/viewpub.jsp?index=4740

In the BMNRI soil seminar Dr. Alan Harvey makes the unequivocal statement that underground wood is the main source of late season moisture and nitrogen fixing activity on warm dry sites and that capturing mortality from the above ground wood pool will eventually deprive the below-ground wood pool of a long term supply of large persistent wood.
http://maps.wildrockies.org/ecosystem_defense/Resources_Species_Topics/Soils/Harvey%20on%20%20Soils.doc

ACS objective #2 requires that "connectivity" be maintained and restored so that large wood can get from the upland to the streams via debris flows during storm events. Roads often act as "sinks" that intercept wood and sediment and prevent it from getting to streams. Meeting this ACS objective will require that many mid-slope and valley bottom roads be removed.

Retain more down wood to mimic the natural range of variability and prevent nutrient leaching.

Nitrogen saturated forest sites will begin leaching negatively charged nitrate taking with it positively charged cations such as calcium which ends up in short supply reducing forest productivity.

> "[H]igh nitrogen levels in soil and can accelerate nitrogen cycling, nitrification, and coupled nitrate-calcium leaching in a manner similar to chronic nitrogen pollution. ... [A]tmospheric calcium deposition only supported about 12% of what the plants needed in any given year. Over the long term, natural forest stands must have developed efficient mechanisms of calcium retention and recycling between plants and soils to support the high productivity of forests in this region. However, there is potential that forest harvest on some soils may deplete available calcium more quickly than it is replenished, which could decrease forest productivity in the future. ... Leaving felled stems onsite could provide benefits in the most nitrogen-rich sites by providing a source of woody material for nitrogen immobilization, thus reducing nitrate leaching, while adding back calcium in wood and twigs."

Does Excess Nitrogen Cause Calcium Deficiency in Coast Range Forests? CFER News. Erickson. J. ed. Spring 2006. http://www.fsl.orst.edu/cfer/pdfs/Vol6_2.pdf citing Perakis,

S.S., D.A. Maguire, T.D., Bullen, K. Cromack, R.H., Waring, J.R., Boyle. 2006. Coupled nitrogen and calcium cycling in forests of the Oregon Coast Range. Ecosystems 9:63-74.

New information on Snags.

The 9th Circuit recently reiterated that "species viability may be met by estimating and preserving habitat '*only* where *both* the Forest Service's knowledge of what quality and quantity of habitat is necessary to support the species *and* the Forest Service's *method for measuring the existing amount of that habitat are reasonably reliable and accurate*.' *Earth Island Inst. v. U.S. Forest Serv.*, 442 F.3d 1147, 1175-76 (9th Cir. 2006) (quoting *Native Ecosystems Council v. U.S. Forest Serv.*, 428 F.3d 1233, 1250 (9th Cir. 2005))" ONRC v. Goodman (Mt Ashland case, 9th Circuit Sept 24, 2007) (emphasis added). http://www.ca9.uscourts.gov/ca9/newopinions.nsf/499E49C2E3B21A128825736000533BBA/$file/0735110.pdf The BLM cannot provide any assurance that it's plans and projects will assure viable populations of native wildlife that depend on dead trees. The BLM 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%."[6] There is no reason to think that thinning in densely stocked forests elsewhere would be any different.

The federal forest agencies now recognize that current methods and assumptions concerning snag habitat standards are outdated, and the old snag standards do not ensure enough snags to meet the intent of the standard, yet the agencies have not adjusted their management plans to account for this new information nor have they developed new standards that are consistent with the latest scientific information.

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;

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

- 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 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.

> Bull et al. states that the current direction for providing wildlife habitat on public forest lands does not reflect the new information that is available which suggests that to fully meet the needs of wildlife, additional snags and habitat are required for foraging, denning, nesting, and roosting (1997). Johnson and O'Neil (2001) and Rose et al. (2001) also state that several major lessons have been learned in the period 1979 to 1999 that have tested critical assumptions of earlier management advisory models (2001), including some of the assumptions used to develop the current recommendations in the LRMP Standards and Guidelines, as amended by the Regional Forester's Amendment #2. Some assumptions include:
>
> > • calculation of numbers of snags required by woodpeckers based on assessing their "biological (population) potential" is a flawed technique (Johnson and O'Neil 2001). Empirical studies are suggesting that snag numbers in areas used and selected by some wildlife species are far higher that those calculated by this technique (Johnson and O'Neil 2001).
> >
> > • numbers and sizes (dbh) of snags used and selected by secondary cavity nesters often exceed those of primary excavators (Johnson and O'Neil 2001).
>
> This suggests the current direction of managing for 100 percent population potential levels of primary excavators may not represent the most meaningful measure of managing for cavity-nesters and that these snag levels, under certain conditions, may not be adequate for some species.

http://www.fs.fed.us/r6/frewin/projects/analyses/barneslong/ea/appb.pdf

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://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://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.

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).

Current Postfire Management Decisions Related to Snag Retention

The following points regarding management decisions apply to western forest types that experience crown fire as at least a minor component of their fire regimes (and that is virtually all western forest types).

(1) The USFS uses fire as a motivation to harvest trees. This is evident because in most cases where postfire logging is proposed they had not already

> sold green-tree harvests in those particular areas prior to the time of fire disturbance. Even though land managers are becoming more aware of the overwhelmingly negative ecological impacts of postfire salvage logging, the management has not shifted correspondingly toward less salvage harvesting. Instead, the most common justification for such harvests seems to have shifted recently from "salvaging" what economic value there might be to preventing another catastrophic fire (McIver & Starr 2000). Recent modifications of legislation and regulations by provincial governments in Canada (cited in Nappi et al. 2003) and by the U.S. government as well (Healthy Forests Restoration Act) expedite or even provide incentives for salvage logging. Such legislation provides no commitment to meaningful snag retention on burned forest lands. This failure to appreciate the value of burned forests to ecosystem sustainability is exacerbated by the fact that industrial lands (and most state lands) are, and probably always will be, completely salvage logged after fire because the value of those lands to those landowners lies entirely with the potential for short-term economic gain. The onus lies squarely on public land managers to provide the necessary protection of snag resources on burned forest land, and that has yet to happen.
>
> (2) The usual agency response to questions about the amount or kind of burned trees to leave is that it does not really matter because they propose taking only a small proportion of what burned, so there must be plenty left for wildlife. Although that could be true, there is no scientific basis for such a conclusion. The volume of burned timber needed to enable populations to expand enough so that they can weather the next hiatus without fire in a particular area is unknown.
>
> (3) If a partial salvage is proposed, the level of snag retention is generally based on a gross misapplication of current snag guidelines. In short, meaningful snag management guidelines for burned forests are lacking because the general public and the land management agencies that act on behalf of the public do not recognize the biological value of snags in burned conifer forests.

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://avianscience.dbs.umt.edu/documents/hutto_conbio_2006.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.

Consider the following before relying on DecAID

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

1. Before relying on DecAID, the agency must prepare a comprehensive NEPA analysis to consider alternative ways of ensuring viability of all species dependent upon snags and dead wood. While it is true that the "potential population" or "habitat capability" method is no longer considered scientifically valid, the agency has not yet considered a full range of alternative methods to replace the habitat capability method mandated in the forest plans.
2. Before using DecAID, the agency must establish a rational link between the tolerance levels in DecAID and the relevant management requirements in the applicable resource management plan. For instance, since the Northwest Forest Plan and the Eastside Screens require maintenance of 100% potential population of at least some cavity-dependent species, the agency must explain why that does not translate into maintaining *100% of the potential tolerance level*. If the site is capable of supporting 80% tolerance levels, the agency should not be able to manage for 30-50% tolerance levels and still meet the 100% potential population requirement.
3. DecAID does not replace the discredited forest plan standards because DecAID is informational only. DecAID does not specify management objectives. The agency must specify the management objective based on RMP objectives for the land allocation or based on natural "range of variation." Since large snags are outside the natural range of variability across the landscape, the agency must retain all large snags to start moving the landscape toward the natural range of variability, or the agency must carefully justify in the NEPA analysis every large snag it proposes to remove. See Jerome J. Korol, Miles A. Hemstrom, Wendel J. Hann, and Rebecca A. Gravenmier. 2002. *Snags and Down Wood in the Interior Columbia Basin Ecosystem Management Project.* PNW-GTR-181. http://www.fs.fed.us/psw/publications/documents/gtr-181/049_Korol.pdf This paper estimates that even if we apply enlightened forest management on federal lands for the next 100 years, we will still reach only 75% of the historic large snag abundance measured across the interior Columbia Basin, and most of the increase in large snags will occur in roadless and wilderness areas.

4. The agency cannot use "average" snag levels (e.g. 50% tolerance level) as a management objective within treatment areas, because treatments are essentially displacing natural disturbance events which would normally create and retain large numbers of snags, so disturbance areas should have abundant snags, not average levels of snags. It would be inconsistent with current science and current management direction to manage only for the mid-points and low points. The agency should manage for the full natural range dead wood levels, including the peaks of snag abundance that follow disturbance.
5. 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 <u>at specific time intervals</u> and for a specific set of conditions, but <u>dynamic changes in forest and landscape conditions would have to be modeled or evaluated outside the confines of the DecAID Advisor</u>."

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

http://wwwnotes.fs.fed.us:81/pnw/DecAID/DecAID.nsf/HomePageLinks/863EEA66F39752C088256C02007DF2C0?OpenDocument

6. The tolerance levels from DecAID may be too low to support viable populations of wildlife associated with dead wood, because anthropogenic factors that tend to reduce snags (e.g., firewood cutting, hazard tree felling, fire suppression, and salvage logging) may have biased the baseline data that DecAID relies upon to describe "natural" conditions. See Kim Mellen, Bruce G. Marcot, Janet L. Ohmann, Karen L. Waddell, Elizabeth A. Willhite, Bruce B. Hostetler, Susan A. Livingston, and Cay Ogden. *DecAID: A Decaying Wood Advisory Model for Oregon and Washington* in PNW-GTR-181, *citing* Harrod, Richy J.; Gaines, William L.; Hartl, William E.; Camp, Ann. 1998. *Estimating historical snag density in dry forests east of the Cascade Range.* PNW-GTR-428. http://www.fs.fed.us/pnw/pubs/gtr_428.pdf
7. DecAID is still an untested new tool. The agencies must conduct effectiveness monitoring to determine whether the snag and down wood retention recommendations in the DecAID advisor will meet management objectives for wildlife and other resource values.
8. The "unharvested" inventory data used in DecAID may represent but a snapshot in time, and fail to capture the variability of dead wood over time, including the pulses of abundant dead wood that follow disturbances and may prove essential for many wildlife species.
9. DecAID must be used with extreme caution in post-fire landscapes because the data supporting DecAID does not include natural post-fire landscapes. ("The inventory data likely do not represent recent post-fire conditions very well … young stands originating after recent wildfire are not well represented because they are an extremely small proportion of the current landscape … The dead wood summaries cannot be assumed to apply to areas that are not represented in the inventory data." "DecAID caveats" http://wwwnotes.fs.fed.us:81/pnw/DecAID/DecAID.nsf).
10. DecAID relies on a wide range of sources in the literature, some of which recommend much higher levels of snag retention than reflected in the advisor. The agency NEPA analysis should disclose the published literature with higher levels of snag and wood retention and discuss their potential relevance for the project. ("the agency must disclose responsible opposing scientific opinion and indicate its response in the text of the final statement itself. 40 C.F.R. § 1502.9(b)." Center for Biological Diversity v. United States Forest Service, No. 02-16481 (9th Cir., Nov. 18, 2003).)
11. DecAID tolerance levels need careful explanation. These tolerance levels are very difficult to put in terms that are understandable by the general public, but if the Forest Service is going to use this tool they must make it understandable. The NEPA analysis should provide cumulative species curves for each habitat type and each forest structural stage and should explain the studies and publications that support the data points on the curves. What kind of habitat were the studies located in? What was the management history of the site? Was the study investigated nesting/denning, or roosting and foraging too?

12. DecAID does not account for the unique habitat features associated with some types of snags. DecAID primarily just counts snags and assumes that all snags of approximately the same size have equal habitat value, but this fails to account for the fact that certain types of snags and dead wood features are unique, such as: hardwood snags, hollow trees and logs, different decay classes, etc. The NEPA analysis must account for these features and the agency should disproportionately retain dead wood likely to serve these unique habitat functions.
13. DecAID authors caution that "it is imperative, however, to not average snag and down wood densities and sizes across too broad an area, such as across entire watersheds, leaving large areas within watersheds with snags or down wood elements that are too scarce or too small" Kim Mellen, Bruce G. Marcot, Janet L. Ohmann, Karen L. Waddell, Elizabeth A. Willhite, Bruce B. Hostetler, Susan A. Livingston, and Cay Ogden. *DecAID: A Decaying Wood Advisory Model for Oregon and Washington* in PNW-GTR-181. http://www.fs.fed.us/psw/publications/documents/gtr-181/042_MellenDec.pdf While we agree that snags and down wood must not be averaged over wide areas, we also must emphasize that snags and down wood are far below historic levels on non-federal lands, so in order to ensure viable populations of wildlife and avoid trends toward ESA listing, federal lands must be managed to compensate for the lack of down wood on non-federal lands.
14. DecAID appears to be based on the idea that the habitat needs of certain key wildlife species represent the best determinant of how much dead wood to retain, and this may in fact be true, but DecAID should also include cumulative curves for other ecological functions provided by dead wood, including: site productivity, nutrient storage and release, erosion control, sediment storage, water storage, water infiltration and percolation, post-fire micro-site maintenance, biological substrate, thermal mass, etc. How much dead wood is needed for thee functions?
15. DecAID may be best used for program level planning rather than project level planning. See Dallas Emch and Gary Larson, 2006. Review & Analysis of Remainder of Comments on EA Supplements for Multiple Timber Sales on Mt. Hood & Willamette National Forests on Remand in ONRCA v. Forest Service CV-03-613-KI (D.Or.). 4-10-06.
16. Any activity that degrades snag habitat is arbitrary and capricious until the agency develops new procedures in compliance with NEPA and NFMA or LFPMA. Compliance with old standards is meaningless, and in the absence of new standards, the agency cannot draw any credible conclusions about impacts to snag associated species. There is no way to use DecAID to comply with the east side screens' requirement to maintain 100% potential populations of cavity species (until the Forest Service develops some credible way to translate DecAID tolerance levels into potential population levels).

Snag retention standards overestimate habitat capability

The traditional snag habitat model used by the agency is based on outdated science[7] which vastly overestimates habitat capability for snag-dependent species because it fails to consider important factors such as:

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

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

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

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

New information on Pileated Woodpeckers indicates Standards & Guidelines are Inadequate.

Pileated woodpeckers play a unique role in the forest ecosystem

a. They excavate cavities in trees that are later used by numerous other species not just for nesting, but also for roosting and foraging. Benefited species include spotted owls and their prey.
b. Their excavations accelerate wood decomposition, nutrient cycling, and fungi dispersal. Kerry L. Farris, Martin J. Huss And Steve Zack. The Role Of Foraging Woodpeckers In The Decomposition Of Ponderosa Pine Snags. The Condor 106:50–59. The Cooper Ornithological Society 2004. http://www.wcs.org/media/file/FarrisandZack_2005.pdf
c. The pileated woodpecker's ability to excavate large cavities in relatively sound trees that are in the early stages of heart wood decay, means that the resulting cavity trees may provide uniquely long-lasting habitat.
d. The combined foraging activities of pileated woodpeckers and all the species they assist tend to mediate insect outbreaks.

The NEPA analysis failed to consider significant new information on pileated woodpeckers including:

a. Pileated woodpeckers need more and larger roosting trees than nesting trees. They may use only one nesting tree in a year, they may use 7 or more roosting trees.
b. West of the Cascades, pileated woodpeckers tend to prefer nesting in decadent trees rather than snags.
c. West of the Cascades, standing snags are important foraging sites because down wood may be too wet to harbor carpenter ants (the favored foods of the pileated woodpecker).
d. West of the Cascades, Pacific silver fir is often used for nesting (but not roosting).
e. West of the Cascades, western redcedar is often used for roosting (but not nesting).

Determining pileated woodpeckers population potential based on nesting sites alone will not provide adequate habitat for viable populations of this species. This new information is not recognized in current management requirements at the plan or project level. The EIS must address this new scientific information. See *Science Findings* Issue 57 (October 2003) Coming home to roost: the pileated woodpecker as ecosystem engineer, by Keith Aubry, and Catherine Raley http://www.fs.fed.us/pnw/sciencef/scifi57.pdf

The Agency Must Completely Rethink its Salvage Policy.

Prepare a new programmatic EIS on young complex forests.

The agency must prepare a new programmatic EIS to consider the effect of salvage logging on young complex forests and the development of complex older forest. The agencies are still operating in the "dark ages" in terms of salvage policy. The agencies should not conduct any more salvage logging until they have fully disclosed and

considered current scientific understandings about the role of fire in forest development. The agency must prepare a programmatic EIS to comprehensively disclose and consider:

a. the natural range of variability and existing rarity of complex young forests (e.g., young forests that are unsalvaged after disturbances). Since large snags are outside the natural range of variability across the landscape, the agency must retain all large snags to start moving the landscape toward the natural range of variability, or the agency must carefully justify in the NEPA analysis every large snag it proposes to remove. See Jerome J. Korol, Miles A. Hemstrom, Wendel J. Hann, and Rebecca A. Gravenmier. Snags and Down Wood in the Interior Columbia Basin Ecosystem Management Project. PNW-GTR-181. http://www.fs.fed.us/psw/publications/documents/gtr-181/049_Korol.pdf This paper estimates that even if we apply enlightened forest management on federal lands for the next 100 years, we will still reach only 75% of the historic large snag abundance measured across the interior Columbia Basin, and most of the increase in large snags will occur in roadless and wilderness areas.
b. the ecological values (such as wildlife habitat) associated with snags, dead wood, and complex young forests. 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://www.nwhi.org/inc/data/GISdata/docs/chapter24.pdf
c. Given the regional deficit of young complex forests and the fact that many species, such as woodpeckers and secondary cavity users, appear to be adapted to exploit the structure and resources available within disturbed forests, the agencies should comprehensively consider and disclose the direct and indirect effects of salvage logging on species associated with young complex forests. The Forest Service has numerous Management Indicator Species whose populations have not been monitored, so the agencies lack the information necessary to that the salvage logging program will maintain species viability.
d. the effects of salvage logging on the development of complex forest habitat;
e. all the new science related to salvage logging and dead wood, including but not limited to: Beschta R.L., J.J. Rhodes, J.B. Kauffman, R.E. Gresswell, G.W. Minshall, J.R. Karr, D.A. Perry, F.R. Hauer, and C.A.Frissell, In Press. Postfire management on forested public lands of the western USA. Cons. Bio., 18:x-xx. And Rose et al.
f. "Conservation of diverse young forests has received little attention in forest policy." USDA PNW Research Station. *Science Findings.* Sept 2003. http://www.fs.fed.us/pnw/sciencef/scifi56.pdf "[T]here's a looming shortage of diverse young forests - where seedlings intermingle with fallen logs, standing dead snags, and shrubs - that provide specialized habitat for certain animals and plants. … there's a looming gap in diverse, young, early-successional conifer forest, the type of forest that once came in naturally after

forest fires. These young forests, up to 10 years old, have a diversity of forest structures - fallen logs and dead snags - and a diversity of plant life. They are important habitat for the western bluebird and other birds that prefer open areas, as well as some shrub species. Today, because of intense timber management on private lands, young forests don't get the chance to develop much diversity." OSU. 2001. Press Release: Researchers Assess Forest Sustainability. http://oregonstate.edu/dept/ncs/newsarch/2001/Oct01/assess.htm According to the CLAMS project: "Diverse young forests: also rare but receiving less attention. Legacy tree habitat: uncertain future.." Ohmann, Spies, Gregory, Johnson. 2002. Vegetation Biodiversity in the Oregon Coast Range. http://www.fsl.orst.edu/clams/download/presentations/j02s_ohmann_10june02.pdf (slide 24).

g. 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://avianscience.dbs.umt.edu/documents/hutto_conbio_2006.pdf ("Species such as the Black-backed Woodpecker (*Picoides arcticus*) are nearly restricted in their habitat distribution to severely burned forests. Moreover, existing postfire salvage-logging studies reveal that most postfire specialist species are completely absent from burned forests that have been (even partially) salvage logged. I call for the long-overdue development and use of more meaningful snag-retention guidelines for postfire specialists, and I note that the biology of the most fire-dependent bird species suggests that even a cursory attempt to meet their snag needs would preclude postfire salvage logging in those severely burned conifer forests wherein the maintenance of biological diversity is deemed important.")

h. A recent study of birds that use post-fire mosaics highlighted the importance of resprouting shrubs and forbs on the re-establishment of nesting birds following wildfire. "Of the 39 species for which nests were found, 14 (37%) used cavities and 25 (63%) built open-cup nests. ... Species that built cup nests used snags, residual live trees, resprouting hardwoods, and other ground vegetation and downed wood. The associations between the presence of breeding species and forb and shrub cover indicate that these are important components of the early establishment of bird populations following stand-replacing fires. These data suggest that post-fire management of resprouting hardwoods and herbaceous vegetation should consider potential impacts to bird species that nest and forage in burned forests." CFER 2007. Response of Birds to Fire Mosaics. CFER News. Winter 2007. http://www.fsl.orst.edu/cfer/pdfs/Vol7_1.pdf

i. BLM's Western Oregon Plan Revision DEIS (p. LII) admits that structurally complex young forests develop old forest characteristics twice as fast as structurally deprived initial conditions.

The agencies are still operating in the "dark ages" in terms of salvage policy. The agencies should not conduct any more salvage logging until they have fully disclosed and considered these issues.

Salvage is not Restoration

A recent article from respected scientists in one of the world's leading science journals said:

> … [N]atural disturbances are key ecosystem processes rather than ecological disasters that require human repair. Recent ecological paradigms emphasize the dynamic, nonequilibrial nature of ecological systems in which disturbance is a normal feature and how natural disturbance regimes and the maintenance of biodiversity and productivity are interrelated … Salvage harvesting activities undermine many of the ecosystem benefits of major disturbances. … [R]emoval of large quantities of biological legacies can have negative impacts on many taxa. For example, salvage harvesting removes critical habitat for species, such as cavity-nesting mammals, [and] woodpeckers, … Large-scale salvage harvesting is often begun soon after a wildfire, when resource managers make decisions rapidly, with longlasting ecological consequences….

Lindenmayer, Franklin, Hunter, Noss, et al., ECOLOGY: Salvage Harvesting Policies After Natural Disturbance, Science 2004 303: 1303

The ICBEMP analysis showed that traditional salvage logging that removes large trees is not compatible with ecosystem management.

> **Can salvage timber sales be compatible with ecosystem-based management?**
> … Our findings suggest that this type of harvesting is not compatible with contemporary ecosystem-based management. Ecosystem-based management would emphasize removing smaller green trees with greater attention to prevention of mortality rather than removal of large dead trees.

Quigley, Thomas M., tech. ed. 1996; The Interior Columbia Basin Ecosystem Management Project: Scientific Assessment.) Gen. Tech. Rep. PNW-GTR-382; Page 178.

Salvage logging and replanting will convert a structurally complex landscape into a simplified and biologically depraved landscape. Unsalvaged, naturally regenerated, young stands are one of the rarest forest types in the Pacific northwest, and their biodiversity rivals that of old-growth forests.

> Indeed, naturally developed early-successional forest habitats, with their rich array of snags and logs and nonarborescent vegetation, are probably the scarcest habitat in the current regional [Pacific Northwest] landscape.

Lindenmayer, David B. and Jerry F. Franklin. 2002. Conserving Forest Biodiversity: A Comprehensive Multiscale Approach. Island Press. Washington, DC: 69. *See also*, DellaSala, D.A., J.E. Williams, C. Deacon-Williams, and J.F. Franklin. Beyond smoke and mirrors: a synthesis of fire policy and science. In review - Conservation Biology.

> "There has been a loss of diverse young forests on all ownerships. … Conservation of diverse young forests has received little attention in forest policy."

Janet Ohmann; Science Findings, Issue 56; Seeing the trees for the forest: mapping vegetation biodiversity in coastal Oregon forests; (September 2003). http://www.fs.fed.us/pnw/sciencef/scifi56.pdf

The agency often cites Franklin and Agee. 2003 "Forging a Science-Based National Forest Fire Policy," Issues in Science and Technology *Online.* Fall 2003. http://www.issues.org/issues/20.1/franklin.html to support "active management" after fire. This paper simply does not support aggressive salvage logging. In fact, it has very short discussion of post fire logging that includes the following:

> Management of postburn areas, including timber salvage, needs to incorporate the concept of biological legacies. Salvaging dead and damaged trees from burns involves the ecology of a place, not simply economics and fuels. In addition to effects on postfire wildlife habitat, there are also effects of salvage logging on soils, sediments, water quality, and aquatic organisms. Significant scientific information exists on this topic as well as on biological legacies.
>
> Biological legacies differ by orders of magnitude in natural forests, a fact that should guide restoration programs. Where stand-replacement fires are characteristic, such as with lodgepole pine and Pacific Coast Douglas fir forests, massive areas of standing dead and down trees are usual; salvage operations generally are not needed and do not contribute to ecological recovery, even though they do provide economic return. On the other hand, uncharacteristic stand-replacement fires in dry forests can produce uncharacteristic levels of postfire fuels, including standing dead and down trees. Removing portions of that particular biological legacy may be appropriate as part of an intelligent ecological restoration program, and not simply as salvage. (emphasis added)

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

> Specific principles to guide removal of trees, snags, and logs from burned sites are as follows:
>
> …
>
> 2) Trees (live and dead) and down wood will be retained in sufficient quantities to provide for wildlife and ecological needs, including long-term structural enrichment of the site.
>
> However, this goal does have to be evaluated in the context of whether the post-fire levels of snags and down wood are within the characteristic range for the plant association; i.e., where pre-burn stands had uncharacteristic stand densities for that plant association. General guidelines for retention of trees (live and dead) and down wood within the wildfire area are as follows: Retain amounts and

distributions of trees as would be characteristic of the pre-burn (historical) landscape …

…

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

…

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

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

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

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

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

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

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

> Hutto and others have been surveying birds in the Black Mountain fire area and nearly 20 other 2003 fire sites from Glacier National Park down to the Bitterroot, some of which have been salvage-logged. Nearly all woodpeckers have proven absent from salvaged areas, Hutto says, and all other bird species are less abundant in those spots than in areas left unlogged following fires.
>
> "I can't think of any other land-use practice where it's uniformly negative, at least in terms of birds," Hutto says. "That's why I end up thinking that a burned place should be lower on our priority list for logging—because it's so sensitive."
>
> Hutto's research is some of the first post-fire work that's been done in areas broader than one forest or one salvage-logging job, which may help it yield insightful facts for policymakers as they struggle to find a balance for post-fire salvage logging nationwide.

Jessie McQuillan. 2006. Still life, with woodpeckers. Missoula Independent. 6/22/2006. http://www.missoulanews.com/News/News.asp?no=5791

> "More than 10 years ago, and again two years ago, I joined eight other scientists to explore whether forests might be restored by logging soon after a fire. We had among us a wealth of knowledge across a wide range of fields. We pored over several decades of research but found nothing to show that fire-adapted forests might be improved by logging in the wake of a fire.
>
> In fact, we found just the opposite: Most plants and animals in these forests are adapted to periodic fires; they have a remarkable way of recovering – literally rising from the ashes.
>
> These forests have evolved with fire. Periodic fires have been part of a normal cycle lasting thousands of years. Logging a burned forest damages the soil, carrying away nutrients, robbing seedlings of moisture and clogging nearby streams. Trees in a burned landscape, both dead and alive, continue to provide homes for wildlife after a fire and form the building blocks of new forests."

Karr, James. 2005 Nature doesn't benefit from logging fire-damaged lands | The News Tribune, Tacoma, WA.
http://www.thenewstribune.com/opinion/othervoices/story/5379671p-4864728c.html

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

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

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

> … The response of birds to forestry practices has been mixed and highly species-specific, but in general, net change in community richness following timber harvest was negligible. Among silvicultural practices, uneven-aged management (e.g., selection harvest) appears to be the most favorable for birds. In contrast, snag removal was highly deleterious, with >80 percent of studies reporting net species loss; net gain was never reported. ...
>
> … What seems to be particularly detrimental to forest avifauna is removal of snags. When prescriptions involved manipulation of snag densities, either by removing (Kilgore 1971, Scott 1979, Dingledine and Haufler 1983, Scott and Oldemeyer 1983, Schreiber and deCalesta 1992), retaining (Dickson et al. 1983, Zarnowitz and Manuwal 1985, Stribling et al. 1990, Schreiber and deCalesta 1992, Welsh et al. 1992), or creating (McPeek et al. 1987) snags, bird numbers were typically found to be positively correlated with snag density. Unlike even-aged and unevenaged management practices, removal of snags never resulted in more species increasing in abundance than decreasing. The importance of snags to birds is wellknown (Davis et al. 1983 and references therein, Bull et al. 1997, references above), not only to cavity nesters, but also songbirds (Sallabanks et al. 2002) that may use snags for nesting, perching, foraging, singing, and scanning for predators.
>
> … Since large remnant snags and "defective" residual green trees provide much of the snag habitat for cavity-nesters in early- to mid-successional stands, particularly on private lands (Ohmann et al. 1994), retention of these structures will be important for maintaining populations of cavity- and snag-using avian species in managed forests. Snag retention and/or creation were the most commonly listed management recommendations from studies included in our review. We concur that leaving snags wherever possible is another important way that foresters can improve or maintain avian habitat quality within managed forest landscapes.

Rex Sallabanks and Edward B. Arnett. Accommodating Birds in Managed Forests of North America: A Review of Bird-Forestry Relationships. PSW-GTR-191. http://www.fs.fed.us/psw/publications/documents/psw_gtr191/Asilomar/pdfs/345-372.pdf

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

> Beetle droppings—known in the scientific world as frass—are crucial to forests recovering from fire. The tiny piles of droppings, found at

> the bases of trees, resemble cones of sawdust, and they help nourish the forest floor by increasing microbial activity in the soil. This process can also determine which kinds of trees grow back.
>
> "This means that rather than being considered a pest or a nuisance, these beetles are in fact very important to helping burned forests recover," Cobb said. He is concerned, though, because salvage logging is taking the beetles out of the forest before they can do their job; the insects lay their eggs in the dead trees, and the larvae are subsequently destroyed when the wood is processed at sawmills. "That population is being removed from the salvage site and that takes away the mechanism by which the nutrients are returned to the soil."
>
> Salvage logging should be delayed after a fire to allow the beetles to complete their life cycle, Cobb said. …

Betkowski, Bev. 2007. Beetle dung helps forests recover from fire. University of Alberta. Public release date: 3-Dec-2007. http://www.eurekalert.org/pub_releases/2007-12/uoa-bdh120307.php http://www.rso.ualberta.ca/news.cfm?story=69803 *citing* Tyler Cobb. 2007. Boreal Mixed-wood Beetles and the Cumulative Ecological Consequences of Disturbance. PhD Dissertation. University of Alberta. Spring 2007.

Many species of wildlife thrive on dead trees.

The Oregon Wildlife Conservation Plan recommends maintaining and creating snags and down logs for a variety of at-risk "strategy" species, including: American marten, California myotis, Fringed myotis, long-legged myotis, Pallid bat, ringtail, silver-haired bat, Townsend's big-eared bat, three-toed woodpecker, black-backed woodpecker, flammulated owls, Lewis' woodpecker, spotted owl, Pileated woodpecker, western bluebird, western purple martin, white-headed woodpecker, clouded salamander, Oregon slender salamander, Chace sideband, evening fieldslug, Oregon shoulderband, and traveling sideband. The Oregon Conservation Plan. February 2006. http://www.dfw.state.or.us/conservationstrategy/contents.asp

Scientific study of the effects of the Davis fire salvage showed that black-backed woodpecker, hairy woodpecker, western wood-pewee, brown creeper and yellow-rumped warbler were more common in unsalvaged stands. See Rebecca Cahall, Influence of Salvage Logging on Forest Birds After Fire in the Eastern Cascades. CFER News, Summer 2007. http://www.fsl.orst.edu/cfer/pdfs/Vol7_2.pdf http://ir.library.oregonstate.edu/dspace/bitstream/1957/5898/1/Cahall_Thesis.pdf

Consider and disclose reasons <u>NOT</u> to remove snags

Science tells us that natural forests develop after disturbance with abundant structural legacies. These legacy features include snags and down wood which play a wide variety of valuable ecological services for the developing forest, including but not limited to:

- nutrient uptake, storage, and release

- water uptake, storage, and release
- micorhyizal colonization
- wildlife habitat, in particular for primary cavity species which are recognized as a "keystone" element of healthy forests
- allowing some forest species to linger in burned forests after disturbance and to recolonize burned forests sooner after disturbance, thereby shortening the period during which burned stands are unsuitable for wildlife
- providing food for insects that in turn feed a wide variety of other wildlife such as birds and bats
- favorable sites for seed germination and establishment
- mechanical thinning of the regenerating stand due to the process of snag fall
- shade and cover for everything from seedlings to big game
- perches, nest, and den structures,

In general, the larger the piece size, the longer they tend to last. But salvage logging removes those very elements that are most valuable for wildlife and most difficult to replace.

Since this project involves post-fire commodity extraction (also often referred to erroneously as "salvage" logging) please carefully analyze, consider, and disclose the site-specific analysis of the many reasons NOT to do post-fire commodity extraction, including but not limited to:

- adverse impacts to soil, such as erosion, compaction, displacement, litter disturbance, nutrient depletion; loss of chemical buffering; loss of soil organic matter; loss of burrowing wildlife that help aerate soils; reduction of nitrogen fixing plants that boost soil fertility; loss of slope and snow stabilizing effects which could lead to mass wasting or eliminate mechanisms that may mitigate mass wasting;
- loss of down wood functions s such as trapping sediment and aiding water infiltration, and creating microsites favorable for germination and establishment of diverse plants, and habitat for diverse wildlife;
- loss of decaying wood and depletion of the "savings account for nutrients and organic matter" which affects site productivity through the removal of dead trees which store nutrients and slowly release them to the next stand. Recent studies indicate that wood may release nutrients more rapidly than previously thought through a variety of decay mechanisms mediated by means other than microbial decomposers, i.e. fungal sporocarps, mycorrhizae and roots, leaching, fragmentation, and insects;
- loss of nutrients from live trees that are determined to be "dying." Live trees produce serve as refugia for animals, invertebrates, and mycorrhizae; produce litter fall; and help cycle nutrients which are all extremely valuable in the post-fire landscape;
- loss of wood that serves to buffer soil chemistry and prevent extreme changes in soil chemistry;
- water quality degradation;
- loss of water storage capacity in down logs;

- altered timing of storm run-off which could lead to peak flows that erode stream banks and scour fish eggs;
- delaying the pace of vegetative recovery and reducing the quality/diversity of the vegetation community;
- spread of invasive weeds through soil disturbance and extensive use of transportation systems;
- loss of legacy structures that can carry species, functions, and processes over from one stand to the next;
- loss of terrestrial and aquatic habitat (mostly snags and down logs) potentially harming at least 93 forest species (63 birds, 26 mammals, and 4 amphibians) that use snags for nesting, roosting, preening, foraging, perching, courtship, drumming, and hibernating, plus many more species that use down logs for foraging sites, hiding and thermal cover, denning, nesting, travel corridors, and vantage points for predator avoidance;
- Depletion of large wood structures in streams that can cause: 1) simplification of channel morphology, 2) increased bank erosion, 3) increased sediment export, 4) decreased nutrient retention, 5) loss of habitats associated with diversity in cover, hydrologic patterns, and sediment retention;
- commercial salvage usually removes the largest trees, but this will disproportionately harm wildlife because: (1) larger snags persist longer and therefore provide their valuable ecosystem services longer and then serve longer as down wood too, and (2) most snag-using wildlife species are associated with snags >14.2 inches diameter at breast height (dbh), and about a third of these species use snags >29.1 inches dbh.
- Truncation of symbiotic species relations and loss of biodiversity. Sixteen species are primary cavity excavators and 35 are secondary cavity users; 8 are primary burrow excavators and 11 are secondary burrow users; 5 are primary terrestrial runway excavators and 6 are secondary runway users. Nine snag-associated species create nesting or denning structures and 8 use created structures.
- Reduced avian and terrestrial species diversity which affects plant and invertebrate diversity. Since different wildlife help disperse different sets of seeds and invertebrates, reduced wildlife diversity can significantly affect pace of recovery and the diversity of the regenerating stand. Snag- associated wildlife play a greater role in dispersal of invertebrates and plants, while down wood-associated wildlife play a greater role in dispersal of fungi and lichens. Down wood-associated species might contribute more to improving soil structure and aeration through digging, and to fragmenting wood which increases surface area encouraging biological action that releases nutrients.
- loss of partial shade that helps protect the next generation of forest;
- loss of cover quality and fawning areas for big game;
- loss of future disturbance processes such as falling snags that help thin and diversify the next generation of forest;
- increased human activity and human access that can increase fire risk;
- increased fine fuels on the forest floor that can cause an increase in fire hazard;
- loss of seed sources, and
- loss of diversity of vegetation and microsite conditions.

- The fact that regional standards for snags and down wood fail to incorporate the most recent science indicating that more snags and down wood (especially large snags and logs) are required in order to maintain species viability and sustain site productivity.
- Arguments in support of the "reburn hypothesis" are specious. (1) partial reburn may be completely natural and desirable in some cases to consume some fuel and diversify the regenerating forest, and (2) salvage logging will cause a pulse of fine fuels on the ground and actually increase the reburn risk/hazard above natural levels, and (3) fuels that fall to the ground over time will to some extent decay as they fall.
- Uncertainty calls for a cautious approach.

Compare these adverse impacts of salvage logging to the few scant reasons to salvage (e.g., economic recovery of fiber).

Prevention of reburn must not be used as a justification for post-fire logging, without carefully documenting the rationale and providing references to published scientific studies (not just hypotheses and speculation and anecdotes). Also, the Forest Service must explain whether logging will increase or decrease the risk of reburn in terms of fuels profiles over various time horizons, ignition sources, etc. Salvage logging increases fine and mid-size fuels in the short-term by leaving treetops, branches, and needles on site. Fine and mid-size surface fuels also occur in unsalvaged areas, but accumulate gradually over time. It is unlikely that fuels in an unsalvaged area would reach the same magnitude as in the post-salvage scenario because decomposition breaks down new material accumulates. As noted by scientists interviewed by the Oregonian, "There would be less risk by leaving dead trees standing where they gradually would decay while keeping their tinder above the reach of flames." Michael Milstein. "Scorched forests best left alone, study finds." The Oregonian, Jan 6, 2006.

Please consider at least one non-commercial, restoration-only alternative that invests in restoration and recovery of the fire area by, for instance, eliminating livestock grazing, emphasizing native species recovery, not building any new roads, stabilizing soils disturbed by the fire suppression effort, decommissioning unneeded roads.

Also, consider an alternative modeled on the recommendations of the Beschta report. Specifically:

- prohibit post-fire logging AND roadbuilding on all sensitive sites, including: severely burned areas (areas with litter destruction), on erosive soils, on fragile soils, in roadless/unroaded areas, in riparian areas, on steep slopes, and any site where accelerated erosion is possible. We would add: Late-Successional and Riparian Reserves, and protective land allocations or designations including Botanical and Scenic River Areas;
- protect all live trees;
- protect all old snags over 150 years old;
- protect all large snags over 20 inches dbh;
- protect at least 50% of each size class of dead trees less than 20 inches dbh.

See Beschta RL, Frissell CA, Gresswell R, Hauer R, Karr JR, Minshall GW, Perry DA, and Rhodes JJ. 1995. Wildfire and Salvage Logging: recommendations for ecologically sound post-fire salvage logging and other post-fire treatments on Federal lands in the West. Corvallis, OR: Oregon State University. Available at: http://www.fire-ecology.org/science/Beschta_Report.pdf

Consider the salvage logging recommendations of the Society for Conservation Biology

The Society for Conservation Biology in 2006 prepared a white paper summarizing the scientific approach to forest management after fire. This report was later peer-reviewed and published in Frontiers in Ecology and Environment 2006; 4(9): 481-487.

> **Forest Management After Wildfire**
>
> Forest landscapes that have been affected by a major natural disturbance—such as a severe wildfire or windstorm event—are commonly viewed as devastated and biologically impoverished. Such perspectives are usually far from ecological reality. Overall species diversity measured as number of species—at least of higher plants and vertebrates—is often highest following a natural stand-replacement disturbance and before re-development of closed-canopy forest. Important reasons for this include an abundance of biological legacies, such as living organisms and dead tree structures, the migration and establishment of additional organisms adapted to the disturbed, early-successional environment, and temporary release of other plants on the site from dominance by trees.
>
> Currently, natural, early-successional forest habitat—naturally disturbed areas with a full array of legacies (i.e., not subject to post-fire logging) and experiencing natural recovery processes (i.e., not seeded or planted)—are among the scarcest habitat condition in some regions, such as the Pacific Northwest.
>
> **Key Findings:**
>
> • **Research by both ecologists and foresters provides evidence that areas affected by large-scale natural disturbances often recover naturally.** Post-burn landscapes have substantial capacity for natural recovery. Reestablishment of closed forest following stand-replacement fire characteristically occurs at widely varying rates, providing temporary, but ecologically important and now rare early-successional habitat for a variety of native species and key ecological processes.
>
> • **Post-fire logging does not contribute to ecological recovery; rather it negatively impacts recovery processes, with the intensity of such impacts depending upon the nature of the logging activity.** Post-fire logging in naturally-disturbed forest landscapes generally has no direct ecological benefits and many potential negative impacts from an ecological standpoint. Trees that

survive the fire for even a short period of time are critical as seed sources and as habitat that will sustain many elements of biodiversity both above and below ground. The dead wood, including large snags and logs, is second only to live trees in overall ecological importance. Removal of these structural legacies—living and dead—is inconsistent with our scientific understanding of natural disturbance regimes and short- and long-term recovery processes.

• **Post-fire logging destroys much of whatever natural tree regeneration is occurring on a burned site.** This is a fundamental concern since these tree seedlings are derived from local seed sources, which are most likely the best adapted to the site. Furthermore, environmental variables, such as moisture and temperature conditions, are major selective factors in determining which natural tree seedlings survive, which favors genotypes more tolerant of environmental stresses than are nursery- or greenhouse-grown seedlings.

• **Evidence from empirical studies is that post-fire logging typically generates significant short- to mid-term increases in fine and medium fuels.** In some cases this may result in increased reburn potential rather than a decreased reburn potential, as is often claimed. In any case, from an ecological perspective large wood is of demonstrated importance in ecological recovery; removing this wood in an attempt to influence the behavior of a potential reburn event has little scientific support.

• **In forests subjected to severe fire and post-fire logging, streams and other aquatic ecosystems will take longer to return to historic conditions or may switch to a different (and often less desirable) state altogether.** Following a severe fire the biggest impacts on aquatic ecosystems are often increased sedimentation caused by runoff from roads. High sediment loads from roads may continue for years, greatly increasing the time for recovery.

• **Post-fire seeding of non-native plants generally damages natural ecological values,** such as reducing the recovery of native plant cover and biodiversity, including tree regeneration. Non-native plants typically compete with native species, reducing both native plant diversity and cover. Reductions in natural tree regeneration as a result of seeding of non-native plants have also been reported in numerous studies.

• **Post-fire seeding of non-native plants is often ineffective at reducing soil erosion.** Aerial seeding of grasses (primarily non-native) is common on federal lands following moderate- to high-severity fire to reduce postfire erosion. The effectiveness of seeding in reducing erosion is mixed. Grass seeding generally does not mitigate erosion during the first winter following fire, when seeded grasses are not yet well established. Seeding may slow erosion during the second year following fire but is rarely effective during intense storms.

• **There is no scientific or operational linkage between reforestation and post-**

fire logging; potential ecological impacts of reforestation are varied and may be either positive or negative depending upon the specifics of activity, site conditions, and management objectives. On the other hand, ecological impacts of post-fire logging appear to be consistently negative. Salvage and reforestation are often presented as though they are interdependent activities, which they are not from either a scientific or operational perspective. From a scientific perspective, policy and practice should consider each activity separately. As noted above, post-fire logging is a consistently negative practice from the standpoint of ecological recovery. Natural tree regeneration is ecologically most appropriate, but intentional reforestation could also be designed to provide significant ecological benefits in some cases.

• **Accelerated reestablishment of extensive closed forest conditions after fire is usually not an appropriate objective on sites managed with a major ecological focus.** Wildfires have been viewed historically as events that destroy valuable standing forest and create undesirable expanses of deforested (i.e., unproductive) landscape. Reestablishment of fully stocked stands of commercially important tree species on burned sites has been a fundamental forest management objective on most private and public forestlands; hence the historic commitment to intensive reforestation. However, timber production is no longer the primary objective on many federal lands, where the focus on provision of biodiversity and ecosystem services equals or exceeds wood production objectives. The ecological importance of biological legacies and of uncommon, structurally complex early-successional stands argues against actions to achieve rapid and complete reforestation except where the primary goal is wood production. In addition, it is also inappropriate to re-establish fully stocked stands on sites characterized by low severity fire—the same sites where managers are trying to restore fuel loadings to their historical range of variability.

• **Where timber production, other societal management goals, or special ecological needs are the focus, planting or seeding some native trees and other plants using local seed sources may be appropriate.** Ecological assessments of the post-burn area and considerations of management objectives should be used to determine appropriate activity. Special ecological circumstances might include a need to restore an uncommon plant species or habitat for a threatened or endangered species. Innovative practices, such as low or variable density planting, will likely be more appropriate ecologically than traditional practices that involve dense tree plantations of one or a few commercial species. Dense uniform conifer plantations are always inappropriate on sites characterized by low-severity fire unless the intent is intensive management of such sites for wood production.

Society for Conservation Biology Scientific Panel on Fire in Western U.S. Forests
Reed F. Noss (editor), Jerry F. Franklin, William Baker, Tania Schoennagel, and Peter B. Moyle. **Ecological Science Relevant to Management Policies for Fire-prone Forests of the Western United States.** February 24, 2006.

http://www.conbio.org/Sections/NAmerica/NAPolicy.CFM#NA20060228
http://www.conbio.org/Sections/NAmerica/FireWhitepaperExecutiveSummary.pdf
See also the published version, Reed F. Noss (editor), Jerry F. Franklin, William L. Baker, Tania Schoennagel, and Peter B. Moyle. 2006. Ecology and Management of Fire-prone Forests of the Western United States. Society for Conservation Biology Scientific Panel on Fire in Western U.S. Forests. August 2006.
http://www.conbio.org/Sections/NAmerica/FireWhitepaper.pdf

Recognize the effects of compound disturbances such as fire and fire suppression followed by logging and treatment of activity fuels.

> Compound disturbances have the potential to fundamentally alter an ecosystem structure and function. This study examines the effects of a natural disturbance and a compounded natural and anthropogenic disturbance on soil properties, biogeochemical cycles, and ecosystem reorganization in a windblown and salvage-logged ecosystem in northwestern Colorado. Areas of intact forest are used as a control to compare the disturbance effects. Results indicate that soils in the salvage-logged areas are drier, significantly warmer, denser, and contain less organic matter than soils in blowdown or control areas. Significant amounts of erosion occurred in the salvage-logged areas to produce these results. Furthermore, net nitrogen mineralization rates are lower in soils from salvage-logged areas than in blowdown areas. By contrast, net nitrogen mineralization rates are twice as high in blowdown areas than in control areas. Seedling density, herbaceous cover, and plant species diversity are greatest in blowdown areas, and least in salvaged-logged areas. The results of this four-year study indicate that the mitigation effects of salvage logging significantly alter ecosystem functions and retard the rate of recovery when compared to unlogged blowdown areas.

Cristina M. Rumbaitis-Del Rio and Carol A. Wessman. **Impact of compound disturbances on N-cycling and forest reorganization in a wind-disturbed and logged forest.** Paper presented to the 86th Annual Meeting of the Ecological Society of America, August 6 –10, 2001.
http://www.fs.fed.us/r2/mbr/resourcemgmt/blowdown/CRresearch.pdf

Studying the effects of wildfire and salvage logging on boreal forest insects and nutrient dynamics, Tyler Cobb found that "disturbance combinations … should be avoided whenever possible…"

> While many studies have examined the effects of single disturbances on biodiversity (e.g., Hunter 1999; Stelfox 1995), there is a growing awareness that independent consideration of disturbances may be insufficient from a sustainable forest management perspective (Lindenmayer and Noss, 2006). Today, forest ecosystems face multiple, often simultaneous, natural and anthropogenic environmental stressors. Disturbance regimes in most forest ecosystems now include environmental stress associated with increasing natural resource extraction (e.g., timber, natural gas, oil, minerals, etc.) (Kennedy 2002; Schneider 2002), pollution (Perry 1994) and global climate change (Flannigan et al., 1998; Li et al. 2000; Overpeck et al., 1990). Thus, forest management models based on

emulating natural disturbances like wildfire (Attiwill 1994; Hunter 1993) may be overly simplistic and fail dramatically in application on many landscapes. … Research presented here suggests that combining wildfire and forestry-related disturbances in boreal ecosystems may not only impact beetle diversity, but has significant potential to also impact decomposition and nutrient cycling processes. These effects, in turn, may well affect successional pathways and have broad effects on regeneration Thus, the ecological integrity of these ecosystems may depend, at least in part, on organisms we consider to be either economic "pests" or of no economic significance.

…

For saproxylic [dead wood dependent] beetle assemblages, the combination of wildfire and forest harvesting (postfire salvage logging) reduced species richness and altered species composition to a greater extent that either disturbance alone. Postfire salvage logging also altered the trophic structure of the saproxylic beetle assemblage and was particularly detrimental for wood- and barkboring species. Through a series of experiments, the abundance of one such species, *Monochamus scutellatus scutellatus*, was linked to decomposition processes in burned forests. Together, the results of these studies suggest that disturbance combinations should be avoided whenever possible because they may impact not only beetle diversity, but also decomposition processes in forests recovering from wildfire.

…

Broadly, my results showed that removal of dead wood from burned forests by postfire salvage logging has the potential to alter naturally occurring links between wood-feeding insects and nutrient dynamics in forests recovering from wildfire. … By feeding on burned dead wood, M. s. scutellatus larvae help to begin the process of gradually returning organic materials from standing burned coniferous trees to the soil. My data show that this feeding activity is linked to changes in soil microbial activity, N availability, and the germination and growth of colonizing plants in early postfire ecosystems. … [T]he fact that the development time for M. s. scutellatus is 1 or 2 years (Rose, 1957; Wilson, 1962) suggests that organic nutrient inputs in the frass of this species are somewhat gradual, which may also reduce leaching of N from burned stands. … While M. s. scutellatus and other wood-feeding beetle species may be considered "pests" that rapidly reduce the economic value of salvaged timber (Ross, 1960; Sessions et al., 2004), their role in nutrient cycling and food web dynamics (Hoyt & Hannon, 2002) in burned forests should not be overlooked in the development of guidelines for postfire management. By removing fire-killed trees, postfire salvage logging in boreal ecosystems may be as damaging to saproxylic insect diversity as have intensive forestry and fire suppression in Europe (Grove, 2002; Siitonen, 2001). In addition to biodiversity consequences, the results of this study indicate that postfire salvage logging may also influence nutrient dynamics and succession in regenerating burned forests. Therefore, the long-term persistence of boreal ecosystem function may require the retention of some burned timber.

Tyler Cobb. 2007. Boreal Mixed-wood Beetles and the Cumulative Ecological Consequences of Disturbance. PhD dissertation. University of Alberta. Spring 2007.

Consider the additive and cumulative effects of salvage logging and associated activities.

The agency must consider the additive effects of salvage logging, road construction, log hauling, activity fuel treatment (broadcast burning, pile burning, and mechanical fuel reduction), site preparation, tree planting, OHVs, as well as the cumulative effects of past logging, roads, fire effects, fight fighting, etc.

The agency must not adopt the reasoning that the effects of the fire are greater than the effects of the logging and are likely to mask the latter. The Ninth Circuit rejected precisely this type of analysis as faulty and violating NEPA in Blue Mountains Biodiversity Project v. Blackwood, 161 F.3d 1208 (9th Cir. 1998). http://laws.findlaw.com/9th/9835783.html. The Court held that

> Despite the lack of data, the Forest Service asserts throughout the EA that the expected level of sediment delivery will be small in comparison to that caused by the fire. Whether the increased erosion from logging and roadbuilding is smaller or larger than that produced by the fire is irrelevant. The proper evaluation should identify the impact of the increased sediment from the logging and roadbuilding on the fisheries habitat in light of the documented increases that have already resulted from the fire.

161 F.3d at 1213 (9th Cir. 1998) (emphasis added).

Recognize that dead and down wood are key elements of the forest ecosystem.

> There are implications for management of old-growth stands selected for perpetuation. Salvage logging is inappropriate since it removes at least two of the major structural components-dead and down-that are key elements of the system. In all likelihood, some of the more decadent, live trees would also be removed. Salvage logging is also inappropriate because of the damage inevitably done to root systems and trunks of the residual stand which results in accelerated mortality of trees and overall deterioration of the stand.

Franklin, J.F., K. Cromack, Jr., W. Denison, A. McKee, C. Maser, J. Sedell, F. Swanson, and G. Juday. 1981. Ecological characteristics of old-growth Douglas-fir forests. PNW-GTR-118. USDA Forest Service. PNW Research Station. February 1981.
http://www.fs.fed.us/pnw/pubs/gtr118part1.pdf
http://www.fs.fed.us/pnw/pubs/118part2.pdf

- Salvage has been shown to increase fire hazard, especially when dead trees less than 10" diameter will be left behind. Harvesting all the larger diameter trees, especially in an old growth preserve is not acceptable. Large trees need to be left behind.

- As stated in Appendix C-9 of the Warner Fire Recovery Project EIS (Willamette NF), standing dead trees provide about 25% daily shade to seedlings. This in itself is reason to leave standing trees, especially larger ones.
- Pile burning leaves the area prone to invasives.

Salvage: let nature sort things out

DO NOT conduct salvage logging to provide a variety of snag densities to match the preferences of a variety of species. Over the landscape and over time, the different species will find their place and time. For instance, Black-backed woodpecker will benefit most from the highest densities of unsalvaged burned trees in the immediate post-fire landscape (and this is a rare thing and should be preserved), then as snags begin falling and snag densities begin to naturally decline, the habitat will become more favorable to species such as Lewis' woodpeckers. The Black Backed woodpecker and the Lewis' woodpecker can share the same landscape at different stages of the post-fire recovery process. The agency does not need to "create" habitat for Lewis' woodpecker through salvage logging. Natural attrition of snags over time will automatically create ideal Lewis' woodpecker habitat. Note that even Lewis' woodpecker nest sites have higher density of snag than randomly selected unlogged sites that have burned. Saab and Dudley 1998. Responses of Cavity-Nesting Birds to Stand Replacement Fire and Salvage Logging in Ponderosa Pine/Douglas-fir Forests of Southwestern Idaho. RMRS-RP-11.

Salvage: Protect all live trees

> … These scattered large trees occurred as a lasting remnant after stand replacement disturbances providing an important structural and habitat legacy that would typically last for many centuries, first as a standing live tree, then as a snag, and ultimately as large down wood.[8]

A review of past fires indicates that large pine trees are surviving after fire better than expected. The latest scientific information indicates that <u>large pines with any green needles at all should be retained</u> because they may survive.

Surviving green trees are rare and valuable after a fire especially for:

- recovery of soil biota,
- proving current live tree habitat such as cover
- producing seeds for natural reforestation and for animal foraging, and
- provide critically important future snag and down wood recruitment.

The agency's NEPA analysis must address all of these issues by explaining the extent to which surviving trees and their specific functions and values will be lost due to safety, operational constraints, and yarding corridors, road rights-of-way, etc.

[8] Paul F. Hessburg, James K. Agee, Jerry F. Franklin. 2005. Dry forests and wildland fires of the inland Northwest USA: Contrasting the landscape ecology of the pre-settlement and modern eras. Forest Ecology and Management. Vol. 211: 117-139. http://www.fs.fed.us/pnw/pubs/journals/pnw_2005_hessburg002.pdf.

Cable logging should be disfavored. The Siskiyou National Forest's Biscuit Fire Salvage FEIS (page III-177) admits that 12% of live trees >20" dbh will die in skyline yarding units. This is likely true of all cable logging types.

While it is true that some trees injured by fire will soon die, the agency fails to acknowledge or disclose the degree of confidence in their estimates (i.e. how many false positive predictions of imminent death will the agency make) and fails to recognize the huge importance of remaining live trees as current habitat (cover, shade, microclimate, nest/roost/foraging structures, etc.), as seed sources for natural recovery of locally adapted vegetation, as refugia for beneficial soil organisms including symbiotic fungi, as generators of fine root biomass, and as future sources of snags to fill the temporal gap between the batch of snags created by this fire and those to be produced in the distant future by the next stand of trees.

Salvage operations typically assume that many living trees will soon die and then salvage becomes a self-fulfilling prophecy. Trees that may survive the fire are an extremely valuable feature of the future forest. Providing scarce canopy and shelter in the short-term and providing scarce large snag and down wood habitat in the long-term, during a period when forest-fire landscapes are typically depauperate in snags and large wood. The NEPA analysis failed to adequately disclose and analyze this and an EIS is necessary to consider the effects of harvesting numerous trees that may survive.

See: Residual Trees as Biological Legacies, CCEM Communiqué #2. Sept. 1995. http://www.fsl.orst.edu/ccem/pdf/95Comque.pdf

The agency must recognize the large trees are more likely to survive fire and retain large trees with any signs of life. Large are more likely to survive due to two factors: (1) they are tall so more of their canopy is above the scorch height, and (2) their bark is thicker and better protects their cambium. See: Reinhardt, E.D. and K.C. Ryan. 1989. **Estimating tree mortality resulting from prescribed fire** *in* Symposium proceedings: Prescribed fire in the Intermountain Region edited by Baumgartner, D.M., D.W. Breuer, B.A. Zamora, L.F. Neuenschwander and R.H. Wakimoto. Washington State University 41-44. http://www.fs.fed.us/r1-r4/spf/fhp/publications/survival/appip2.htm

Forest Service entomologist Julie Weatherby found that many large pines that were expected to die from fire damage and beetles after a fire on the Payette National Forest have in fact lived beyond their expectations. See Sonner, Scott, AP, "Salvage trees may grow after all," Eugene Register Guard, Aug 31, 1997. "Currently our biggest errors are associated with trees that living which have been expected to die from our selection guidelines." Weatherby said in her report. The NEPA document for this project must disclose the risk and consequences of false positive findings of tree mortality.

The agency's use of the 20% green canopy criteria to determine "dying" trees will lead to violations of the eastside screens 21 inch diameter limit. While it's true that salvage is exempt from the ESS diameter limit. Cutting live trees is not exempt. Since the 20% green crown criteria are *probabilistic* (i.e. there is a >0% risk of false positive findings

that trees are "dying") so some large live trees will by definition be killed in violation of the screens. The Forest Service must err on the side of protecting large trees that *might* survive (and any large trees that are green now and later die actually help achieve the overall objectives of the screens).

Salvage: Protect all large snags

Because large snags last much longer than small snags, large snags are disproportionately valuable as wildlife habitat, nutrient and water reservoirs, soil stabilizers, etc. If the agency chooses to conduct a salvage operation in this fire area, they must use a diameter cap and protect these scarce and valuable forest structures.

Since large snags last longest, if large trees are retained, maybe there will not be a temporal gap in snag habitat. Everett, Richard et al. 1999. Snag Dynamics in a Chronosequence of 26 Wildfires on the East Slope of the Cascade Range Washington Sate, USA. International Journal of Wildland Fire. 9(4) 223-234 (1999). http://www.fs.fed.us/pnw/pubs/journals/snag.pdf

The Siskiyou National Forest's Biscuit Fire FEIS admits that up to 53% of small Douglas-fir snags (10-30" dbh) and up to 85% of large Douglas-fir snags (>30" dbh) are likely to remain standing for 50 years or more. Even after 100 years, up to 63% of the large Douglas-fir snags may remain standing. In a natural ecosystem these snags play critical roles as habitat and microclimate modifiers. If they are salvaged or knocked down for safety reasons they are not able to fulfill these purposes. Biscuit FEIS Appendix G-9 http://www.biscuitfire.com/feis/feis-app-g-final.pdf

A study conducted in the Black Hills National Forest found that 1) Wildlife disproportionately forage on large diameter snags; 2) Cavity nesters disproportionately utilized large diameter snags for nesting; 3) Cavity nesters were less abundant (usually absent in this case) in managed forest because of the scarcity of large diameter snags; and 4) Logging and thinning has led to serious shortages of large diameter snags. D.J. Spiering, R.L. Knight. 2005. Snag density and use by cavity-nesting birds in managed stands of the Black Hills National Forest. Forest Ecology and Management 214 (2005) 40–52. The agency should consider the significant implications of this study. Large snags are critically important for species viability, yet further loss of large snags (such as that caused by this project) will make a bad situation worse.

Briefly meeting management plan snag targets is grossly inadequate. Historically, a mosaic of recent and not-so-recent fires, left lots of "snag patches" and patchy accumulations of down wood of various sizes and decay-stages. These snag patches provided tremendous habitat value for a whole host of wildlife species, include birds, mammals, amphibians, insects. 96 species are known to be associated with snags and 86 species are associated with down wood. Most of these species depend upon or prefer large snags and wood. With aggressive salvage policies that continue to this day, these snag patches are an under-represented feature on the landscape.

The agency's snag retention guidelines are based on wildlife needs, but fail to consider or analyze the need to large snags and large down logs for shade, water storage, disturbance (via falling and sliding), nutrient storage, channel forming, sediment trapping, soil conservation, underground processes, etc.

The NEPA analysis failed to disclose and analyze these significant issues. An EIS is needed to fully consider them.

> Although rate of biomass input and average piece size generally are thought to increase with succession (Harmon and others 1986), the amount of dead wood can follow a U-shaped pattern if young forests inherit large amounts of dead wood and live trees from preceding stands (Spies and others 1988). The snags in our study—especially large snags—increased with succession in almost all of the habitats. No wildlife habitats exhibited a U-shaped pattern, probably because snags tend to be cut within harvest units, which reduces the density found in early successional forests. . . .
> … The lack of a U-shaped successional pattern for snags is not surprising. . . . Snags also are much more likely than down wood to be damaged or intentionally removed by humans through the course of forest management and harvest activities. …
>
> All of the habitats we examined had similar patterns: distributions were non-normally distributed and strongly skewed to the right. A large proportion of the plots did not contain snags or down wood, and a very small proportion of the plots contained extremely large accumulations of dead wood.

Janet L. Ohmann and Karen L. Waddell; **Regional Patterns of Dead Wood in Forested Habitats of Oregon and Washington;** USDA Forest Service Gen. Tech. Rep. PSW-GTR-181. 2002. http://www.fs.fed.us/pnw/pubs/journals/PSWGTR181Deadwood.pdf

The Trapper Project on the Willamette NF proposed to retain 30 snags per acre in a project intended to mimic a stand replacing fire event. This is an example of how much wood should be retained in salvage projects.

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

1. retaining large quantities of legacy structures will more closely match the natural historic development of post-fire landscapes.
2. retaining large numbers of standing trees will preserve an important ecological process, that is falling snags over time that will help to thin and break up the continuity of brush and other reprod.
3. retaining snags and dying trees will help provide some level of shade that will help suppress growth and break up the continuity of brush and other reprod

4. retaining large quantities of snags will help provide some hiding cover for Mule deer and elk
5. retaining large quantities of tree boles will help to retain water storage mechanisms on site.

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

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

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

There is a value to retaining more dead wood on every acre. We know that dead wood has important ecological values. Why would you plan for areas that are so dramatically deprived of an important resource? (Sure humans can go for days without food, and historically we did, but you try to provide three meals a day for your family. Same for forests and snags.) Areas of extreme low snags abundance are already over-represented within logged areas on both federal and non-federal lands. We should not be creating any more of this over-represented snag-deprived forest type. Instead we should be relishing the fact that we have an opportunity to provide complex early seral habitat with abundant structural legacies, which is a significantly under-represented forest type, relative to the historic condition.

Soil development processes are the quintessential process that must be well-distributed. Roger Hungerford, writing in *Effects of Fire or Fire Exclusion on Soil Sustainability New Perspectives* a workshop given Nov. 1820, 1991, at Coeur d'Alene, said "Evidence does exist that much of the soil wood and organic components originated from fire killed trees." We are concerned that the salvage logging will continue the trend of loss of site productivity, depleting nutrients through biomass removal, and interfering with ecological and hydrological processes that should be well-distributed, not clumped.

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

> A 200-year study of rotting logs in the Oregon Cascade Range is only 10 percent complete, but findings from this research have already helped save hundreds of

millions of dollars, improved forest health and **shattered conventional wisdom about the decay of woody debris.**

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

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

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

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

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

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

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

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

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

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

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

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

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

…

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

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

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

http://www.sciencedaily.com/releases/2005/08/050819123757.htm
http://oregonstate.edu/dept/ncs/newsarch/2005/Aug05/decay.htm

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

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

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

Both clumped and scattered snag distributions are desirable. Rochelle, James A., 2002. Green trees, snags, logs, and wildlife in managed forests: An Overview. presented to The Wildlife Society, Oregon Chapter. Feb 11, 2002. http://fw.oregonstate.edu/tws/workshop%20files/green%20trees.pdf

The proposed salvage activities are in fundamental conflict with the Northwest Forest Plan **Aquatic Conservation Strategy** objectives, especially because proposed logging, yarding, soil ripping, helicopter landings, safety zones, and road activities will—

a) cause soil erosion and sedimentation. For instance, road use will cause sediment to enter streams, which will reduce aquatic insect abundance, which will adversely affect fish.
b) Chronic lack of large woody debris does not support complex aquatic habitat structures, functions, and processes including: pools, gravel retention and storage, stream energy dissipation, side-channels, cover, winter refugia, and substrate and nutrients supporting organisms of all kinds.
c) fires are a primary mechanism of large wood recruitment to streams. Removal of large quantities of large wood will limit recruitment of large woody to streams that are already severely degraded in terms of large wood and the aquatic habitat complexity it provides. If the large trees are retained they may some day be delivered to streams via landslides, but if the large snags are removed they will never reach streams.
d) The NEPA analysis inappropriately relies on the filtering effect of riparian buffers that are severely affected by the fire and will very likely NOT filter sediment to the degree found in studies involving unburned riparian buffers. To be effective, riparian buffers need healthy vegetation, coarse woody debris, and adequate cover of litter and duff, all of which have been significantly reduced by the fire.
e) Some riparian areas on private land located below BLM salvage areas will not function to filter sediment both because of fire effects and subsequent disturbance from private land salvage logging.
f) Channel morphology and large woody debris recruitment will be adversely affected by logging in riparian reserves.

Salvage retards watershed and aquatic recovery

Salvage logging will set back vegetative recovery that has already started and thereby retard attainment of riparian and aquatic management objectives. In research on post-fire logging on the Winema NF, Sexton (1998) found that salvage logged sites produced only about 38% of the understory biomass of that on the unlogged site; and one year later produced only about 27% of the understory biomass of that on the unlogged site. In fact, Sexton's (1998) study comparing salvaged and unsalvaged areas of a fire on the Winema NF one and two years after logging showed:

Salvage Areas	**Unsalvaged Areas**
reduced vegetation biomass	greater vegetation biomass
reduced species diversity	greater species diversity
reduced species richness	greater species richness

reduced growth of planted seedlings	greater growth of planted seedlings
reduced survival of planted seedlings	greater survival of planted seedlings

Sexton, Timothy O. 1998. Ecological effects of post wildfire activities (salvage-logging and grass-seeding) on vegetation composition, diversity, biomass, and growth and survival of *Pinus ponderosa* and *Purshia tridentata*. MS Thesis Oregon State University. Corvallis, OR. 121p

Similarly, Dan Donato, looked at the effects of salvage logging at the Biscuit fire in SW Oregon and found that cutting down dead trees and hauling away logs killed 71 percent of the naturally established seedlings which were abundant after the fire but scarce after logging. D. C. Donato, J. B. Fontaine, J. L. Campbell, W. D. Robinson, J. B. Kauffman, B. E. Law. Post-Wildfire Logging Hinders Regeneration and Increases Fire Risk. www.sciencexpress.org. 5 January 2006.

Shatford and Hibbs recently found similarly encouraging results of natural regeneration.

> Over the 2005 field season, natural regenerating conifers were sampled in 38 plots within 11 historic fires in the Klamath-Siskiyou Region … Years since stand replacing wildfire ranged from [18 years to 9 years] … The density of natural regenerating conifers ranged over three orders of magnitude … Although the abundance of natural regeneration was frequently high, the age and size of saplings ranged considerably … Frequently, the regenerating saplings were overtopped by shrubs and hardwoods. There was no evidence of recent conifer mortality (i.e. no dead or dying saplings) caused by competition … Saplings were generally in good condition with dominant trees having live crown ratios of 50% or greater.

Shatford, J., Hibbs, D.E. 2005. Predicting Post-fire Regeneration Needs: Spatial and Temporal Variation in Natural Regneration in Southwestern Oregonadn Northern California. Pp 29-32 *in* Cooperative Forest Ecosystem Research Program (CFER) 2005 Annual Report. http://www.fsl.orst.edu/cfer/pdfs/CFER_ar05.pdf This data reveals that natural regeneration is not only demonstrably successful but also species diverse and variable both spatially and temporally. All of these attributes are highly beneficial in terms of both wildlife habitat and fuel hazard.

The adverse effects of salvage logging on vegetative recovery described by Sexton are not unique to the Ponderosa pine forest type. The results are in fact quite consistent with the results found by Michael Grifantini et al after salvage logging in Douglas fir forests in northwestern California. Grifantini, M.C., Stuart J.D., and L. Fox III, 1992. "Deer Habitat Changes Following Wildfire, Salvage, Logging and Reforestation, Klamath Mountains, California," Proceedings of the Symposium on Biodiversity of Northwestern California, Oct 28-30, 1991, Santa Rosa, CA. UC Wildland Resource Center Report 29. December 1992.

The adverse effects described by Sexton appear to be long lasting. Busse at al 1996 found that the annual growth rate of pines was reduced by almost 20% where understory vegetation had been removed thirty years earlier. In addition, research has shown a direct relationship between the level of on-site coarse woody debris and the amount active ectomycorrhizal root tips. Graham, R. T., Harvey, A. E., Jurgensen, M., F., Jain T. B.,

Tonn, J. R., and Page-Dumroese, D. S. 1994. Managing coarse woody debris in forests of the Rocky Mountains. Res. Pap. INT-RP-477. Ogden, UT: U. S. Department of Agriculture, Forest Service, Intermountain Research Station, 13 p. See also Russell T. Graham, Theresa Benevidez Jain, and Alan E. Harvey FUEL: LOGS, STICKS, NEEDLES, DUFF, AND MUCH MORE. The Joint Fire Science Conference and Workshop http://jfsp.nifc.gov/conferenceproc/T-10Grahametal.pdf

Salvage logging and associated activities such as site prep, fuel treatment, and planting kills understory vegetation which will significantly reduce site productivity.

The quantity, quality, and rate of revegetation has a direct contribution to controlling erosion and sedimentation. USGS has described the role of vegetation in slope stability and erosion as follows:

> In a watershed, vegetation provides five major physical functions that help control soil erosion during rainfall events (Spittler, in press):
>
> - Interception of rainfall, which extends the time for water to reach the ground surface and absorbs raindrop impact energy.
> - Mulching of the ground surface to provide temporary water storage and slow release, slope roughness, and energy absorption.
> - Structural support of loose, surficial material.
> - Reinforcement of the deeper soil by roots, which increases the natural slope stability.
> - Maintains conditions necessary for soil micro-organisms that provide soil structure.

http://landslides.usgs.gov/html_files/ofr95-508/skrep2.html#General *citing* Spittler, T.E., in press, Fire and the debris-flow potential of winter storms, in, Proceedings of the Symposium on Brush Fires in California Wildlands: Ecology and Resource Management: International Association of Wildland Fire.

> "In places where salvage logging occurs, the amount of snags that can be removed from the uplands without serious adverse effects on stream macroinvertebrate but ecosystem recovery is unknown and is likely to vary with forest type, geology, and topographical relief. However, it is know that virtually all forms of postfire logging can have various adverse effects on stream ecosystems (e.g., Mehahan, 1983; Smith et al., 1993a, b; Stout et al., 1993; Ketcheson and Megahan, 1996). Based on results from watersheds having various proportions of their areas burned by wildfire (e.g., Minshall et al., 1995, 2001b; Minshall, personal observation), **it is probable that the amount of timber removed should not exceed about 25% of the merchantable timber** (unless contradictory information is available). In addition, postfire removal should be appropriately spaced across the landscape and should be in proportion to the size classes (DBH) of trees present at the time of the fire (see also Beschta et al., 1995). This proportional harvesting is necessary because of the important graded inputs (Lyon, 1984) that a mix of such large woody debris contributes to streams over the extended recovery period (Minshall et al., 1989). In addition, fire lines should be obliterated prior to logging, and road construction or other major ground-disturbing activities should

be avoided in order to prevent additional runoff and erosion. Salvage harvest yeilds responses (e.g., ground disturbance, woody debris removal, interruption of normal infiltration pathways, and acceleration of surface flows) that interact with the direct and indirect effects of fire to make these actions so potentially damaging. In addition, the negative effects extend many years beyond the actual time of salvage activities because of the harvest of snags that normally fall and become incorporated into stream channels and forest floors over several decades or more (Lyon, 1984). These wood inputs are important to create habitat, increase nutrients, and retard runoff and channel alteration during what is normally the most critical stage of stream and riparian vegetation recovery (Minshall et al., 1989; Lawrence and Minshall, 1994)."

Minshall, G.W. 2003. Responses of stream benthic macroinvertebrates to fire. Forest ecology and management. 178: 155-161. NOTE: Volume 178, issues 1-2 was a special issue of Forest Ecology and Management on the effects of wildland fire on aquatic ecosystems in the western USA. The Minshall article as well as all others can be found online at www.sciencedirect.com. The *in press* version is here: http://www.fs.fed.us/rm/boise/teams/fisheries/fire/FAE%20Papers/MinshallFEMFinal.pdf

Salvage logging will increase soil erosion and sedimentation through the following mechanisms, each or which must be addressed in detail in the NEPA analysis:

1. Soil disturbance,
2. damage to live and dead roots,
3. removal of organic material,
4. delay of revegetation,
5. construction of roads and landings,
6. increased channel erosion from peak flow caused by
    a. loss of large logs that help anchor snowpacks,
    b. mobilization of fine soil particles that seal the soil surface and increase
    c. loss of dead tree canopy;

See McNabb and Swanson, "Effects of Fire on Soil Erosion," Chapter 14 *in* Natural and Prescribed Fire in Pacific Northwest Forests, Walstad, Radosevich, and Sandberg, editors, OSU Press.

Since the recovery of understory groundcover is the primary recovery mechanism for post fire recovery of erosion and runoff, and consequent downstream sediment-related effects, this indicates that post-fire logging seriously impedes recovery of sediment regimes after fire. Kattleman (1996) noted that "If post fire treatments of salvage logging and site preparation prevent rapid reestablishment of low vegetation, resulting erosion can be greater than that directly produced by the fire."

Undisturbed litterfall after wildfire reduces soil erosion caused by both rain and overland-flow. By disturbing needle cover and effectively reducing the soil coverage, logging and yarding will cause increased in erosion compared to not logging. Pannkuk, C. D., and P. R. Robichaud. 2003. Effectiveness of needle cast at reducing erosion after forest fires,

Water Resources Research, Vol. 39, No. 11, doi:10.1029/2003WR002318, 2003. http://www.agu.org/pubs/crossref/2003/2003WR002318.shtml They found that a 50 percent ground cover of Douglas fir needles reduced water flow erosion by 20 percent and rain-induced erosion by 80 percent. A 50 percent ground cover of ponderosa pine needles reduced water flow erosion by 40 percent and rain-induced erosion by 60 percent.

Post-fire logging inevitably involves increases in road use, which increases erosion and sedimentation, especially at road crossings (Reid and Dunne, 1984; Roni et al., 2001). Roni et al. (2001) identified reductions in road traffic as a component of watershed restoration, indicating that increased road traffic works in opposition to watershed and stream restoration.

Beschta et al. (1995) noted that even relatively low impact logging systems such as helicopter yarding should be avoided where sedimentation is already a major problem for salmonids or other sensitive aquatic species, because any activity that disturbs litter layers of soil surface horizons, either pre- or post-fire can accelerate soil erosion and sediment delivery to aquatic systems.

The USFS and USBLM (1997a; c) conceded that logging generally increases erosion and, consequently, sedimentation, regardless of how carefully it is implemented. Megahan et al. (1992) came to similar conclusions. Elevated erosion and sedimentation persist for several years after logging disturbance (USFS and USBLM, p. 1101, 1997a).

BMPs do not eliminate the persistent erosional impacts of post-fire logging. USFS and USBLM (p. 446, 1997c) concluded that although BMPs can reduce sediment yields compared to historical practices, risks of increased sedimentation will continue to occur if road building or timber harvest occur, damaging aquatic habitats. Ziemer and Lisle (1993) stated that there are no reliable data indicating that BMPs are cumulatively effective in protecting aquatic resources from the adverse effects of logging and associated impacts. Espinosa et al. (1997) provided evidence from watershed case histories that BMPs thoroughly failed to cumulatively protect salmonid habitats and streams from severe damage from roads and logging.

Logging effects on soils and vegetation increase erosion and sedimentation in the post-fire environment. Logging causes soil compaction which causes loss of soil productivity and increased erosion. The latter is essentially permanent (Beschta et al., 1995) and is the most severe source of reductions in long-term soil productivity (USFS and USBLM, 1997a; b). Soil compaction persists for at 50-80 years (USFS and USBLM, 1997a). Compaction and reduced soil productivity are already major concerns on public lands on regional scales (USFS and USBLM, 1997a; CWWR, 1996).

Logging also reduces soil productivity by removing trees which are major sources of the coarse woody debris (CWD) and organic matter critical to soil productivity (USFS and USBLM, 1997a). Even the removal of slash consisting of tops and branches negatively affects soil productivity by negatively affecting nutrient and organic matter levels; **burning these materials in place** (as occurs with wildland fire) causes much less

negative impacts on soils (USFS and USBLM,1997a). USFS and USBLM (p. 466, 1997a) found that losses in soil productivity were correlated with logging and roads within the ICBEMP project area.

USFS and USBLM (p. 206, 1997a) and Kattleman (1996) state that the prevention of soil damage and loss of productivity is easier and more effective than attempts to restore it after damage has occurred. A primary approach to restoring soil productivity is to restore organic matter and coarse woody debris levels by leaving areas undisturbed until organic matter levels have recovered (USFS and USBLM, p. 206, 1997a, emph. is mine). Avoidance of increased erosion is key to restoring soil productivity (Beschta et al., 1995; USFS and USBLM, p. 206, 1997a). The most effective means of controlling erosion is to avoid activities that disrupt/damage soils and vegetation, as is exceedingly well-documented in the literature. Due to the manifold negative effects of logging on soil productivity, erosion, and sedimentation, USFS and USBLM (1997b) concluded that logging had greater negative effects on ecosystem functions than the baring of soils by fire.

The USFS and USBLM (Ch. 4, pp. 12-13, 1997b) notes that although fire may reduce soil productivity, it typically does not reduce it as much as from soil compaction and whole tree removal (e.g. logging), except in the rare cases where fire consumes all organic material. It states: "Because of the mosaic pattern that wildfire produces, and the residual wood that is left on site...wildfire usually has fewer implications for loss of soil productivity and function than disturbances which remove oil organic matter and [increase] bulk density as well." Logging effects on soil properties are usually more severe and more persistent than those of fire (USFS and USBLM, Ch. 4, pp. 13, 1997b).

These multiple impacts on soil productivity are probably why salvage-logging retards post-fire vegetative recovery. Sexton (1998) documented that post-fire salvage logging over snow reduced regrowth of ponderosa pine and other species relative to adjacent burned, but unlogged, areas. Naturally regenerating groundcover in unlogged areas also had greater survival and growth than plantings on areas that had been salvaged logged after fire. Notably, these adverse effects of logging on regrowth were from over-snow logging (Sexton, 1998). It is highly likely that ground-based logging without snowcover retards regrowth to a greater extent due to its greater negative effects on soils.

Kattleman (1996) noted that “If postfire treatments of salvage logging and site preparation prevent rapid reestablishment of low vegetation, resulting erosion can be greater than that directly produced by the fire.” Coupled with Sexton’s work and the known effects of logging on soil productivity and concomitant effects on revegetation, it appears that post-fire logging creates more erosion and sedimentation than fires.

Logging and elevated road use are also primary vectors for the dispersal and establishment of noxious weeds (USFS, 1999; 2000b). Noxious weed establishment can increase erosion and sediment delivery and impede the recovery of native vegetation USFS (2000a). This is of special concern in burned landscapes because noxious weeds are well-adapted to disturbed environments.

The construction and reconstruction of roads and landings also cause tremendous and enduring increases in erosion and sedimentation in both the post-fire and between fire environments. But that's been covered adequately elsewhere and won't be here.

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Salvage: Watershed restoration.

Salvage logging will adversely affect the ability of the land to absorb, store and release high quality water and the NEPA analysis fails to address these concerns.

First, post-fire soils are fragile because the soil duff is often consumed by the fire and the carbon and other nutrients have been largely removed. Logging will further disturb the soils and litter and disrupt the natural soil recovery processes. Logging will also disturb and rearrange the soil protecting needle litter that will fall in the months after the fire.

Second, large wood absorbs water and serves as a significant water reservoir that is especially critical during the dryer summer months. Logging removes the wood and so reduces the potential water reservoir. Recent research indicates that much water is stored in buried wood. This buried wood is likely to result of trees that have fallen on hillslopes and become buried in natural sediment moving downslope. Salvage will adversely affect the recruitment of future buried wood.

The agency's snag retention guidelines are based on wildlife needs, but fail to consider or analyze the need to large snags and large down logs for soil, water storage, nutrient storage, or other purposes.

Third, road construction, reconstruction, and road use all adversely affect the ability of the lad to "distribute quality water."

Salvage will exacerbate peak flow effects

The Effect of Mountain Pine Beetle Attack and Salvage Harvesting On Streamflows Special Investigation. FPB/SIR/16. March 2007.
http://www.fpb.gov.bc.ca/special/investigations/SIR16/The_Effect_%20of_%20Mountain_%20Pine_%20Beetle_%20Attack_%20and_%20Salvage_%20Harvesting_%20on_%20Streamflows_SIR16.pdf

> ("Salvage clearcut logging of grey-attack forest will affect peak flows and water yield significantly more than leaving the grey-attack forest standing. The grey attack forest continues to play a role in snow interception, in reducing incoming solar radiation and reducing wind speed across the snowpack. As a result, the annual peak flows in the stream are delayed and of less magnitude than in clearcut watersheds. Leaving the MPB grey attack forest standing will result in lower peak flows than salvage harvesting the watershed.
>
> ...
>
> MPB-attack and salvage harvesting in Baker Creek, a 1570 km2 watershed, has been modelled using DHSVM to estimate the effects on streamflow. Flood frequency analysis was carried out for the baseline and three disturbance scenarios: conventional harvest, MPB epidemic and salvage harvest.
>
> In Baker Creek watershed, two major land use changes effect the streamflows: the MPB attack and the salvage of the attacked trees. Conventional harvesting in Baker Creek watershed before the MPB-attack did not substantially alter the streamflows. However, the combination of conventional harvesting and MPB attack, to 2006, has significantly increased the magnitude and timing of flood events. For example, former 20-year peak flow events can now be expected every 3 years. On average, peak stream flows will be 60% larger than baseline. As salvage harvesting takes place in the next few years, there will be further increases in peak flow and water yield, for example the 20-year peak flows will increase by 90% compared to baseline.
>
> These peak flow changes have implications on the channel stability and fish habitat of the stream network within Baker Creek watershed, as channel forming flows will occur more frequently.")

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

Fire kills vegetation and dramatically changes forage and cover quality for big game. Big game have also lived with fire for millennia. Deer are known to use areas affected by fire. Wildfire's resulting mosaic of new forage and residual cover may be beneficial for big game. Forage will almost certainly improve following fire, but in order for the big game populations to take advantage of this new flush of forage, the agency must maintain an adequate amount of cover.

Although fire may have reduced big game habitat, salvage logging will make a bad situation worse by reducing cover and delaying recovery of vegetation species that are

favorable for foraging and hiding cover. Even dead trees can provide hiding or thermal cover for a period of time. The NEPA analysis must assess the lost cover associated with salvage logging of dead trees, either those killed by the fire or that will die in the near term from fire-related damage. Grifantini (1990 and 1991) *cited in* McIver, James D.; Starr, Lynn, tech. eds. 2000. Environmental effects of postfire logging: literature review and annotated bibliography. Gen. Tech. Rep. PNW-GTR-486. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. 72 p. http://www.fs.fed.us/pnw/pubs/gtr486.pdf

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

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

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

According to the Fire Effects Information System (FEIS), dead and dying trees do provide cover value for big game, but the agency does not explain why they can just destroy so much of what little cover remains in this winter range. See USFS FEIS Elk narrative:

> Site preference studies show that elk usually prefer to graze on burned as opposed to unburned sites. … Fire in a Southwestern ponderosa pine forest increased forbs, grasses, and shrubs, created edge, and provided snags for cover. Elk increased in the burn, reaching a peak 7 years after fire when grasses were most abundant. … In Glacier National Park fires increased carrying capacity on winter

> range by creating a mosaic of thermal and hiding comver [sic] and forage areas. … Standing dead trees may provide adequate cover within burns.

http://www.fs.fed.us/database/feis/wildlife/mammal/ceel/fire_effects_and_use.html

And the FEIS Mule deer narrative:

> Deer seem to prefer foraging in burned compared to unburned areas … Small burns are more beneficial than large burns to mule deer because they tend to use burned areas close to cover.

http://www.fs.fed.us/database/feis/wildlife/mammal/odhe/fire_effects_and_use.html

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

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

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

Salvage: Importance of Mycorrhiza Formation after Fire.

Rapid mycorrhiza formation is important to establishment and survival of vegetation after a fire. The quantity, quality and rate of revegetation is in turn important for many hydrologic, soil, and habitat qualities. See Amaranthus, M. P. and D. A. Perry. 1994. The functioning of ectomycorrhizal fungi in the field: linkages in space and time. Plant and Soil 159: 133-140. ("The authors review the importance of ectomycorrhizal fungi (ECM) to the growth and survival of trees - they take up nutrients and water, extend feeder root longevity, protect against pathogens, maintain soil structure, and can protect plants from toxic heavy metals. Furthermore, studies document that roots of different plants can be linked by commonly shared ECM fungi. Mycorrhizal hyphae supported by one plant can aid in the establishment of another plant. As a result, young seedlings can form mycorrhizae and obtain energy from an already established host tree. Extending mycelium may also help speed up regeneration in adjacent small forest openings. The authors note that ECM fungi may play a critical role during disturbance when the above-ground community dramatically changes. The existing fungi form a link between the old and new stands by aiding in the establishment of new host trees. Studies showed that tree seedling establishment was much less successful in sites without the appropriate mycorrhizae, such as on sites invaded by non-native plants, which are usually non-mycorrhizal or are associated with different mycorrhizal species.")

From *Long-Term Forest Productivity and the Living Soil* by M. P. Amaranthus, J. M. Trappe, and R. J. Molina—

> On cold, droughty, nutrient-poor, or otherwise stressful sites, there may be only a brief period favorable for seedling growth. Seedlings that do not become well established within that "window" are unlikely to survive. Mycorrhizae increase the capacity of tree seedlings to capture resources early by enhancing uptake of nutrients and water, lengthening root life, and protecting against pathogens. Rapid mycorrhiza formation assures seedlings a continuing resource supply and the vigor necessary to survive environmental stress. Studies in southwest Oregon indicate that rapid mycorrhiza formation is crucial for survival on "difficult" sites (Amaranthus et al. 1987b, Amaranthus and Perry 1987).
>
> Numerous factors directly and indirectly influence the potential for mycorrhiza formation, including seedling physiology, environmental conditions, and abundance of soil microorganisms and propagules (Perry et al. 1987). Modification of these conditions may influence a seedling's ability to form mycorrhizae. Mycorrhizal potential following disturbance such as clearcutting and slash burning depends primarily upon (1) the balance between mortality and input of mycorrhiza-forming propagules (such as spores and hyphae of mycorrhizal fungi); (2) the recovery of host plants, which provides the energy to stabilize populations of mycorrhizal fungi and allows them to grow and colonize nonmycorrhizal roots of surrounding plants; and (3) the diversity of fungus species, which buffers the mycorrhizal community against environmental changes following disturbance.

See: Harvey, A.E., M.F. Jurgenson, and M.J. Larsen. 1980. Clearcut harvesting and ectomycorrhizae: survival of activity on residual roots and influence on a bordering forest stand in western Montana. Can J. For. Res. 10:300-303. Harvey et al. (1980) found that all soil mycorrhizae in clearcut areas were dead by the summer following harvest, except in areas within 5m of a living tree. These declines in soil mycorrhizae can have serious consequences for future forest productivity. Mosses and lichens also disappear following clearcutting (von Ahlefeldt and Speas 1996)."

The NEPA analysis must consider research suggesting that the rapidity of mycorrhizae formation in young plants following disturbance may be critical. Borchers and Perry, “Effects of Prescribed Fire on Soil Organisms, Chapter 13 in Natural and Prescribed Fire in Pacific Northwest Forests, Walstad, Radosevich, and Sandberg, editors, OSU Press. This means that any tendency of salvage logging to delay vegetation recovery or disturb or remove mycorrhizae refugia could have consequences that last longer than suggested by the mere delay. The period of natural recovery of vegetation shortly after fire may be critical. Activities that kill or damage new or residual vegetation (like salvage logging, activity fuel treatment, site prep, planting, etc.) may have serious adverse consequences for the growth and survival of the new stand.

Salvage logging is a controversial issue and requires it's own EIS with a range of alternatives and fully disclosed consequences.

"The costs and benefits of activities such as salvage logging and its appropriate role have emerged as national issues." U.S. Department of Agriculture, Forest Service. 1996. Status of the interior Columbia basin: summary of scientific findings. Gen. Tech. Rep. PNW-GTR-385. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station; U.S. Department of the Interior, Bureau of Land Management. 144 p. p 22.

"Treatment of areas following occurrence of major fires is a complex and controversial topic. Complexities include the trade-offs among various resource management objectives, such as fire fuel management objectives and provision of wildlife habitat. Conflicts often exist between economic and ecological objectives … " K. Norm Johnson, Jerry Franklin, Debora Johnson. The Klamath Tribes' Forest Management Plan. Dec 2003. http://www.klamathtribes.org/forestplan.htm

"What are appropriate restoration treatment policies after a fire? The topic is contentious …" Franklin and Agee. 2003 "Forging a Science-Based National Forest Fire Policy," Issues in Science and Technology *Online.* Fall 2003. http://www.issues.org/issues/20.1/franklin.html

Salvage logging retards development of complex late successional forest ecosystem.

Clark looked at post-fire habitat selection by spotted owls after several wildfires in southern Oregon and determined that low severity fire in nesting, roosting, foraging habitat appears to benefit spotted owl occupancy and colonization.

> Initial occupancy was positively influenced by the amount of roosting and foraging habitat with low severity burn within the core ($\beta = 0.08$, 95% C.I. = -0.02 – 0.17) … Colonization rates were positively influenced by the amount of nesting, roosting and foraging habitat that received a low severity burn within the core ($\beta = 0.08$, 95% C.I. = 0.02 – 0.15).

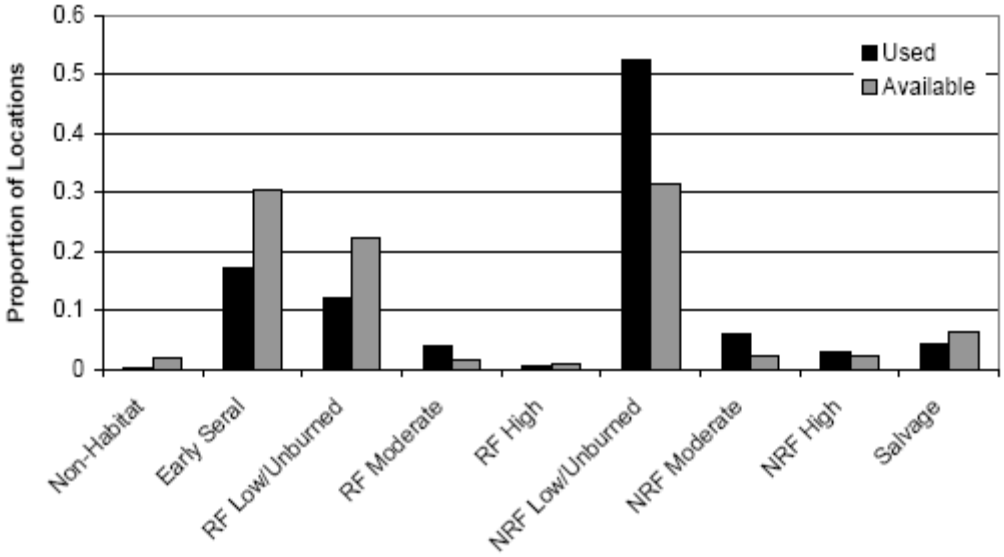

Figure 6.1. Proportions of used and available habitats for northern spotted owls monitored at the Timbered Rock Fire and surrounding areas from September, 2004 to August, 2006.

Darren A. Clark. 2007. Demography and Habitat Selection of Northern Spotted Owls in Post-Fire Landscapes of Southwestern Oregon. M.S. Thesis. Oregon State University. Robert Anthony, Advisor. Figure 6.1 shows that nesting, roosting, foraging habitat is used more frequently than random sites even after it has experienced moderate or high severity fire, while areas that were salvage logged were used less frequently than random sites.

Don't erase stand history by removing large legacies.

The goal of management in LSRs is to protect and restore high quality habitat for late successional species. The goal in CHUs is to recover populations of list species, for instance spotted owls, by providing the primary constituent elements of nesting, roosting and foraging habitat.

Developing high quality habitat requires retention of the legacies that represent the site potential and disturbance history of the site. Every stage of forest development is largely a result of what came before on the site. The quality of future habitat is directly related to the initial conditions (including carry-over from one stand to the next) and the pathway that a stand takes from stand initiation through each successional stand and intermediate disturbance and ultimately to old-growth. In order to develop high quality habitat, one must understand that every late successional stand is a product of its history, and salvage logging erases a critical part of the stands history. Salvage logging eliminates the building blocks for developing complex stand histories that result in complex forests. Salvage logging leads to forests deprived of history, deprived of legacy, deprived of structure, variability and complexity. If forest restoration and recovery is the goal, as it must be in

Late Successional Reserves and Critical Habitat Units, removing large legacy structures through salvage logging is wrong.

> The larger and the most decay resistant snags and logs are the most important ecologically. Larger snags and logs will serve a large array of organisms and functions than smaller snags and logs as well as persist longer. For example, large snags are necessary for large cavity excavators, such as the Pileated Woodpecker and large logs are critical elements in creating stable aquatic habitat. ***Large snags and logs of decay-resistant species--such as cedars and Douglas-fir—can also persist and fulfill habitat and other ecological functions for several centuries in terrestrial environments or even millennia, in the case of stream and river ecosystems.***
>
> The levels of biological legacies such as snags and logs that need to be retained following a major disturbance very much depends upon the natural resource objectives for the property and the natural disturbance regime of the site. Where recovery of natural ecological functions is a primary goal, removal of significant legacies of living trees, snags, and logs through timber salvage is not appropriate. This is particularly true in forest types and on forest sites where stand-replacement ("catastrophic") disturbance regimes are characteristic. It is sometimes argued that following a stand-replacement fire in an old-growth forest that snags and logs are present in "excess" of the needs of the site, in terms of ecosystem recovery. In fact, ***the large pulse of dead wood created by the disturbance is the only significant input of woody debris that the site is going to get for the next 50 to 150 years***—the ecosystem has to "live" off of this woody debris until the forest matures to the point where it has again produced the large trees that can become the source for new snags and logs (Maser et al. 1988).
>
> In conclusion, the scientific lessons regarding biological legacies and the importance of retaining snags, logs, and other woody debris are being applied in regular timber harvesting practices (i.e., structural retention) but have not yet been fully incorporated into restoration policy. Timber salvage may be carried out for economic reasons. However, ***timber salvage will rarely achieve any positive ecological benefit*** as has been pointed out in a recent article in Science (Lindenmayer et al. 2004). Timber salvage should be viewed as a "tax" or debit on the recovery process. Removal of large, decay resistant snags and logs is particularly negative because of impacts on long-term recovery and stand development processes.

Dr. Jerry F. Franklin, Professor of Ecosystem Studies, College of Forest Resources, University of Washington, July 15, 2004. TESTIMONY FOR THE RECORD ON OVERSIGHT HEARING ON "RESTORING FORESTS AFTER CATASTROPHIC EVENTS" BY HOUSE COMMITTEE ON RESOURCES, SUBCOMMITTEE ON FOREST AND FOREST HEALTH. (emphasis in original).

The 20-inch retention standard.

The Northwest Forest Plan says "management should focus on retaining snags that are likely to persist until late successional conditions have developed and the new stand is again producing large snags." NWFP ROD page C-14. This requirement is explicitly based upon the Final Draft Recovery Plan for the Northern Spotted Owl which uses this exact same phrase and adds clarity to the intent by saying "retention of all 20-inch dbh snags should be a starting point." The recovery plan says:

> Snags provide a variety of habitat benefits for owls including nest sites for them and their prey species such as flying squirrels.. Accordingly, following stand replacing disturbances, management should focus on retaining snags that are likely to persist until suitable owl habitat has developed and the new stand is again producing large snags. … Snags from the original stand will be important structural elements of spotted owl habitat as forests develop after the stand-replacing event. Although there is some uncertainty concerning the optimum density of snags to be provided for spotted owls, management to provide the maximum likely benefits for owls and their prey is an appropriate strategy …. Snag retention guidelines should be developed for each physiographic province based on the general guidance in this section. … An example of such guidelines for western Washington and Oregon is presented [and] calls for retention of all snags 20 inches and larger. … retention of all 20-inch dbh snags should be a starting point. Smaller diameter snags are generally less important to cavity nesters and are less likely to persist until suitable owl habitat develops. This salvage of these smaller-diameter snags should not impair the development of suitable habitat …. "

Final Draft Recovery Plan page 71.

The FEMAT report succinctly summarized these requirements as: "… the Final Draft Recovery Plan for the Northern Spotted Owl (USDI 1992c). … would allow removal of small-diameter snags and logs but would also require retention of snags and logs likely to persist until the new stand begins to contribute significant quantities of coarse woody debris." FEMAT page IV-37 (emphasis added). Very simply, the recovery plan allows removal of small snags and retention of large snags.

Importantly the FEMAT report says that a range of LSR salvage options were considered ranging from "no salvage" to "limited salvage as permitted by the Final Draft Recovery Plan." FEMAT p IV-37. This reveals the FEMAT team's view that the "high end" of the spectrum of possible snag removal would be "removal of small trees." The FEMAT team never contemplated large scale removal of large snags, and there is no evidence in the record to support that the EIS team considered more aggressive salvage logging options nor that the ROD adopted more aggressive salvage logging option. All evidence in fact points to the fact that the ROD adopted the approach of the final draft recovery plan. 1994 FSEIS pp 2-60, F-9, F-10, F-21, F-37, F-141; Feb 1994 BiOp p 7;

Note there is a distinction between the *draft* recovery plan and the *final draft* recovery plan. The draft was even more clear than all 20 inches snags should be retained. The draft

says “management to provide maximum benefit likely for this prey species [flying squirrels] is an appropriate strategy for [designated conservation areas]. Therefore, snags larger than 20 inches will be retained.” Draft Recovery Plan pp 113-114.

The final draft recovery plan recognizes the possibility of province-level refinement of Standards & Guidelines but makes clear that “snags larger than 20 inches dbh are important to cavity nesters in all provinces” (p 71). The 20-inch diameter cap is described as a “starting point” for developing province-specific Standards & Guidelines. The final draft recovery plan also provides a clear methodology to help managers develop provincial Standards & Guidelines based on the general guidance in the recovery plan. The methodology is based a scientifically derived estimates of which logs (size and species) will persist for 70 years or more. In the western Cascades, “Retention of all snags larger than 20 inches will maximize the number of residual snags available for flying squirrels, while providing important habitat for bird species that excavate cavities used by squirrels.” (p 73) Note the connection between woodpeckers and spotted owls. Maintaining healthy populations of cavity excavators over many generations will create large numbers of cavities that can later be used by spotted owls and spotted owl prey species.

Significantly, the agency never acknowledges the 20-inch “starting point” nor does it applies the recovery plan methodology to derive the snag retention guidelines for this massive salvage logging project. Until they have disclosed and considered the 20-inch starting point and the methodology, the agency must not be allowed to log trees over 20 inches.

Provide Structure for Spotted Owls and Their Prey

First of all, do not assume that fire has rendered spotted owl habitat unsuitable. “The Timbered Rock Study presented evidence that the northern spotted owl has locations in areas with high severity burns. See AR 341-369. Additionally, there was evidence presented by Jerry Franklin, Professor of Ecosystem Analysis at the University of Washington, that ‘[r]etention of large snags and logs are specifically relevant to Northern Spotted Owl since these structures provide the habitat that sustain most of the owl’s forest-based prey species.’” FSEEE and EPIC v. US Forest Service, Civ. No. C 05-2220 SI & C 05-2227 SI (N.D. Cal.) June 27, 2005. Also, page 6 of the BE for the Rogue River National Forest’s Ashland Forest Resiliency DEIS has a very interesting paragraph that references the Timbered Rock Fire telemetry findings AND habitat analysis conducted at Biscuit:

> "There have been recent large fires in SW Oregon, in particular the Biscuit and the Timbered Rock fires, which have significantly reduced NRF within the province. However, **analysis conducted on the effects of the Biscuit Fire** using recent work by Zabel et al (2003) **showed that of the 49 owl pairs affected by the fire, it was likely that only seven were no longer extant**. In addition, of the 15 spotted owl pairs affected by the Timbered Rock Fire, 11 of those pairs continue to occupy their historic activity centers even thought (sic) they were

subject to varying degrees of fire severity. There is uncertainty as to how spotted owls respond to fire in SW Oregon and research is currently being conducted in an attempt to answer that question."

The referenced study is: Cynthia J. Zabel, Jeffrey R. Dunk, Howard B. Stauffer, Lynn M. Roberts, Barry S. Mulder, and Adrienne Wright. 2003. Northern Spotted Owl habitat models for research and management application in California (USA). *Ecological Applications* 13:1027-1040. This study suggests that "suitable" habitat within 0.5 miles of the nest site is the best indictor of continued NSO presence. And contends that if more than 20% of "suitable" habitat remains within 0.5 miles of the activity center that the NSOs will stick around post-fire.

Second, manage the post-disturbance landscape for owl and their prey by retaining all large snags. The Final Draft Spotted Owl Recovery Plan (USDI 1992 p 71) requirements for post-fire salvage say "management to provide the maximum likely benefits for owls and their prey is an appropriate strategy." Probably the most important things that the agencies can do after fire are:

1. Make sure that current owl habitat (both suitable and marginal) is protected from disturbance. The adverse effects of wildfire are often over-estimated. Courtney et al 2004.[9] Fires cause incomplete loss of spotted owl habitat elements, so the remaining habitat elements such as surviving green trees and large snags may still provide current habitat for spotted owls.
2. Manage for abundant populations of owl prey species. Where owl prey base is diverse and abundant spotted owl home ranges tend to be smaller which is energetically advantageous and enhances owl survival rates. (Carey 2004).[10] "Numerous patches of low foraging quality can have negative impacts on owl demography and behavior (Carey et al 1992)." (Carey 2004). and this is precisely what salvage logging will do to current and future spotted owl home ranges. A large number of owl prey species have some association with snags and down wood either as sites for denning or as a source of fungal food supplies. Removing large amounts of dead trees and down wood after a fire dramatically simplifies the forest structure for many decades and will have adverse effects on the development and recovery of populations of owl prey species. Retaining all large snags is called for in the spotted owl recovery plan and the Northwest Forest Plan.
3. Protect all large snags. Snags and down wood are integral parts of spotted owl suitable habitat, in fact, snags and down wood are included in the official definition of owl habitat. Removal of snags will directly eliminate primary constituent elements of spotted owl habitat.

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[9] Courtney, Blakesley, Bigely, Cody, Dumbacher, Fleischer, Franklin, Franklin, Gutierrez, Marzuluff, Sztukowski. September 2004. Scientific evaluation of the status of the Northern Spotted Owl. Sustainable Ecosystems Institute, Portland, Oregon. http://www.sei.org/owl/finalreport/finalreport.htm

[10] Carey, A. 2004 Relationship of Prey and Forest Management. Appendix 5 pp 3-24, 3-25 *in* Courtney, SP; J A Blakesley. 2004. Scientific evaluation of the status of the Northern Spotted Owl. http://www.sei.org/owl/finalreport/finalreport.htm

4. Allow for slow and natural successional development. The diverse plant communities and complex structures that develop after fire provide excellent habitat for spotted owl prey species. Do not rush to plant conifers at high density which will truncate successional development.

Diminishment and Negative effects

"Salvage guidelines [for Late Successional Reserves] are intended to prevent negative effects on late-successional habitat, while permitting some commercial wood volume removal. … While priority should be given to salvage in areas where it will have a positive effect on late-successional forest habitat, salvage operations should not diminish habitat suitability now or in the future." Northwest Forest Plan ROD page C-13. These words indicate a "zero tolerance" policy for anything that would degrade habitat now or in the future. The agency has a burden to show in the NEPA document that the snags they want to remove have zero habitat value for spotted owls or other late-successional species now or in the future. The NEPA document must meet this burden. The record clearly shows that these large trees provide both future nest sites for owls and their prey species. Dense clumps of snags may also provide near-term foraging habitat. Every large tree removed is a potential nest site lost or a potential foraging opportunity forgone. Retention of snags shortens the time period when these stands are unsuitable habitat, while salvage logging lengthens the unsuitable timber period. When the agency argues that removal affects only a small area of the reserves and abundant habitat is provided in areas not logged, they fail to recognize the "zero tolerance" language. The agency simply cannot argue that removal of potential nest trees and structures important to prey species will not *diminish* habitat value.

The NEPA analysis never reaches the core question, that is: Whether removal of large snags through salvage "prevents negative effects" or "diminishes late successional habitat now or in the future." Removal of large numbers of large snags from the LSR will have negative effects on habitat and will diminish LSOG habitat now and in the future by:

1. directly eliminating nesting opportunities for owls and their prey;
2. reducing the *quality* of future LSOG habitat that develops within salvage areas;
3. extending the time period that salvage areas remain non-suitable for owls and other species; causing the premature departure of some LSOG species that are still hanging on in the legacy-rich post-fire environment, and delaying by decades the return of LSOG species to areas that are salvage logged;
4. retarding vegetative recovery that is already ongoing;
5. increasing the uncertainty that LSOG will develop from the homogenous and simplified initial conditions that result from salvage logging;
6. causing detrimental on current and future LSOG via effects on soils and spreading weeds.

BLM's Western Oregon Plan Revision DEIS (p. LII) admits that structurally complex young forests develop old forest characteristics twice as fast as structurally deprived initial conditions. This is a serious indictment of salvage logging.

LSRs provide habitat for cavity dependent species. Diminishment of the habitat for species associated with dead wood will violate the Northwest Forest Plan.

The Northwest Forest Plan clearly anticipated that salvage logging within LSRs must be limited to provide quality habitat for Black-backed woodpecker, white-headed woodpecker, and Williamson's sapsucker.

> To benefit the black-backed and white-headed woodpeckers, and Williamson's sapsucker in the Eastern Cascade Range, potential mitigation measures would be to reduce harvest and salvage in old-growth areas. Because of the strength of late successional reserves under the selected alternative, standards and guidelines limiting salvage and thinning in those reserves, and matrix management standards and guidelines that specifically incorporate mitigation for white-headed and black-backed woodpeckers, we conclude that these potential mitigation measures are not necessary.

NWFP ROD page 31. Salvage logging will clearly diminish habitat for these three species. If the agencies certainly can't claim to be providing abundant high quality habitat for cavity associated species in the Matrix, so if they don't provide for snag associated species in the reserves, then they really don't provide sufficient habitat for cavity dependent species anywhere, so a new programmatic EIS would be required to rework the regional management framework to provide adequate habitat for viable populations of snag associated species.

Salvage must be beneficial not just neutral.

The Northwest Forest Plan ROD page 66 says that **"**Salvage is not required to be beneficial" but the February 1994 Biological Opinion for the Northwest Forest Plan disagrees. The Northwest Forest Plan Standards & Guidelines must be interpreted to err on the side of caution and retain all large trees. The BiOp says:

1. "ASSUMPTIONS: To ensure that the analysis under section 7 of the Act had a measurable baseline, or starting point, the following assumptions were identified to assist in the development of this opinion: 1. Riparian and Late-Successional Reserves (LSRs) will retain reserve status and will not be available for timber production other than as provided in Alternative 9 (i.e., salvage and silvicultural treatments beneficial to the creation of late-successional conditions)." P 4.
2. "the alternatives presented in this SEIS propose a network of designated areas managed primarily to protect and enhance habitat for the northern spotted owl and other late-successional and old-growth forest related species" p 5.
3. "Late-Successional Reserves would be managed to protect and enhance habitat for late-successional and old-growth related species including the northern spotted owl and marbled murrelet. Some level of silvicultural treatment (such as thinning young stands) is permitted in certain age stands to accelerate the development of old-growth habitat characteristics, subject to review by the Regional Ecosystem

Office…. Stand and vegetation management of any kind, including prescribed burning, is considered a silvicultural treatment and is subject to review." p 5.

4. "SPOTTED OWL ACTIVITY CENTERS: … Salvage of dead trees would be based on guidelines adapted from the Final Draft Spotted Owl Recovery Plan…" p 7.
5. "CONSERVATION RECOMMENDATIONS: … Restricting harvest activities in LSRs to thinning and other silvicultural treatments that are beneficial to creation of late successional forests as identified in Alternative 9 is believed, at the present time, to be necessary to promote the conservation and recovery of listed species consistent with Section 7(a)(1) of the Endangered Species Act." P 48.

This much is clear: Traditional salvage logging results in a 100% probability that large snags will NOT persist and will not contribute to current habitat or future development of late successional habitat. On the other hand, retaining all large snags will result in a >>0% chance that they will dodge the bullets of decay and reburn. Traditional salvage logging clearly removes snags that have a >>0% probability of persisting, and therefore, even in the event of reburn, logging large snags "diminishes" this important component of late-successional old-growth habitat.

Jerry Franklin has said of salvage logging in LSRs that "Salvage would be completely antithetical to the goals of reestablishing late-successional forest habitat. Retention of the large snags and logs are essential to natural recovery processes and none of this material can be viewed as in excess to ecological needs." Jerry Franklin, Comments on the Siskiyou NF's Biscuit Fire Salvage DEIS, Jan. 20, 2004.

The agency may not justify logging on the assumption that the fire has destroyed the spotted owls' habitat. The only sure way to destroy the owls habitat is to conduct heavy handed salvage logging. Studies show that spotted owls are capable of returning to habitat even highly altered by fire. Spotted owl biologist Monica Bond found that owls in northern California returned to four sites where the majority of the territory had burned. Bond, M. L., R. J. Gutierrez, A. B. Franklin, W. S. LaHaye, C. A. May and M. E. Seamans. 2002. Short-term effects of wildfires on spotted owl survival, site fidelity, mate fidelity, and reproductive success. Wildlife Society Bulletin 30(4):1022-1028.

Severe wildfire can decrease the suitability of northern spotted owl nesting and roosting habitat by removing overstory canopy and setting late seral-stage forests back to earlier seral stages. On the other hand, fire appears to be beneficial to fitness of northern spotted owls by creating ecotones that may improve foraging habitat. Larger-sized snags should be retained because they provide the basis for restoration of late successional forest conditions that will support future spotted owl nesting, roosting and foraging habitat.

The Northwest Forest Plan ROD (p B-8, 9) says

> Salvage of dead trees affects the development of future stands and habitat quality for a number of organisms. Snag removal may result in long-term influences on forest stands because large snags are not produced in natural stands until trees become large and begin to die from natural mortality. Snags are used

> extensively by cavity-nesting birds and mammals such as woodpeckers, nuthatches, chickadees, squirrels, red tree voles, and American marten. Removal of snags following disturbance can reduce the carrying capacity for these species for many years.
>
> Coarse woody debris is a necessary component of forest ecosystems. This wood provides habitat for a broad array of vertebrates, invertebrates, fungi, mosses, vascular plants, and micro-organisms. Arthropods, salamanders, reptiles, and small mammals live in or under logs; woodpeckers forage on them; and vascular plants and fungi grow on rotting logs. Provision for retention of snags and logs normally should be made, at least until the new stand begins to contribute coarse woody debris.
>
> Many natural disturbances do not result in complete mortality of stands. For example, recent fires in the Oregon Western Cascades Province killed 25 to 50 percent of trees within the areas burned, leaving 50 to 75 percent of the stands intact. The surviving trees are important elements of the new stand. They provide structural diversity and provide a potential source of additional large snags during the development of new stands. Furthermore, trees injured by disturbance may develop cavities, deformed crowns, and limbs which are habitat components for a variety of wildlife species.

The ROD also says that the intent of salvage in LSRs is to "prevent negative effects" ROD page C-13, but the EA does not identify any negative effects and this project would be preventing. In fact, when viewed from a landscape perspective, there are no negative effects to be avoided, and if there were this project would not do so.

The Northwest Forest Plan ROD also says that "salvage operations should not diminish habitat suitability now or in the future." But this project will diminish habitat quality by removing standing trees for safety reasons and by putting adjacent forests at risk from damage from edge effects.

The ROD says that "all standing live trees should be retained" ROD page C-14, but standing trees and snags may need to be cut for safety reasons. The NEPA document failed to consider just keeping workers out of the safety zone around hazard trees.

In considering the perceived conflict between public safety and LSR objectives around Lake of the Woods, the Rogue River National Forest has said, "The dead and dying trees that are typically identified as hazards to public safety are exactly what LSRs were created to protect, as these are the types of trees that provide habitat for many old growth dependent plants and animals."

This LSR is already severely over-harvested and therefore likely to be severely deficient in large woody debris across the landscape. This disturbance event is a welcome site of LWD build-up that helps to balance out the overall shortage in the analysis area. The NEPA document did not disclose this cumulative/landscape perspective.

The FEMAT scientists recognized that …

> Salvage of dead trees has significant effects on the development of future stands and the suitability as habitat for a number of organisms. Snag removal results in long-term impacts on the forest community because large snags are not produced by the new stand until trees become large and begin to die from natural mortality (often a period of 50-100 years). Snags are used extensively by cavity nesting birds and mammals such as woodpeckers, nuthatches, chickadees, squirrels, red tree voles, and American marten. Removal of snags following disturbance can significantly reduce the carrying capacity of these specie for many years.
> …
> … Salvage policies of options generally ranged from no salvage to limited salvage as permitted by the Final Draft Recovery Plan for the Northern Spotted Owl (USDI 1992). This plan would allow removal of small diameter snags and logs but would also require retention of snags and logs likely to persist until the new stand begins to contribute significant quantities of coarse woody debris."

FEMAT page IV-37. The May 6, 1994 Scientific Analysis Group Q&As clearly indicated the intent of the NFP ROD that salvage for risk reduction in LSRs must be consistent with the salvage recommendations in the Final Draft Recovery Plan for the Northern Spotted Owl (December 1992). See below.

The agency must retain all large snags because they are the most likely to last the longest and fill the snag recruitment gap as the post-fire landscape recovers from the fire. The so-called "brain book" that agency staff use to clarify the direction in the Northwest Forest Plan ROD urges the agency to use the requirements from the final Draft Recovery Plan for the Northern Spotted Owl which requires retention of all scorched trees that "may live" as well as all snags over 20 inches because these live trees and larger snags are most likely to last more than 100 years and help to fill the temporal gap in snag recruitment as the post-fire stand develops. Denton K, 1994. "SEIS Team/Scientific Analysis Group Qs &As [Summary]" May 6, 1994 ("[T]hese responses represent what the SEIS Team intended for many of the standards and guidelines… The following document is a compilation of those SEIS Team questions ands SAG responses that relate to standards and guidelines contained in the final Record of Decision.").

> "**Salvage in LSRs to Reduce Fire Risk** (SAG2;Q#9): Under Alternative 9, is salvage [in Late Successional Reserves] permitted to reduce fire hazard or risk? How and who defines acceptable risk?
>
> > "SAG response: Salvage can be used to reduce risk throughout the range of the owl based on the salvage guidelines adapted from the final draft recovery plan. Silvicultural prescriptions can be used to reduce risk in areas subject to large scale disturbance (east side) using guidelines for reducing large scale disturbance adapted from the final draft recovery plan. (S&Gs pages C-13 and C-12)"

The salvage recommendations in the Final Draft Recovery Plan for the Northern Spotted Owl (December 1992) provide:

a. "Diseased and damaged trees are key structural components of suitable owl habitat ... planning must acknowledge the considerable value of retaining dead and dying trees in the forest"

b. "salvage should not diminish the suitability for owls now or in the future"

c. salvage should be limited to areas with less than 40% canopy closure, and >10 acre disturbances,

d. "Surviving trees provide a significant residual of larger trees in the developing stand ... Consequently, all standing live trees should be retained, including those injured (e.g. scorched) but likely to survive."

e. "focus on retaining snags likely to persist until suitable owl habitat has developed and the new stand is again producing large snags,"

f. "snag retention guidelines should be developed for each physiographic province based on the general guidance provided in this section . . . Retention of all 20-inch dbh snags should be a starting point ... Snags larger than 20 inches dbh are important to cavity nesters in all provinces, and have relatively slow decay rates. Smaller diameter snags are generally less important to cavity nesters and are less likely to persist until suitable habitat develops. Thus, the salvage of these smaller diameter snags should not impair the development of suitable habitat"

g. "guidelines are intended to prevent negative effects on owl habitat"

h. "because there is much to learn about the development of owl habitat, it seems prudent to allow only conservative quantities of salvage material from suitable owl habitat"

i. "although there is some uncertainty concerning the optimum density of snags to be provided for spotted owls, management to provide maximum likely benefit for owls and their prey is an appropriate strategy"

j. "retain adequate CWD quantities in the new stand so that in the future it will still contain amounts similar to naturally regenerated stands," etc.

k. "In addition to the stand level salvage guidelines, the cumulative effects of any proposed salvage should also be considered at a larger scale. One focus of the analysis should be on spotted owl activity centers known before the disturbance and thought to still be occupied after the disturbance. Where owls are still thought to be inhabit the area to be salvaged, the possible effect of the salvage around their activity centers should be considered. In particular, special consideration should be given to stands that could again provide foraging opportunities for owls in the near future. For example, small disturbances or the edges of large disturbances may provide habitat for owl prey and access to that prey by owls. Also, denser clumps of residual dead trees may offer foraging opportunities by owls. The most current knowledge of prey species should be considered in these cases, and special guidelines developed for these areas. The cumulative impact of salvage in these area should be considered."

The final draft recovery plan salvage guidelines are partially excerpted in the Feb 1994 Spotted Owl FSEIS Volume II Appendix B, pages B-75 to B-77. The response to comments in Appendix F (page F-37) of the 1994 FSEIS makes clear that the salvage Standards & Guidelines in the NWFP ROD are derived from the Final Draft Northern Spotted Owl Recovery Plan (1992).

The FEMAT report also spelled out the consequences if excessive salvage is allowed in LSRS, that is

a. "the short- and long-term contributions of salvaged areas to Late Successional Reserves would be decreased.

b. "There would be greater risks to watersheds [than if salvage were more limited]

c. "There would be high levels of distrust of agency motives."

FEMAT page II-18. These are serious adverse consequences that are not disclosed and considered in the DEIS.

Proposed activities, especially commercial log removal, will violate requirements to maintain long-term soil productivity. Soil compaction and erosion, loss of coarse woody debris, and erosion all adversely affect long-term productivity. Removal of a major fraction of the available organic matter through salvage of large trees will adversely affect soil productivity for decades or centuries.

All the commercial removal activities will impede development of <u>high quality</u> LSR habitat in violation of the NFP ROD and violate the requirement to focus LSR salvage on long-term LSR objectives. *See* NFP ROD p. C-14. Salvage logging that removes most of the large material from extensive areas will prevent development of complex young forest reduce options to develop complex old forest.

LSRs were set aside primarily for spotted owls and other species associated with late-successional old-growth. Salvage logging will adversely affect spotted owls and their prey. Proposed activities, especially commercial log removal, will violate the requirement to maintain optimal late-successional habitat, (such as by reducing cavity nesting opportunities for spotted owl prey such as flying squirrels and reducing woody debris far below optimal levels for ground-dwelling spotted owl prey species).

Here is a good description of high quality owl habitat that might develop after fire and without salvage logging. "High use northern spotted owl foraging habitat is typically characterized by high density of large snags and diverse canopy structure that provide habitat for prey species as well as hunting perches for owls (North et al 1999)" USDI FWS 2004. S&M BO BLM FS 03-03-04.doc

> [M]edium and high use areas [for northern spotted owls] often had large rot-resistant snags (western redcedar or Douglas-fir) resulting from the site's past disturbance. … The carry-over of these large structures into the regenerating stands may have produced sufficient foraging habitat for the owl even though other attributes of the stand were typical of younger forests. Old growth legacy structures in younger stands may improve wildlife habitat quality for many late-

> seral associated species. … Legacy structures, such as large trees and snags, may diversify habitat conditions in young, regenerating stands and eventually improve foraging conditions for future spotted owl use.

North, M.P., Franklin, J.F., Carey, A.B., Forsman, E.D., and Hamer, T. 1999. Forest stand structure of the northern spotted owl's foraging habitat. For. Sci. 45: 520-527. http://www.fs.fed.us/pnw/pubs/journals/pnw_1999_north001.pdf

> Buchanan et al. (1999) recommend that younger forests managed for Spotted Owls on the Western Olympic Peninsula should contain ≥10 snags/ ha that are > 50 cm dbh. … Retention of legacy (snags and course woody debris) in current areas of timber harvest will shorten the time necessary for those areas to achieve the habitat complexity deemed to be suitable Northern Spotted Owl habitat."

Courtney, SP; J A Blakesley. 2004. Scientific evaluation of the status of the Northern Spotted Owl. http://www.sei.org/owl/finalreport/finalreport.htm pp 5-15, 6-8.

One study in the southern Oregon Coast Range found that flying squirrels disproportionately chose large snags (80% >50 cm) for nesting. See Carey, Wilson, Maguire, & Biswell; DENS OF NORTHERN FLYING SQUIRRELS IN THE PACIFIC NORTHWEST, *J. WILDL. MANAGE. 61(3):684-699*
http://www.fs.fed.us/pnw/pubs/journals/carey-dens-GLSAs1997.pdf

Another study found that not enough snags are being retained on private land to support viable wildlife populations, so more snags need to be retained on federal lands to compensate. Ohmann, McComb, & Zumrawi; SNAG ABUNDANCE FOR PRIMARY CAVITY-NESTING BIRDS ON NONFEDERAL FOREST LANDS IN OREGON AND WASHINGTON; *Wildl. Soc. Bull. 22:607-620,* 1994
http://www.fs.fed.us/pnw/pubs/journals/ohmann-snagabundance.pdf

A third study relevant to post-fire management supports the idea that abundant structures (i.e. snags & logs) should be retained after fire because complex young forests are more resilient and support more diverse spotted owl prey bases.

> Our results support hypotheses that: (1) biocomplexity resulting from interactions of decadence, understory development, and overstory composition provides pre-interactive niche diversification with predictable, diverse, small mammal communities; (2) these communities incorporate numerous species and multiple trophic pathways, and thus, their integrity measures resiliency and sustainability.
> …
> Thus, increasing complexity of the environment through increasing horizontal and vertical heterogeneity in vegetation structure, species diversity in vascular plant composition, and forest-floor structure with coarse woody debris may simultaneously (1) increase multidimensional habitat space (Carey et al., 1999a), (2) reduce frequencies and intensities of interspecies interactions (Grant, 1972; Carey et al., 1980), (3) increase or maintain the already high abundance and diversity of seed fall, fungal fruiting bodies, and invertebrates characteristic of mesic, temperate coniferous forests (Church field, 1990), and (4) allow not only coexistence, but abundance of potentially competing species within communities

> (Carey and Johnson, 1995, this study). As a result of this complexity, Pacific Northwest forests support the greatest diversity of shrews in North America (Rose, 1994) …
>
> …
>
> These studies do suggest that management can homogenize and simplify (reduce decadence, amounts of coarse woody debris, variety of tree species, diversity and abundance of understory vegetation, and spatial heterogeneity) forest ecosystems. We found local extirpations of a number of species and particularly absence of *G. sabrinus* and *T. townsendii* in multiple plots. These absences raise questions about long-term viability of these species in managed landscapes. Management-induced homogeneity and simplification (1) is a real danger to diversity, resiliency, and susceptibility to invasions of exotic plants (Carey, 1998; Carey et al., 2000; Halpern et al., 1999; Heckman, 1999; Thysell and Carey, 2000), (2) may result in small-mammal communities non-supportive of predators populations (Carey et al., 1992; Carey and Peeler, 1995), …

Andrew B. Carey, Constance A. Harrington; Small mammals in young forests: implications for management for sustainability; Forest Ecology and Management (2001) 154(1-2): 289-309; http://www.fs.fed.us/pnw/pubs/journals/pnw_2001_carey003.pdf

Large snags and the structural contributions should be quite abundant in young stands. It is only because of widespread clearcutting and salvage logging that we do not have more large snags in our young stands. Evidence indicates that large snags should be as abundant in young stands (40-80 years) as in old–growth (≥200 years). See Spies, T.A., J.F. Franklin, and T.B. Thomas. 1988. Coarse woody debris in Douglas-fir forests of western Oregon and Washington. Ecology 69(6)1689-1702.

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

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

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

Salvage increases fire hazard. Faulty analysis of reburn potential.

A core purpose of this NEPA analysis is to balance the value of retaining snags and down wood spotted owls and other wildlife against the fire hazard caused by retaining snags and down wood. The FEIS fails to acknowledge that balance is best achieved if the agencies retain all large snags because they contribute greatly to habitat value and

contribute little to fire hazard, while focusing fuel reduction only on small snags that contribute little to habitat values while contributing disproportionately to fire hazard.

A recent study of the portions of the Biscuit fire that were previously burned by wildlife, reveals that salvage logging did not reduce the severity of subsequent fires, and in fact salvage logging appeared to increase the severity of subsequent wildfires. See Jonathan R. Thompson, Thomas A. Spies, and Lisa M. Ganio. 2007. **Reburn severity in managed and unmanaged vegetation in a large wildfire.** Proceedings of the National Academy of Sciences. *PNAS* published online Jun 11, 2007.

A recent scientific study scientific study of post-fire logging (McIver and Ottmar 2007) showed that salvage logging causes a four-fold increase in fine fuels and that increase can last for 15 years. Fine fuels tend to cause wildfires to rapidly spread which is more likely to kill young trees and set back forest recovery. Unlogged fire areas (the controls) had lower levels of fine fuels but had higher levels of large fuels. Large fuels do not tend to exacerbate the spread of fire but they can heat the soil. However, soil heating is a patchy phenomena that forests have evolved with and can tolerate. Retaining the large wood is also important for wildlife habitat and soil conservation. The scientific consensus in the fuel management literature is that it is more important to control small fuels. J.D. McIver, and R. Ottmar. 2007. Fuel mass and stand structure after post-fire logging of a severely burned ponderosa pine forest in northeastern Oregon. Forest Ecology and Management. Volume 238, Issues 1-3 , 30 January 2007, Pages 268-279.
http://www.sciencedirect.com/science?_ob=ArticleURL&_udi=B6T6X-4MG1NY3-2&_user=4250274&_coverDate=01%2F30%2F2007&_alid=527480516&_rdoc=1&_fmt=summary&_orig=search&_cdi=5042&_sort=d&_docanchor=&view=c&_acct=C000052423&_version=1&_urlVersion=0&_userid=4250274&md5=ca8f3cad4d5ec6fcd4277ebff3abf7f6

Donato looked at the effects of salvage logging after the Biscuit fire and found that—

> Postfire logging significantly increased both fine and coarse downed woody fuel loads (Fig. 1B). This pulse was comprised of unmerchantable material (e.g., branches), and far exceeded expectations for postfire logging-generated fuel loads (5, 6). In terms of short-term fire risk, a reburn in logged stands would likely exhibit elevated rates of fire spread, fireline intensity and soil heating impacts (7). Postfire logging alone was notably incongruent with fuel reduction goals. Fuel reduction treatments (prescribed burning or mechanical removal) are frequently intended following postfire logging, including in the Biscuit plan, but resources are often not allocated to complete them (8). Our study underscores that, after logging, mitigation of short-term fire risk is not possible without subsequent fuel reduction treatments.

D. C. Donato, J. B. Fontaine, J. L. Campbell, W. D. Robinson, J. B. Kauffman, B. E. Law. Post-Wildfire Logging Hinders Regeneration and Increases Fire Risk. www.sciencexpress.org. 5 January 2006.

The 1987 Bland Mountain fire burned east of Canyonville and was heavily salvage logged. The same area then reburned in 2004 with high fire intensity. Salvage logging did

not appear to save these plantations from intense fire, in fact, the removal of large logs and dense replanting may have made the fire more intense. One fact is unquestionable, that is that fire hazard is high in young plantations even when they are salvaged. Salvage logging does nothing to address this fact, and may in fact lead to increased density of conifer vegetation types that are more flammable than the mixed conifer-broadleaf vegetation types that may be less flammable.

The NEPA analysis asserts that leaving large numbers of snags is unsafe and the NEPA document describes an undesirable scenario with respect to the no action and restoration alternatives, but the NEPA document must acknowledge the fire risks associated with salvage logging including: (a) salvage logging will remove most of the largest logs that least prone to burn (because large logs hold the most water the longest and they have relatively high ratios of volume to surface area), (b) salvage logging leave behind almost all of the smallest material which is most prone to drying and burning (e.g., relatively low ratio of volume to surface area), (c) the proposed action may lop and scatter the tops of large trees that are too big for the ground-based harvest machinery, (d) salvage logging equipment and workers could start fires, (e) increased human access increases the risk of human caused ignition, (f) the replanting will create a fuel load that is dense, uniform, extensive, volatile, and close to the ground (During an extreme weather conditions this is one of the most extreme fire hazards in the forest).

There is little empirical support for the idea that salvage logging reduces the intensity or severity of subsequent fire. Recent data show an actual increase in fire severity where post-fire logging had occurred. McIver, James D.; Starr, Lynn; [Technical Editors] 2000. Environmental effects of postfire logging: literature review and annotated bibliography Gen. Tech. Rep. PNW-GTR-486. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. 72 p. http://www.fs.fed.us/pnw/pubs/gtr486.pdf . Harma K., and P. Morrison. 2002. Analysis of Vegetation Mortality and Prior Landscape Condition, 2002 Biscuit Fire Complex. Pacific Biodiversity Institute. http://www.siskiyou.org/issues/pbivegetative.pdf Dennis C. Odion, Evan J. Frost, James R. Strittholt, Hong Jiang, Dominick A. Dellasala§, And Max A. Moritz. 2004. Patterns of Fire Severity and Forest Conditions in the Western Klamath Mountains, California. Conservation Biology. Volume 18 Issue 4 Page 927 - August 2004. http://www.blackwell-synergy.com/links/doi/10.1111/j.1523-1739.2004.00493.x

The agency also over-states the risk of leaving standing snags. Where large numbers of standing snags were present in bug killed areas burned by the Hayman fire in Colorado, fire was generally less severe compared to other areas where large numbers of dead trees were absent.

> In addition to wildfires, the Hayman Fire burned over another type of natural fuel modification: an area affected by a spruce budworm outbreak. Most Douglas-fir in the area between points 47 and 48 on figure 63 were killed by spruce budworm in the early 1990s with subsequent mortality in remaining trees from Douglas-fir beetle. Surface fuel loads were not excessive, since most of the Douglas-fir snags remained standing. The only live trees remaining prior to the Hayman fire were

> scattered ponderosa pine and the reduction in crown cover due to insect mortality seemed to affect fire behavior. The fire spread towards the southeast through this area during the relatively inactive period between the runs of June 9 and 17. The fire burned mostly as a surface fire on both sides of Westcreek, with small patches of crown fire activity. From the air, the burn appeared less severe than in areas outside the budworm affected area (fig. 70).

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

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

Salvage typically removes the largest logs that act as water "reservoirs" and are least prone to drying. *See* Amaranthus, M.P.; Parrish, D.S.; and D.A. Perry. 1989. Decaying Logs as Moisture Reservoirs After Drought and Wildfire. In: Alexander, E.B. (ed.) Proceedings of Watershed '89: Conference on the Stewardship of Soil, Air, and Water Resources. USDA-FS Alaska Region. RIO-MB-77. p. 191-194. This study found that large down logs in a post-fire landscape contain 25 times more moisture than the surrounding soil. While the authors recommended preventing large accumulations of "woody residue" (which the author described as very small diameter material--branches, twigs, etc.), they also recommended leaving down logs after fires to PREVENT future fire severity. They concluded that, "When forest managers are analyzing for fire risk, they should take into account the high water content of fallen logs during the period in which wildfire potential is greatest ... Fallen trees, in a range of decay classes, therefore provide a long-term reservoir of moisture. A continuous supply of woody material left on the forest floor, not only protects the productive potential of the forest soil, but also provides a sanctuary for ectomycorrhizae and a significant source of moisture in the event of prolonged drought or wildfire." The study was conducted in the Klamath region in an area with roughly 40 inches of annual rainfall. It was published in 1989 in Proceedings of Watershed '89: a conference on the stewardship of soil, air and water resources. USDA Forest Service, Alaska Region: pp. 191-194 (1989).

The agencies' NEPA analysis too often lumps all sizes of woody material together for purposes of estimating fire hazard. This leads to arbitrary and capricious decision-making because the availability of fuel to combustion is inversely related to size. Small fuels are hazardous, while large fuels pose little or no hazard. Fuel models do not generally consider fuels larger than 8" in diameter. Commercial salvage logging removes primarily (sometimes exclusively) wood that does not contribute to fire hazard. Large amounts of fuels >8" that can be retained on a given site without detrimental effect. Lumping fuel sizes together prevents the decision-maker from accurately understanding the actual magnitude of the risk from logging or not logging.

If fuels must be removed, the agency should remove the smaller fuels that are most hazardous and leave the largest logs that are least flammable and most valuable for habitat and other ecological services. The Forest Service own research shows that pound-for-pound small fuels are far more hazardous than large fuels, and that if the agency would remove more small fuels they could safely leave more large logs that are beneficial to wildlife:

> **Small and large downed woody fuels contribute differently to the various elements of fire hazard. … Large woody fuels have little influence on spread and intensity of the initiating surface fire in current fire behavior models**… [T]he spatial distribution of snags was highly variable . . .
> …
> **For cavity-nesting birds, up to 25 tons per acre may be desirable depending on species …. For small mammals, more than 30 tons per acre is best. …**
>
> To summarize the negative values, fire hazard including resistance-to-control and fire behavior reach high ratings when large fuels exceed about 25 to 30 tons per acre in combination with small woody fuels of 5 tons per acre or less. Excessive soil heating is likely at approximately 40 tons per acre and higher. Thus, generally high to extreme fire hazard potential exists when downed CWD exceeds 30 to 40 tons per acre. **Consideration of these positive and negative aspects indicates that the optimum quantity of CWD is about 5 to 20 tons per acre for warm dry ponderosa pine and Douglas-fir types and 10 to 30 tons per acre for cool Douglas-fir and lodgepole pine types and lower subalpine fir types. The recommended optimum ranges of CWD quantities (fig. 2) should be modified by consideration of other factors such as quantity of small woody fuel, diameter of CWD, landscape level needs, and ecosystem restoration objectives**. …
>
> **Higher loadings of CWD are acceptable where larger piece sizes predominate**, for example in accumulated falldown of old growth trees. Larger piece sizes also are desirable because, faced with decomposition and fire, they persist longer to benefit wildlife and soil productivity. Unfortunately, the relationship between quantity and size of CWD and the various measures of fire hazard is largely undefined. Thus, it is a matter of judgment to consider that the **larger the diameter of downed CWD the greater the loading that could be allowed without undesirable fire effects**. … surface area. . . . This suggests that where CWD comprises predominately 3- to 6-inch material, the optimum quantity is less, perhaps by 5 tons per acre or more, than for larger sized material. . . .
>
> … The probability of a reburn occurrence, which is small for a particular site but high over a large area …
> …
> [S]ome general statements about the effects of a reburn during high to extreme burning conditions with low fuel moistures can be made:

0 to 10 Years After First Fire—High severity fire is unlikely because duff and downed woody fuels that support prolonged burning would be absent. Large woody fuels would still be accumulating through falldown, and they would not have decayed enough to support smoldering combustion, which can extend the period of downward heating. **If salvage operations leave concentrations of small woody fuels, high severity burning could occur where the fuels are concentrated**. …

…

… The time interval chosen for predicting CWD should be long enough for a new immature or mature forest to develop.

…

[S]alvage may be desirable in the wildland-urban interface zone …

…

Salvage may be undesirable where large diameter snags needed by wildlife are in short supply in adjoining areas.

… Many years elapse in high fire severity burns before newly grown large diameter snags can replace the fallen snags, so **leaving an ample density of snags following fire can help maintain a minimal snag resource during the 20 to 40 year postfire period** when many snags have already fallen. Leaving a high density of snags would require constraints on harvesting. …

…

… Salvage accompanied by fuel treatment lowered CWD into the optimum range (fig. 9). The simulations for salvage of all dead merchantable trees without fuel treatment and 50 percent salvage accompanied by fuel treatment produced nearly the same amount of CWD … [T]he level of salvage affected snag density significantly … In planning for retention of a given amount of CWD, **treatment of fuel that reduces small-sized CWD (trees up to 6 inches d.b.h.) makes it possible to retain more large-diameter dead snags.**

Brown, James K.; Reinhardt, Elizabeth D.; Kramer, Kylie A. 2003. **Coarse woody debris: managing benefits and fire hazard in the recovering forest**. Gen. Tech. Rep. RMRSGTR-105. Ogden, UT: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. 16 p. http://www.fs.fed.us/rm/pubs/rmrs_gtr105.html (This paper reveals a scientific controversy about how much wood and of what size to leave after a fire and this issue needs to be fully analyzed in an EIS.)

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

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

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

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

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

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

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

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

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

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

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

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

Resistance to control is defined as—

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

National Wildfire Coordinating Group. 1998. page G-16. While future fire in the next 50 years is by no means a certainty, large logs may increase the time and effort needed to construct fire lines in the event of a future fire. However, this is only a concern in specific locations where fire lines are likely to be built, not all across the landscape. The only

place it makes sense to remove large wood to reduce resistance-to-control is in areas where the agency anticipates building fire lines, such as "shaded fuel breaks." Furthermore, fire lines are often built along ridgelines, so the interest in reducing resistance-to-control must be balanced against the significant impacts of removing large snag and logs other ecological values associated with ridgetop locations. These unique ridgetop values include rare plants and bats roosts.

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

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

Harmon, Mark E. Moving towards a New Paradigm for Woody Detritus Management. http://www.fs.fed.us/psw/publications/documents/gtr-181/071_Harm.pdf *in* William F. Laudenslayer, Jr., Patrick J. Shea, Bradley E. Valentine, C. Phillip Weatherspoon, and Thomas E. Lisle Technical Coordinators. Proceedings of the Symposium on the Ecology and Management of Dead Wood in Western Forests. PSW-GTR-181. http://www.fs.fed.us/psw/publications/documents/gtr-181/

Variable density thinning

Recognizing the need for landscape level diversity of habitat and stand trajectories, the agencies should be doing things very differently from non-federal forest managers. The trends on non-federal lands are toward: younger age and size classes[11], shorter rotations, higher planting density, greater use of herbicides to control competing vegetation, increased use of planting stock with a narrow genetic bandwidth, reduced or delayed pre-commercial and commercial thinning (due to the disappearing price premium for large logs). Talbert and Marshall. 2005. Plantation Productivity in the Douglas-fir Region Under Intensive Silvicultural Practices: Results From Research And Operations. Journal of Forestry. March 2005. pp 65-70. These trends are very bad because they tend to increase conifer dominance at the expense of biodiversity. Federal forest managers should manage forests differently in an effort to moderate conifer dominance and increase biodiversity.

We wish that you would use variable density thinning prescriptions in all young stand thinning projects regardless of land allocation. Uniform spacing basically sets up the need

[11] Adams & Latta. 2005. Timber Harvest Potential From Private Lands in the Pacific Northwest: Biological, Investment, and Policy Issues. PNW-GTR-626.

for future thinning that the agency may not have sufficient funding, capacity, and public support to accomplish. Whereas variable density thinning leaves more options for either more or less intensive management in the future and is a good hedge against uncertainty. The benefits of variable density thinning include: creating a patchy variety of conditions of light, heat, wind, moisture, competitive stress, and hiding cover within the stand and the landscape; setting up the stand so that there are future "winners" and "losers" (the winners become big trees and the losers become snags and coarse woody debris), etc. Andy Carey has found that:

> "Conventional thinning alone produced few flying squirrels or Douglas' squirrels, but many chipmunks; high plant species diversity but dominated by clonal natives with many exotic species; relatively abundant winter birds, but few woodpeckers; abundant small mammals but in imbalanced communities; and diverse fungi, low in abundance."

Carey, Andrew. **THINKING AND THINNING ECOLOGICALLY**, slideshow http://www.fs.fed.us/pnw/olympia/efb/flash/thinking_&_thinning_ecologically.swf

> Conventional thinning in the Western Hemlock Zone may result in very low flying squirrel populations through negative effects on truffle production and arboreal travelways (Colgan et al. 1999, Carey 2000b) and reduced foraging by spotted owls (Meiman et al. 2003) for a long time while increasing numbers of forest-floor rodents (Wilson and Carey 2000). Conventional thinning, however, may result in uniform dense understories unfavorable to both flying squirrels and owl foraging in the midterm. Variable-density thinning, however, hold promise for acceleration of the development of spotted owl habitat and dense prey populations (Carey 1995, 2001, 2003a. Carey et al. 1999a,b; Carey and Wilson 2001; Muir et al. 2002) especially when appropriate attention is paid to decadence (snags, cavity trees, and coarse woody debris) (Bunnell et al. 1999; Carey et al. 1999a, b; Carey 2002). There maybe a short-term impact on truffle production, flying squirrel abundance, and owl foraging, the ecosystem recovers more quickly and begins to develop more quickly and completely than following conventional thinning. Variable-density thinning has all the positive effects of conventional thinning, such and increased growth of trees, crown differentiation, development of understory, and increased flowering and fruiting of understory plants (Harrington et al. 2002, Wender et al. 2004) that provide important ancillary foods to spotted owl prey (Carey 2000a) without the same extent of negative mechanical impacts, loss of canopy connectivity, loss of spatial heterogeneity, loss of woody plant diversity (variable-density thinning stresses multi-species management).

Carey, A. 2004 Relationship of Prey and Forest Management. Appendix 5 pp 3-24, 3-25 *in* Courtney, SP; J A Blakesley. 2004. Scientific evaluation of the status of the Northern Spotted Owl. http://www.sei.org/owl/finalreport/finalreport.htm

We urge you to prescribe variable spacing for all thinning projects. The great benefits in terms ecosystem processes far outweigh any minor loss of future timber value. The Matrix is not a tree farm. It still has a role to play in providing diverse habitats, so don't just grow *trees*, grow *forests.* According to the 2003 Draft SEIS for survey and manage,

"Matrix was also expected to provide for ecologically diverse early-successional conditions and planned timber harvest." (DSEIS page 68). Variable density thinning is appropriate in the matrix because VDT expands future options for multiple-use/sustained yield in its fullest dimension and VDT does not foreclose any matrix objectives.

> A concern with evenly spaced thinnings is that the uniformly open canopy will encourage a homogenous understory dominated by a few species instead of a patchy and heterogeneous understory

Liane R. Davis, and Klaus J. Puettmann, Gabriel F. Tucker. 2007. Overstory Response to Alternative Thinning Treatments in Young Douglas-fir Forests of Western Oregon. Northwest Science 81(1). 2007.

Refer to the following resources to inform your implementation of variable density thinning:

- Duncan S. Wilson, and Klaus J. Puettmann. Density management and biodiversity in young Douglas-fir forests: challenges of managing across scales. DRAFT submitted to Forest Ecology and Management. August 2006. ("Spatially variable treatments provide for variable canopy structure and understory vegetation and results from the LSMEs suggest incorporating these into thinning prescriptions may be beneficial where biodiversity is of concern. The need for spatially variable treatments is highlighted by the hierarchical habitat-selection framework of various wildlife species. This framework provides a basis for matching spatial variability in forest structure and vegetation to the spatial scales that wildlife species perceive and respond to. Silvicultural prescriptions that increase within-stand variability can provide important habitat features across multiple scales and enhance habitat quality beyond that provided by stand-level prescriptions. … [M]anaging for biodiversity necessarily includes activities on several disturbance and spatial scales, which may include variable-density thinning, creating gaps and unthinned patches of different sizes, and creating two-storied stands through natural regeneration or underplanting (Carey et al., 1999; Hayes and Hagar, 2002; Puettmann et al., 2004). … The added objective of increasing understory vegetation for wildlife habitat and other ecological functions likely will require more intensive density management in order to ensure adequate resources for understory development (McComb et al., 1993; Hayes et al., 1997). … Complex vertical canopy structures are of interest when managing for biodiversity because they have been associated with increased songbird diversity and use (Carey, 1996). … Windstorms and disease that kill trees are common in young stands (Lutz and Halpern, 2006) and may result in natural gaps of widely varying sizes (from single trees to entire stands). … [M]anaging for understory vegetation and diverse habitat features will require either multiple, or heavy thinnings. Alternatively, variable density thinnings with areas of extremely low density or gap creation may provide long term openings. … Managing large deciduous tree patches to minimize overtopping by conifers will be advantageous for developing large crowns, large durable snags, and heavy seed production. Many songbird and bat species nest or roost in deciduous trees, and retention of these in thinning operations can provide vital features in otherwise suitable habitat (Hayes and

Hagar, 2002). … Young stands with high understory vegetation cover and diverse composition will benefit many wildlife species especially where this habitat is rare, such as in dense unthinned stands (Hayes and Hagar, 2002; Beggs, 2005). … Providing within-stand heterogeneity of understory vegetation can further increase the odds that suitable habitat will be available at the correct spatial scales for multiple species. … Understory deciduous trees and shrubs are especially important habitat, as they provide berries and seeds (Wender et al., 2004), small mammal cover (Martin and McComb, 2002), contribute to foliage height diversity, and are an important substrate for lichen growth. Abundance of arthropods, an important food source for most neotropical songbirds, has been linked to the deciduous shrub component (Schowalter, 1995; Muir et al., 2002). A diverse understory composition is also beneficial, as deciduous shrubs, grasses and forbs are generally more palatable than evergreen plants and thus serve as an important food source for small mammals and invertebrates (Muir et al., 2002). … Density management tends to homogenize shrub cover slightly when pre-treatment cover is relatively high. In contrast, thinning tends to increase shrub cover and greatly increase within-stand variability where shrub cover is absent before treatment (Harrington et al., 2005). High uniform shrub cover of a few species might reduce diversity of function, and treatments such as variable-density thinning or gap creation have been proposed to increase spatial variability in shrub cover and thus stand diversity. … In contrast to early thinning results, retrospective studies, which documented conditions 10–30 years postharvest, generally showed no effect or a strong increase in tall and short shrub cover. … The distinction between early and late responses to thinning also needs to consider trends in stand dynamics where stands develop higher shrub and herb cover as they move from the stem exclusion to the understory initiation and old-growth stages (Spies, 1991; Wender et al., 2004). … Herb cover generally responds either neutrally or slightly negatively to thinning … competition from rapidly increasing shrub cover may have confounded the impacts of overstory removal (Beggs, 2005). … Ten to thirty years after thinning, herb cover was higher in thinned than unthinned stands (Bailey et al., 1998; Thysell and Carey, 2001). Herb response to thinning, however, may be negatively correlated with the response of the competing shrub and tree layers (He and Barclay, 2000). … Unthinned patches have been proposed to promote diversity and better mimic natural stand development patterns, especially patterns of spatial diversity in overstory cover and species composition (Carey et al. 1999). … Small patches that were 36 and 50-m in diameter (0.1 and 0.2 ha, respectively) at the DMS study were compositionally similar to the thinned stand (200 tph residual density), whereas the interiors of 71-m diameter patches (0.4 ha) were compositionally similar to the unthinned stands (Wessell, 2006). Unthinned patches of any size supported several species not present in the thinned stands, suggesting the value of these patches to within-stand heterogeneity and potential for propagation into adjacent areas. … Thinning disturbs existing vegetation and frees up resources, compounding the risk that interfering species will expand and dominate understory vegetation. … Too much regeneration, however, especially of shade-tolerant species, can provide a “secondary stem exclusion” that results in nearly

complete loss of shrub and herb cover (Alaback and Herman, 1988; Bailey and Tappeiner, 1998). Although none of the short-term results of the LSMEs documented this response … In areas where tall shrub cover is of special concern, harvesting activities may be designed to protect shrub patches. …

- Kevin W. Zobrist. 2005. A literature review of management practices to support increased biodiversity in intensively managed Douglas-fir plantations. Final Technical Report to the National Commission on Science for Sustainable Forestry (NCSSF). http://www.ncseonline.org/ewebeditpro/items/O62F7175.pdf ("To meet the needs of a broad range of species, structural diversity is needed to provide a variety of habitat elements (Helgerson and Bottorff 2003, Muir et al. 2002). This requires complex three-dimensional canopy attributes and spatial relationships … Structural manipulations … should greatly shorten the time necessary for occupancy [by late-seral dependent species]. … Stem exclusion stage … supports few wildlife species. … the positive effects of thinning [is to] allow light to reach the forest floor. This provides better developed understories … Studies have found direct links between thinning and wildlife abundance … more winter birds … abundance of small mammals … Old forest conditions [are] most lacking on the landscape and difficult to replace … Instead of traditional, uniform thinning, irregular thinning with different densities, unthinned areas, and openings can greatly enhance structural diversity (Curtis et al. 1998, Helgerson and Bottorff 2003). This is also called variable density thinning, which treats alternating areas of usually around 0.25 to 0.5 acres leaving two or more different levels of residual density (Carey and Curtis 1996, Carey and Johnson 1995, Carey et al. 1999b, Carey and Wilson 2001). Variable density thinning is intended to mimic natural forest processes of suppression and mortality to create a structural mosaic and maintain wind stability (Carey et al. 1999b). … Another important way to increase stand-level structural diversity is to retain biological legacies … such as large, live trees, snags, and downed wood can better mimic natural disturbances and give plantations a structure more similar to natural stands (Franklin et al. 2002, Hansen et al. 1991). … The practices described above can be combined to create "biodiversity pathways" for forest management. Biodiversity pathways begin with legacy retention at the time of harvest, less intensive site preparation to conserve downed wood and other forest floor substrates, and planting at wider spacing. Successive variable density thinnings are done over longer rotations. These thinnings are heavier than traditional commercial thinnings and favor multiple species. The goal of biodiversity pathways is to minimize the dense stem-exclusion stage and accelerate the development of old forest structure and function to support increased biodiversity (Carey and Curtis 1996, Carey et al. 1996).")
- Poage, Nathan, J. 2005, Variability in Older Forest Structure in Western Oregon. U.S. Geological Survey, Open-file Report 2005-1385, 28 p. http://fresc.usgs.gov/products/papers/1445_Poage.pdf (Vegetation patterns are highly variable within and between stands. Patch size and density generally decreased with increasing stand diameter class. Observed patterns and trends "are most likely reflection of the normal processes of tree mortality and snag production and decay within stands. As the trees in a patch increase in size, self-

thinning reduces patch density and—by creating gaps within a patch—can divide the original patch into two smaller ones. Similarly, tree growth and mortality lead to fewer but larger snags in a patch. Decay also decreases the patch density of snags and can lead to the formation of gaps within patches of snags. The formation of gaps within patches appears somewhat random … ”

- SÁNDOR BARTHA et al. 2004. On the Importance of Fine-Scale Spatial Complexity in Vegetation Restoration Studies. International Journal of Ecology and Environmental Sciences 30: 101-116, 2004 http://www.zpok.hu/img_upload/cb39111eba7a31c9c0e48686fa8e3c87/IJEES2004.pdf (“Effective restoration should start from an understanding of the spontaneous processes of vegetation succession and utilize the natural “self-repair” mechanisms. ... This context dependence of local vegetation dynamics is emphasized by the non-equilibrium ecological paradigm. This paradigm views the developing plant community as a complex dissipative system, which involve a methodology with explicit representation of spatiotemporal patterns. …. Descriptive and experimental evidences on natural succession (especially the accumulating data from long-term permanent plots and paleo-pollen spectra) revealed that succession is highly stochastic and the related mechanisms are far more complex than expected. … The variability of succession trajectories and the individualistic nature of local community dynamics can be understood by considering the effects from the spatiotemporal neighbourhoods at various scales. By temporal neighbourhood effects we mean the long lasting influence of initial conditions and the accumulating effects of specific events experienced during the site history … The neighbourhood relationships enfold along a hierarchy of scales. This means that history and spatial context are of vital at finer scales as well. Since restoration is the reassembly of community through human intervention (MacMahon and Hall 2001), understanding the community’s assembly rules is of considerable importance (Wilson 1999). Fine-scale contingencies are probably more significant in plant communities where individuals are sessile and interactions are local (Czárán and Bartha 1992). … [W]e propose a simple and quick method appropriate for monitoring the finescale structural complexity of developing vegetation, and well able to collect additional information relevant for manipulating both rates and directions of processes. … The under-estimated complexity of natural systems implies that we might restore over-simplified versions of target communities. … [W]e showed that ignoring the fine-scale, within-stand community patterns, complexity would be underestimated again, and the resulting limited knowledge might lead to wrong restoration decisions. … Our case studies illustrated that the number of realized species combinations (as a measure of fine-scale structural complexity) is a better indicator of the early stage of degradation and the optimum disturbance regimes, than the stand-scale aggregated averages…. We argue that non-equilibrium conditions require specific methodology which ables to represent the spatiotemporal variation and dependence at multiple scales.”)
- Franklin J.F.; Van Pelt R. 2004. Spatial Aspects of Structural Complexity in Old-Growth Forests. Journal of Forestry, Volume 102, Number 3, April/May 2004, pp. 22-28(7). (“We find a gradual evolution of (1) canopies from simple, top-

loaded, single-layered canopies in young stands to the vertically continuous, bottom-loaded canopies in older forests; and (2) spatial heterogeneity from uniform young stands that are initially dominated by competitive processes to the fine-scale structural patchwork of old-growth forests. … Old temperate forests can be viewed as fine-scale structural mosaics that are developed and maintained as a consequence of chronic disturbances. Forests subject to stand replacement disturbances evolve through an even-aged cohort that is initially homogenized by competitive-based mortality before arriving at the developmental stage where chronic disturbances become the dominant influence on stand structure. … [T]he functional old-growth forest consists of a fine-scale structural mosaic in which all elements of the structural mosaic are needed to achieve a complete old-growth forest.")

- Competitive mortality tends to homogenize. Chronic intermediate disturbances act on the homogeneous forest to create spatial heterogeneity.
- Non-competitive mortality (insects, disease, wind, low to mixed-severity fire) tends to be contagious, creates canopy gaps and decadence, and tends toward heterogeneity.
- Chronic low- to moderate-intensity disturbance maintains fine scale structural mosaic until an uncommon stand replacing event occurs.
- This fine scale mosaic is characteristic of old forests in both stand-replacing and gap-replacing disturbance regimes.
- Natural canopy gaps tend to be 1/4 to 1/2 acres, a scale that is smaller than those proposed for group selection, so group selection may not be consistent with HRV.
- Spatial patterns exist at multiple scales. [Perhaps ~1/f distribution of habitat patchiness. With many small and a few large patches, but most habitat represented in the large patches. Fractal edge dimensions. Contagious disturbance takes long path. See e.g. Gisiger, T. 2001. Scale invariance in biology: coincidence or footprint of universal mechanism? Bio. Rev. (2001) 76 pp 161-209. http://www.pasteur.fr/recherche/unites/neubiomol/ARTICLES/Gisiger2001.pdf and Sole and Manrubia http://complex.upf.es/~susanna/ABS1.html]
- Epicormic branches are excellent habitat platforms for birds, mammals, and epiphytes.
- Older stands have higher leaf areas.
- All stand development process are simultaneously present within the stand, so new definition of forest "stand" may be need to account for the wide range of processes and conditions present concurrently within an otherwise "uniform" distinguishable stand.

➢ NOTE: Franklin and Van Pelt may have over-simplified the range of processes in operation within young stands. See: Lutz. J.A. 2005. The Contribution of Mortality to Early Coniferous Forest Development. MS Thesis. University of Washington. http://faculty.washington.edu/chalpern/Lutz_2005.pdf This MS Thesis looked at long-term transect data from young forests in Western Oregon and found that non-competitive mortality and gap forming processes are very much in operation in young stands. The study sites in the JH Andrews Experimental Forest were not naturally regenerated, so it is likely that in

unsalvaged young stands that are naturally regenerating from major disturbance such as fire, the gap forming mortality from snag fall would be even more pronounced. This indicates that in natural young stands the homogenizing influence of stand growth and competitive mortality is significantly counter-balanced by non-competitive mortality that tends toward heterogeneity and structural diversification. This means that if young stand management is to effectively mimic natural patterns and processes, that variable density treatments must be the rule, and the scale of the mosaic must be very fine scale.

- Carey, Andrew B., Janet Kershner, Brian Biswell, and Laura Dominguez de Toledo. 1999. Ecological Scale and Forest Development: Squirrels, Dietary Fungi, and Vascular Plants in Managed and Unmanaged Forests. Wildlife Monographs, No 142, Supplement to the Journal of Wildlife Management, Vol. 63 No. 1, January 1999. http://www.fs.fed.us/pnw/pubs/journals/pnw_1999_carey003.pdf ("[S]ilviculture can contribute to simplification or to diversification of the ecosystem.

  . . .

  It is our contention that aggradation and redistribution of biomass, living and dead, results in niche diversification, an expansion of the niche hyperspace of the ecosystem and the community it contains....It is this expansion that may result in emergenct properties through symbiosis and synergy. . . . Thus we hypothesize that conservation of biodiversity could be achieved in managed forests through planned human-caused disturbances and gradual change that create a multidimensional space of particular dimensions; it is those dimensions we seek to describe here.

  . . .

  Crown-class differentiation accounted for more variance in our data set than any other factor. Similarly, Carey et al. (1991b) reported that dbh alone could separate age classes in their sample, and Spies and Franklin (19901) reported that most variance among age classes across the Pacific Northwest could be reduced to a single canonical variate related to the standard deviation of dbh and the density of large trees.

  . . .

  In our study, crown-class differentiation accounted for 25% of variance in vegetation structure, but proved to be a major dimension of the realized habitat of chipmunk abundance.

  . . .

  Crown-class differentiation is perhaps the factor of forest development most amenable to management: (1) species composition can be determined managerially at initiation of a new stand by legacy retention, planting, and precommercial thinning, (2) management of stem density and growth rates is well founded (Curtis and Carey 1996), and (3) spacing can be varied tree to tree or patch to patch within stands (Carey 1995, Carey et al. 1996a,b). Growth of large trees and time lead to disease, injury, decay, and death of trees and consequent expansion of multidimensional niche space. Decay processes seem less deterministic; management of decadence is more problematic.

  . . .

Of all the habitat elements we measured, coarse woody debris proved to be the best predictor of the realized habitat space, activity; and carrying capacity of northern flying squirrels and carrying capacity for Townsend's chipmunk.

. . .

If catastrophic disturbance sets the stage, it is small-scale disturbances in the canopy that determines the pace of the ecosystem development. Whitmore (1989) claimed that gaps drive the forest cycle in all forests; but the ecological process of tree death (Franklin et al. 1987) is particularly important in expansion of niche space.

. . .

. . . biodiversity is suppressed in competitive exclusion (which historically was rare in many landscapes; Tappeiner et al. 1997a) and there is expansion of niche space and increased biodiversity in understory-reinitiation and niche-diversification stands.

. . .

. . . Ecosystem dynamics . . . suggest active ecosystem management would be more effective than passive management (withdrawals or reserves) for conservation of biodiversity in second-growth forests.

. . .

Thinnings, active promotion of decadence, and legacy retention hold potential in managing forests for biodiversity, but spatial scale of management is important.

. . .

Thinning

In the Pacific northwest, the best opportunities for conservation of biodiversity through ecosystem management lie in the millions of hectares of second growth forest <50 years old. (DeBell et al 1997, Hayes et al 1997). Crown class differentiation, canopy stratification, understory development, and habitat breadth can be enhanced through thinning, but spatial patterning is important. . . . Traditional, light commercial thinning will not preclude or move a stand out of competitive exclusion and will not increase habitat breadth. Heavy thinning with even spacing can cause can cause stands to become drier through increase wind and sunlight, could result in salal brushfields (simple structure with low habitat breadth), and if applied in a dense stand) could disrupt mycorrhizal links and increase probability of massive windthrow (Carey et al 1996b).

. . .

Variable-density thinning on a 0.1-0.5 ha scale that removes subordinate or codominant trees appears to have potential for increasing crown-class differentiation, canopy stratification, understory development, and habitat breadth. . . . [W]e suggest that maintaining relative densities of 0.5 and 0.35 in a ratio of 2:1 over the stand could result in accelerating the development of stand structure and heterogeneity characteristic of late-seral, natural forests. Hagar et al. (1996) recommended variable-density thinning with relative densities of 0.2 - 0.7. Actual choice of relative densities should entail consideration of risk of windthrow, potential for creation of salal or salmonberry (Rubus spectabilis) brushfields, the silvics of the species being managed, and site conditions. Multiple thinnings would be necessary to (1) keep the disturbance intermediate to

small scale, (2) avoid disrupting connectivity among tree crowns (3) prevent excessive drying of the forest floor, (4) avoid development of a sparse overstory with a dense salal brushfield underneath, and (5) keep the canopy from closing into a stage of competitive exclusion.

. . .

. . . Traditional commercial thinning with systematic spacing allowed quick (ca. 10 yr) canopy closure and return to competitive exclusion; biodiversity targets were not met. . . . In forests being restored for late-seral wildlife, biodiversity thinnings appeared to have substantial value in creating late-seral forest relatively quickly. In forest managed for economic values....

. . .

Managing for decadence

Managing decadence is the most challenging aspect of intentional ecosystem management. Our research shows that decadence is more than snags and logs; it is a process that is influential in multiple aspects of ecosystem development from providing cavities for wildlife, to creating gaps in the canopy, to altering forest floor microclimate and structure.")

Thinning in the Matrix must be Variable

In the NWFP conservation scheme the role of matrix lands is primarily to support owl dispersal, but also:

- To provide connectivity for dispersal and interaction of owls among HCAs. ….
- To maintain options for returning owls to the forest matrix by retaining older forest structures in the managed landscape.
- To develop and apply experimental silvicultural treatments that may support a viable owl population in the forest matrix.
- To contribute toward a short-term viable population (less than 50 years).

(ISC Report p 318). The quality of matrix lands for meeting these objectives is directly related to the extent that it resembles nesting, roosting, and foraging habitat. If structurally simple stands in the matrix can be modified to be more complex in terms of species diversity, niche diversity, and dead wood abundance, they will support better foraging opportunities which will greatly improve the quality of dispersal habitat.

Owl habitat is characterized by large trees, high canopy closure, abundant dead wood, well-developed understories. A few of these qualities can be attained with traditional uniform thinning (large trees and canopy closure), but all of them are more likely to be attained with variable density thinning and managing for decadence. In particular, canopy closure and well-developed understories are best achieved with variable density thinning.

The agency should design matrix thins to support abundant and diverse populations of owl prey species. Where owl prey base is diverse and abundant spotted owl home ranges tend to be smaller which is energetically advantageous and enhances owl survival rates. Carey, A. 2004 Relationship of Prey and Forest Management. Appendix 5 pp 3-24, 3-25 *in* Courtney, SP; J A Blakesley. 2004. Scientific evaluation of the status of the Northern Spotted Owl. http://www.sei.org/owl/finalreport/finalreport.htm "Numerous patches of

low foraging quality can have negative impacts on owl demography and behavior (Carey et al 1992)." id. and this is precisely what uniform thinning that "captures mortality" will do to current and future spotted owl home ranges. A large number of owl prey species have some association with snags and down wood either as sites for denning or as a source of fungal food supplies. Traditional thinning will reduce the recruitment of dead trees and down wood and further simplify the forest structure for many decades. Establishing diverse micro-habitats and creating and retaining large numbers of snags and down wood will help the spotted owl through the habitat bottleneck that it is now going through.

Small mammal populations also appear to increase with understory cover which can follow some forms of thinning. Waldien and Hayes. 2006. Influence of Alternative Silviculture on Small Mammals. USGS/CFER Fact Sheet. July 2006. http://www.fsl.orst.edu/cfer/pdfs/CFERFS05.pdf

North et al (1999) concluded that "stands with 142 m^3/ha of intact snags and a high diversity of tree heights had medium or high foraging use by spotted owls. In these old-growth stands, biological legacies (e.g., large trees and snags) produced by past disturbance provide important forest structures associated with spotted owl foraging." North, Franklin, Carey, Forsman, Hamer. 1999. Forest Stand Structure of the Northern Spotted Owl's Foraging Habitat. For. Sci. 45(4):520-527.

Some have concluded that light, uniform thinnings in young stands are unlikely to attain biodiversity conservation objectives. See Duncan S. Wilson, and Klaus J. Puettmann. Density management and biodiversity in young Douglas-fir forests: challenges of managing across scales. DRAFT submitted to Forest Ecology and Management. August 2006.

Given all the new information on the risks and uncertainties faced by spotted owls, thinning projects in the Matrix should apply variable density thinning techniques because variable density thinning and managing for decadence will help increase the complexity of the forest (structural complexity and plant species diversity) thereby increasing populations of owl prey species and enhancing owl foraging opportunities within owl dispersal/foraging habitat.

VDT will not conflict with matrix objectives. Matrix objectives include timber production as well as habitat and species diversity. Variable thinning will produce potentially more wood products in the short-term as well as significant wood products in the long-term. There is absolutely no requirement that the agencies MAXIMIZE timber production. The ecological benefits of variable density thinning are significant and should not be forgone. There are operational challenges with implementing effective variable thinning prescriptions but the agencies must embrace the challenges and instead of retreating from the ecological objectives of the matrix, the agencies must apply their best thinking and creativity to the objective of creating species-diverse and structurally rich and complex mid-seral forest habitat.

The matrix is supposed to provide wildlife habitat and connectivity and VDT will help the matrix achieve these objectives while also improving the growth of favored commercial tree species. Matrix is not a tree farm. It still has a role to play in providing diverse habitats, so don't just grow trees, grow forests.

> The matrix is an integral part of the management direction included in these standards and guidelines. Production of timber and other commodities is an important objective for the matrix. However, forests in the matrix function as connectivity between Late-Successional Reserves and provide habitat for a variety of organisms associated with both late-successional and younger forests. Standards and guidelines for the matrix are designed to provide for important ecological functions such as dispersal of organisms, carryover of some species from one stand to the next, and maintenance of ecologically valuable structural components such as down logs, snags, and large trees. The matrix will also add ecological diversity by providing early-successional habitat.
>
> …
>
> Matrix objectives for silviculture should include: (1) production of commercial yields of wood, including those species such as Pacific yew and western red cedar that require extended rotations, (2) retention of moderate levels of ecologically valuable old-growth components such as snags, logs, and relatively large green trees, and (3) increasing ecological diversity by providing early-successional habitat.
>
> …
>
> Stands in the matrix can be managed for timber and other commodity production, and to perform an important role in maintaining biodiversity. Silvicultural treatments of forest stands in the matrix can provide for retention of old-growth ecosystem components such as large green trees, snags and down logs, and depending on site and forest type, can provide for a diversity of species. Retention of green trees following timber harvest in the matrix provides a legacy that bridges past and future forests. Retaining green trees serves several important functions including snag recruitment, promoting multistoried canopies, and providing shade and suitable habitat for many organisms in the matrix.

1994 NWFP ROD pp B-1 to B-6 (emphasis added). Clearly VDT, will meet matrix objectives by providing wood products, and by promoting multistoried canopies, providing diversity of species, creating and maintaining structural features such as snags, logs, and large trees, and providing opportunities for early-seral species to persist in mid-seral stands.

According to the 2003 Draft SEIS for survey and manage, "Matrix was also expected to provide for ecologically diverse early-successional conditions and planned timber harvest." (DSEIS page 68). Variable density thinning is appropriate in the matrix because VDT expands future options for multiple-use/sustained yield in its fullest dimension and VDT does not foreclose any matrix objectives.

Variable Density prescriptions will also improve connectivity by enhancing foraging opportunities for dispersing predators such as spotted owls (and other raptors), marten, fisher, etc. Young and mid-seral forest may not provide ideal nesting/denning conditions

but they often do provide for important dispersal functions. If these young and mid-seral forests are species-diverse and structural complex, they are more likely to have healthy populations of small mammals, birds, and other prey species relied upon by predator species of concern.

Variable density thinning can create a variety of micro-habitats that may be suitable for different species. Andy Carey found that VDT could establish patchy habitat patterns that could lead to the development of small mammal populations that are not only more dense but more diverse compared to uniformly thinned stands.

> Our results support hypotheses that: (1) biocomplexity resulting from interactions of decadence, understory development, and overstory composition provides pre-interactive niche diversification with predictable, diverse, small mammal communities; (2) these communities incorporate numerous species and multiple trophic pathways, and thus, their integrity measures resiliency and sustainability.
> …
> Thus, increasing complexity of the environment through increasing horizontal and vertical heterogeneity in vegetation structure, species diversity in vascular plant composition, and forest-floor structure with coarse woody debris may simultaneously (1) increase multidimensional habitat space (Carey et al., 1999a), (2) reduce frequencies and intensities of interspecies interactions (Grant, 1972; Carey et al., 1980), (3) increase or maintain the already high abundance and diversity of seed fall, fungal fruiting bodies, and invertebrates characteristic of mesic, temperate coniferous forests (Church field, 1990), and (4) allow not only coexistence, but abundance of potentially competing species within communities (Carey and Johnson, 1995, this study). As a result of this complexity, Pacific Northwest forests support the greatest diversity of shrews in North America (Rose, 1994) …
> …
> These studies do suggest that management can homogenize and simplify (reduce decadence, amounts of coarse woody debris, variety of tree species, diversity and abundance of understory vegetation, and spatial heterogeneity) forest ecosystems. We found local extirpations of a number of species and particularly absence of *G. sabrinus* and *T. townsendii* in multiple plots. These absences raise questions about long-term viability of these species in managed landscapes. Management-induced homogeneity and simplification (1) is a real danger to diversity, resiliency, and susceptibility to invasions of exotic plants (Carey, 1998; Carey et al., 2000; Halpern et al., 1999; Heckman, 1999; Thysell and Carey, 2000), (2) may result in small-mammal communities non-supportive of predators populations (Carey et al., 1992; Carey and Peeler, 1995), …

Andrew B. Carey, Constance A. Harrington; Small mammals in young forests: implications for management for sustainability; Forest Ecology and Management (2001) 154(1-2): 289-309; http://www.fs.fed.us/pnw/pubs/journals/pnw_2001_carey003.pdf

High density and diversity of prey species is clearly advantageous for spotted owls. Dense populations of prey allow for smaller home ranges which is energetically

advantageous, while diverse populations reduces the risk that any one species population will decline and leave the owl vulnerable. "[E]xperiments in both terrestrial and aquatic microcosms have tended to find that increasing the number of prey items enhances stability." Kevin Shear Mccann, The diversity–stability debate. Nature 405, 228 - 233 (11 May 2000). http://www.nature.com/cgi-taf/DynaPage.taf?file=/nature/journal/v405/n6783/full/405228a0_fs.html Thinning variably will enhance the habitat for more than one prey species. If one species declines, the owl has other options so diverse prey base tends to have a stabilizing effect on owl populations. The agency can have all these ecological benefits from restoration silviculture and still support some jobs and produce some wood products.

Manage for Decadence

"Natural processes and disturbances such as windthrow fire and the effects of pathogens and insects are also part of old forest development that thinning does not mimic." http://www.fsl.orst.edu/Oldgrowthworkshop/statements/Tappeiner.pdf

Andrews et al (2005) used modeling to show that variable thinning could accelerate the development of forests that resemble known spotted owl nest sites. However, this study cautioned that their study could not address habitat breadth. "Habitat breadth results from fine scale spatial heterogeneity that produces structural and compositional diversity-tree species diversity, foliage-height diversity, and variety of recurring vegetation site-types."[12] "Nesting sites are one component of the habitat requirements of spotted owls. The forest structure at spotted owl nesting sites may not provide other life-history requirements of spotted owls. … Provisions need to be made for the retention and production of snags and course woody material under these scenarios [variable density thinning to create spotted owl nest sites]." Andrews, Perkins, Thrailkill, Poage, Tappeneiner. 2005. Silvicultural Approaches to Develop Northern Spotted Owl Nesting Sites, Central Coast Ranges, Oregon. West. J. Appl. For. 20(1):13-27.

One of the big challenges of VDT or any restoration thinning regime, is that thinning tends to "capture mortality," yet the trees that are removed represent future snags and down logs and are valuable (even essential) components of any complex forest. "Carey et al. (1999) found that coarse woody debris amounts declined significantly as a result of variable density thinning, especially the higher decay classes, despite the intent of the treatment to leave all existing debris in place."[13] The agency cannot use "average" snag levels as a management objective within treatment areas, because treatments are essentially displacing natural disturbance events which would normally create and retain large numbers of snags, so disturbance areas should have abundant snags, not average levels of snags. Managing for decadence in young stands is not a trivial issue because among the many other valuable attributes of dead wood, it is strongly associated with

[12] Carey, Andrew B. 1998. Ecological foundations of biodiversity: lessons from natural and managed forests of the Pacific Northwest Northwest Science. 72(2): 127-133. http://www.fs.fed.us/pnw/pubs/journals/pnw_1998_carey001.pdf

[13] Jan 2004 SEIS for Removing Survey and Manage Mitigation, page 189.

healthy populations of many small animals species that in turn help support populations of at-risk predators such as spotted owls, goshawk, fisher, marten, etc.

The snag dynamics white paper on the DecAID website indicates that timber harvest typically results in the loss of a majority of the standing snags (62% of snags within a variety of timber harvest areas were cut down.) http://wwwnotes.fs.fed.us:81/pnw/DecAID/DecAID.nsf/HomePageLinks/863EEA66F39752C088256C02007DF2C0?OpenDocument Also, in the Windjammer EA the Siuslaw NF noted that at least six times more coarse wood carries over from old-growth forests after wildfire compared to after timber harvest, and the CWD left after logging is smaller and decays faster (*citing* Spies & Cline 1988)[14] so young stands are already deprived of dead wood. This is very troubling. The agency must start by carefully designing the project to keep workers away from existing snags. The agency must then consciously and very deliberately manage for decadence in the design of all thinning efforts. One way to think of this is to figure out how many trees the agency think they want to kill and remove a small portion of those while leaving the remainder as standing snags or down wood.

North et al (1999) concluded that "stands with 142 m^3/ha of intact snags and a high diversity of tree heights had medium or high foraging use by spotted owls. In these old-growth stands, biological legacies (e.g., large trees and snags) produced by past disturbance provide important forest structures associated with spotted owl foraging." North, Franklin, Carey, Forsman, Hamer. 1999. Forest Stand Structure of the Northern Spotted Owl's Foraging Habitat. For. Sci. 45(4):520-527.

Techniques for enhancing decadence may include:

- Retaining all large snag and large dead wood by keeping workers out of the hazard zone if necessary,
- Intentionally retaining leaning trees, and trees with defects, broken tops, forked tops, etc.
- Leaving some untreated skips where future mortality can be expected,
- When determined to be necessary, snag creation must be a creative endeavor. Trees killed in different way will die and decay in different ways. A variety of techniques should be used within and between stands: girdling, topping, burning, infecting with heart rot fungus or other native pathogens, etc.

The Mt Hood National Forest has made an effort to mange for decadence in the Cloak Thinning EA, 11/2004 http://www.fs.fed.us/r6/mthood/projects/cloak-thinning/CloakEA.pdf Design Criteria #6 (p 23) indicates that "live trees would also be selected as leave trees that have the 'elements of wood decay' as described in the DecAID advisor. This may include trees with features such as dead tops, broken tops and heart rot." This technique will be applied not only in thinning native second growth but

[14] Spies, T. A., and S. P. Cline. 1988. Coarse woody debris in forests and plantations of coastal Oregon. Pp. 5-23 in: C. Maser, R. F. Tarrant, J. M. Trappe, and J. F. Franklin, ed. From the forest to the sea: a story of fallen trees. Gen. Tech. Rpt. PNW- GTR-229. USDA Forest Service, Portland OR. http://www.fs.fed.us/pnw/pubs/229chpt1.pdf

also in thinning dense young plantations. The agency should incorporate this design element in all projects and instruct marking crews and cutting crews to "look up" so they can retain key elements of structural complexity such as broken tops, forked trees, etc.

Using data from stand exams modeled through FVS-FFE (West Cascades variant) the Umpqua NF found that the actual effect of thinning is to capture mortality and *delay* recruitment of large wood for up to 60 years. WOPR EIS must include an honest disclosure of thinning impacts on snag habitat similar to that found in the Cottage Grove District's Curran Junetta Thin EA:

> There is currently an excess of forested land in this area without snags (roughly 5 times higher than what DecAID recommends) and a deficiency in areas with high snag densities (roughly 12% of what DecAID recommends). Management prescriptions should allow for these extremes because they are ecologically important (White et al. 2002, Mellen et al. 2005). Common natural disturbances that produce areas with high levels of dead wood include wildfire, insects and disease, and wind (blow down) events.
>
> …
>
> The action alternatives cause a decrease in stand levels of snags and down wood caused by incidental falling of snags for logging or safety reasons, and consumption of down wood during the fuels reduction treatments. Thinning would then reduce the amount of suppression mortality within the thinned portions of stands, indirectly affecting future recruitment of CWD. Existing snags and logs would be protected to the extent practical and safe. However, it is probable that the action alternatives would lower levels of these structures (to approximately one to two snags per acre) through mechanical disturbance from tree falling and harvesting. … To mitigate for effect on large snags, the action alternatives would include the inoculation of two trees per acre on 857 acres and five snags per acre on 379 acres (within CHU OR-20) with locally collected native heart rot fungus. Inoculated trees begin to develop heart rot within five years as they continue to grow (Duncan, 1999), eventually producing larger trees with cavities and future snags that remain standing longer than if girdled. Inoculation is a management tool being used to offset the reduction of suppression mortality caused by thinning and to maintain a component of decadence within these managed stands. Additional snag mitigation would occur within CHU OR-20; six snags per acre would be created by fire during fuels reduction activities. In unit seven, mitigation would occur by girdling trees (>15 inch dbh or largest trees available) to achieve six snags per acre within the thinned portions of the unit.
>
> …
>
> Large snag (≥20" DBH) densities within the stands are currently below the levels advised for in DecAID (4.7 snags/acre – 30% tolerance level). Under the no action alternative this level of snags would not be achieved for another two decades (Figure 15). The action alternatives would delay reaching this level by an additional 10 to 30 years (10 years for units thinned to 70 to 90 trees per acre, 30 years for units thinned to 40 to 60 trees per acre).
>
> …

Cumulative impacts

Substantial adverse impacts to levels of CWD at both the stand and landscape-scale have resulted from past clearcut timber harvesting, road building, roadside salvage and fire exclusion. The Layng Creek inventory showed an overabundance of land area with no snags, and a deficit of land area with high snag densities (caused by fire exclusion). It would take several decades to restore snag and log conditions to within the ranges advised for in DecAID at these two extreme ends of the range of CWD.

USDA Forest Service. 2007. Curran Junetta Thin EA. Cottage Grove Ranger District, Umpqua National Forest. June 2007.
http://www.fs.fed.us/r6/umpqua/projects/projectdocs/curran-junetta-thin/index.shtml

This graph from the Curran Junetta Thin EA shows that heavy thinning delays by more than 60 years the attainment of habitat objectives for large snags (i.e. mid-point of the gray band representing 30-80% tolerance level).

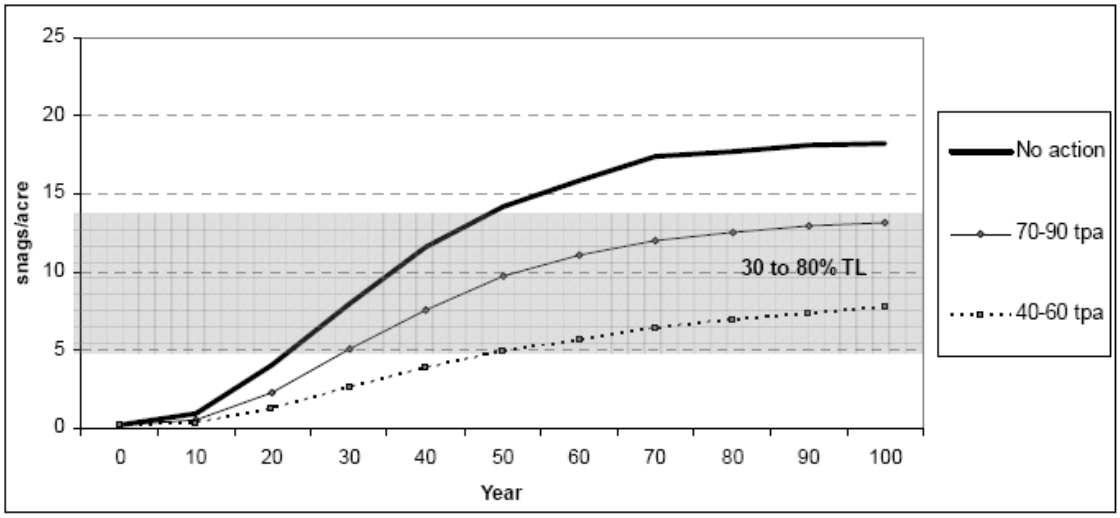

Figure 15. Short and long-term changes to ≥20" dbh snags.

This analysis is likely transferable to any thinning project, though the DecAID tolerance levels might be different for different forest types. The agency must come up with way to manage for decadence in order to mitigate for the fact that thinning captures and delays mortality. Data free analysis that concludes that "thinning grows big trees faster to create big snags faster" does not cut it anymore.

Concerns about Fuels Management Effectiveness

Oregon Wild supports use of prescribed fire, and, if necessary, careful thinning and removal of small diameter material and flammable brush in ecologically appropriate locations in order to help restore fire regimes. We urge the agency to avoid road building and prioritize such activities in the wildland-urban interface.

We support efforts to limit the initiation and spread of crown fires through the reduction of fine surface fuels and (partial) treatment of ladder fuels to increase the crown base height, but we oppose efforts to heavily thin the overstory canopy in an effort control crown-to-crown fire spread. The most significant effect of this type of heavy thinning is to increase the warming and drying of ground fuels and to increase the growth of ladder fuels, both of which significantly detract of the risk reduction objectives and are expensive to treat. The NEPA analysis must address the complex effects of thinning including tendencies to reduce and increase fire hazard.

The Report to the President that forms the foundation for the National Fire Plan recommends that we "Invest in Projects to Reduce Fire Risk. **Addressing the brush, small trees, and downed material** that have accumulated in many forests because of past management activities, especially a century of suppressing wildland fires, **will require significant investments** to treat landscapes through thinning and prescribed fire." Whitehouse. Managing the Impact of Wildfires on Communities and the Environment. A Report to the President In Response to the Wildfires of 2000. September 8, 2000. http://199.134.225.81/Documents/Managing_Impact.pdf The main point here is that the fuels that need to be removed are small fuels, including brush and down wood that will require "investments" as opposed to commercial sized material.

The NEPA document must address the fact that there is very little scientific support for aggressive thinning to reduce fire hazard. In fact, there is building scientific evidence that thinning can make the fuel hazard worse instead of better. Thinning makes forests "Hotter, Drier and Winder." Science still has a long way to go to be able to confidently predict the consequences of various combinations of thinning and other treatments. "Detailed site-specific data on anything beyond basic forest structure and fuel properties are rare, limiting our analytical capability to prescribe management actions to achieve desired conditions for altering fuels and fire hazard." Graham, Russell T.; McCaffrey, Sarah; Jain, Theresa B.(tech. eds.) 2004. Science basis for changing forest structure to modify wildfire behavior and severity. Gen. Tech. Rep. RMRS-GTR-120. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. 43 p. http://www.fs.fed.us/rm/pubs/rmrs_gtr120.html

Page 771 of BLM's 2007 WOPR DEIS admits that "The greater than canopy retained, the less influence wind has on surface fire. This in turn reduces flame length which can lead to reduced mortality. (Fire Behavior Field Reference Guide: NFES 2224)."

In a mixed-conifer, mixed-severity fire regime study area in SW Oregon, Crystal Raymond found that "Fire severity was greater in thinned treatments than untreated. … The additional fine wood left from the thinning operation (despite whole-tree yarding) most likely caused higher fire intensity and severity in the thinned treatments."

> … [T]he presence of activity fuels increased potential surface fire intensity, so increases in canopy base height did not decrease the potential for crown fire initiation. … [C]rown fire is not a prerequisite for high fire severity; damage and

> mortality of overstory trees in the wildfire was extensive despite the absence of crown fire, and the low predicted crown fire potential before and after the fuel treatment. Damage to and mortality of overstory trees were most severe in thinned treatments (80 – 100% mortality), least severe in the thinned and under-burned treatment (5% mortality), and moderate in untreated stands (53-54% mortality) following a wildfire in 2002. Fine fuel loading was the only fuel structure variable significantly correlated with crown scorch of overstory trees. Percentage crown scorch was the best predictor of mortality 2 years post-fire. Efforts to reduce canopy fuels through thinning treatments may be rendered ineffective if not accompanied by adequate reduction in surface fuels.

Crystal L. Raymond. 2004. The Effects of Fuel Treatments on Fire Severity in a Mixed-Evergreen Forest of Southwestern Oregon. MS Thesis. http://depts.washington.edu/nwfire/publication/Raymond_2004.pdf Raymond also found that "A greater percentage of pre-fire fine wood was consumed in the thinned plots than in the unthinned plots during the Biscuit fire suggesting that fine fuel moisture may have been lower in the thinned plots." And "the Biscuit Fire was observed to have more moderate fire behavior in stands with a sub-canopy tree layer compared to more open stands, suggesting that the sub-canopy trees did not function as ladder fuels. … Higher foliar moisture of broad-leaved species could have dampened fire behavior, inhibiting rather than aiding crown fire initiation."

Similarly, Hanson and Odion (2006)[15] compared wildfire behavior in seven previously thinned mixed-conifer forests vs. adjacent unthinned forest in the Sierra Nevada and found —

> Contrary to our hypothesis, the mechanically thinned areas had significantly higher fire-induced mortality ($p = .016$, $df = 6$) and combined mortality ($p = .008$, $df = 6$) than the adjacent unthinned areas. Thinned areas predominantly burned at high severity, while unthinned areas burned predominantly at low and moderate severity … Possible explanations for the increased severity in thinned areas include persistence of activity fuels, enhanced growth of combustible brush post-logging, desiccation and heating of surface fuels from increased insolation, and increased mid-flame windspeeds. Given that sampling transects in thinned versus unthinned areas were only 100 m apart in each experimental unit, fire weather should have been the same for the thinned and unthinned areas sampled in each site. Thus, mechanical thinning on these sites appears to have effectively lowered the fire weather threshold necessary for high severity fire occurrence.

A study in mixed-conifer forests in California showed that forest reserves were more effective than logging in terms of reducing fire hazard.

> [T]he efficacy of seven traditional silvicultural systems and two types of reserves used in the Sierra Nevada mixed conifer forests is evaluated in

[15] Hanson and Odion. 2006. FIRE SEVERITY IN MECHANICALLY THINNED VERSUS UNTHINNED FORESTS OF THE SIERRA NEVADA, CALIFORNIA 2006 Fire Congress Proceedings. http://www.emmps.wsu.edu/2006firecongressproceedings/Extended%20Abstracts%20PDf%20Files/Poster/hanson.pdf

> terms of vegetation structure, fuel bed characteristics, modeled fire behavior, and potential wildfire related mortality. The systems include old-growth reserve, young-growth reserve, thinning from below, individual tree selection, overstory removal, and four types of plantations. These are the most commonly used silvicultural systems and reserves on federal, state, and private lands in the western United States. Each silvicultural system or reserve had three replicates and varied in size from 15 to 25 ha; a systematic design of plots was used to collect tree and fuel information. The majority of the traditional silvicultural systems examined in this work (all plantation treatments, overstory removal, individual tree selection) did not effectively reduce potential fire behavior and effects, especially wildfire induced tree mortality at high and extreme fire weather conditions. Overall, thinning from below, and old-growth and young-growth reserves were more effective at reducing predicted tree mortality.

Scott L. Stephens and Jason J. Moghaddas. 2005. Silvicultural and reserve impacts on potential fire behavior and forest conservation: Twenty-five years of experience from Sierra Nevada mixed conifer forests. Biological Conservation 125 (2005) 369–379.

> Thinning opens stands to greater solar radiation and wind movement, resulting in warmer temperatures and drier fuels throughout the fire season. [T]his openness can encourage a surface fire to spread, …

USDA Forest Service; Influence of Forest Structure on Wildfire Behavior and the Severity of Its Effects, November 2003.
http://www.fs.fed.us/projects/hfi/2003/november/documents/forest-structure-wildfire.pdf

> Opening up closed forests through selective logging can accelerate the spread of fire through them because a physical principle of combustion is that reducing the bulk density of potential fuel increases the velocity of the combustion reaction. Wind can flow more rapidly through the flaming zone. Thinned stands have more sun exposure in the understory, and a warmer microclimate, which facilitates fire (Countryman 1955).
> …
> [F]uel reduction activities – particularly mechanized treatments – inevitably function to disturb soils and promote the invasion and establishment of non-native species. Pile burned areas associated with the treatments are also prone to invasion (Korb et al. 2004). Annual grasses can invade treated areas if light levels are high enough, leading to increased likelihood of ignition, and more rapid spread of fire, which can further favor annual grasses (Mack and D'Antonio 1998). This type of feedback loop following the establishment of non-native plants may result in an altered fire regime for an impacted region, requiring extensive (and expensive) remedial action by land managers (Brooks et al. 2004).

Odion, Dennis. 2004. Declaration in NWEA v. Forest Service. c*iting* Countryman, C. M. 1955. Old-growth conversion also converts fire climate. U.S. Forest Service Fire Control Notes 17: 15-19.

> Theoretically, fuel treatments have the potential to exacerbate fire behavior. Crown fuel reduction exposes surface fuels to increased solar radiation, which would be expected to lower fuel moisture content and promote production of fine herbaceous fuels. Surface fuels may also be exposed to intensified wind fields, accelerating both desiccation and heat transfer. Treatments that include prescribed burning will increase nutrient availability and further stimulate production of fuels with high surface-area-to-volume ratios. All these factors facilitate the combustion process, increase rates of heat release, and intensify surface fire behavior.
>
> …
>
> Thus, treatments that reduce canopy fuels increase and decrease fire hazard simultaneously. …. Still unanswered are questions regarding necessary treatment intensities … more information is clearly needed.

Omi, P.N., and Martinson, E. J. 2002. Effect of fuels treatment on wildfire severity. Final report. Western Forest Fire Research Center. Submitted to the Joint Fire Science Program Governing Board
http://www.cnr.colostate.edu/frws/research/westfire/FinalReport.pdf

EPA also recognizes that unmaintained fuel management zones can "increase the risk of fire as slopes are opened up to sunlight and undergrowth is stimulated." See EPA 2-18-04 comments on the Biscuit Fire Salvage Project.

"Accelerating the development of multi-storied stands may increase the risk of wildfire." Andrews, Perkins, Thrailkill, Poage, Tappeneiner. 2005. Silvicultural Approaches to Develop Northern Spotted Owl Nesting Sites, Central Coast Ranges, Oregon. West. J. Appl. For. 20(1):13-27.

The Forest Trust conducted a thorough literature review and found that:

- Although the assertion is frequently made that simply reducing tree density can reduce wildfire hazard, the scientific literature provides tenuous support for this hypothesis.
- The literature leaves little doubt, however, that fuel treatments can modify fire behavior. Thus**, factors other than tree density, such as the distance from the ground to the base of the tree crown, surface vegetation and dead materials play a key role. Research has not yet fully developed the relationship among these factors in changing fire behavior.**
- The specifics of how treatments are to be carried out and the relative effectiveness of alternative prescriptions in changing wildfire behavior are not supported by a significant consensus of scientific research at this point in time.
- Substantial evidence **supports the effectiveness of prescribed fire**, a treatment that addresses all of the factors mentioned above.

Significantly, several empirical studies demonstrated the effectiveness of prescribed fire in altering wildfire behavior.

- By contrast, we found a limited number of papers on the effects of mechanical thinning alone on wildfire behavior. The most extensive research involved mathematical simulation of the impact of mechanical thinning on wildfire behavior. However, the results of this research are highly variable.
- A more limited number of studies addressed the effectiveness of a **combination of thinning and burning** in moderating wildfire behavior. The impacts varied, depending on the treatment of thinning slash prior to burning. Again, **crown base height appeared as important a factor as tree density. The research community is still building a scientific basis for this combination of treatments.**
- **The proposal that commercial logging can reduce the incidence of canopy fire was untested in the scientific literature. Commercial logging focuses on large diameter trees and does not address crown base height – the branches, seedlings and saplings which contribute so significantly to the "ladder effect" in wildfire behavior.**
- Much of the research on the effectiveness of fuel treatments uses dramatically different methodology, making a comparison of results difficult. To provide a basis for analysis, we structured our review of the literature into four general groupings: observations, case studies, simulation models and empirical studies. Empirical studies provide the strongest basis for evaluating treatments whereas personal observations are the least reliable.
- **We found the fewest studies in the most reliable class – empirical research. We found the greatest number of studies in the least reliable class of research – reports of personal observation. Several other reviews of the literature confirm this finding, stating that the evidence of the efficacy of fuel treatment for reducing wildfire damage is largely anecdotal.**
- The **results of simulation studies are highly variable**, in terms of such factors as fire spread, intensity and the occurrence of spotting and crowning.
- Scientists recognize **that large scale prescribed burning and mechanical thinning are still experimental and may yet reveal unanticipated effects on biodiversity, wildlife populations and ecosystem function.**

Henry Carey and Martha Schumann. Modifying WildFire Behavior – The Effectiveness of Fuel Treatments — The Status of Our Knowledge. April 2003; http://www.theforesttrust.org/images/swcenter/pdf/WorkingPaper2.pdf This report also said:

> Stephens [1998. "Evaluation of the effects of silvicultural and fuels treatments on potential fire behaviour in Sierra Nevada mixed-conifer forests." *Forest Ecology and Management* 105(1):21-35.] used FARSITE to investigate the interaction

> between slash from logging and fire behavior. When silvicultural treatments were conducted without reducing slash, the simulated fire behavior appeared more extreme than in the area that had not been harvested at all.
> …
> We did not find any empirical studies that evaluated commercial harvesting as a means of altering fire behavior. … studies suggest that slash resulting from logging is a key factor in predicting subsequent fire risk and that removal of large diameter trees alone may contribute to increased fire severity.
> …
> A report prepared for Congress stated: "We do not presume that there is a broad scientific consensus surrounding appropriate methods or techniques for dealing with fuel build-up or agreement on the size of areas where, and the time frames when, such methods or techniques should be applied" (US GAO RCED-99-65. 1999:56). A research report by Omi and Martinson (2002:1) stated: "Evidence of fuel treatment efficacy for reducing wildfire damages is largely restricted to anecdotal observations and simulations."

Duke University issued an "expert advisory" May 24, 2004 with Professor Norm Christensen saying:

> "…the practice of suppressing wildfires has allowed debris to accumulate to dangerous levels on the forest floor."
>
> Indiscriminate logging aggravates the problem by thinning a fire-prone forest's canopy and littering its floor with sawdust and other combustible debris.
>
> "Loss of canopy increases wind speed and air temperatures and decreases humidity in the forest," Christensen notes. "As a result, ground fuel fires that break out can spread faster and farther than they would normally."

http://www.ascribe.org/cgi-bin/spew4th.pl?ascribeid=20040524.081406

Studies have shown that thinned stands are warmer and windier than unthinned stands. Trevor D. Hindmarch and Mary L. Reid. Effects of Commercial Thinning on Bark Beetle Diversity and Abundance. PROJECT REPORT 1999-13. May 1999.
http://sfm-1.biology.ualberta.ca/english/pubs/PDF/PR_1999-13.pdf
(see figures 2&3, pp 14-15).

The 9th Circuit recently admonished the Forest Service to ensure the effectiveness of treatments before embarking on potentially irreversible treatment programs.

> Just as it would be arbitrary and capricious for a pharmaceutical company to market a drug to the general population without first conducting a clinical trial to verify that the drug is safe and effective, it is arbitrary and capricious for the Forest Service to irreversibly "treat" more and more old-growth forest without first determining that such treatment is safe and effective for dependent species.
> ...

> The EIS discusses in detail only the Service's own reasons for proposing treatment, and it treats the prediction that treatment will benefit old-growth dependent species as a fact instead of an untested and debated hypothesis."

Ecology Center v. Austin, 9th Circuit. Dec 8, 2005. http://tinyurl.com/b37k4

The NEPA document must acknowledge the paucity of scientific support for commercial logging to reduce fuels and reduce fire effects and fails to recognize that logging often increases fine fuel loads while removing the large logs that are relatively less prone to burn. Thinning also increases wind and light penetration of the canopy and causes fuels to dry out which make them more prone to burn and increases the time it takes woody material to decompose. Removing medium and large trees also removes shade and resource competition that helps suppress the growth of small trees and brush known as "ladder fuels."

In a challenge to a timber sale in the Sierra Nevada Mountains, U.S. District Judge Morrison C. England Jr. found on July 1, 2003 that John Muir Project and Earth Island Institute had made a strong case that logging slash could fuel future fires and that logging would harm wildlife habitat by increasing the risk of fire. A stay to halt the fuels reduction project was granted. Judge England issued a temporary restraining order (TRO) in Earth Island Institute v. USDA Civ. No. S-03-1242 MCE DAD (Eastern District of California 2003) because logging would create "extreme levels of flammable slash."

Consider these words from Mike Dombeck, former Chief of the Forest Service:

> "Some argue that more commercial timber harvest is needed to remove small-diameter trees and brush that are fueling our worst wildlands fires in the interior West. However, small-diameter trees and brush typically have little or no commercial value. To offset losses from their removal, a commercial operator would have to remove large, merchantable trees in the overstory. Overstory removal lets more light reach the forest floor, promoting vigorous forest regeneration. Where the overstory has been entirely removed, regeneration produces thickets of 2,000 to 10,000 small trees per acre, precisely the small diameter materials that are causing our worst fire problems. In fact, many large fires in 2000 burned in previously logged areas laced with roads. It seems unlikely that commercial timber harvest can solve our forest health problems."

Dombeck on Fires in 2001 - How Can We Reduce the Fire Danger in the Interior West (Fire Management Today, Winter 2001, page 11).

As eloquently stated by Neil Lawrence:

> We're a long way from a model that accounts for the drying affect of insolation and increased wind penetration, the loss of water from run-off on machine compacted soil, the increased availability of residual fine fuels post-thinning, the morbidity and mortality associated with diseases and pests imported by logging equipment, and all the other real world phenomena that cut against the ivory tower view that large fuel structure and crown bulk density are the sole significant drivers of fire occurrence, intensity, and spread.

Logging very likely will have little effect on the severity or controllability of large intense canopy fires that are of most concern both environmentally and economically. If proposed logging has any effect it will likely lead to increased controllability of low intensity surface fires, but these lower intensity fires are precisely the fires that are beneficial ecologically and should probably not be controlled. So logging will help control fires which should remain wild and free, while logging will fail to control that which is most destructive.

SW Oregon fire regimes are unique

Fuel reduction projects in SW Oregon must consider the implications of 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.

Excerpts:

> Tree plantations experienced twice as much severe fire as multi-aged forests. (Abstract)
>
> We concluded that fuel buildup in the absence of fire did not cause increased fire severity as hypothesized. Instead, fuel that is receptive to combustion may decrease in the long absence of fire in the closed forests of our study area, which will favor the fire regime that has maintained these forests. However, plantations are now found in one-third of the roaded landscape. Together with warming climate, this may increase the size and severity of future fires, favoring further establishment of structurally and biologically simple plantations. (Abstract)
>
> Forestry practices other than fire exclusion also may influence fire regimes. Even-aged silviculture can increase fire hazard by creating more combustible fuel complexes (Perry 1994; Weatherspoon & Skinner 1995). (Page 928)
>
> The hypothesis that fire severity is greater where previous fire has been long absent was refuted by our study (Table 1). There was three times more high-severity fire in areas last burned since 1920 (recently burned landscape). The amount of high-severity fire in all areas previously burned in 1920 or earlier (long-unburned landscape) was significantly lower than in the burned landscape as a whole ($Z=-2.10$, $n=86$, $p=0.018$). (Page 932)
>
> Areas burned severely in 1977 were subsequently logged with helicopters. Activity fuels (branches and tops of trees) left untreated after such logging could have contributed to the elevated fire severity in nonforest vegetation in the 1987 reburn compared with elsewhere. (Page 932-3)

There was little overall difference in fire severity between roaded and unroaded areas, even though tree plantations had twice the burn severity of closed-canopy forests (Table 1). Fire severity tended to increase with plantation age. (Page 933)

We found evidence for important changes in combustibility over time because the probability of stand-replacing fire was lower in long-unburned forests. A number of factors may contribute to this pattern. (Page 934)

The much greater fire severity we found in early successional, nonforest vegetation will tend to favor the persistence of this vegetation. In the long absence of stand-replacing fire, however, it is replaced by forests (Wills & Stuart 1994). Multi-aged, closed forests become less combustible with time since fire, and therefore become more likely to persist when fire does occur following a long fire-free interval. Temporal heterogeneity in fire, like its spatial counterpart, appears to be important to the maintenance of both successional types and a naturally patchy landscape structure in our study area. (Page 934)

Plantations of any age are more receptive to combustion than co-occurring forests in our study area. Because plantations are often established following high-severity fire, a self-reinforcing relationship is possible (Perry 1995).

Weather conditions often override the sensitivity of a fire regime to internally regulated biomass processes operating over time…. Extreme fire weather was previously invoked as the primary explanation for fire-severity patterns in the 1987 fires in the Klamath-Siskiyou region (Agee 1997), although strong local effects of plantations and logging were also observed (Weatherspoon &Skinner 1995). (Page 934)

In our study area, harvest treatments to reduce fire severity based on a model of fuel build-up in the absence of fire would be misdirected because long-unburned areas exhibited the lowest fire severity. Moreover, these treatments may be ecologically detrimental because stand-replacing or stand-thinning fire plays a key role in the regeneration of Douglas-fir and most other conifers and natural vegetation in our study areas (Wills &Stuart 1994, Thornburgh 1995). (Page 935)

Other elements of biodiversity may depend on these fire effects and the habitat heterogeneity that results. There are also more immediate biological consequences of harvest treatments-for example, to understory plants, soil organisms, and aquatic resources. The potential for these treatments to spread exotic forest diseases and plants also needs to be addressed. (Page 935)

Conversely, fuel treatments that reduce fire severity in portions of the landscape where human activities have increased available fuel will address the problem of unnaturally high fire severity. Not only have we found high fire severity in plantations but, working in the same region, Key (2000) also found that

plantations and adjacent vegetation burned more severely than natural forests (see also Weatherspoon & Skinner 1995). (Page 935)

SUMMARY

Contemporary wildland fires in the western Klamath Mountains exhibit severity patterns consistent with those of historical fires. Low-severity fire effects predominate with variable amounts of moderate and highly severe effects creating landscape patches. Only differences in mapping criteria applied to fires in 2001 and 2002 reflect severity patterns different from those of historical fires.

Long absence of fire predicts low severity fire effects. Absence of fire enables closed canopy forest vegetation to replace shrub and open forest vegetation through succession. Shade reduces available fuel below the canopy as well as its potential surface heat output during fire events, making canopy fires less likely to occur. Therefore, severe fire effects are not correlated with the age of woody fuels. Instead, weather and climate dictate canopy fire behavior in closed canopy forests.

The proportion of highly severe fire effects in 1987 was greatest in open forest and non-forest vegetation. High-severity effects to vegetation communities dominated by shrubs, hardwoods and young trees tend to maintain that vegetation over time, just as fires of lower severity in closed canopy forests tend to maintain that vegetation type. This heterogeneity of fire effects may be an important contributor to landscape structure and biodiversity. Stand replacing fires, to some degree, are ecologically beneficial.

The spatial distribution of highly severe fire effects in 1987 was strongly associated with the previous occurrence of fires that exhibited high-severity effects in the same locations. Much of the observed high-severity "reburn" effects happened where post-fire salvage logging in 1977 had left behind flammable slash and tree plantations.

Tree plantations, which typically follow high-severity fires under traditional forestry practices, exhibited "twice the burn severity" of closed canopy forests (20 percent), even though they accounted for only four (4) percent of the study area. The relative combustibility of structurally homogenous tree plantations supports a self-reinforcing "feedback" dynamic of high-severity fires, and the authors anticipate continued high-severity fires in roaded and planted portions of the landscape.

IMPLICATIONS

The central conclusion of the paper is that long absence of fire predicts low-severity fire effects in Klamath mixed evergreen forests. This conclusion has four management implications:

1. The fuel build-up model formulated for southwestern ponderosa pine forests does not apply to Klamath mixed evergreen forests, and fuel treatments intended to prevent crown fires based on this model are misdirected.

2. Fuel treatments designed to impose a low-severity fire regime may be ecologically detrimental because highly severe fire effects, to some degree, support diverse vegetation community structures and habitats for which the Klamath region is globally unique. Some fuel treatments also may adversely affect soils, water quality, wildlife habitat, and spread noxious weeds.

3. Fuel treatments may be ecologically beneficial in tree plantations where past logging left behind unnatural fuel profiles.

4. Naturally ignited wildland fires may be beneficial to a variety of conservation objectives in Klamath forests. Home ignitability mitigation in the wildland-urban interface may increase options for backcountry wildland fire use.

Avoid Roadbuilding Please

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

Noss, Reed; The Ecological Effects of Roads;
http://www.wildrockies.org/WildCPR/reports/ECO-EFFECTS-ROADS.html
http://www.wildlandscpr.org/roads/reports/ecoleffectsroads.html

See also NRDC Report: "End of the Road: The Adverse Ecological Impacts of Roads and Logging: A Compilation of Independently Reviewed Research" (1999) which discusses the fact that roads:
1. Harm Wildlife
2. Spread Tree Diseases and Bark Beetles
3. Promote Insect Infestations
4. Cause Invasion by Harmful Non-native Plant and Animal Species
5. Damage Soil Resources and Tree Growth
6. Adversely Impact Aquatic Ecosystems
http://www.nrdc.org/land/forests/roads/eotrinx.asp

See also this annotated bibliography of road related research:
http://www.wildlandscpr.org/resourcelibrary/rremresources/RoadReferences.doc

A Draft Review and Comment on: Forest Service Roads: A Synthesis of Scientific Information, 2nd Draft, USDA FS:
Ecological impacts - by Jack Wade
(http://www.wildlandscpr.org/roads/reports/wade_report2.html)
Socio-economic impacts - by Daniel Brister
(http://www.wildlandscpr.org/roads/reports/brister_commnets.html)

The agency lacks the funds to maintain existing roads, so it is arbitrary and capricious to build more. In Oregon alone, there are over 70,000 miles of national forest roads with more than a half billion dollars of deferred maintenance needs. Over 100 million dollars of that maintenance need is considered "critical." From 1998 to 2002, the Forest Service subsidized road construction to the tune of almost $40,000,000.00 See Road Wrecked: Why the $10 Billion Forest Service Road Maintenance Backlog Is Bad for Taxpayers, Taxpayers for Common Sense. March 2004.
http://www.taxpayer.net/forest/roadwrecked/

The Forest Service has reported that forest roads have negative effects on water quality, fires, wildlife habitat, invasion by exotic species, and local economies. USDA Forest Service, "Forest Roads: A Synthesis of Scientific Information," Pacific Northwest Research Station, General Technical Report PNW-GTR-509. May, 2001. Page 4.

ROADS CAUSE MORE FIRES and BIGGER FIRES

According to the Forest Service:

- The number of large fires are dramatically higher in areas that are already roaded than in inventoried roadless areas. USDA Forest Service, Roadless Area Conservation Final Environmental Impact Statement, Volume 1. November, 2000. Page 3-115.
- Human-caused wildland fire is nearly five times more likely to occur on essentially roaded lands than on essentially unroaded lands. USDA Forest Service, Roadless Area Conservation Final Environmental Impact Statement, Volume 1. November, 2000. Page 3-116.
- According to independent scientists: Based on an objective study over 15 years, large wildfires are more likely to occur and to burn to greater extents in areas outside of roadless areas. Eastman, Jill C., John R.G. Townshend, Christopher O. Justice, Robert Sohlberg, and Compton J. Tucker. "Roadless Areas and Forest Fires in the Western United States." May 29, 2002: American Geographical Union Spring Meeting.

ROADS POLLUTE CLEAN WATER

According to the Forest Service:

- Road construction and timber harvest can result in measurable reductions in water quality. USDA Forest Service, Roadless Area Conservation Final Environmental Impact Statement, Volume 1. November, 2000. Page 3-49.
- More than 60 million people in 3,400 communities in 33 states rely on national forests for their drinking water.

ROADS INCREASE THE SPREAD OF NON-NATIVE ORGANISMS

According to independent scientists, the spread of both native and exotic pests and pathogens in many forest systems can be linked to the ready travel corridors provided by extensive road networks.

- Trees at forest edges created by roads had 2.4 times more gypsy moth egg masses than trees in the forest interior. Bellinger, R.G., F. W. Ravlin and M.L. McManus. "Forest Edge Effects and Their Influence on Gypsy Moth (Lepidoptera: Lymantriidae) Egg Mass Distribution." 1989. Environmental Entomology. 18: 840-843.
- Forest edges have been found to be source populations for tent caterpillars. Roland, J. "Large-Scale Forest Fragmentation Increases the Duration of Tent Caterpillar Outbreak." 1993. Oecologia 93:25-30.

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

The November 2000 National Forest Roadless Area Conservation FEIS says:

> In addition to posing many of the same risks as road construction, road reconstruction could result in substantial changes in the kinds and amount of human uses in an area. Improvements such as realignment or improving road surfacing or gradient to provide easy access for low clearance vehicles may promote increases in the amount of human disturbances and disruptions to species and habitats, exceeding those previously experienced before reconstruction.

Temporary Roads

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

The Roadless FEIS also says:

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

Roadless Area Conservation FEIS — Specialist Report for Terrestrial and Aquatic Habitats and Species prepared by Seona Brown and Ron Archuleta, EIS Team Biologists http://roadless.fs.fed.us/documents/feis/specrep/index.shtml

For the semi-permanent roads that will be tilled, BLM's own soils scientist has little faith in the restorative value of this technique. He says: "What I have seen so far have been nothing more than modified rock rippers and little lateral fracture of the soil occurs and the extent of de-compacting is very limited." Coos Bay BLM, Big Creek Analysis file, section F, Soils Report. page 4.

The agency assumes that temporary and semi-permanent new roads will have no effect because they are temporary. The agency has shown no scientific evidence for this assumption. In fact, scientific research has shown exactly the opposite. Effectiveness of Road Ripping in Restoring Infiltration Capacity of Forest Roads. Charles H. Luce, USDA Forest Service Intermountain Research Station, 1221 S. Main, Moscow, ID 83843. September 1996. Restoration Ecology, Vol. 5, No. 3. page 268.

Research results, published in *Restoration Ecology,* shows there is nothing temporary about temporary roads, and that ripping out a road is NOT equal to never building a road to begin with. The saturated hydraulic conductivity of a ripped road following three rainfall events was significantly greater than that of the road surface before ripping... most saturated hydraulic conductivities after the third rainfall event on a ripped road were in the range of 22 to 35 mm/hr for the belt series and 7 to 25 mm/hr for the granitics. These conductivities are modest compared to the saturated hydraulic conductivity of a lightly disturbed forest soil of 60 to 80 mm/hr." id. Even this poor showing of restoring pre-road hydrologic effects worsened with repeated rainfall. "Hydraulic conductivity values for the ripped treatment on the granitic soil decreased about 50% with added rainfall (p(K1=K2)=0.0015). This corresponded to field observations of soil settlement and large clods of soil created by the fracture of the road surface dissolving under the rainfall... The saturated hydraulic conductivity of the ripped belt series soils also dropped from its initial value. Initially, and for much of the first event, the ripped plots on the belt series soil showed no runoff. During these periods, run-off from higher areas flowed to low areas and into macropores.... Erosion of fine sediment and small gravel eventually clogged these macropores... Anecdotal observations of roads ripped in earlier years revealed that after one winter, the surfaces were nearly as solid and dense as the original road surfaces." Id. Even though ripped roads increase water infiltration over un-ripped roads, it does not restore the forest to a pre-road condition. "These increases do not represent "hydrologic recovery" for the treated areas, however, and a risk of erosion and concentration of water into unstable areas still exists." Luce, C.H., 1997. Effectiveness of Road Ripping in Restoring Infiltration Capacity of Forest Roads, Restoration Ecology; 5(3):265-270. http://www.fs.fed.us/rm/boise/teams/soils/People/luce.htm

Plan and implement road systems with big storms in mind.

Big storms are the driving force behind many large geomorphologic events such as floods, landslides, etc, that shape underlying forest hydrology. Project design must look beyond the 2-5 year storms that are typically considered.

Roads and their artificial water drainage structures are long-lasting alien features in the forest landscape and the effects of big storms are particularly important to consider in the decision whether, where and how to build roads and how to drain them.

Road-stream crossings can be highly dynamic during large storms, so they must consider large events, and not just rosy scenarios where culverts remain unblocked.

Avoid Regen Harvest

Regen harvest is far worse than thinning (and thinning worse than no action) in terms of: habitat destruction and fragmentation, soil erosion, soil compaction, degraded soil foodweb, degraded water quality, future snag recruitment, edge effects including blowdown, rain-on-snow effects including peak flows, degraded scenic values, release of sequestered carbon pools, lost wilderness potential, and increased fire hazard. The NEPA analysis must make these distinctions crystal clear to the public and the decision maker.

Plantations are a fire hazard

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).[16]

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

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. are 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.[2] Page 26-27.

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.worldwildlife.org/forests/attachments/fire_report.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.

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.fs.fed.us/rm/pubs/rmrs_gtr114/rmrs_gtr114_2.pdf

Odion, D.C., J.R. Strittholt, H. Jiang, E.J. Frost and D.A. DellaSala. 2004. Fire history and severity patterns and forest management in the Klamath National Forest, northwestern California, USA. Ecological Applications.

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.

> "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.

Basically it is almost impossible to have a beneficial surface fire in a dense young plantation because the fuel is too close to the ground. 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). 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://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.

> 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).

Logging after fire also increases future fire risks.

The Biscuit Fire in southern Oregon was the largest fire in Oregon's history in terms of acreage. A large part of this fire area had burned 15 years earlier in 1987. Researchers found that areas that had been logged after the Silver Fire burned with much higher severity than those that were unlogged. While only 28% of the unlogged portions of the Silver Fire burned with high severity in the Biscuit Fire, 68% of the logged portion burned severe. The unlogged portion of the Silver Fire area experienced relatively equal amounts of land burning as high, moderate, low and unburned. The vegetation mortality in the logged units stands out in sharp contrast to the conditions in the unlogged land that was also affected by the 1987 Silver Fire. (Harma and Morrison 2003).

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

Unsalvaged, naturally regenerated, young stands are one of the rarest forest types in the Pacific northwest, and their biodiversity rivals that of old-growth forests.

> Indeed, naturally developed early-successional forest habitats, with their rich array of snags and logs and nonarborescent vegetation, are probably the scarcest habitat in the current regional [Pacific Northwest] landscape.

Lindenmayer, David B. and Jerry F. Franklin. 2002. Conserving Forest Biodiversity: A Comprehensive Multiscale Approach. Island Press. Washington, DC: 69. *See also*, DellaSala, D.A., J.E. Williams, C. Deacon-Williams, and J.F. Franklin. Beyond smoke and mirrors: a synthesis of fire policy and science. In review - Conservation Biology.

> "There has been a loss of diverse young forests on all ownerships. … Conservation of diverse young forests has received little attention in forest policy."

Janet Ohmann; Science Findings, Issue 56; Seeing the trees for the forest: mapping vegetation biodiversity in coastal Oregon forests; (September 2003). http://www.fs.fed.us/pnw/sciencef/scifi56.pdf

If this project involves artificial planting, avoid dense replanting that creates dense homogenous plantations. Such areas inhibit biodiversity and also represent dangerous fuel conditions. Please replant in patches and/or at a fairly low density and avoid the need for future thinning and other stand management costs. Let's be patient and allow these stands recover slowly as diverse early seral communities. Diverse early seral plant communities are becoming less common and we should encourage slow and easy regeneration of forest communities. This is consistent with the research being done by Nathan Poage which indicates that many stands developed over much longer time periods than we typically allow under the agricultural model of forest management. David Hibbs' research is also showing that natural regeneration is sufficient to reforest most sites after disturbance.[17] And Jerry Franklin points out that the more diverse forests that develop from natural regeneration are more resilient to climate change.

Brown and Kertis studied the seedlings that came up naturally after the Warner Creek fire, and found that "seedling density can vary a lot within a plot. You might have a general density of 50 thousand per hectare, but locally those numbers could be anywhere from 0 to 300 per hectare. These seedlings are numerous, but not laid out in a grid!" http://www.brownandbrown.tv/warner-presentation-2002-05-14b.pdf

Plantation forestry is bad for soil

Clearcutting reduces soil organic matter, simplifies vegetation diversity, and ultimately reduces soil productivity.

[17] http://oregonstate.edu/dept/ncs/newsarch/2007/Apr07/forestrecovery.html

Tree Species Control of Soil Nutrients in Old-Growth Forests. Tree species directly and indirectly affect soil nutrient cycles and fertility. On July 27, [2006] graduate student Alison Cross will present her Master's thesis research characterizing how common late-successional tree species influence soils in forests of the Oregon Coast Range. Soils in old-growth forests containing Douglas-fir, western hemlock, western redcedar, and bigleaf maple were sampled for carbon and nitrogen (elements derived from the atmosphere) and other nutrients derived from rock weathering. For carbon and nitrogen, tree species effects on nutrient status emerged only at carbon- and nitrogen-rich sites. For rock-derived nutrients, species imprints on soils occurred across all levels of site fertility. Each tree species fostered a unique soil chemical profile when all nutrients are considered, so that no single species increased the availability of all nutrients at all sites. Consequently, forest management that results in stands dominated by a single tree species are likely to reduce soil nutrient complexity, which may reduce soil fertility overall.

http://fresc.usgs.gov/news/highlights.asp?HDate=07212006
CFER 2005 Annual Report:
http://www.fsl.orst.edu/cfer/pdfs/CFER_ar05.pdf
http://www.fsl.orst.edu/cfer/research/resproj/structr/str-stdy/s17.html

Thinning must be very carefully done.

Thinning must be done very carefully (and in many cases avoided) in order to avoid, minimize, and mitigate logging's numerous adverse ecological effects including: (1) removal of large trees that are disease and fire resistant (Frost 1999); (2) increased levels of fine fuels and short term fire hazard (Weatherspoon 1996, Huff et al. 1995, Wilson & Dell 1971, Fahnestock 1968); (3) increased mortality of residual trees due to pathogens and mechanical damage to boles and roots (Filip 1994, Hagle & Schmitz 1993); (4) damage to soil integrity through increased erosion, compaction, and loss of litter layer (Harvey et al. 1994, Meurisse & Geist 1994); (5) creation of sediment that may eventually be delivered to streams and harm fish (Grant & Wolff 1991, Beschta 1978); (6) retention of insufficient densities of large trees and woody debris to sustain viable populations of cavity-nesting and woody debris dependent species (DellaSala et al. 1996); and (7) reduced habitat quality for sensitive species associated with cool, moist microsites or closed canopy forests (FEMAT 1993, Thomas et al. 1993).

General plantation thinning recommendations

Oregon Wild makes the following recommendations to enhance the quality of restoration-thinning prescriptions:

1. When conducting commercial thinning projects take the opportunity to implement other critical aspects of watershed restoration especially pre-commercial thinning,

restoring fish passage, reducing the impacts of the road system, and treating invasive weeds.

2. Focus on treating the youngest stands that are most "plastic" and amenable to restoration.
3. Generally retain all the largest trees, then “free thin from below” retaining some smaller trees in all age-size classes.
4. Retain and protect under-represented conifer and non-conifer trees and shrubs.
5. Strive for a variable density outcome. Use your creativity to establish diversity and complexity both within and between stands. Use skips and gaps within units to help achieve diversity. Gaps should be small, while skips should be a little larger, but even small clumps and patches of trees are desirable. Gaps should not be clearcut but rather should retain some residual structure in the form of live or dead trees. Landings do not make good gaps because they are clearcut, highly compacted and disturbed, more likely subject to repeated disturbance, and directly associated with roads.
6. The scale of patches in variable density thinning regimes is important. Ideally variability should be implemented at numerous scales ranging from small to large, including: the scale of tree fall events; pockets of variably contagious disturbance from insects, disease, and mixed-severity fire; soil-property heterogeneity; topographic discontinuities; the imprint of natural historical events; etc.
7. Retain abundant snags and course wood both distributed and in clumps so that thinning mimics natural disturbance. Retention of dead wood should generally be proportional to the intensity of the thinning, e.g., heavy thinning should leave behind more snags not less. Retain wildlife trees such as hollows, forked tops, broken tops, leaning trees, etc.
8. Thin heavy enough to stimulate development of understory vegetation, but don’t thin too heavy. Recognize that thinning captures mortality and that plantation stands are already lacking critical values from dead wood due to the unnatural stand history of all clearcut and planted stands.[18]
9. If using whole tree yarding or yarding with tops attached to control fuels, the agency should top a portion of the trees and leave the greens in the forest in order to retain nutrients on site.

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

10. Avoid impacts to raptor nests and enhance habitat for diverse prey species. Train marking crews and cutting crews to look up and avoid cutting trees with nests of any sort and trees with defects.
11. Take proactive steps to avoid the spread of weeds. Use canopy cover to suppress weeds.
12. Buffer streams from the effects of heavy equipment and loss of bank trees and trees that shade streams. Mitigate for the loss of LWD input by retaining extra snags and wood in riparian areas. Recognize that thinning captures mortality that is not necessarily compensated by future growth.[19]
13. Avoid road construction. Where road building is necessary, ensure that the realized restoration benefits far outweigh the adverse impacts of the road. Rank new road segments according to their relative costs (e.g. length, slope position, soil type, ease of rehabilitation, weed risk, native vegetation impacts, etc.) and benefits (e.g. acres of restoration facilitated), then use that ranking to consider dropping the roads with the lowest ratio of benefits to costs. Do not allow log hauling during the wet season.
14. Make the NEPA analysis transparent and explicit on all these issues.

Thinning in riparian reserves.

Thinning in riparian reserves does in fact raise ambient air temperatures that the microclimate effects must be accounted for. Anderson, Paul D.; Larson, David J.; Chan, Samuel S. 2007. Riparian Buffer and Density Management Influences on Microclimate of Young Headwater Forests of Western Oregon. Forest Science, Volume 53, Number 2, April 2007 , pp. 254-269(16).
http://www.ingentaconnect.com/content/saf/fs/2007/00000053/00000002/art00012

Thinning in stands of trees that are not yet of "pool forming" size should be beneficial, but after trees are of pool-forming size thinning might just capture and remove the mortality that should end up in the stream. (In simplistic terms, a pool-forming tree is one big enough to fall all the way across the stream, so it varies by stream size). See Roni and Beechie (2002) below.

There are also two schools of thought on thinning in large wood source areas such as landslide prone areas (which are supposed to be protected in riparian reserves). Some fear thinning will increase the risk of premature mass movement while the trees are still small, and end up delivering fewer and smaller trees than if left unthinned. Others think the increase risk of slides from partial removal is minimal and these are an area where thinning should be targeted in order to grow bigger trees faster for eventual delivery to streams. Please discuss this question in the NEPA analysis.

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

Also, when the objective of riparian thinning is to develop structures suitable for instream habitat structures, there is a trade-off between the size of individual pieces and the absolute volume of woody input. Contrary to common assumptions, thinning is not a zero sum game, especially not in the years immediately follow thinning. The wood that is captured and removed does not regrow for decades, and if a disturbance event comes along during that time, the absolute volume of wood recruited to streams WILL be adversely affected. "[T]he data have not supported early expectations of 'bonus' volume from thinned stands compared with unthinned. … [T]hinnings that are late or heavy can actually decrease harvest volume considerably." Talbert and Marshall. 2005. Plantation Productivity in the Douglas-fir Region Under Intensive Silvicultural Practices: Results From Research And Operations. Journal of Forestry. March 2005. pp 65-70 *citing* Curtis and Marshall. 1997. LOGS: A Pioneering Example of Silvicultural Research in Coastal Douglas-fir. Journal of Forestry 95(7):19-25.

See Roni, Philip, Timothy J. Beechie, Robert E. Bilby, Frank E. Leonetti,2 Michael M. Pollock, And George R. Pess. 2002. **A Review of Stream Restoration Techniques and a Hierarchical Strategy for Prioritizing Restoration in Pacific Northwest Watersheds.** *North American Journal of Fisheries Management* 22:1–20, 2002 American Fisheries Society 2002
http://yosemite.epa.gov/R10/ECOCOMM.NSF/adea00f56cb8903f88256ab6007a3a6f/a10e063e194cecbb88256c0900743686/$FILE/Ronietal2002.pdf

> Beechie et al. (2000) [i.e. Beechie, T., S. Bolton, G. Pess, R. Bilby, and P. Kennard. 2000. Rates and pathways of recovery for woody debris recruitment in northwestern Washington streams. North American Journal of Fisheries Management. 20:436–452] provided guidance for determining when thinning is appropriate and when it will result in a loss of near-term recruitment of LWD that may create fish habitat. Their model predicts that thinning of the riparian forest does not increase recruitment of pool-forming LWD where the trees are already large enough to form pools in the adjacent channel and that thinning reduces the availability of adequately sized wood. Conversely, thinning increases LWD recruitment in riparian areas where trees are too small to form pools within the adjacent channel.

General recommendations for fuel reduction thinning

1. When conducting commercial thinning projects take the opportunity to implement other critical aspects of watershed restoration especially reducing the impacts of the road system and livestock grazing and establishing the ecological processes that will allow streams and fire regimes to recover.
2. Try to restore ecological *processes* that can be self-sustaining; don't just restore forest *structure* which requires continuous expenditure of money and effort to maintain.

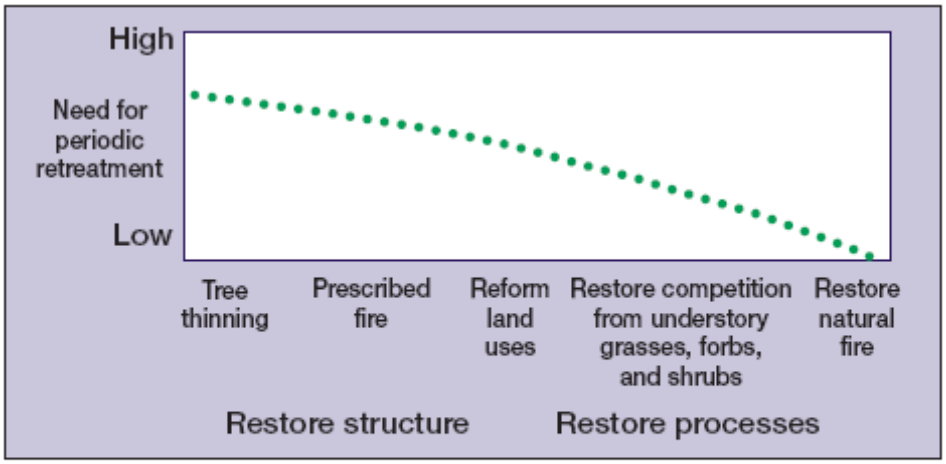

Figure 4. Forest restoration varies along a continuum from restoring structure (which requires periodic retreatment) to restoring potentially self-sustaining processes.

www.frontiersinecology.org

Reed F Noss, Jerry F Franklin, William L Baker, Tania Schoennagel, and Peter B Moyle. 2006. Managing fire-prone forests in the western United States. Front Ecol Environ 2006; 4(9): 481–487. http://spot.colorado.edu/~schoenna/images/Nossetal2006Frontiers.pdf

3. Don't let logging economics determine restoration priorities. If we restore primarily those areas that have commercial sized logs and fail to treat the thousands of acres of areas lacking economic return, we will not be accomplishing real restoration which requires carefully and strategically choosing the subset of the landscape that can be treated to provide the greatest gain (both ecological and fire hazard reduction) for the least ecological "cost" in terms of soil, water, wildlife, and weeds. Allowing economics to drive these choices will result in greater ecological impacts and lower ecological gains. The NEPA analysis must honestly disclose what "needs" treatment vs. what is actually being proposed so the public can see what's being sacrificed.
4. Use the historic range of variability as a guide, but don't just focus on seral stage. Consider also the historic abundance of ecological attributes like large trees, large snags, roadless areas, etc. all of which have been severely reduced from historic norms.
5. New evidence indicates that far more of the "dry" forests, rather than being typified low severity fire regimes, were in fact dominated by mixed severity fire regimes (including significant areas of stand replacing fire), so mixed severity fire is an important part of the historic range of variability that should be restored. The goal should not be a uniform low severity fire regime, but rather a wide mix of tree densities in patches of varying sizes. This objective can often be met by allowing natural fire regimes to operate, or by leaving significant areas untreated when planning fuel reduction projects.
6. Prioritize treating dry forest types at low elevation and on south slopes. Treatments in the wildland urban interface may also be a priority, but don't define the WUI too broadly, because fire hazard can be reduced by treating the area

immediately adjacent to structures and this home ignition zone is usually on no-federal lands. Treatments in forests with naturally mixed-severity fire regimes should be carefully scrutinized to ensure those areas are really outside of the HRV and treatments are really needed. Treatments in mixed severity fire regimes should be more patchy and leave behind more structure, more snags and large dead wood.

7. Prioritize treatment of the dense young stands that are most "plastic" and amenable to restoration. Another priority is to carefully plan and narrowly target treatments to protect specific groves of fire-resistant, old-growth trees that are threatened by ingrowth of small fuels, but don't focus on rigid density reduction targets. Leave all medium and large trees that show old-growth characteristics.
8. Thin from below, retaining the largest trees, or use "free thinning" with a diameter cap so that some trees of all size classes are retained. Retain all large trees and most medium sized trees so they can recruit into the larger classes of trees and snags. Regardless of size, retain all trees with old-growth characteristics such as thick bark, yellowing bark, flat top, asymmetric crown, broken top, forked top, etc. These trees have important habitat value and human values regardless whether they are 21" dbh. Allow natural processes of succession and mortality turn some of these medium and large trees into ecologically valuable snags and down wood.
9. Remember that diameter limits are a tool in the tool box. Don't reject the tool out of hand. The public likes diameter limits a lot because they provide assurances. It is usually OK to use lower diameter limits for fire resistant species, higher limits for fire intolerant species. The exceptional circumstances in which diameter caps allegedly don't work, are more rare than the circumstances in which alternative techniques will lead to unintended consequences, including lack of public trust.[20]
10. Recognize that thinning affects fire hazard in complex ways, possibly even making fire hazard worse because thinning: creates slash; moves fine fuels from the canopy to the ground (increasing their availability for combustion); thinning increases ignition risk; thinning makes the forest hotter, dryer, and windier; and makes site resources available that could stimulate the growth of future surface and ladder fuels. Fuel reduction must find the "sweet spot," by removing enough of the small surface and ladder fuels while retaining enough of the medium and large trees to maintain canopy cover for purposes of microclimate, habitat, hydrology, suppression of ingrowth, etc.
11. There is growing evidence that in order to be effective, mechanical treatments must be followed by prescribed fire. But the effects of such fires must also be carefully considered.
12. Don't thin to uniform spacing. Use variable density thinning techniques to establish a variety of microhabitats, break up fuel continuity, create discontinuities to disrupt the spread of other contagious disturbances such as

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

disease, bugs, weeds, fire, etc. Retain patchy clumps of trees which is the natural pattern for many species.

13. Use your creativity to establish diversity and complexity both within and between stands. "Gappy and clumpy" is often use to describe the distribution of trees in dry forests. Use skips and gaps within units to help achieve diversity. Gaps should be small, while skips should be a little larger. Landings do not make good gaps because they are clearcut, highly compacted and disturbed, more likely subject to repeated disturbance, and directly associated with roads. Gaps should be located away from roads and should not be clearcut but rather should retain some residual structure in the form of live or dead trees.
14. Thin heavy enough to stimulate development of some patches of understory vegetation, but don't thin so heavy that future development of the understory becomes a more significant fuel problem than the one being addressed by the current project.
15. The scale of patches in variable density thinning regimes is important. Ideally variability should be implemented at numerous scales ranging from small to large, including: the scale of tree fall events; pockets of variably contagious disturbance from insects, disease, and mixed-severity fire; soil-property heterogeneity; topographic discontinuities; the imprint of natural historical events; etc.
16. Retain and protect under-represented species of conifer and non-conifer trees and shrubs. Retain patches of dense young stands as wildlife cover and pools for recruitment of future forests.
17. Recognize that thinning captures mortality and that most stands (especially plantations) are already lacking critical values from dead wood due to the unnatural stand history of logging, planting, and disrupted natural processes.[21]
18. Retain abundant snags and course wood and green trees for future recruitment of snags and wood. Retention should be both distributed and in clumps so that thinning mimics natural disturbance. Retention of dead wood should generally be proportional to the intensity of the thinning, e.g., heavy thinning should leave behind more snags not less. Retain wildlife trees such as hollows, forked tops, broken tops, leaning trees, etc.
19. If using techniques such as whole tree yarding or yarding with tops attached to control fuels, the agency should top a portion of the trees and leave the greens in the forest in order to retain nutrients on site.

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

20. Avoid impacts to raptor nests and enhance habitat for diverse prey species. Train marking crews and cutting crews to look up and avoid cutting trees with nests of any sort and trees with defects.
21. Take proactive steps to avoid the spread of weeds. Avoid and minimize soil disturbance. Retain canopy cover and native ground cover to suppress weeds.
22. Buffer streams from the effects of heavy equipment and loss of bank trees and trees that shade streams. Mitigate for the loss of LWD input by retaining extra snags and wood in riparian areas. Recognize that thinning captures mortality that is not necessarily compensated by future growth.[22]
23. Protect soils by avoiding road construction, minimizing ground-based logging, and avoiding numerous large burn piles. Rank new road segments according to their relative costs (e.g. length, slope position, soil type, ease of rehabilitation, weed risk, native vegetation impacts, etc.) and benefits (e.g. acres of restoration facilitated), then use that ranking to consider dropping the roads with the lowest ratio of benefits to costs. Where road building is deemed necessary, ensure that the realized restoration benefits far outweigh the adverse impacts of the road, build the roads to the absolute minimum standard necessary to accomplish the job, and remove the road as soon as possible to avoid firewood theft, OHV trespass, and certainly before the next rainy season to avoid stormwater pollution. Do not allow log hauling during the wet season.
24. Acknowledge and consider the following potentially significant issues in the NEPA analysis:

    a. Removing commercial sized logs, and associated roads and slash disposal, often conflicts with other resource values such as soil, water, weeds, wildlife habitat, fire hazard, and carbon storage;
    b. Removal of commercial sized logs can make the stand hotter, dryer, and windier, making fire hazard worse instead of better;
    c. Commercial logging tends to present significant risks of weed infestations because of soil disturbance and canopy reduction;
    d. Removal of commercial logs necessitates road related impacts on soil and water resources. Machine piling and pile burning tend to cause significant adverse impacts on soil and water, especially when combined with road impacts and other logging disturbances.
    e. "Capturing mortality" reduces future snag habitat that is already deficient. Increasing vigor via thinning delays recruitment of snag habitat that is already deficient;
    f. The unavoidable adverse impacts of logging and roads must be balanced against the rather uncertain benefits of fuel reduction. There is actually a very low probability that moderate intensity fire will affect any given stand during

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

the relatively brief time period that fuel reduction is alleged to be reduced. Fuel reduction has little or no beneficial effect on low severity fires (controlled by favorable weather conditions) or on high severity fires (controlled by unfavorable weather conditions).

g. Forest health thinning is just darn complex with many feedback loops. There is still a fair amount of scientific uncertainty about several critical factors relevant to a decision about fuel reduction, including: (A) uncertain rates of tree mortality and how many young trees need to be retained to ensure proper recruitment of future stands of old trees and large snags; (B) uncertainty about how much the canopy can be reduced without making the stand hotter, dryer, and windier (and exacerbating fire hazard); (C) uncertainty whether logging has any significant beneficial effect on controlling insects and diseases like mistletoe.

Set realistic goals and expectations for fuel reduction.

The NEPA analysis must set realistic expectations about the efficacy of fuel reduction treatments. First of all, the timber industry and some in the agencies like to think that all logging is created equal. (i.e., It's all good.) In fact, logging could make things better or they could make things worse. Even thinning can increase fire hazard instead of decrease it because it makes the forest hotter, dryer, and windier and stimulates the growth of future ladder fuels.

Another problem is that the effectiveness of even the best treatments is often grossly overstated because (a) most of the acres that burn do so in severe fires where weather instead of fuels is the controlling factor (i.e. thinning won't help control severe fires which dominate the system), and (b) there is a relatively low probability (e.g. <10%) that any given treated area will be affected by severe fire during the ~20 year period that fire hazard might be reduced.

Third, all logging has impacts that must be factored in and if we are going to treat anywhere near the acres needed to affect landscape level fire patters, then the number of acres treated will be very significant and the cumulative impacts will be tremendous. This has yet to be accounted for in the NEPA analysis here or anywhere else.

We are not arguing that we should do nothing, only that we need to move forward carefully and not accept the mistaken view that logging equals restoration. We have yet to see the safeguards or sideboards that would be needed to ensure that this project program would do more good than harm.

See Finney and Cohen. Expectation and Evaluation of Fuel Management Objectives. USDA Forest Service Proceedings RMRS-P-29. 2003. http://www.fs.fed.us/rm/pubs/rmrs_p029/rmrs_p029_351_366.pdf **Table 1—** Expectations of fire and fuel management compared to more realistic performance.

Expectation	Reality
Wildland fuel management	Wildland fuel management changes wildland fire behavior. Structure loss (i.e., homes burning) is dependent on local properties of the structure and its immediate

prevents structure loss.	surroundings. This means that the proximate responsibility for structure loss from fire primarily resides with the private owners of the structure and immediate property, not with public land management agencies.
Fuel treatments will stop wildland fires.	Fuel treatments change fire behavior within limitations of their prescription. That is, the design criteria or prescription of fuel treatments (see below) allows them to perform alterations in fire behavior up to a limit of weather conditions (primarily fuel moisture and winds). This change in behavior includes reduced intensities and spread rates, but does not prevent combustion. The changes in fire behavior and fuel conditions may enhance the effectiveness of fire suppression tactics, but it is impossible for fuel treatments alone to stop fires from burning or spreading.
Fuel management can be equally successful for all vegetation and fire regimes.	Fuel management can alter fire behavior but the longevity of these alterations and the ecological appropriateness of the treatment are specific to a given vegetation type. The most common fuel treatments today are concomitant with forest restoration of low-elevation pine and mixed-conifer forests. The same ecological justification and desired changes in fire behavior are inappropriate models for fuel hazard reduction in grasslands that recover following a single growing season or to high-elevation forest characterized by stand-destroying fire regimes. Fuel management strategies and ecological rationale are required for each fire regime and vegetation community.

The paper makes clear that if the goal is protection of structures then the fuel reduction activity must focus on the immediate environment around the structures, not on fuels far removed from the threatened structure.

> Surface fuels removed by prescribed burning or canopy fuels removed by thinning change fire behavior within the local domain of the treatment unit. Many studies have shown that fire behavior responds at this local scale to fuel management measures (Helms 1982; Martin et al. 1989; Deeming 1988; Pollet and Omi 2002). This scale, and only this scale, corresponds to the physics of home ignition, whether from firebrands or flames impinging upon home construction materials (Cohen 2000b). The physical properties of the home and its immediate surroundings determine ignition potential and are restricted to the structure and material in very close proximity as determined by principles of radiation and convective heat transfer.

Fuel breaks also fall outside the realm of reasonable expectations because --

> …fuel break performance and benefit is based on the questionable expectation that fire suppression will be capable of "stopping" fires after initial attack fails (see Expectations above). Large fires escape initial attack for many reasons that include resource scarcity due to high numbers of ignitions, and spotting and crown fire behaviors that make holding a pre-defined position by firefighters untenable and perhaps dangerous. Furthermore, the only firefighting tactics supported by fuel breaks are categorized as "indirect" (Brown and Davis 1973). This means that the rest of firefighting tactics (direct attack and parallel attack) are not enhanced regardless of the current fire behavior or fire position on the landscape relative to the location of the fuel break. A large fire that slows before reaching a fuel break (because of a change in weather conditions, nighttime, etc.) must be attacked (by direct or parallel tactics) with no benefit of the fuel break.

> Utilizing fuel breaks involves a large burnout operation, which may be of a size equal to the original wildfire, take place regardless of the fire behavior at its current location, and produce negative effects on wildland vegetation greater than the original wildfire. Maintenance costs of fuel breaks are often ignored by proponents but maintenance is a perpetual burden that is likely to divert efforts from managing fuels and vegetation on the remaining majority of the landscape.
> …
> Evidence that fuel breaks surrounding urban zones are sufficient to reduce threats to urban values is lacking. Because of their location on the periphery of wildlands, fuel breaks cannot reduce losses of wildland values associated with a community. Although it is commonly argued that fuel breaks will reduce wildfire intensities adjacent to residential development and thereby allows firefighters to protect homes, wildland-urban fire disasters tend to occur during severe fire conditions when fire behavior characteristics often overwhelm fire protection resources.

Expectation and Evaluation of Fuel Management Objectives Finney and Cohen 364 USDA Forest Service Proceedings RMRS-P-29. 2003.

The agency must also recognize that the effects of logging projects are often determined by future weather events that are beyond their control. The consequences of land management in the event of bad weather must be disclosed and considered.

> [T]he local climate and weather conditions during and after the human activities ... are major determinants of the impact on aquatic systems, ...
>
> [T]he actual weather conditions that occur at any specific place and time are much less predictable, and inevitably include extreme conditions that are hidden within the long-term average conditions. ...
>
> [T]he impact of any forest management action on aquatic systems is partially a matter of chance. With the bad luck of a severe rainstorm, even an action that follows best management practices can have a strong negative effect on aquatic resources, while a poorly conducted action can have little or no negative effect because of the good fortune of moderate precipitation.

Michael Huston, Enrique Gomezdelcampo, Rachel Sewell Nesteruk. Linking Topography, Hydrology, and Biodiversity to Understand Terrestrial Impacts on Aquatic Systems. NCSSF. http://www.ncseonline.org/ewebeditpro/items/O62F3298.pdf

> "Westerling et al. used the most comprehensive data set of wildfire occurrences yet compiled for the western United States to analyze the geographic location, seasonal timing, and regional climatology of the 1166 recorded wildfires with an extent of more than 400 ha. They found that the length of the active wildfire season (when fires are actually burning) in the western United States has increased by 78 days, and that the average burn duration of large fires has increased from 7.5 to 37.1 days."

http://www.sciencemag.org/cgi/content/full/313/5789/927 citing A. L. Westerling, H. G. Hidalgo, D. R. Cayan, and T. W. Swetnam. 2006. Warming and Earlier Spring Increase Western U.S. Forest Wildfire Activity. (18 August 2006). Science 313 (5789), 940.

In the "San Diego Declaration" scientists say that global warming limits our ability to manage wildland fire, "Increased temperatures are projected to lead to broad-scale alteration of storm tracks thereby changing precipitation patterns. Historical data show that such changes in past millennia were often accompanied by disruption of fire regimes with major migration and reorganization of vegetation at regional and continental scales." See THE SAN DIEGO DECLARATION ON CLIMATE CHANGE AND FIRE MANAGEMENT at http://emmps.wsu.edu/firecongress/PDF1/San%20Diego%20Declaration%20on%20Climate%20Change%20and%20Fire%20Management_06M.pdf

Raymond (2004) looked at the effects of the Biscuit fire on areas previously thinned to reduce fuels. She concluded:

> *Management Implications*
>
> Efforts to reduce canopy fuels through thinning treatments may be rendered ineffective if not accompanied by adequate reduction in surface fuels. Surface fuels were a more important control over fire severity than canopy fuels under conditions of extreme drought but moderate wind-speeds. Fine fuel loading was the only fuel structure variable significantly correlated with crown scorch. Despite the reductions in crown fire potential associated with lower CBD, higher CBH and lower tree density, these variables were not significantly correlated with crown scorch. This study shows the need for fire hazard reduction treatments to simultaneously address multiple fuel strata in order to adequately reduce fire severity.
>
> This study also suggests the need to establish acceptable levels of fire severity following wildfires in mixed-severity fire regimes. Does the fire severity in the untreated stands (about 50% mortality) exceed desired future conditions? Are the costs and effort of fuel treatments justified? These are management questions that depend on more than just fire hazard reduction. The acceptable level of fire damage in a mixed-severity fire regime such as the mixed-evergreen forest of southwestern Oregon will vary for areas with different management objectives (e.g. wildlife habitat, timber production, recreation). Fuel treatment options should be considered within the context of other management objectives.

Crystal L. Raymond. 2004. The Effects of Fuel Treatments on Fire Severity in a Mixed-Evergreen Forest of Southwestern Oregon. MS Thesis.
http://depts.washington.edu/nwfire/publication/Raymond_2004.pdf

Consider the Effects of Livestock Grazing on Forest Health

Livestock grazing has a direct influence on the vegetation structure that this project is designed to address. The agency must analyze the effect of past and future grazing which will tend to reduce palatable fine fuels like grasses and shift the plant community toward less palatable shrubs and trees which are more hazardous as ladder fuels. Livestock grazing probably contributed to the development of plant communities where grass and forbs are underrepresented and small conifers are over-represented. Grazing also likely

contributes to the spread of juniper. Future livestock grazing will tend to cause these same trends, so the NEPA analysis must consider the connected and cumulative impacts of livestock grazing.

This project does nothing to address the threat that livestock grazing causes to forest health. There is virtually no point in trying to mechanically reduce tree density unless you deal with other underlying causes of overstocking, e.g. livestock grazing. The NEPA document describes the effects "on" range resources (e.g., fences and transitory range) but fails to disclose or analyze the effects "of" livestock on forest health and the desired future condition of vegetation composition.

Grazing reduces the density and vigor of grasses which usually outcompete tree seedlings, leading to dense stands of fire-prone small trees. Cows also decrease the abundance of fine fuels which are necessary to carry periodic, low intensity surface fires. This reduces the frequency of fires, but increases their severity. See Belsky, A.J., Blumenthal, D.M., "Effects of Livestock Grazing on Stand Dynamics and Soils in Upland Forest of the Interior West," Conservation Biology, 11(2), April 1997. http://www.onda.org/library/papers/standdynamics.pdf See also Wuerthner, George. Livestock Grazing and Fire. January, 2003. http://www.onda.org/library/papers/Livestock_Grazing_and_Fire.pdf

The NEPA document failed to address these issues and failed to consider alternative ways of avoiding these impacts by not grazing. The combination of fire suppression, past high-grading, and livestock grazing together caused the overstocked condition of the stands in the analysis area. Logging and prescribed fire will only partially address the problem. To be effective, livestock grazing must also be eliminated. Grazing and logging cause cumulative effects that must be considered together in one NEPA document.

The court's decision in League of Wilderness Defenders v. USFS, Civil No. 04--488—HA. 2004 U.S. Dist. LEXIS 24413. November 19, 2004, makes clear that the agency has a duty to take a hard look at the effects of grazing in the context of making timber sale decisions. The agency must disclose cumulative impacts and cannot compartmentalize.

Further evidence of the adverse forest health effects of livestock are presented in Michael H. Madany, and Niel E. West. Livestock Grazing-Fire Regime Interactions within Montane Forests of Zion National Park, Utah. Ecology: Vol. 64, No. 4, pp. 661-667.

> Abstract. Major differences were found between the vegetation structure of ponderosa pine-dominated communities on the Horse Pasture Plateau and those on the nearby but isolated Church and Greatheart Mesas in Zion National Park. The Horse Pasture Plateau was heavily grazed by livestock in the late 19th and early 20th centuries, while the mesas were never grazed. Conditions on the mesas now approximate the pre-European situation of the region as described in the earliest written accounts. Pine, oak, and juniper sapling density and cover were much higher on the formerly grazed plateau than on the relict mesas. Herbaceous species dominated the groundlayer in mesa ponderosa pine savanna stands, while grass and forb cover was low on analogous sites of the plateau. Age-class

> distributions of major tree species further substantiated that major physiognomic changes have occurred on the plateau since the arrival of European man. Analysis of fire scars showed that prior to 1881, the mean fire-free interval for ponderosa pine stands on the plateau was 4 to 7 yr, while the interval for Church Mesa was 69 yr. Since there were no recorded fires on Church Mesa between 1892 and 1964, and yet no corresponding increase in sapling density, the increased understory density of plateau stands should not be attributed primarily to cessation of fires. Instead, heavy grazing by livestock and associated reduction of the herbaceous groundlayer promoted the establishment of less palatable tree and shrub seedlings, Fire, however, played an important secondary role in maintaining savanna and woodland communities.

Grazing is also known to have significant adverse impacts on ground nesting birds. Cattle Grazing in a National Forest Greatly Reduces Nesting Success in a Ground-nesting Sparrow. Glenn E. Walsberg. The Condor Volume 107, No. 3. August, 2005.

The agency often erroneously concludes that livestock grazing will not affect upland vegetation of fuel profiles because fire suppressed stands are too dense to allow livestock access, but this is a gross oversimplification. The agency is conducting so-called "restoration" projects to reduce fuels and vegetation density which has and will allow livestock use. The NEPA document must disclose how livestock grazing interacts with the so-called forest restoration projects. The goal of restoration is a more open stand, and the agency wants more grass and forbs and fewer conifers, but grazing in those "restored" stands will cause the opposite effect – more conifers and less grass and forbs – thereby conflicting with the restoration objectives.

Protect Soil and Water Quality

Soil is among the most valuable of forest resources since it is intimately involved in plant health, water quality, and primary production. Logging and associated road building and fuel treatment can have serious adverse impacts on soil. See Jurgensen, M. F., A. E. Harvey, R. T. Graham, D. S. Page-Dumroese, J. R. Tonn, M. J. Larsen and T. B. Jain. 1997. Impacts of timber harvesting on soil organic matter, nitrogen, productivity, and health of inland Northwest forests. Forest Science 43: 234-251. (ABSTRACT: "The authors review scientific literature on the impact logging has on soil properties and site productivity (e.g. tree growth) in the Inland Northwest. Logging and site preparation result in soil compaction, displacement of surface mineral soil, and loss of organic matter (including woody residues and forest floor layers). Loss of soil organic matter also results in the loss of soil nitrogen and decreased ability of a site to fix new nitrogen. Soil organic matter is important for ectomycorrhizal development, which in turn plays a role in nutrient uptake and seedling survival. Studies on tree growth indicated that growth is reduced on soils affected by logging, and losses of soil organic matter and nutrients are estimated to last from 10 to 250 years, depending on site conditions.")

The agency seems to claim that the direct sediment input from timber harvest in addition to any other sources of sediment will be sufficiently mitigated by the use of Best Management Practices (BMPs). While the use of BMPs is to be encouraged in timber projects, we note that the use of these measures are not themselves sufficient to ensure compliance with the Clean Water Act (CWA*). Northwest Indian Cemetery Protective Ass'n v. Peterson* 795 F.2d 688, 697 (9th Cir. 1986) (holding that compliance with BMPs does not equate to compliance with the CWA). Indeed, the agency assumes that the implementation of BMPs will sufficiently mitigate any problems that the proposed project will have on aquatic systems, but offers no proof of this assertion. Consequently, this assumption is flawed and violates the law.

This passage from *Idaho Sporting Congress v. Thomas*,137 F.3d 1146, 1151 (9th Cir. 1998) may help the agency understand their Clean Water Act obligations:

> The Forest Service also argues that water quality will not be affected by the proposed logging because of the mitigation measures described in the EA that will be undertaken. However, since the effects of the sale will not be known until the EIS is prepared we cannot know whether the mitigation measures are sufficient. In the context of an EIS, an agency is required to "discuss the extent to which adverse effects can be avoided" by mitigation measures. *Robertson*, 490 U.S. at 352. "A mere listing of mitigation measures is insufficient to qualify as the reasoned discussion required by the NEPA." *Northwest Indian Cemetery Protective Assoc. v. Peterson*, 795 F.2d 688, 697 (9th Cir.1986), rev'd on other grounds, *Lyng v. Northwest Indian Cemetery Protective Assoc*., 485 U.S. 439, 108 S.Ct. 1319, 99 L.Ed.2d 534 (1988). Without analytical data to support the proposed mitigation measures, we are not persuaded that they amount to anything more than a "mere listing" of good management practices.

Each proposed mitigation measure, including all BMPs, must be evaluated at the site-specific level for "effectiveness" and "ability to implement." This analysis must reflect: availability of funding and personnel, institutional constraints, water quality objectives, soils, topography, geology, land-form, channel morphology, vegetation, OHV use, and climate.

A recent USDA Office of the Inspector General Report concluded that reliance on speculative mitigation measures in order to reach a FONSI significantly compromised environmental quality. OFFICE OF INSPECTOR GENERAL, U.S. DEPT' OF AGRIC., EVALUATION REPORT NO. 08801-10-AT: FOREST SERVICE TIMBER SALE ENVIRONMENTAL ANALYSIS REQUIREMENTS (1999). http://www.usda.gov/agency/oig/webdocs/088011.pdf The OIG concluded that:

> Applicable mitigation measures contained in 10 of 12 decision notices and referenced environmental assessments reviewed, were not always implemented. In addition, mitigation measures were either omitted or incorrectly incorporated into 4 of 12 accompanying timber sale contracts. These mitigation measures are designed to reduce the adverse impacts of timber sale activities on the environment. Generally, mitigation measures were not implemented due to district personnel (a) not being familiar with the mitigation measure contained in the environmental documents, (b)

> not adequately monitoring actual implementation of the mitigation measures, (c) not comparing timber sale contract clauses with the applicable environmental documents and, (d) oversight. As a result, streams, wildlife habitat, heritage resources, water quality, and visual quality were or could be adversely affected. In addition, "Findings of No Significant Impact" conclusions (i.e. that there was no significant affect on the quality of the human environment) were questionable . . . Timber sale field visits disclosed that mitigation measures designed to protect key resource areas were not adequately implemented. The measures involved mitigation of riparian areas and stream management zones, wildlife habitat, heritage resource sites, visual quality, and soils.

Until the agency is able to substantiate its proposed mitigation measures - i.e., that they are appropriate, will be implemented, and will be effective - the agency must withdraw the proposed project.

Further logging in this watershed threatens further violations of state water quality standards. This triggers an EIS and also requires that a TMDL/water quality management plan precede further actions that could increase stream temperature, nutrients, or sediment.

When conducting activities that could impact 303(d) listed streams, the land management agencies have agreed to validate impairment of listed streams, demonstrate that measures are in place to prevent further degradation, and develop *water quality restoration* plans before TMDL are developed. USDA Forest Service, USDI Bureau of Land Management, Environmental Protection Agency, 1999. Forest Service and Bureau of Land Management Protocol for Addressing Clean Water Act Section 303(d) Listed Waters http://www.fs.fed.us/r6/water/protocol.pdf The agency has not fulfilled its obligations under this interagency agreement.

Anti-degradation provisions of the Oregon's water quality standards apply to those water bodies that are *currently meeting* water quality standards. The purpose of the anti-degradation provisions is to prevent the deterioration of existing levels of high water quality. The CWA provisions prohibit degrading the water quality unless an analysis shows that important economic and social development necessitates degrading water quality. The NEPA analysis should explain how the antidegradation provisions of the State of Oregon's water quality standards would be met by each Alternative.

Where waters are 303(d) listed as non-compliant, Oregon water quality standards state: "Unless specifically allowed under a DEQ surface water temperature management plan (as required under (OAR 340-041-0026(3)(a)(D)) no measurable surface water temperature increases resulting from anthropogenic activities is allowed in State of Oregon Waters determined out of compliance with the temperature standard."

This project will cause erosion. Accelerated or excess sedimentation contributes to temperature increases by reducing pool depth, filling interstitial space, altering substrate

composition, causing channels to braid, increasing surface area and affects shading of the water surface. See EPA 2-18-04 comments on the Biscuit Fire Salvage Project.

The NEPA analysis must address the cumulative effects of logging and grazing on water quality and discuss the fact that further grazing will retard the attainment of riparian and aquatic management objectives in violation of the applicable land management plan as amended.

On October 14, US District Court Judge Marilyn Patel of San Francisco ruled that the EPA has erred in exempting timber harvesting from the requirement of obtaining a stormwater runoff permit under the Clean Water Act. The case was brought by environmentalists against Pacific Lumber Company operations in northern California. Judge Patel reached her findings based on the fact that harvest unit erosion often enters roadside ditches and passes through culverts, thus making it point source pollution subject to the NPDES permitting requirements of the Clean Water Act. This project will similarly cause erosion, and discharge polluted ditch water to streams. The agency should obtain a NPDES permit. The EPA put the Forest Service and BLM on notice of this new permit requirement during a IAC meeting November 5th, 2003. ("In October of 2003, Judge Marilyn Hall Patel, a U.S. District Court Judge for the Northern District of California, ruled that once runoff from a silvicultural activity enters a conduit, such as a drainpipe, ditch or culvert, the runoff ceases to be "natural runoff", and that silvicultural businesses [sic] cannot be absolved of the CWA's point source requirements. This means that where those engaging in silvicultural enterprises employ point sources, they must comport with the NPDES's attendant permit requirements.")
http://www.reo.gov/library/iac/letters/1899iac.htm

***Avoid* rather than *mitigate* soil and water quality. Do not rely on BMPs.**

Scientific assessments have repeatedly concluded that there is no reliable empirical evidence that BMPs reduce impacts of logging and roads to ecologically insignificant levels. Beschta, Rhodes, Kauffman, Gresswell, Minshall, Karr, Perry, Hauer, Frissell. 2004. Post-fire management on forested public lands of the Western USA. Cons. Bio. Vol 18 No. 4. August 2004. pp 957-967. Espinosa, F. Al, Jr., J. J. Rhodes, and D. McCullough. 1997. The Failure of Existing Plans to Protect Salmon Habitat in the Clearwater National Forest in Idaho. Journal of Environmental Management (1997) 49, pp 205-230. NPPC Independent Science Group, 1996. Return to the River: Restoration of Salmonid Fishes in the Columbia River Ecosystem. NPPC, Portland, OR. Rhodes, J. J., D. McCullough, and F. A. Espinosa, Jr., 1994. A Coarse Screening Process for Evaluation of the Effects of Land Management Activities on Salmon Spawning and Rearing Habitat in ESA Consultations. CRITFC Tech Rpt 94-4, Portland, OR. http://www.critfc.org/tech/94-4report.htm Ziemer, Lisle, 1993. Evaluating sediment production by activities related to forest uses— A Northwest Perspective. Proceedings: Technical Workshop on Sediments, Feb. 1992, Corvallis, OR. Pp 71-74. http://www.fs.fed.us/psw/rsl/projects/water/Ziemer93.PDF

In recognition of the vast superiority of prevention over mitigation, the Northwest Forest Plan mandates "Do not use mitigation or planned restoration as a substitute for preventing habitat degradation." WR-3, NWFP ROD page C-37. See also *Northwest Indian Cemetery Protective Ass'n v. Peterson* 795 F.2d 688, 697 (9th Cir. 1986) (holding that compliance with BMPs does not equate to compliance with water quality standards).

Most agency evaluations claiming to support the effectiveness of BMPs are not scientifically credible and lack statistical rigor.

We have seen too often where the agency promises to mitigate impacts and then waives those very protections during contract administration. Examples of post-NEPA contract modifications include wet season log hauling, operating off skid trials, new roads and landings, remarking large trees, expanding the boundaries of cutting areas, and on and on This makes a mockery of the NEPA process and abusing the public's trust. One of the reasons we often favor no action, is that mitigation turns out to be a meaningless promise. Please disclose the environmental consequence of what you will really do, not what will make the project look good on paper.

Address The Causes And Consequences Of Soil Erosion And Sedimentation.

The NEPA document did not address the consequences of erosion and sedimentation within a proper framework of sediment dynamics. Aquatic habitat attributes such as spawning gravel availability or the amount of fine sediment in bed sediments are determined by hillslope sediment inputs and by the capacity of stream channels to store and transport sediment. Sediment dynamics exert important controls on channel morphology and grain size distribution that affect habitat quantity and quality for aquatic and riparian species. Sediment dynamics include sediment supply from hillslopes to channels, sediment transport and flux (yield) from a channel reach, and the change in storage within a channel reach. Sediment storage characteristics and transport rates control the average time required for sediment of various sizes to be routed through the channel network, influencing the sensitivity of channels to disturbances. Estimation of sediment budgets for historical and current conditions can be used to evaluate the ongoing effects of human activities on sediment supply, transport, and storage characteristics and how such changes may affect aquatic and riparian habitats.

Mass failures from roads and logged areas are more frequent, larger, travel farther, contain less wood, and damage a far greater percentage of stream channels in a watershed than do those from mature forests. May, C.L., 2002. Debris flows through different forest age classes in the central Oregon Coast Range. J. Amer. Water Resour. Assoc., 38: 1097-1113.

Strictly Conserve Soil Resources.

The National Forest Management Act and its implementing regulations mandate soil protection. NFMA requires the Forest Service to "ensure that timber will be harvested from National Forest System lands only where—soil, slope, or other watershed

conditions will not be irreversibly damaged." *16 U.S.C. § 1604 (g)(3)(E).* NFMA's implementing regulations state, "All management prescriptions shall … Conserve soil and water resources and not allow significant or permanent impairment of the productivity of the land." *36 C.F.R. § 219.27(a)(1).*

According to the regional guidelines soils in 80% of an activity area must be maintained in a non-detrimental condition (i.e., non-compacted, non-displaced, non-burned, and non-puddled). Soils must be "maintained," not "mitigated" or "restored" to attain that objective. Mitigation should not be used as an excuse for violation of the regional soil guidelines.

The Forest Service policy to ignore detrimental effects to soil areas less than 5 feet wide and les than 100 square feet is arbitrary and capricious. Under this senseless policy many small areas could add up to significant detrimental soil conditions, yet not trigger any management concern whatsoever. This violates NFMA, and failure to disclose the true extent of DSC violates NEPA.

Scarification, ripping, and subsoiling does not alleviate the following negative impacts, therefore not completely mitigating:

- compaction of soil and alteration of the soil ecosystem;
- alteration of hydrology, water storage, flow, timing, from soil compaction;
- alteration or loss of native plant communities, and tendency to create conditions which favor noxious weeds or other non-native plants;
- disruption of soil foodweb and biotic communities that serve important soil functions and processes such as aeration, nutrient cycling,

Ripping and tilling can in fact increase the risk of soil movement, so ripping and tilling are not really mitigation, but just another cumulative harm to the soil resource.

Soil productivity must be zealously guarded in order to protect our forests for future generations. This project will cause unacceptable impacts to soil resources. Use of ground-based logging equipment almost always compacts soil causing reduced site productivity, drastically altered soil food web relationships, reduced infiltration, and increase surface runoff. Spring burning can also be very harmful to soil and the thousands of creatures that live all or part of their lives in the soil profile. The EA needs to consider these impacts and consider alternative ways to avoiding these impacts.

Ground-based logging causes higher incidences of root damage and scarring of residual trees (compared to skyline systems). Kellog, L., Han, H.S., Mayo, J., and J. Sissel, "Residual Stand Damage from Thinning— Young Stand Diversity Study," Cascade Center for Ecosystem Management.

Soil disturbance caused by logging, road building, skid trails, and pile burning also causes erosion that adversely impacts both soil and water resources. The existing level of soil disturbance has not been measured and disclosed in the EA so the Agency cannot say with any factual basis whether forest plan standards will be met. This is arbitrary and capricious. Existing soil impacts must be measured and future impacts estimated so that an adequate cumulative effects analysis can be prepared and included in a supplemental EIS.

In modern forestry, soils are chronically impacted yet very slow to recover leading to cumulative impacts. Cumulative soil impacts caused by this project and all past and future projects (including livestock grazing, roads, landings, fuel treatments, fires, OHVs etc) is also significant issue. See http://www.cof.orst.edu/cof/teach/for341/Cumulative%20Effects%20of%20Forestry%20on%20Soils/CHAPT6Soils.htm. An EIS is needed to address these significant soil issues.

See: http://www.subtleenergies.com/ormus/bmnfa/Soilcmts.htm

Cumulative effects of standard logging practices likely violate soil standards.

As described in the Deschutes National Forest, Eyerly Fire DEIS, a typical dendritic system of yarding corridors can cause detrimental soil conditions across 14% of an activity area. Compaction from off-trail travel adds 5% detrimental conditions. Burning fuel piles adds 2% (just the piles, not including machine use).[23] All these cumulative soil impacts add up to OVER 21% detrimental soil conditions, and this is WITHOUT considering the road system, landings (which typically add 5%), and the machines often used to pile fuels, not to mention the effects of past logging. This is simply illegal and irresponsible.

[23] BLM's February 2006 Planning Criteria for the Western Oregon Plan Revision says, "All (100%) of the soil directly beneath burn piles is expected to have detrimental soil damage due to deep burning." p 133.

Soil Quality Standards underestimate soil impacts.

Soil degradation occurs at thresholds that are not detected by the FS definition of "detrimental soil conditions" the NEPA analysis based on these criteria will underestimate the effects of management. NEPA requires the agency to disclose all soil impacts not just those that meet these crude criteria.

Detrimental soil conditions are described in the Soil Quality Standards as follows:

- Detrimental soil compaction in volcanic ash/pumice soils is an increase in soil bulk density of 20 percent or greater over the undisturbed level.
- Detrimental puddling occurs when the depth of ruts or imprints is six inches or greater.
- Detrimental displacement is the removal of more than 50 percent of the A horizon from an area greater than 100 square feet and at least 5 feet in width.
- Detrimental burn damage requires significant color change of the mineral soil surface to an oxidized reddish color, with the next one-half inch below blackened from organic matter charring as a result of heat conducted from the fire.
- Detrimental erosion requires visual evidence of surface loss over areas greater than 100 square feet, rills or gullies, and/or water quality degradation from sediment or nutrient enrichment."

It is obvious from reading this that the soils of the project area could be high impacted yet still not trigger concern under these definitions. For instance, a proposed harvest unit might be compacted over a wide area, but only increase bulk density by 18% instead of the magic 20%; or an area could be 50% displaced or eroded, but in areas less than 5 feet wide and or less than 100 square feet; or an area could be burned but not quite enough to “significantly” change the mineral soil color. And what about combinations of these things. What about some burned soil, some displaced soil, some compacted soil. The cumulative and synergistic effects of sub-threshold soil effects can be significant.

NEPA requires disclose of all effects. The bottom line is that there can be serious adverse soil effects that are not considered by the agencies arbitrary and capricious soil quality criteria.

Respect the soil foodweb.

In undisturbed ecosystems, the soil foodweb is a tightly coupled below-ground ecosystem that directly affects many above ground processes such as succession, plant establishment and growth, and erosion and water quality.

In a forest, this below-ground ecosystem is fed primarily by photosynthates exuded from the fine roots of trees. These photosynthates feed a plethora of bacteria and fungi species which feed thousands of arthropod and nematode species and so on. Each species fills a

niche and represents both a sink and a source and of nutrients for other organisms. Logging will kill trees and cut off the supply of photosythate which forms the basis of this food web, so the tightly coupled nutrient retention systems will be disrupted, allowing nutrients to "leak" from the system.

Burning slash piles also kills the below ground ecosystem[24] and soil compaction from road building and other heavy equipment kills or destroys habitat for many soil dwelling species and shifts the below ground ecosystem from aerobic to anaerobic.

The NEPA document must consider these significant effects.

> **Soil Foodweb Significance**
>
> The structure and function of the soil foodweb has been suggested as a prime indicator of ecosystem health (Coleman, et al. 1992; Klopatek, et al. 1993). Measurement of disrupted soil processes, decreased bacterial or fungal activity, decreased fungal or bacterial biomass, changes in the ratio of fungal to bacterial biomass relative to expected ratios for particular ecosystems, decreases in the number or diversity of protozoa, and a change in nematode numbers, nematode community structure or maturity index, can serve to indicate a problem long before the natural vegetation is lost or human health problems occur (Bongers, 1990; Klopatek et al. 1993).
>
> Soil ecology has just begun to identify the importance of understanding soil foodweb structure and how it can control plant vegetation, and how, in turn, plant community structure affects soil organic matter quality, root exudates and therefore, alters soil foodweb structure. Since this field is relatively new, not all the relationships have been explored, nor is the fine-tuning within ecosystems well understood.
>
> Regardless, some relationships between ecosystem productivity, soil organisms, soil foodweb structure and plant community structure and dynamics are known, and can be extremely important determinants of ecosystem processes (Ingham and Thies, 1995). Alteration of the soil foodweb structure can result in sites which cannot be regenerated to conifers, even with 20 years of regeneration efforts (Perry, 1988; Colinas et al, 1993). Work in intensely disturbed forested ecosystems suggests that alteration of soil foodweb structure can alter the direction of succession. By managing foodweb structure appropriately, early stages of succession can be prolonged, or deleted (Allen and Allen, 1993). Initial data indicates that replacement of grassland with forest in normal successional sequences requires alteration of soil foodweb structure from a bacterial-dominated foodweb in grasslands to a fungal-dominated foodweb in forests (Ingham, E. et al, 1986 a, b; 1991; Ingham and Thies, 1995).
>
> …

[24] BLM's February 2006 Planning Criteria for the Western Oregon Plan Revision says, "All (100%) of the soil directly beneath burn piles is expected to have detrimental soil damage due to deep burning." p 133.

…Without doubt, plant establishment, survival and successional processes are influenced by these soil organisms

Soil processes are important for maintaining normal nutrient cycling in all ecosystems (Coleman et al., 1985; Dindal 1990; Ingham, E. et al. 1986a, b). Plant growth is dependent on the microbial immobilization and soil foodweb interactions to mineralize nutrients. In undisturbed ecosystems, the processes of immobilization and mineralization are tightly coupled to plant growth but following disturbance, this coupling may be lost or reduced. Nutrients may be no longer retained within the system, causing problems for systems into which nutrients move (Ingham and Coleman, 1984; Hendrix et al. 1986; Nannipieri et al. 1990). Measurement of disrupted processes may allow determination of a problem long before normal cycling processes are altered, before the natural vegetation is lost, or human health problems occur. By monitoring soil organism dynamics, we can perhaps detect detrimental ecosystem changes and possibly prevent further degradation.

Immobilization of nutrients in soil, i.e., retention of carbon, nitrogen, phosphorus, and many micronutrients in the horizons of soil from which plants obtain their nutrients, is a process performed by bacteria and fungi. Without these organisms present and functioning, nutrients are not retained by soil, and the ecosystem undergoes degradation. Thus, to assess the ability of an ecosystem to retain nutrients, the decomposed portion of the ecosystem, i.e., active and total fungal biomass, and active bacterial biomass must be assessed.

Ingham, Elaine, The Soil Foodweb: It's Importance in Ecosystem Health
http://www.rain.org/~sals/ingham.html

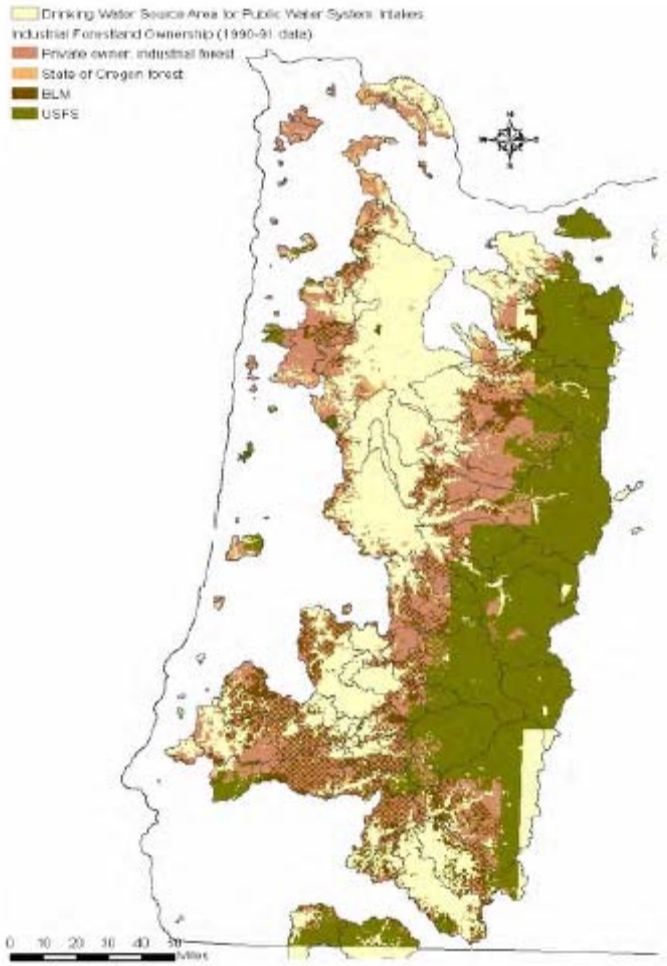
Soil is full of **beneficial soil organisms** profoundly affecting forest site productivity; for example, **mycorrhizal fungi** (fungi that form a close and mutually beneficial relation with the roots of plants) and **nitrogen-fixing organisms** (specialized soil microbes that change atmospheric nitrogen into chemical forms usable by plants) These organisms capture and take in nutrients and water, protect roots against diseases, and promote soil structure. Severe disturbance, such as intense fire or the piling and removing of surface organic matter, can reduce or eliminate beneficial soil organisms (Amaranthus et al., 1990) Impacts on these beneficial organisms is minimized when forest practices emphasize retention of organic matter and rapid regeneration...Myocrrhizal fungi, essential for plant nutrient and water uptake, also are most prevalent near the soil surface. Site preparation activities...can displace surface soil and organic layers thereby decreasing tree growth between rows of slash."

Little is known about the effects of soil erosion from deforested areas, but the density and diversity of mycorrhizal inocula are reduced.

Amaranthus, M.P.; Molina R.; and Trappe J. M. 1990. Long-term forest productivity and the living soil. Chapter 3. In Perry D.A. ed. Maintaining Long-term Forest Productivity in the Pacific Northwest Forest Ecosystem. Timber Press. Portland, OR 97208.

Municipal water supply

Most Oregonians in western Oregon drink water from surface sources originating on federal forest lands.



Small increases in sediment and turbidity can have adverse consequences for municipal drinking water supplies. According to DEQ:

> Medford, OR, filtered water treatment system reports difficulty treating water when the NTUs exceed 50. And according to Robert Noelle, Water Quality Superintendent for the Medford Water Commission (personal communication) turbidity increases of only 2 to 3 NTUs can have detrimental effects on there treatment process, especially with no advance warning, in part due to the 0.3 NTU

> treatment level now required by EPA to protect for Cryptosporidium, Giardia and other protozoa, viruses, and pathogenic bacteria.
>
> Noelle also stated that free residual chlorination is the most common disinfection method used in Oregon, and it is also susceptible to turbidity increases. Ultraviolet (UV) light treatment processes may be inhibited by turbidity, especially if particles absorb UV light or if pathogens are imbedded in turbidity causing particles.
>
> The Clackamas River, Oregon, filtered water treatment system must change its treatment at between 25 and 50 NTUs. Facility specialists of the Albany filtered water treatment system reported that costs generally increase with increasing turbidity. A 1997 draft study by Dermont et al. estimated that on average, for each 1-percent reduction in turbidity, chemical costs (coagulation) would be reduced by $0.20 per million gallons. Water supplies with lower turbidity can actually require more coagulant than water supplies that are more turbid. However, all of the Oregon treatment facilities contacted stated that reduced ambient turbidity would reduce their treatment costs.
>
> ... Water treatment facility operators in Oregon have expressed a desire for advanced warning of upstream source exceedences of turbidity criteria, in order to prepare for timely adjustments to their treatment processes.

Tom Rosetta 2005. DRAFT TECHNICAL BASIS FOR REVISING TURBIDITY CRITERIA. Oregon Department of Environmental Quality. http://www.deq.state.or.us/WQ/WQRules/Rulemaking/Div041DraftTechBasisRevTurbidity.pdf

In 1992 the Oregon State Office of the BLM published "Fish and Wildlife 2000: A Vision For The Future." Among the objectives stated in the document is:

> Protect the full range of genetic diversity for plants and animals on public land ecosystems (e.g., old growth forest, wetlands, riparian, and native sagebrush steppe) and on other unique habitat such as cliffs, talus, caves, meadows, lakes, headwaters, playas, lithosols, ash deposits, and serpentine soils. This includes not only the most obvious vegetation types, but also key habitat components such as snags, dead or down woody material, light, moisture, soil structure, and processes such as fire, flooding, and migration.

OR/WA BLM, F&W 2000 page 40 (emphasis added).

The tenets of this "policy tier" document were derived from a national BLM Fish and Wildlife 2000 signed by the national Director of the BLM in May 1987. OR/WA BLM F&W 2000 page 1. RMPs are to allocate resources and select appropriate uses of BLM land "based on direction from the policy tier." OR/WA BLM, F&W 2000 page 3.

> BLM Manual 6840.22
>
> **Conservation of species other than under the ESA.** The ESA establishes

policy, procedures, and requirements for the conservation of listed species, designated critical habitat, proposed species, and proposed critical habitat. BLM policy is broader than the ESA in that it addresses special status species that may be affected by BLM activities, as well as federally listed and proposed species. It is in the interest of the public and the affected special status species for BLM to undertake conservation actions for such species before listing is warranted or the designation of critical habitat becomes necessary. It is also in the interest of the public and the affected special status species for BLM to undertake conservation actions that improve the status of such species to the point where their special status recognition is no longer warranted. By doing so, BLM will have greater flexibility in managing the public lands to accomplish native species conservation objectives, while fulfilling other FLPMA mandates.

A. Planning. The BLM should obtain and use the best available information deemed necessary to evaluate the status of special status species in areas affected by land use plans or other proposed actions and to develop sound conservation practices. Land use plans shall be sufficiently detailed to identify and resolve significant land use conflicts with special status species without deferring conflict resolution to implementation-level planning. Implementation-level planning should consider all site-specific methods and procedures which are needed to bring the species and their habitats to the condition under which the provisions of the ESA are not necessary, current listings under special status species categories are no longer necessary, and future listings under special status species categories would not be necessary.

...

C. Agreements, Assessments, and Cooperative Strategies for Conservation. The BLM shall work cooperatively with other agencies, organizations, governments, and interested parties for the conservation of plants and animals and their habitats to reduce, mitigate, and possibly eliminate the need for their identification as a special status species. Cooperative efforts are important for conservation based on an ecosystem management approach and will improve efficiency by combining efforts and fostering better working relationships. Stabilizing and improving habitat conditions before a species is listed may allow more conservation and other management flexibility, reduce conflicts, and reduce the cost of conservation.

...

2. Habitat Conservation Assessments and Conservation Agreements. In an effort to eliminate the need for listings under the ESA, the BLM shall participate in developing habitat conservation assessments leading to conservation agreements for proposed, candidate, and sensitive species, groups of species, or specific ecosystems. This is pursuant to the MOU (94-SMU-058, dated June 25, 1994) entered into by the BLM, U. S. Forest Service, FWS, NMFS and the National Park Service to establish an interagency framework for cooperation and participation to achieve this objective.

...

4. Ecosystem Management and Native Biodiversity. BLM management should

take into consideration ecosystem management and the conservation of native biodiversity to reduce the likelihood of placing any native species on a special status species list.
http://www.blm.gov/nhp/efoia/wo/manual/6840.pdf

Significant new information on Spotted owls (and Barred owls)

New information on the Threatened northern spotted owl indicates that there are significant new uncertainties for the owl that have not been fully considered at the regional or local scale. As recognized by the spotted owl status review, all existing suitable habitat could be critical to the survival of the spotted owl. These new concerns include:

- Competition and displacement from the barred owl which is dramatically increasing in numbers throughout the range of the spotted owl. The barred owl is barely mentioned in the 1994 SEIS. There is no discussion at all in the body of the 1994 SEIS volume I, and there is only one mention of "possible" adverse impacts in volume II of the 1994 SEIS; **Implications**: Based on principles of island biogeography, protection of more suitable habitat is needed to ensure that these two owl species can co-exist.
- The effects of West Nile Virus which is fatal to the spotted owl; **Implications**: A larger population may be better able to survive the stochastic pressures of this disease. It may be important to avoid any further "take" of birds or habitat at least until the disease has run its course. Isolated stands of old-growth may also be important because they may be dryer and have fewer mosquito vectors. Geographic isolation might also help protect them from the contagious spread of the disease.
- The potential loss of habitat from Sudden Oak Death syndrome; **Implications**: Loss of habitat to SOD, makes remaining habitat more valuable than previously considered in any programmatic NEPA document.
- Greater than expected loss of habitat to wildfire over the last several years; **Implications**: Loss of habitat to fire and the risk of more such losses, makes all remaining habitat more valuable than previously considered in any programmatic NEPA document.
- The potential effect of climate change 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 uncertainty whether suitable habitat can be regrown from altered young stands in an altered climate regime. **Implications**: 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

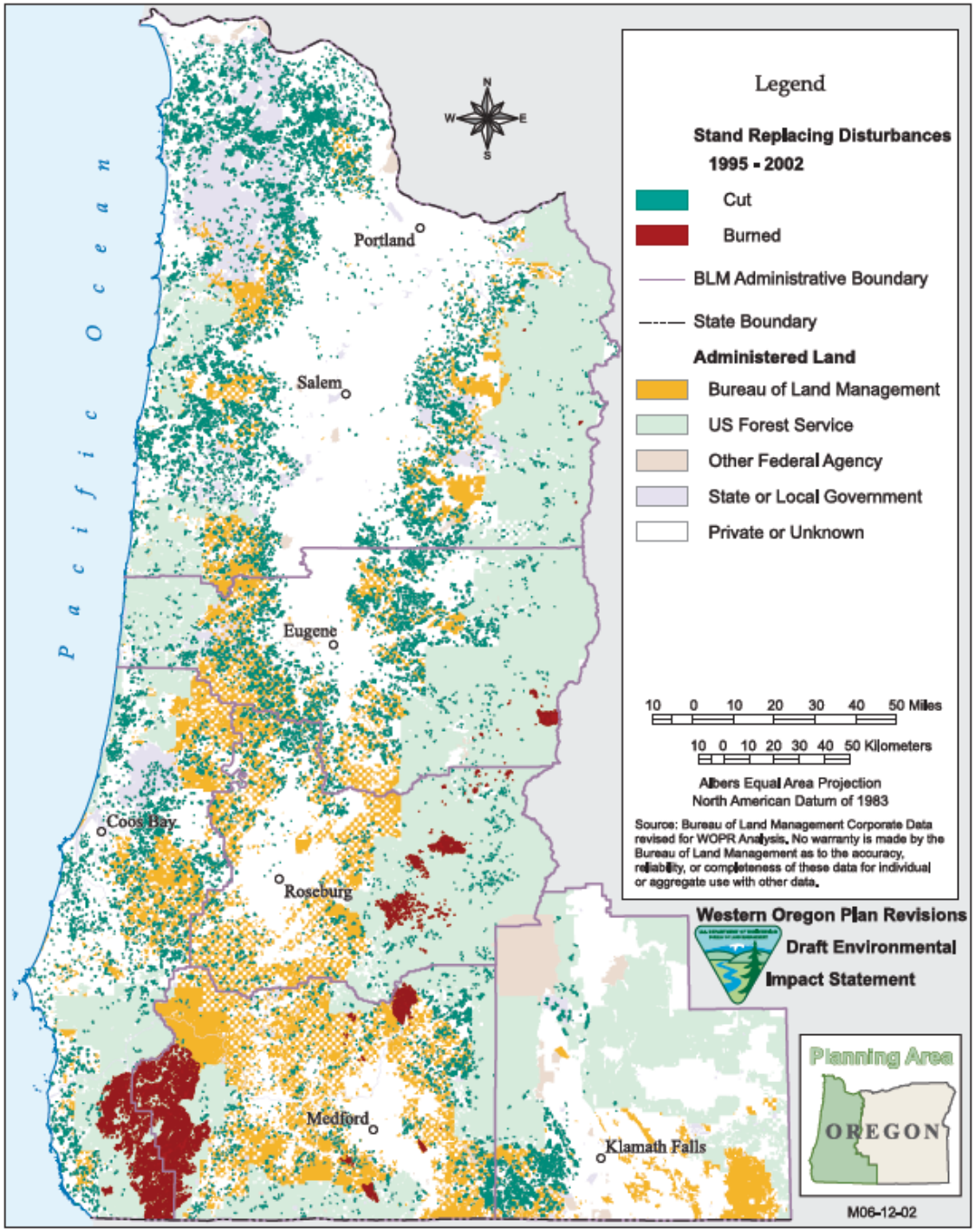
adversely affected. Dense forests provide owls more protection from inclement weather;

- Overly Aggressive Fuel Reduction Logging and Misapplication of the Healthy Forest Initiative and Healthy Forest Restoration Act. **Implications**: While it is true that some treatments if carefully done could help reduce the risk of fire while also retaining some owl habitat values, many such fuel reduction treatments in owl habitat will degrade or downgrade some existing owl habitat (or put that habitat at greater risk of fire or barred owl invasion), so the remaining owl habitat throughout the owls range becomes more important than previously considered in any programmatic NEPA document.
- Fuel reduction objectives conflict with owl habitat objectives. 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.[25] 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%. http://www.fs.fed.us/pnw/sciencef/scifi85.pdf NEPA analysis must recognize removal of surface fuels reduces habitat for owl prey species; removal of ladder fuels reduces owl roosting habitat; and removal of canopy fuels reduces owl nesting habitat. This is significant new information that undercuts the assumptions made in the 1994 FSEIS. **Implications:** The agencies should determine if that 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.
- The 9th Circuit ruled in Gifford Pinchot Task Force v. USFWS, 378 F.3d at 1062, that avoiding jeopardy is not enough, that critical habitat is intended for recovery. The Gifford Pinchot case invalidated the FWS's regulatory definition of Adverse Modification of Critical Habitat and found that FWS's application of the erroneous standard in the relevant Biological Opinions was not harmless error. The Gifford Pinchot case also held that FWS could not rely on the presence of suitable owl habitat in the late successional reserve network to find that the loss of critical habitat was not "destruction or adverse modification.". **Implications:** The decision to approve logging must not be based on an erroneous standard. A change in information, requiring NEPA supplementation "need not be strictly environmental . . . ; the test is whether the new information so alters the project's character that a new 'hard-look' at the environmental consequences is needed." . . . [I]nformation "that does not seriously change the environmental picture, but that nevertheless affects, or could affect, the decisionmaking process, is subject to the procedural requirements of NEPA." Natural Resources Defense Council v. Lujan, 768 F. Supp. 870, 886-87 (D.D.C. 1991).
- There has also been a continuous loss of suitable owl habitat on non-federal lands that should be considered as a cumulative impact on the viability of the species. **Implications:** Continued loss of habitat on private lands renders

[25] FEMAT p IV-55.

remaining suitable habitat on federal land more valuable than it was in 1994 when there was more owl habitat on all ownerships. See WOPR DEIS page 195.

Figure 19. Disturbance map from the Northwest Forest Plan's *Late-Successional Forest Monitoring Report*



- The entire Northwest Forest Plan is premised on the existence of the network of reserves. On Sept 7, 2005 the BLM published a notice of intent to prepare a EIS to revise its western Oregon RMP which will consider eliminating the reserve

> system on BLM lands. Continued 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.[26] **Implications:** If there is a chance that BLM reserves will no longer be protected, 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 NOI means that elimination of the reserves is a "reasonably foreseeable" action.

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. 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 September of 2004, FWS' contractor, Sustainable Ecosystems Institute, completed a 500+ page report on the current status of the spotted owl. The report brings to light a series of new concerns about the continued viability of the spotted owl and the agency must prepare a new NEPA analysis to review and consider all the new information about new threats contained in this report. See Courtney, Blakesley, Bigely, Cody, Dumbacher,

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[26] 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 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."

Fleischer, Franklin, Franklin, Gutierrez, Marzuluff, Sztukowski. September 2004. Scientific evaluation of the status of the Northern Spotted Owl. Sustainable Ecosystems Institute, Portland, Oregon. http://www.sei.org/owl/finalreport/finalreport.htm A few months later, the FWS completed it's status review and analysis of the SEIS report. This official FWS report dated November 2004 describes relevant new information about the owl and is available here:
http://pacific.fws.gov/ecoservices/endangered/recovery/pdf/NSO_5-yr_Summary.pdf

New and increasing threats to spotted owls (Barred owl competition, West Nile Virus, Sudden Oak Death, and increasing habitat loss from wildfires) were not fully considered in the 1994 SEIS for the NW Forest Plan, so the agencies cannot tier to that EIS.

Spotted owls are now declining so rapidly in Washington and Canada that the protection of the remaining owls in Oregon may be far more important to overall survival of the species than previously considered.

The status review shows that habitat loss has been greatest in Oregon. Before allowing any more "take" of spotted owls and before allowing any more adverse modification of suitable habitat, the agencies must prepare a new EIS that considers all the new information and considers whether to increase protection for spotted owls in Oregon.

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. http://www.sei.org/owl/meetings/minutes/june-meeting-transcripts.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.

Well supported expert opinions (from the 2004 status review):

- Late successional habitat is a limiting factor for owl populations in some areas;
- Hardwoods are a significant component of owl habitat in some areas;
- In the Klamath province, heterogeneous habitat may favor higher demographic performance, but this conclusion is not strongly-supported in other areas such as the Cascades;
- Timber harvest and fire are major factors contributing to habitat loss;
- Barred Owls are currently having (strong) negative effects (on occupancy, survival and reproduction) of spotted owl populations;
- Significant current threats to spotted owl populations include: barred owl, past harvest, current harvest, fire, and synergistic interactions among threats;
- Significant future (5-10 years) threats to spotted owl populations include: barred owl, current harvest, fire, SOD, WNV, demographic isolation, synergistic interactions among threats.

http://www.sei.org/owl/meetings/Presentations/June/Courtney-Questionnaire-summary.pdf

Consider how climate change may affect spotted owls.

Global climate change, caused by increasing "greenhouse" gases such as carbon dioxide and methane, has the potential to alter the vegetation patterns across wide areas. Among the possible effects are:

- the shifting of vegetation communities upward in elevation and northward in latitude;
- Changing fire patterns (which can be very significant in this area because fire is one of the controlling variables that determines patterns of vegetation structural development and species composition;
- Increasing summer drought stress for ecosystems.
- Changing weather patterns. Inclement weather can have a significant effect on the success of spotted owl nesting and fledging success rates. If global change brings wetter Springs, then the owl may suffer.

Red tree voles require greater protection.

Only 35% of the range of the red tree vole is on federal land and only 17% of the red tree vole range is in reserved land allocations. FEMAT Table IV-C-9 (last page of Chapter

IV). Plus, The LSRs do not represent red tree vole habitat very well, mostly because the reserves are skewed to the higher elevations, and red tree vole prefers lower elevations. See RTV 2003 ASR step-two review.

Protection of healthy well-distributed populations of red tree vole may be important for conservation of the spotted owl because they are an arboreal species and spotted owls may have a competitive advantage in obtaining RTVs relative to barred owls which seem to forage and hunt more on the ground.

The inactive Red tree vole nests should be fully buffered because Red tree vole are known to frequently reoccupy previously inactive nests. Until more is know about the status and life needs of the Red tree vole, protecting this species requires buffering all active and inactive nests.

The limited size of fragmented old-growth stands may be a limiting factor for red tree voles. Andy Carey.1991. PNW-GTR-276. http://www.fs.fed.us/pnw/pubs/gtr276.pdf There is evidence that red tree vole populations may require 100 acre minimum buffers to remain stable. See Step 2 Worksheet, 2003 Annual Species Review, Red Tree Vole, April 2003 pages 23-24. The NEPA analysis must consider alternatives that include larger buffers (100 acres or larger per the science) and smaller buffers (10 acres per the RTV Management Recommendations) and describe the consequences of each. The agencies must also prepare a NEPA document to consider the consequences of alternative survey protocols, e.g. ground transects vs. tree climbing.

> Our results also indicated that, in some areas, there are relatively high densities of tree voles in young forests. In areas where old forests have been largely eliminated, young forests may play a critical role in the persistence of tree voles. Thus, we think there is much to learn about the relative suitability of young and old forests as habitat for tree voles.

James Kerr Swingle. 2005. Daily Activity Patterns, Survival, and Movements of Red Tree Voles (Arborimus longicaudus) in Western Oregon. OSU Masters Thesis Presented November 29, 2005.

Similar consideration of NEPA alternatives is required for other special management species as well.

Red tree voles should have been surveyed.

Red tree voles are an uncommon yet important species. They make up an important part of the prey base of Threatened spotted owls. The agency should conduct surveys to determine the presence or absence of red tree voles and the extent of red tree vole sites which should be fully protected with 100 acre buffers. The agencies should continue to survey for red tree voles because:

1. **2004 and 2007 RODs are illegal.** A court ruling has legally invalidated the 2004 EIS upon which the agencies attempted to eliminate the survey and manage

program. NWEA v. Rey, Judge Pechman, W.D. Wash, Aug 2005. Now the agencies must either do the surveys or refrain from logging the old forest habitat where rare and uncommon species live.

2. **ASR unsupported by facts.** A recent court ruling invalidated the ASRs because they failed to comply with NEPA and FLPMA (and by implication NFMA). Klamath Siskiyou Wildlands v. BLM (9th Circuit 2006). The 2003 Annual Species Review was completely unjustified in removing protection for red tree voles in the central mesic portion of its range because they lack sufficient information on red tree vole biology and ecology to ensure species viability and persistence. See below.
3. **RTV disclosure and protection is required not just by S&M but also by NEPA and ESA.** Since the red tree vole is important prey for Threatened spotted owls, the BLM should have disclosed the presence or absence of red tree vole in order to comply with NEPA and the ESA. The agency cannot make an informed decision on how this project affects spotted owls survival and recovery without knowing if red tree vole population may be killed by this project.

We also urge the agency to fulfill the NEPA mandate for informed decision-making by surveying for red tree vole, and we urge the agency to fulfill the ESA mandate to conserve Threatened spotted owls by buffering and protecting red tree voles sites (i.e. spotted owl prey).

The agencies lack sufficient information to remove protection for red tree voles.

The 2003 Annual Species Review was completely unjustified in removing protection for red tree voles in the central *mesic* portion of its range because they lack sufficient information on red tree vole biology and ecology to ensure species viability and persistence.

In the 2001 ROD, the agencies rejected Alternative 2, which would have removed Survey and Manage protections for the vole in the year 2006. "Given our limited knowledge of the red tree vole population dynamics and ecology, the 5-year timeframe is not likely to be sufficient for completion of the studies necessary to make an informed recommendation to the species future disposition." 2000 FSEIS Survey and Manage at 392. "Information on the genetic variation between these small isolated populations, combined with studies of red tree vole population trend, longevity, demographics, and population densities, require collection of data over several generations of red tree voles (more than 5 years)." Id. at 392-93.

Before we can prioritize RTV sites the following information is necessary (as noted on pages 261 and 263 of the 2000 DSEIS):

1. quantitative species abundance;
2. relative abundance at known sites;
3. spatial extent at known sites;
4. population trend (the DSEIS notes that population numbers at

many known sites my be declining);

5. other demographic information, such as reproductive potential;
6. which historic sites are extant;
7. distribution of the species in the reserves;
8. genetic variation within and between populations;
9. dispersal capabilities;
10. the necessary scale of protected sites to ensure persistence at the site;
11. connectivity among sites and subpopulations; and
12. risk and consequences from catastrophic events such as fire.

Ground based surveys are inadequate. Surveys must focus on determining the extent of Red tree vole "sites."

The agency should not rely on ground-based transects because many RTV nests are not visible form the ground. The survey protocols are supposed to determine presence or absence of voles with a high degree of confidence. The RTV survey protocol fails to do this.

> Comparisons of nests located by visual searches from the ground versus nests located by following radio collared voles indicated that many active nests could not be seen from the ground, … Our results also indicated that a management approach based only on the protection of active nests detected during ground-based surveys will result in destruction of large numbers of nests not detectable from the ground.

James Kerr Swingle. 2005. Daily Activity Patterns, Survival, and Movements of Red Tree Voles (*Arborimus longicaudus*) in Western Oregon. OSU Masters Thesis Presented November 29, 2005. Swingle found that only about 45% of <u>known</u> nests are <u>detectable</u> from the ground. Even fewer nests will actually be detected when the survey area contains nests are not already known.

The fact that the agency found so few Red tree vole nest is highly suspect. The protocol says that Red tree vole populations tend to be clumped (protocol at page 3). They appear to be a colonial or semi-colonial species that move from nest to nest over the course of several weeks. (protocol at page 7). Red tree vole "sites" are made up of groups of active and inactive Red tree vole "nests."

One of the main goals of the protocol is to identify the extent of Red tree vole "sites" as opposed to just "nests. (protocol at page 9). To accomplish this the protocol requires that when an active or inactive Red tree vole nest is confirmed, an intensive search must be performed in the area 100 meters around the nest tree. (protocol at 12). If another nest is found within 100 meters, an intensive search must be made 100 meters around that tree, and so on until the extent of the site is determined. This intensive search may require tree climbing. Then the protection buffer must be applied to the site, not the nests.

The fact that the agency found so few Red tree vole nests, and the fact that the EA contains no evidence that they followed the 2/18/00 protocol or performed the intensive

search 100 meters around the known Red tree vole nest(s) is grounds for redoing the Red tree vole surveys to finally determine the extent of the Red tree vole site in this sale area.

New Information on Goshawk Habitat Selection

A recent review of the most accurate information on goshawk habitat selection confirms that goshawks select late successional forest structure (e.g. high canopy closure, large tree for forest type, canopy layering, abundant course woody debris). This review continues to support Reynolds' 1992 recommendations to manage nest core areas and post-fledging areas for late successional forest characteristics.

This review also does not find support for a few of the assumptions underlying Reynolds' 1992 management recommendations.

(1) Goshawks are habitat generalists only in the sense of using forests with a variety of tree species, but they are not habitat generalists in terms of selecting forest structure. They disproportionately select for late successional forest.
(2) Goshawks are not opportunistic foragers. Rather they appear to select for prey availability as determined by late successional forest structure.
(3) Goshawk are not limited by prey abundance. They select for prey availability, with absolute prey abundance being only a component of availability, late successional forest structure being an important determining factor.

Some relevant excerpts from this review include:

> Boal et al (2001) found that stands used by goshawks contained 1.6 to 2.4 km of down woody debris per hectare with an average diameter of 17-19 cm, depending on forest type, and Bloxton (2002) documented that goshawk kill sites has greater numbers of snags ≥12.5 cm dbh/ha (u=77) than random sites.
> …
> … the consistency of results in demonstrates goshawk selection for late successional forest structures (e.g. high canopy closure, large tree for forest type, canopy layering, abundant course woody debris) when using areas within their studies home ranges. …
> …
> A majority of studies found selection for stands with >40% canopy closure and greater densities of trees over 40 cm dbh. …
> … goshawks may be broad habitat generalists in terms of tree species but are habitat specialists with respect to forest structure. …
> … prey abundance is not the most important factor is selecting foraging sites ... Several studies determined that goshawks select foraging habitat based not on prey abundance but rather prey availability as determined by habitat structure. … [R]ecommendations focusing on increasing prey abundance at the expense of forest structure within occupied home ranges are not likely to improve goshawk occupancy rates.
> …

> goshawks avoided open areas, particularly logged open areas, and none found selection for openings. … current information does not conclusively support a contention that creating openings through logging will benefit the goshawk. Given the history of clearcutting in much of the western United States range of the goshawk, we very much doubt that forest clearing are a limiting factor for the species.
> …
> Occupancy rates were reduced by removing forest cover in the home range…
> …
> We have no way of knowing assessing whether 40% of the landscape in mature and old-growth forests is sufficient to sustain goshawks. … we recommend protecting existing mature and old-growth forest characteristics and ensuring that such forests are allowed to develop in proportions similar to pre-settlement conditions. This can be accomplished by restricting cutting to small trees and prohibiting large reductions in canopy closure. A similar proposal was recently adopted by Region 5 of the United States Forest Service for the Sierra Nevada.

Greenwald, Crocker-Bedford, Broberg, Suckling, and Tibbitts. 2005. A review of Northern goshawk habitat selection in the home range and implications for forest management in the western United States. Wildlife Society Bulletin 33(1):120-129.

This comprehensive review of telemetry studies does not find support for the hypothesis that thinning improves goshawk foraging habitat. Absent clear scientific support, the agency should clearly label the statement as an unsupported hypothesis.

Non-Economic Values Of Biodiversity

> We may know the names of every tree in the forest, but we don't begin to understand the complex matrix of organisms and relationships that comprise the web of life. We are not capable of predicting the consequences of losing a species; nor can we predict the future importance of some as-yet-undiscovered human use of a forest organism. Therefore, an economic impact analysis is beyond reach and perhaps even trivializes the profound meaning of biological diversity to life on earth; in short, this benefit is unquantifiable. A look at recent forest history points to the commercial importance of hemlock bark for the tanning process and white pine for boxboard--two uses now obsolete. The recent discovery of a cancer-fighting chemical in Pacific yew bark serves as a prominent example of important new forest products. Because we can't read the future, no dollar value can be attached to unknown goods and services. What we can do is adopt an approach that conserves all the native elements of the web of life, common and rare alike. At the same time, public policies that give incentives to protect biological diversity can be created and employed.

Massachusetts Forest Stewardship Program's, Task Force on Reforming Forest Taxation, "Quantifying Public Benefits on Private Forestland, in Massachusetts," January, 2000 http://www.massforesters.org/public.htm

> David Newman, a chemist with the National Cancer Institute's Natural Products Branch did a survey of all the cancer drugs created between 1981 and 2002 and

> found a surprisingly high number look amazingly like chemicals found in nature, whether the chemists intended them to or not. "Sixty percent or more of all anti-tumor drugs have Mother Nature in their background," he said. There is so much potential in finding cures this way that the Natural Products Branch maintains a collection of tens of thousands of plants and sea creatures from more than 25 countries in giant freezers. [but these samples represent only a small fraction of the true scope of biodiversity]

"Slimy sea sponges inspire cancer treatment" Dec 9, 2005. The Eagle Tribune online, Andover, Mass. http://www.ecnnews.com/cgi-bin/15/etstory.pl?-sec-News+fn-fn-seasponges111.1209+page_0

It is also important to conserve biodiversity because it could prove useful to humans in was that have not yet been investigated. Only a fraction of plant species have been tested for activity against cancer, AIDs, Alzheimer's, infectious bacteria, etc. For example, RTI.org is funded by a grant from the American Cancer Society, to test more than 10,000 mushroom extracts for the presence of chemicals that have potential as chemotherapy drugs.

> Recently, some scientists have expressed renewed interest in natural products research following the failure of alternative drug discovery methods to deliver lead compounds in key therapeutic areas such as immunosuppression, anti-infectives and metabolic diseases.
>
> "Natural products research remains invaluable when it comes to providing that initial lead," Wani said. "Before we explored the Pacific Yew tree we had no idea that we could treat cancer and other diseases through microtubule overproduction."
>
> …
>
> Wani said such discoveries support his contention that "nature is the best chemist."
>
> Another proponent of natural products research at RTI, Dr. David Kroll researches milk thistle compounds as a possible way to treat prostate cancer.
>
> "The natural world has 10 times more chemical diversity than synthetic compounds," said Kroll, a senior research pharmacologist. "We just have to get to it in time."

Taxol Pioneer Calls for Greater Emphasis on Natural Products Research , Feb 18, 2005. http://triangle.dbusinessnews.com/shownews.php?newsid=11664

> "Preserving biodiversity also means preserving a reservoir of as-yet-undiscovered medical treatments and cures. … Ecological policies that seek to preserve biodiversity and limit human influences on ecosystem organization may thus be in the best interest of public health, both because biodiversity can yield treatments for existing diseases and provide a buffer against exposure to emergent ones. …

Conservation makes good sense in just the same way that preventive medicine does."

American Council on Science and Health. Why Biodiversity Is a Public Health Issue. November 2, 2005. http://www.acsh.org/factsfears/newsID.658/news_detail.asp

Eric Chivian M.D. Ed. 2002. "Biodiversity: Its Importance to Human Health." Center for Health and the Global Environment Harvard Medical School Harvard Medical School. http://www.med.harvard.edu/chge/Biodiversity_v2_screen.pdf

Migratory Bird Treaty Act

In Humane Society of the United States v. Glickman, No. 99-5309 (D.C. Cir. July 18, 2000), the appeals court held that the USDA violated the MBTA § 703 when it took protected geese species without a permit and that federal agencies must obtain permits from DOI like any other person who takes migratory bird species. If conducted during the nesting season, the proposed harvest of timber will very likely kill nesting migratory birds in violation of the Migratory Bird Treaty Act.

The US government has also taken the position in international tribunals that logging activities can lead to MBTA liability. (Section 5.3.1 "logging that kills birds will be prosecuted"). See Final Factual Record for Submission SEM-99-002 (Migratory Birds); Prepared in Accordance with Article 15 of the North American Agreement on Environmental Cooperation. April 22, 2003.
http://www.cec.org/files/pdf/sem/MigratoryBirds-FFR_EN.pdf
http://www.cec.org/citizen/submissions/details/index.cfm?varlan=english&ID=64

Executive Order 13186, Fed Reg January 17, 2001 requires that all federal agencies:

1. "support the conservation intent of migratory bird conventions … by avoiding or minimizing … adverse impacts to migratory bird resources" [e.g. habitat]
2. "restore and enhance the habitat of migratory birds"
3. "prevent or abate the … detrimental alteration of the environment for the benefit of migratory birds"
4. "design migratory bird habitat and population conservation principles, measures, and practices, into agency plans and planning processes …"
5. "ensure the environmental analyses of Federal actions as required by NEPA … evaluate the effects of actions and agency plans on migratory birds …"
6. "identify where unintentional take reasonably attributable to agency actions is having, or is likely to have, a measurable negative effect on migratory bird populations … With respect to those action … lessen the amount of unintentional take"
7. "inventory and monitor bird habitat and populations"
8. "recognize and promote the economic and recreational values of birds"
9. "each agency is encouraged to immediately begin implementing the conservation measures set forth above"

http://frwebgate.access.gpo.gov/cgi-bin/getdoc.cgi?dbname=2001_register&docid=01-1387-filed

Be sure to protect the following bird species of conservation concern to the U.S. Fish & Wildlife Service:

Table 8. BCR 5 (Northern Pacific Forest–U.S. portions only) BCC 2002 List.
Yellow-billed Loon
Black-footed Albatross
Northern Goshawk (resident *laingi* ssp. only)
Peregrine Falcon (including resident *pealei* ssp. in Alaska)
Black Oystercatcher
Whimbrel
Long-billed Curlew
Marbled Godwit (*beringiae* ssp. only)
Black Turnstone
Surfbird
Red Knot
Rock Sandpiper
Short-billed Dowitcher
Caspian Tern
Arctic Tern
Aleutian Tern
Marbled Murrelet (except where listed as Threatened)
Kittlitz's Murrelet
Yellow-billed Cuckoo
Flammulated Owl
Black Swift
Rufous Hummingbird
Lewis's Woodpecker
White-headed Woodpecker
Olive-sided Flycatcher
Horned Lark (*strigata* ssp. only)
Vesper Sparrow (*affinis* ssp. only)

Table 9. BCR 9 (Great Basin) BCC 2002 List.
Swainson's Hawk
Ferruginous Hawk
Golden Eagle
Peregrine Falcon
Prairie Falcon
[Greater Sage-Grouse (Columbia Basin population)]
Yellow Rail
American Golden-Plover
Snowy Plover
American Avocet
Solitary Sandpiper
Whimbrel

Long-billed Curlew
Marbled Godwit
Sanderling
Wilson's Phalarope
Yellow-billed Cuckoo
Flammulated Owl
Burrowing Owl
Black Swift
Lewis's Woodpecker
Williamson's Sapsucker
White-headed Woodpecker
Loggerhead Shrike
Gray Vireo
Virginia's Warbler
Brewer's Sparrow
Sage Sparrow
Tricolored Blackbird

USFWS. Birds of Conservation Concern 2002. Arlington, Virginia. December 2002. http://migratorybirds.fws.gov/reports/BCC2002.pdf

Avoid Creating Conditions Which Spread Invasive Weeds

Non-native plant species occur on high-use, low-use, and abandoned forest roads, with the greatest frequency on roads with the highest level of disturbance and lowest percentage of canopy cover. Parendes, L. A. and J. A. Jones. In press. Light availability, dispersal, and exotic plant invasion along roads and streams in the H. J. Andrews Experimental Forest, Oregon. Conservation Biology. Exotic weeds spread outward from roadsides in lowland forest and rangeland in Montana, invading relatively undisturbed areas. Forcella, F. and S. J. Harvey. 1983. Eurasian weed infestation in western Montana in relation to vegetation and disturbance. Madroño 30: 102-109. Spotted knapweed invaded new areas along roadsides. Spotted knapweed preferred open canopies and disturbed areas. Marcus, W. A., G. Milner and B. Maxwell. 1998. Spotted knapweed distribution in stock camps and trails of the Selway-Bitterroot Wilderness. Great Basin Naturalist 58: 156-166.

> "... This analysis of recent forest inventory data in western Oregon indicates that nonnative species have become an important part of the flora in these forests, having been detected on 40 percent of the plots on non-Federal forest lands. ... Abundance of most nonnatives was greater on lands that had been recently clearcut or thinned and was more closely related to stand density than climate. ... "

Gray, Andrew N. 2005 Nonnative Plants in the Inventory of Western Oregon Forests. In: McRoberts, Ronald E.; Reams, Gregory A.; Van Deusen, Paul C.; McWilliams, William H.; Cieszewski, Chris J., eds. Proceedings of the fourth annual forest inventory and analysis symposium; Gen. Tech. Rep. NC-252. St. Paul, MN: U.S. Department of

Agriculture, Forest Service, North Central Research Station. 11-16.
http://ncrs.fs.fed.us/pubs/gtr/gtr_nc252/gtr_nc252_011.pdf

On October 1, 2004 Regional Forester Linda Goodman issued a directive to Forest Supervisors stating:

> As appropriate, environmental analysis for ground disturbing activities will assess invasive plant populations in the project area; analyze the potential risks of the activities to introduce, favor establishment, or spread invasive plants; and incorporate prevention practices and follow-up inspections into the project design if needed. Document the analysis in the project file. The enclosed document, "Prevention Analysis Principles" is intended to help guide this analysis …

The "Prevention Principles" state:

> Environmental analyses should consider non-native invasive plant risk in evaluating project location and design, and in the development of alternatives and mitigating measures, including any or all of the following, as determined to be appropriate by the Forest Officer in charge:
> (1) The presence of existing non-native invasive plants within the project site by species and magnitude.
> (2) The susceptibility of the habitat type to non-native invasive plant invasion.
> (3) The risk for invasion or spread of non-native invasive plants that could be caused by the project.
> (4) The evaluation of alternative sites, which are non-native invasive plant-free and/or low risk, for project implementation.
> (5) The evaluation of alternative implementation methods where they are practical and would reduce risk of invasion or spread of non-native invasive plants.
> (6) The inclusion of other mitigation measures (practices) designed to minimize risk of invasion or spread of non-native invasive plants.
> (7) The evaluation of direct, indirect, and cumulative effects of the project to non-native invasive plant species and populations.
> From: File Code 2080, R4 Supplement 2000-2001-1

On Earthday 2003 Chief Dale Bosworth said that more attention needs to be paid to beating back invasive species. The Forest Service's national strategic goal for invasive plants is to "Reduce, minimize, or eliminate the potential for introduction, establishment, spread, and impact of invasive species across all landscapes." The FS March 2005 "Science Update" says, "clearly prevention is the least expensive and most effective way to manage invasive plants."

The FS March 2005 "Science Update" summarized the findings of the Forest Inventory and Analysis results including the fact that "nonnative species were significantly more abundant in stands with the smallest and youngest trees, and in stands with fewer overstory trees, such as stands recently thinned. This trend held true for different forest types." This confirms that opening up the canopy and disturbing the soil through road building and logging could spread non-native weeds far and wide. The invasive weed

sites in the analysis area and along all log and gravel haul routes should be fully inventoried and documented as part of the NEPA process for this project . In the absence of valid and complete weed survey information, harvest and road and fuel treatment activities planned as part of this project might exacerbate the problem instead of contain it.

We find it highly unlikely that conducting ground disturbing activities over so many acres of this planning are will not make the weed problems worse instead of better. These weeds are "a slow motion explosion" that should not be taken lightly. It is often better to just close roads and avoid ground disturbing activities while sending crews in to do hand-pulling of weed infestations as necessary.

A recent study by Dodson & Fiedler (2006) showed that fuel reduction efforts are of particular concern for the spread of weeds because of the large scale of planned treatments and the combined effect of canopy reduction and soil disturbance. Comparing the invasive weed effects of untreated control, thin-only, burn-only and thin-burn treatments, they found that the treatments that were both thinned and burned consistently had the greatest abundance of both exotic and undesirable species, and this pattern was consistent across all scales of analysis. In fact, the thin+burn treatments had almost an order of magnitude higher cover of undesirable and exotic species than an of the other treatments. The thin-only treatment had the second highest levels of exotic abundance.

Summary

1. Invasion by alien plant species represents a challenge to land managers throughout the world as they attempt to restore frequent fire-adapted ecosystems following decades of fire exclusion. In ponderosa pine Pinus ponderosa forests of western North America, the response of alien species to restoration treatments has not been well documented, particularly for alien species capable of altering environmental conditions (transformers). Understanding alien species dynamics is critical for developing treatments that accomplish restoration goals while minimizing alien invasion.

2. We used a replicated, randomized block experiment to compare the effects of an untreated control and thin-only, burn-only and thin-burn treatments on alien and transformer understorey species at multiple spatial scales (1 m2, 100 m2 and 1000 m2). Data were collected pre-treatment and for multiple post-treatment years. We compared richness and cover of alien species and transformer species among treatments, and identified environmental variables correlated with transformer species cover. Indicator species analysis was used to identify transformer species associated with specific treatments.

3. Alien and transformer species richness and cover were significantly higher in the thin-burn than in all other treatments at all spatial scales. Thin-only and

burn-only treatments showed greater alien and transformer species responses than the control at the larger 100-m2 and 1000-m2 scales.

4. Increased transformer cover was strongly correlated with increased tree crown scorch height and removal of overstorey trees.

5. The thin-burn treatment had four transformer species as indicators, the thin-only had one, while the burn-only and control had none.

6. Synthesis and applications. The results show that alien species, including transformers, respond to restoration treatments, especially the combined thin-burn treatment. Therefore monitoring for alien species invasion is an essential component of a restoration programme. Abundance of transformer species increased with increasing disturbance intensity, suggesting that less intense single-disturbance treatments (burn-only, thin-only) or incremental treatments may be preferred in some applications. Where more intense treatments are required to meet management objectives, specific strategies, such as seeding of native species, limiting grazing before and after treatment and harvesting over a protective winter snowpack, may be necessary to limit alien invasion.

ERICH K. DODSON and CARL E. FIEDLER. 2006. Impacts of restoration treatments on alien plant invasion in Pinus ponderosa forests, Montana, USA. Journal of Applied Ecology (2006) 43, 887–897. http://www.blackwell-synergy.com/doi/abs/10.1111/j.1365-2664.2006.01206.x

See also, Dodson, Erich. Monitoring change in exotic plant abundance after fuel reduction/restoration treatments in ponderosa pine forests of Western Montana. Masters Thesis University of Montana. May 2004.
http://www.fs.fed.us/ffs/docs/lubrecht/Dodson%20Final%20thesis.pdf

> "While the thin-only and burn-only generally showed increases in exotic richness and cover greater than that of the control, adding together the effects of each treatment does not explain all of the invasion observed in the thin/burn, suggesting a synergistic relationship. … In fact, understory productivity in ponderosa pine forests has been shown to be limited by competition from trees for soil nutrients and water, not light (Riegel et al. 1992). When combined, treatments may reach a threshold of resource availability necessary for exotics to invade or establish. Individually treatments may not be sufficiently intense to reach this threshold. There is evidence to support the idea of disturbances (fire and mechanical cutting) acting in a synergistic fashion to promote invasion (Hobbs and Huenneke 1992). … Moreover, fire may be the type of disturbance that promotes colonization for *C. biebersteinii* [spotted knapweed] (Sheley et al. 1999). Adding nitrogen to a system, which may occur the first year after burning (Deluca and Zouhar 2000), has been shown to shift the competitive advantage to *C. biebersteinii* (Blicker et al. 2002)."

Consider how weeds were addressed in the MIDDLE NORTH UMPQUA WATERSHED ANALYSIS; Version 1.0, January 2001; North Umpqua Ranger District, Umpqua National Forest; Chapter 4, pages 88-89.
http://www.fs.fed.us/r6/umpqua/planning/watershed_analysis/mid_n_ump/mid_n_ump_wa.html

Aggressive Species

There are many aggressive non-native plant species that compromise the ecology of the area and may threaten native communities besides those listed as "noxious". For the most part, these are pioneer species that occupy disturbed areas in great numbers. In some cases the invasive ability of these plants rivals those listed as noxious, but they are either already so firmly established that eradication efforts have not been effective or their ecological threat has not been recognized. Three species of particular concern are cat's ear daisy (Hypocharis radiata), dogtail hedgehog grass (Cynosurus echinatus), and ox-eye daisy (Leucanthemum vulgare). All of these species are commonly transported along roads. Dogtail hedgehog grass is quite likely the most common grass species in the watershed. It dominates nearly all dry meadows that were grazed in the past and provides stiff competition to recolonization by native species. None of these species are easily eradicated.

Arguments are often made that non-native species will die out over time as the vegetation moves from open clear-cut to forested conditions. To some extent this is true. Pioneer plant populations decline in the shaded conditions that increase as the seral stages progress. However, non-native seed banks remain in the soil and plants continue reproducing and spreading from and to recently disturbed areas. How this disruption of early seral processes affects the long-term viability of native pioneer plants and the species that depend on them is unknown. The extent of the detrimental effect on the composition of later seral herbaceous communities is, for the most part, also unknown.

Non-native plants impact rare plants by causing physical displacement, loss of nutrient availability, changes in environmental parameters (e.g., water, light, and temperature) and through the interruption of crucial relationships with other species. The extent of this type of disturbance to populations of rare plants is not known. Neither the exact nature of the damage to the rare plants resulting from the presence of non-native plant species nor its extent is known in the Middle North Umpqua Watershed. Based on observed situations, it is reasonable to assume the trend has been negative.

Besides the plant species immediately replaced by non-native invasion, the most highly affected species may be insects involved in pollination. Native plants have established relationships with native pollinators. The decrease in plant diversity caused by non-native encroachment can cause displacement or loss of pollinators.

Orchids may be particularly at risk, since they often are dependent on a single pollinator.

In addition to affecting pollinators, the replacement of native plants by non-natives affects both the structure and food production provided to wildlife by native plants. These changes are not necessarily negative. For instance, Himalayan blackberry provides extensive habitat and food for certain species. The net loss or gain to wildlife in the analysis area has not been ascertained, but is likely to be negative.

Riparian areas in the watershed are also being impacted by non-native species. One mode of introduction of these plants is the road system within the watershed. Vehicles traveling these roads pick up non-native seed and deposit it along their way. These non-natives establish and produce more seed that is then transported downstream along waterways. The best current example of this action in the watershed is meadow knapweed (Centaurea pratensis). The species was planted in the 1960s for erosion control despite its ability to spread rapidly. It now is common along the North Umpqua and tributary streams near the roads it was planted on. It will likely soon become the dominant riparian herb species. It is actively displacing such species as chatterbox orchid (Epipactis gigantea), great northern aster (Aster modestus) and willows (Salix spp.). Meadow knapweed produces an extensive root system that is capable of rapidly occupying and stabilizing sand and gravel bars. Besides limiting habitat for native plant species, it is likely to affect the ecology of the river system.

Both upland and riparian areas are at risk from Scotch broom and Portuguese broom. These species have demonstrated the ability to change patterns of succession. They dominate disturbed sites and form dense thickets that exclude other species from becoming established. They contain highly flammable oils, are very fire prone, and burn intensely. The plants produce copious amounts of seed that can lay dormant in the soil for decades, then sprout quickly after fire, producing a single species brush field that precludes the establishment of other native species.

Please comply with Executive Order 13112 of February 3, 1999 which provides:

(a) Each Federal agency whose actions may affect the status of invasive species shall, to the extent practicable and permitted by law,

(1) identify such actions;

(2) subject to the availability of appropriations, and within Administration budgetary limits, use relevant programs and authorities to: (i) prevent the introduction of invasive species; (ii) detect and respond rapidly to and control populations of such species in a cost-effective and environmentally sound

manner; (iii) monitor invasive species populations accurately and reliably; (iv) provide for restoration of native species and habitat conditions in ecosystems that have been invaded; (v) conduct research on invasive species and develop technologies to prevent introduction and provide for environmentally sound control of invasive species; and (vi) promote public education on invasive species and the means to address them; and

(3) not authorize, fund, or carry out actions that it believes are likely to cause or promote the introduction or spread of invasive species in the United States or elsewhere unless, pursuant to guidelines that it has prescribed, the agency has determined and made public its determination that the benefits of such actions clearly outweigh the potential harm caused by invasive species; and that all feasible and prudent measures to minimize risk of harm will be taken in conjunction with the actions.

http://www.invasivespecies.gov/laws/execorder.shtml

Manage Weeds with Diversity and Complexity

According to Richy Harrod, (The effects of invasive and noxious plants on land management in eastern Oregon and Washington. Northwest Science Vol 75, Special Issue 2001) forest restoration strategies have two primary effects on weeds: (1) sites recently disturbed by logging and road building provide suitable habitat for many weed species and weeds may become established as a result of restoration; and (2) if restoration improves diversity and productivity of native plant communities, they may become more resistant to weed invasion. This project must take steps to minimize the former (disturbance) and emphasize the latter (improve diversity and productivity of native plant communities).

Sheley et al (1996 Sheley, R.L., T.J. Svejcar and B.D. Maxwell. A theoretical framework for developing successional weed management strategies on rangeland. Weed Technology 10:766-773) presented a framework for enhancing natural processes and mechanisms to regulate vegetation in a way that addresses weeds through directed successional trajectories.

Traditional regen harvest, salvage logging, and thinning to uniform densities, all tend to simplify and homogenize forests and disturb soils which lead to invasive species and hard-to-alter successional trajectories. Livestock grazing will exacerbate these problems in all cases.

The agency must manage for biodiversity and biocomplexity including healthy and diverse plant communities. The reason why is clearly articulated by Kennedy, T. A., S. Naeem, K. M. Howell et al. (2002) Biodiversity as a barrier to ecological invasion. Nature (417) 636-638.
http://www.eeb.cornell.edu/sdv2/Readings/Kennedy_etal_Invasion_Nature2002.pdf

Our study suggests that losses of biodiversity mean possible degradation of local resistance against invasion once factors that previously insulated habitats from

> invasion, such as geographical barriers, are breached by the changing patterns of human transport. These results also indicate that restoration and re-vegetation practitioners would benefit from establishing communities with as high a diversity of plants as is ecologically realistic and logistically feasible—diverse communities will probably require minimal maintenance and monitoring because they are generally effective at excluding undesirable invaders.

And see Andrew Carey. Globilization of Flora: Inviting Worldwide Ecosystem Disaster; Renewable Resources Journal. 20(1): 13- 17 (Spring 2002).
http://www.fs.fed.us/pnw/pubs/journals/carey-global-flora2002.pdf

> Recent research, however; points to even more pernicious phenomena. Agriculture and timber management deliberately simplify vegetation, in similar fashions around the world, creating homogeneous environmental conditions that benefit a few rapidly spreading species to the detriment of many other, especially indigenous, species …
>
> …
>
> Ecological simplification promotes dominance by a few weedy native and non-native species in intensively managed ecosystems; it also promotes system connectedness that increases susceptibility to catastrophe (wind, floods, fire, disease, insects) and risk of system collapse over time (Tilman *1999,* Holling *2001).* In other words, homogeneity produces universal vulnerabilities and promotes epidemics of damaging agents. Ecosystems not only collapse catastrophically; they can shift among alternative stable states. These states differ in the mix of ecological, economic, and social values they provide to people, and the degree of external (managerial) support they need to provide those values. …
>
> …
>
> In the Pacific Northwest, second growth forests are widespread and there is considerable debate about how to manage these forests to meet societal wants and needs. Some of these forests have been so simplified that they have lost the capacity to provide numerous ecological services to people, including providing habitat for a variety of native wildlife, fungi, and plants. In attempting to restore full ecological function to second-growth forests originating through clearcutting, I (and others elsewhere) have found surprising resistance to change. Forests with relatively open canopies of evenly spaced trees have homogeneous understory vegetation dominated by clonal, native plants that exclude many of the species common in natural stands. Forests with dense, even canopies have few understory species compared to natural forests and persistent seeds of weedy species in the soil that would germinate in response to further management. Management activities to open the canopy that disturb the forest floor are immediately followed by the invasion of exotic plants …
>
> …
>
> Thus, any management that opens canopies in a uniform way can lead to relatively uniform understories dominated by aggressive native and exotic plants to the detriment of the bulk of the native understory species. Dominance by these few aggressive species can change the ecology of the forest floor, including the

> nature of the organic component of the soil and soil food webs that are important to the growth of many trees. Thus, historical management has produced undesirable understory conditions that are difficult to alter …
> …
> Plants like scotchbroom [sic], bunch grasses, English ivy, and English holly are capable of bringing about fundamental changes in the ecosystems including reduced capacity for indigenous flora and fauna and traditional human use.
> …
> [D]isruption of historical patterns of disturbance together with management that simplified the ecosystems (1) made ecosystems more homogeneous, (2) removed small-to intermediate-scale disturbance that creates heterogeneity (patchiness), (3) opened the way to invasion by exotics, and (4) led to the development of novel alternative stable states of low diversity and productivity, and decreased sustainability of the goods, services, and amenities we rely on our natural and semi-natural systems to provide. Thus, diversity, invasibility, and biocomplexity are linked …
>
> What Can Be Done In Forestry?
>
> Based on my studies involving the induction of spatial heterogeneity, it appears that managerially inducing heterogeneity into canopies in second growth forests can help develop complexity and promote diversity of native plants while reducing susceptibility to invasion by exotic plants. …

The Agencies' Failure to Address Climate Change is a Environmental Justice/Human Rights Issue

The agencies' continued liquidation of carbon-rich forests and soils fails to take necessary steps to mitigate climate change and threatens the basic human rights of humanity. The agency must address this as part of it NEPA analysis.

> It is widely recognized that the earth's climate is undergoing some fundamental changes. I argue that these changes undermine several core human interests - including, interests in (i) decent health, (ii) economic necessities, and (iii) physical security. Building on this, and after taking into account the kinds of duties required to protect these
>
> interests, I argue that persons have a right to the protection of these vital interests. These rights, I argue, are held by future people as well as contemporaries. I further explore how one specifies the level of protection that is required by these rights. The paper then proceeds to examine two kinds of challenge to this position - an extreme challenge
>
> (which denies that future people have rights) and a moderate challenge (which claims that a positive social discount rate should be applied to the rights of future generations). Neither kind of challenge is found persuasive.

Simon Caney, "Climate Change and Human Rights"
http://depts.washington.edu/ponvins/ecc/abstracts.html

The Klamath-Siskiyou Mountains are unique.

The "H" configuration

From a satellite view only the major rivers, valleys and mountain ranges stand out. The Cascade-Sierra chain and the California-Oregon Coast ranges appear as north-south parallel tracks, with the Cascades appearing as occasional white-capped volcanic peaks. The Klamath Geologic Province stands out as a crosstie joining the tracks, like the crosstie of a gigantic capital 'H.' The Klamath and Columbia Rivers completely breach the Cascade barrier. They appear as deep, winding gorges allowing water, air, spores, seeds, fish and other animals lowland passage through the Cascade mountain barrier. The Klamath River effectively joins east with west, sagebrush, juniper and aspen with Sitka spruce, madrone, Douglas-fir and shore pine.

In the Klamath Province, the backbone or "crosstie" of the Siskiyou Range provides a high elevation east-west corridor and a sink for genetic material uninterrupted by the glacial advances. The Siskiyous have been an "intersection" for migration and dispersal of fauna and flora for at least the last 60 million years. Genetic material from the Oregon and California Coast Ranges, the Sierras and Cascades, the Klamath River corridor and southern lowland chaparral species, migrate in, recombine and disperse. Wittaker and Axelrod both alluded to the Klamath's "central significance" on the west coast.

http://resourcescommittee.house.gov/archives/109/testimony/2006/thomasatzet.pdf

- There would be a 75% reduction in the acres of riparian management areas compared to the Northwest Forest Plan (p LX) (note: the pie charts on p XLVIII indicate a 48% reduction);
- On 2.4 mm acres (93%) of BLM lands OHVs would be designated as "limited to designated roads and trails" for OHVs.
- Greatly reduced riparian protection:
    - permanent and fish bearing streams get 0-25' no harvest buffer, 25-60' logging allowed with 80% shade retention; 60-100' logging allowed with 50% canopy retention
    - small streams: within 0-25' retain 12 trees per acre and retain non-commercial vegetation. (12 tpa is equivalent to one seedling or sapling every 175 feet along streams.)
- After 100 years, marbled murrelet habitat would be reduced by 40% compared to the Northwest Forest Plan;
- After 100 years, spotted owl dispersal habitat between the reserves would be reduced by 41% compared to the Northwest Forest Plan;
- Increased logging will create more dense young forests that are prone to high severity fire;
- BLM would continue logging 4 of 9 areas that they admit contain wilderness characteristics.
- BLM undermine Congressional intent by changing the rules for management of forests around the Coquille Tribal Forest so that they would not have to follow even the meager protections of the Northwest Forest Plan "matrix" standards and guidelines.
- 52 "relevant and important" values in proposed Areas of Critical Environmental Concern would receive no management attention or protection;
- Logging will cause "major modification" of visual resources across 2.3 million acres of forest.

A sub-alternative considers emulation of industrial-style short rotations on BLM lands.

<u>Quotes that seem relevant to the WOPR fiasco:</u>

> "Good policy is difficult to make when information is systematically collected in a way that minimizes discrepancy with policy goals." — Iraq Study Group, December 2006. (This relates to BLM's choice to remain ignorant of the broader implications of the WOPR decision on regulatory stability of non-federal lands, the Forest Service's future ability to meet Northwest Forest Plan goals, and community stability derived from quality of life, as well as unsupportable conclusions about the effects of the WOPR on water quality and imperiled species).
>
> "It is difficult to get a man to understand something when his job depends on not understanding it." — Upton Sinclair (… related to BLM's views of issues such as climate change and salvage logging.)

"Not everything that can be counted counts, and not all that counts can be counted." —Albert Einstein (… failure to account for non-market economic values.)

"If we learn, finally, that what we need to 'manage' is not the land so much as ourselves in the land, we will have turned the history of American land-use on its head." — Gaylord Nelson, Founder of Earth Day

"Those who speak most of progress measure it by quantity and not by quality." George Santayana. (… BLM places more value on logging money, which benefits a few, and less value on ecosystem services and quality of life which is shared by many.)

"The absence of alternatives clears the mind marvelously." - Henry Kissinger (BLM can see no alternative to their timber-dominant interpretation of the O&C Act.)

"A great deal of intelligence can be invested in ignorance when the need for illusion is deep." Saul Bellow (BLM went to great effort to develop models and assumptions that would give the "preferred" answer, however inaccurate.)

"How hard it is, sometimes, to trust the evidence of one's senses! How reluctantly the mind consents to reality." - Norman Douglas (One need only look at the aerial photos to know what our forests need most— time to grow back.)

"We know next to nothing about Douglas fir, and it's the species we know the most about," Ken Bible, University of Washington forest ecologist. http://seattletimes.nwsource.com/html/localnews/2004037053_trees27m.html

Summary of Key Flaws in the WOPR DEIS.

1. The WOPR would not meet the stated reasons for the preferred alternative. Alt 2 would set back recovery of threatened species relative to the Northwest Forest Plan (especially spotted owl, murrelet, and salmon). Alt 2 would degrade and retard recovery of water quality relative to the Northwest Forest Plan. Alt 2 would increase fire hazard relative to the Northwest Forest Plan. Alt 2 would provide inadequate recreational facilities and cause crowding in recreational areas. Alt 2 threatens the economic stability of local communities by: recoupling counties to the boom-bust timber industry, by increasing local communities dependence on a volatile and declining industry, and by reducing the quality of life that helps sustain and grow a more healthy and diverse economy. The Northwest Forest Plan clearly meets the stated goals of the WOPR better than Alt 2.
2. The EIS has yet to describe and consider the cumulative/compound/synergistic impacts caused by all management activities on BLM lands (logging, roads, mining, grazing, OHVs, weeds), within the context of all activities on non-federal lands, as affected by disturbances such as fire and extreme weather, and under the influence of

global climate change. BLM still needs to consider how these cumulative influences will affect each resource of concern both on BLM lands and throughout their range.

3. BLM still must consider how much additional spotted owl habitat needs to be protected on BLM lands in order to compensate for suitable habitat occupied and defended by barred owls. BLM needs a reliable strategy to assure well-distributed blocks of habitat where viable clusters of spotted owls can co-exist with barred owls, and move across the landscape between the blocks. Since barred owls render some of the large blocks unavailable to spotted owls, BLM must provide extra habitat in order to achieve the objective of "*n*" pairs (to ensure viable clusters, *n* maybe 30-40 pairs according to Noon and McKelvey (1996). If some of the stepping stones used for dispersal are rendered unavailable to spotted owls, then more stepping stone need to be provided for dispersal.
4. BLM still needs to disclose the effects of its management on *populations* of wildlife instead of just *habitat* effects. Populations and habitat are inter-related and must both be discussed, not just one or the other. For instance, sometimes habitat and populations are partially decoupled due to the effects of fragmentation, habitat bottlenecks, and species interactions.
5. BLM has yet to explain how they can dramatically increase highly controversial old-growth logging without compromising social and economic stability. Old-growth logging has in the past generated lawsuits and civil protests. The WOPR calls for clearcutting virtually all stands 200 years and older in the timber management areas. Logging these stands would be highly controversial. One of the main reasons the BLM has not been successful under the Northwest Forest Plan is because the Northwest Forest Plan leaves approximately one million acres of old forests unprotected and virtually every proposed old-growth timber sale brings conflict and controversy. The EIS needs to disclose that conflict generated by old-growth logging detract from community stability.
6. BLM failed to consider reasonable alternatives that would actually meet the objectives of all the governing laws while having a reasonable chance of public acceptance and successful implementation. BLM must conserve and restore more mature and old-growth forests in order to achieve climate stability, permanent forest production, watershed protection, regulating water flow, recovery of imperiled species, meeting water quality standards and attainment of beneficial uses of water, avoiding the need to list additional species, avoiding emissions of air pollutants such as CO_2, etc.
7. The DEIS would allocate only 8% of BLM lands in the west Cascades province to protected status (LSMAs). There is a high concentration of municipal drinking watersheds in the West Cascades serving among others, Salem, Albany, Eugene, Roseburg, and suburbs of Portland. BLM's overly optimistic water quality analysis notwithstanding, the EIS fails to recognize that this high concentration of timber management allocations would sacrifice drinking water quality, because (a) extreme weather events *will* happen, especially under climate change, (b) landslide risk will increase with logging because areas prone to landslides will not be reliably identified or protected, and (c) the WOPR gives to much discretion to managers and overly

aggressive timber targets so BLM managers will be compelled to log and build roads in inappropriate places.

8. THE DEIS has not considered the full suite of ways in which water can be polluted by BLM activities. The EIS for instance:
   - ignores sediment input from increased road use by heavy logging trucks and other support vehicles;
   - ignores surface and subsurface erosion caused by rutting and gouging the soil during logging and yarding;
   - ignores pollution caused by OHVs that seem to enjoy disturbing soil in both authorized and unauthorized locations;
   - ignores the chronic sediment inputs from poorly maintained roads;
   - ignores cumulative impacts from non-federal activities;
   - Nor can the BLM assume that all livestock grazing near streams will be implemented with the precision and rigor required to avoid water quality impacts.
9. BLM has yet to address the effects of climate change on forests, fish, wildlife, water, etc; BLM has yet to acknowledge that BLM's past policies of old-growth liquidation contributed significantly to past carbon emissions; and most importantly BLM has yet to consider their essential role in reducing and mitigating future climate change by adopting policies to restore and conserve large carbon reservoirs in the form of mature and old-growth forests.
10. BLM has yet to acknowledge that limiting climate change is essential to meeting BLM's responsibilities under the ESA, CWA, and O&C Act. Permanent forest production, regulating water flow, watershed protection, and community economic stability are directly threatened by climate change and BLM must do everything it can to help limit emissions in order to meet O&C Act objectives.
11. BLM needs to stop rewriting history. Past analyses show the WOPR strategy to be highly risky and implausible. BLM must acknowledge and rationally address past conclusions that …
    - Ecosystem management is preferable to single-resource management. Ecosystem management takes of advantage of synergies such as, aquatic benefits of large late successional reserves, and terrestrial benefits from wide riparian reserves.
    - Ecosystem management that restores ecosystem processes and functions and is consistent with the natural range of variability is most likely to assure a continuing flow of ecosystem services that are essential for meeting legal obligations under the ESA, CWA, and O&C Act.[1]

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[1] The Secretary of Interior insists that the ecosystem approach is best. "The purpose of this cooperative policy is to promote healthy ecosystems through activities undertaken by the Services under authority of the Endangered Species Act of 1973 (Act), … in the following manner: … B. Interagency Cooperation — (1) Develop cooperative approaches to threatened and endangered species conservation that restore, reconstruct, or rehabilitate the structure, distribution, connectivity and function upon which those listed species depend. C. Recovery — … (2) Develop and implement recovery plans for threatened and endangered species in a manner that restores, reconstructs, or rehabilitates the structure, distribution,

- Small, fragmented, widely-spaced reserves would not restore a functional interconnected late successional forest ecosystem which is necessary to recover threatened species and prevent the listing of additional species;
- Small stream buffers are inadequate to meet aquatic objectives. FEMAT Option 7 is similar to WOPR Alt 2, and the 1994 FSEIS concluded that Alt 7 would not meet objectives for aquatic species and the Clean Water Act.
- BLM lands are essential to the overall conservation scheme of the Northwest Forest Plan because, among other things, BLM lands help provide well-distributed habitat, BLM lands increase the abundance of older forests that are in very short supply, and BLM lands provide essential habitat connectivity between the Coast Range, Cascades, and Klamath Provinces;
- Avoiding ESA listing of new species helps stabilize timber outputs and contributes to the stability of communities and industries. FEMAT concluded that Option 7 (like WOPR Alt 2) would likely NOT adequately conserve mollusks, lichen, fungi, salamanders, salmonids, etc.
- Federal lands were supposed to carry the burden of conservation so that non-federal lands could practice more aggressive forestry. BLM is going back on its promise to help compensate for high levels of disturbance on non-federal lands. BLM has not considered the economic consequences of this significant policy change.
- BLM lands were supposed to provide additional habitat for marbled murrelets and Pacific salmon in order to compensate for adverse ocean conditions (and adverse conditions on non-federal lands).
- Interagency cooperation is essential to successfully achieving the objectives of the Northwest Forest Plan. The Western Oregon Plan Revision threatens even the success of the Forest Service's implementation of the Northwest Forest Plan conservation scheme.
- The Northwest Forest Plan provided the maximum allowable logging levels. For instance, "The design of the preferred alternative [option 9] … is intend to allow as high a level of sustainable timber supply as possible without risking further curtailments in the timber supply in the future due to the requirements of a myriad of other laws under which the BLM must operate." 1995 Medford RMP.

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connectivity and function upon which those listed species depend. In particular, these recovery plans shall be developed and implemented in a manner that conserves the biotic diversity (including the conservation of candidate species, other rare species that may not be listed, unique biotic communities, etc.) of the ecosystems upon which the listed species depend. … D. Cooperative Efforts — (1) Use the authorities of the Act to develop clear, consistent policies that integrate the mandates of Federal, State, Tribal, and local governments to prevent species endangerment by protecting, conserving, restoring, or rehabilitating ecosystems that are important for conservation of biodiversity. … (4) Integrate ecosystem-based goals of the Endangered Species Act with existing mandates under other environmental laws, such as the National Environmental Policy Act, Clean Water Act, Clean Air Act, Marine Mammal Protection Act, Magnuson Fishery Conservation and Management Act, and Fish and Wildlife Coordination Act." USFWS, NMFS. 1994. **Notice of Interagency Cooperative Policy for the Ecosystem Approach to the Endangered Species Act.** *Federal Register* for Friday, July 1, 1994.

12. BLM's internal agency reward system leads to unintended consequences. Unreasonably high timber targets combined with highly discretionary standards and guidelines will lead to abuse of discretion and failure to attain environmental objectives.
13. The action alternatives encourage clearcutting that creates dense young forests that are more susceptible to severe stand-replacing fire which can threaten communities, homes, and habitat. The DEIS fails to account for the increase fire hazard as part of its community economic stability analysis. The Northwest Forest Plan would contribute more to community stability because it would result in the greatest decrease in fire hazard through the growth of fire resilient older forests.
14. BLM ignores that logging is a boom-bust industry that undermines community stability rather than enhancing it. BLM ignores the extent to which forest conservation helps stabilize communities by enhancing quality of life and helping to diversify the economy so communities are less dependent on the inherently volatile timber industry. BLM has yet to consider the economic impacts of shifting the regulatory burden to non-federal lands, and the economic costs of increasing communities' dependence on the inherently boom-bust timber industry.
15. BLM ignores the non-market economic values provided by forest conservation, even when those values directly serve the objectives of the O&C Act: watershed protection, regulating water flow, and community economic stability. Non-market economic values are no less real than those values that are sold in markets, it's just that non-market values are harder to measure and harder to capture in market transactions. The WOPR EIS must recognize that non-market values like clean water, pure air, healthy biosphere, and a stable climate are fundamental to human survival, and more important than money.
16. The O&C Act does not require BLM to ignore non-market values. In fact, the O&C Act's qualification to sell timber only at "reasonable prices on a normal market" are an implicit acknowledgement that markets can fail and BLM must intervene to account for non-market factors. BLM's NEPA analysis failed to recognize that prices are <u>un</u>reasonable and markets are <u>not</u> normal because current markets and prices do not reflect the true adverse environmental costs of logging mature and old-growth forests in terms of loss of biodiversity, degraded water quality, loss of climate stability, etc. The recent UK Stern Report said that climate change is being caused by the greatest market failure in history because those who conduct activities that emit carbon (such as logging mature and old-growth forests) do not pay the full cost of the global impacts of those emissions.
17. BLM has yet to provide a compelling explanation of how they have harmonized their new timber dominant interpretation of the O&C Act with their equally important legal duties under the Endangered Species Act, Clean Water Act, Federal Land Policy and Management Act, and Clean Air Act. Logging proponents are misconstruing the recent case of <u>Homebuilders v. Defenders</u> (U.S. Supreme Court, June 2007). The Clean Water Act's procedural criteria (at issue in <u>Homebuilders</u>) stand in sharp contrast to the type of discretion that BLM exercises in developing resource management plans. The O&C Act does NOT create non-discretionary mandate to maximize logging. The O&C Act requires BLM to exercise discretion in finding a

harmonious way to achieve many objectives: permanent forest protection, recreational facilities, sustained yield watershed protection, regulated water flow, community stability, reasonable prices, normal markets, etc... See Interior Solicitors Opinions dated October 4, 1978, August 27, 1979, and May 14, 1981. In Seattle Audubon Society v. Lyons, 871 F. Supp. 1291 (W.D. Wash. 1994), Judge Dwyer said BLM exercises "broad authority to manage the O&CLA lands: the BLM is steward of these lands, not merely regulator. Management under the O&CLA must look not only to annual timber production but also to protecting watersheds, contributing to economic stability, and providing recreational facilities." Id. at 1314. The Secretary of Interior has previously taken the position that managing BLM forests so as to avoid future ESA listings furthers the purposes of the O&C Act to provide predictable timber supply. Furthermore, the Homebuilders precedent could not exempt BLM from other ESA requirements such as sections 9 and 7(a)(1).

18. The EIS has yet to consider the effects of salvage logging in its environmental effects analysis. BLM cannot approve salvage logging (even in the abstract) without fully considering the environmental consequences of that policy. BLM can't just postpone consideration of salvage logging to the project level, because there are significant cumulative effects of salvage logging that must be considered at a programmatic level (e.g., large numbers of species that rely on dead wood and complex young forests, numerous ecological functions and processes that are influenced by the cumulative impacts of all management activities including salvage logging).

19. The DEIS relies on several flawed assumptions:

    - BLM incorrectly assumes that all suitable owl habitat is available to spotted owls, which is false because barred owls occupy many areas of suitable habitat. BLM claims ignorance of any influence of habitat management on the competitive relationship between spotted owls and barred owls, when in reality this relationship is well established in ecological theory— increasing habitat area decreases competitive pressures and increases the likelihood of co-existence.
    - BLM incorrectly assumes that unstable slopes will be correctly identified and protected 100 percent of the time, when in fact unstable slopes will be misidentified, and discretion will be abused resulting in the loss of large wood structure from those areas.
    - BLM incorrectly assumes that BMPs will we implemented and effective, when in fact this is often not the case, especially given the fact that their analysis relies on an unattainable set of burdensome BMPs.
    - BLM incorrectly assumes that the effects of climate change on water resources are uncertain because precipitation is uncertain, but in fact, scientists are fairly confident that temperature increases (which are virtually certain) will increase evaporative demand and overwhelm any likely increase in precipitation. Even though precipitation may be uncertain, increasing drought stress is highly likely.
    - BLM incorrectly assumes that fuel reduction logging is always effective at reducing fire hazard, which is not true because logging creates hazards slash, stimulates the growth of ladder fuels, and makes the stands hotter, dryer, and windier.

- BLM's predictive models are flawed because they do not account for natural disturbances such as fire, or extreme weather events such as big winter storms. BLM assumes these natural events will not occur, while both are in fact predicted to increase under the influence of climate change. BLM is abandoning the Northwest Forest Plan strategy to accommodate natural disturbance through redundancy in the reserve system.

20. BLM has yet to conduct a sensitivity analysis to show which assumptions are most in need of scrutiny. BLM still needs to prepare and disclose a multi-scale analysis that reveals the scales at which different resources are most sensitive to the effects of BLM management and other cumulative impacts.
21. BLM still needs to consider how the WOPR action alternatives will cause trends toward listing for:
    - Dispersal limited species;
    - Species associated with headwater streams,
    - Species associated with dead wood;
    - Forest floor associated species;
    - Species sensitive to global climate change, e.g., bull trout, western snowy plovers, polar bears, endemic alpine species; and
    - Former survey and manage species.
22. BLM must explain why all the bad outcomes for wildlife and water quality described for FEMAT Option 7 would not be manifested by WOPR Alt 2 which is quite similar in design. BLM must review, consider, and disclose the conclusions in the 1994 Northwest Forest Plan FSEIS and Appendix J2 which disclose serious adverse consequences of FEMAT Option 7 (similar to WOPR Alt 2) on water quality, aquatic recovery, as well as numerous species of mollusks, fungi, lichen, salamanders, salmon and trout, and already threatened spotted owls and marbled murrelets, etc.
23. BLM has yet to disclose the effects of BLM management in light of the significant qualitative difference between stands with a few snags and little dead wood, vs. stands with abundant snags and dead wood. The EIS just looks at stands with "some" vs "none." BLM's analysis is insensitive to the significant ecological differences between "some" vs. "abundant."
24. BLM has yet to explain how they can rely on the extensive reserves in the Northwest Forest Plan to justify elimination of the survey and manage program in 2007, while at the same time proceeding to significantly reduce reserves through the WOPR. This is very difficult to reconcile. The WOPR represents significant new information that should lead to reconsideration of the 2007 survey and manage RODs, or re-adoption of the survey and manage program through the WOPR.
25. The DEIS described several alleged conflicts between the O&C Act sustained yield mandate and FLPMA requirements in the areas of ACECs, wilderness management, visual management, and special status species that are not yet listed under the ESA, but BLM fails to explain why these values cannot be harmonized.
26. The proposal to change management adjacent to the Coquille Tribal Forest is an unacceptable attempt to undermine Congressional intent to maintain consistency between the Coquille Forest and federal forest management policy and to provide a

floor below which Coquille forest management would not fall. The WOPR would create a new lower floor allowing the Coquille tribe to more aggressively log their lands, and BLM would accept lower standards on our public lands in order to accomplish that.

27. BLM should not allow recovery of beneficial uses of water to be slowed down compared to natural rate of recovery. Retarding recovery violates the anti-degradation policy during the period that water quality standards remain unmet due to the delayed recovery.
28. The EIS must acknowledge that the timber industry has an increasing appetite for wood, but it does not result in an increasing or widely shared economic benefits for the citizens of the state.
29. BLM fails to recognize that economic objectives for the wood products industry are adequately provided on non-federal lands, and the highest and best use of BLM resources is to try to repair the significant landscape scale deficit of mature and old-growth forests and to achieve aquatic restoration. Even if we stopped all logging on BLM land, there would still be lots of timber harvest on non-federal land, and there would still be a large deficit of mature and old-growth forest in 100 years. Degraded natural systems are far more in need of BLM's attention, rather than the timber industry, which already controls more than half of the productive capacity of Oregon's forests.
30. The EIS admits that increased logging on BLM land would cause log prices to fall BLM must disclose and consider the social harms caused by falling log prices. Wood is already far too cheap because prices do not account for the carbon value of forests. This price imperfection causes wood to be over-produced and causes under-production of the ecosystem services that flow from protected forests.
31. The EIS assumes that Congress will never reauthorize county payments legislation to provide popular county services like schools and libraries, while on the other had the EIS assumes that Congress will approve a 60% increase in BLM's budget to facilitate a controversial program of old-growth logging. These assumptions are not only inconsistent but unjustified.
32. The fire and fuels analysis must recognize that many if not most fuel reduction logging activities are actually counter-productive and will make fire hazard worse instead of better. PNW Research Station "Science Findings" reports that "[R]equiring landscape treatments to earn a profit negatively impacted both habitat and fire objectives." http://www.fs.fed.us/pnw/sciencef/scifi85.pdf Removal of canopy trees causes fire hazard to increase because larger trees create more slash; and because removing canopy trees makes stands hotter, dryer, and windier. Canopy removal also makes more light, water, and nutrients available to grow future ladder fuels. The EIS must consider that logging, even well-intentioned logging, makes fire hazard worse.
33. The EIS needs to recognize that there are opposing viewpoints to the idea that "time since fire" causes fir hazard to increase. In some forest types, such as SW Oregon, long periods between fires helps to grown dense canopies that suppress ladder fuels, absorb heat from the advancing fire, and can increase stand resilience. This implies that less canopy removal is better if the goals include permanent forest production,

community stability, watershed recovery, regulating water flow, and species recovery.

34. In several cases USFWS and NMFS relied on the Northwest Forest Plan to decide either not list a species or exclude areas from critical habitat, including decisions not to list the northern goshawk, Lower Columbia River/SW Washington ESU of coastal cutthroat, and Siskiyou Mountains and Scott Bar Salamanders, as well as a decisions to exclude basically all federal lands from critical habitat for Bull Trout and the marbled murrelet. These and other decisions will need to be reconsidered.

A supplemental Draft EIS is needed to address all these flaws described in these comments and a to allow public comment on a more complete and credible NEPA analysis. We just recently learned that BLM is decoupling from the spotted owl recovery process and instead of relying on the owl recovery plan MOCAs BLM appears to be re-running the reserve design models to create an entirely new set of reserve boundaries. This has a significant impact on the public's ability to meaningfully comment on the WOPR proposal. Those who live near BLM lands rely on the fact that the preferred alternative will protect certain areas, potentially affecting their water supplies and quality of life. Now if those reserve boundaries change, the comments submitted (or not submitted) by the public in reliance on the DEIS are significantly undermined. New reserve boundaries represent an entirely new alternative that may assume logging instead of protection for specific areas that are very important to the public, especially those who live near those lands. BLM must provide a new round of public comment on the final boundaries of the reserves and to provide public input on a credible analysis which addresses all the flaws in the DEIS identified through public comments.

BLM should halt work on the WOPR until the spotted owl recovery plan is complete and deemed legally sufficient. First, let's recognize that the Northwest Forest Plan reserve system is the bare legal minimum for conserving spotted owls and a host of other fish and wildlife dependent upon late-successional old-growth forests. There is no evidence that the Northwest Forest Plan protected "too much" habitat. "We believe the persistence of the NWFP reserve system will be critical to maintaining owls and other old forest associated species." S.P. Courtney, J.A. Blakesley, R.E. Bigley, M.L. Cody, J.P. Dumbacher, R.C. Fleischer, A.B. Franklin, J.F. Franklin, R.J. Gutiérrez, J.M. Marzluff, L. Sztukowski 2004. Scientific Evaluation Of The Status Of The Northern Spotted Owl. SEI. (emphasis added).

The LSMAs in the preferred alternative are based on the reserve design described in the draft recovery plan for the northern spotted owl which has been strongly criticized by many scientists who do not agree with the single-species, minimum-management approach taken by the new recovery plan which diverges from ecosystem management approach of the Northwest Forest Plan. FWS is now responding to those criticisms but it make little sense for BLM to continue to plan based on an assumption that the draft recovery plan is a valid approach to conservation of the spotted owl. We incorporate by reference the administrative record of the spotted owl status review and the spotted owl recovery plan both of which were conducted within the Department of Interior and included active participation by BLM.

A significant new development was revealed by Sue Haig at the Owl Recovery Science Review meeting convened by SEI in Portland on January 7-8, 2008. Sue Haig reported that spotted owl populations are experiencing a genetic bottleneck at all spatial scales (range-wide, regions, and areas) indicating a significant population decline and loss of genetic diversity, and this bottleneck occurred recently. It is not a lingering effect of past populations fluctuations.

Consider Oregon Wild's recent comments before the Federal Forest Advisory Committee.

In the near future, maximizing our forests' capacity to sustainably store carbon to reduce and mitigate climate change will likely be the dominant measure of how much old forest should be conserved and restored. Luckily such forest carbon storage will be highly complementary with societal objectives for clean water, wildlife, and quality of life.

The natural range of variability is a another useful template for managing older forests because many scientists agree that the natural or historic range of variability is more likely to achieve recovery of imperiled species' populations, as well as restore and sustain ecosystem services such as clean water, carbon storage, habitat, biodiversity, soil stability, fire resilience, recreation, quality of life, and the capture, storage & release of sediment, nutrients & water.

In the Pacific Northwest on average over the last few thousand years scientists say that about two-thirds or 67% our forests were mature and old-growth.[2] The proportion of old forests certainly varied over time and space, but the system varied most at the smallest scales, and varied least at the largest scales. As with most variable systems they spent more time near the middle of the range and less time near the extremes.

After decades of clearcutting on both public and private lands, Oregon's older forests are currently far outside the historic range of variability. Currently, federal lands are thought to contain roughly 30% older forests and the landscape as a whole is only about 15% older forest, some areas like the Oregon Coast Range contain dangerously less than this regionwide average.

What should the target be? The long-term objective should be to attain a dynamic range, similar to the natural system. The short-term objective should be to move the landscape "above average" to compensate for the time spent "below average." We do not need to fight over the definition of old growth nor even the precise amount of old forest needed, because we know what direction we need to move. That's all we need to know to decide we should stop sacrificing any old forest and start restoring it.

The many definitions of old-growth are a useful distraction provided by the timber industry, but this is not really a barrier to moving forward. Let's focus on which forests

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[2] It is important to recognize that historically, those forests that were NOT old actually contained significant structural legacies left over from disturbance and that is clearly not the case today, because clearcutting and salvage logging deprive developing forests of those important structural legacies. This has adverse impacts on species associated with dead wood and complex young forests as well as old forest species that can often utilize old forest legacies when they occur in young forests.

need to be protected and which need to be restored. Careful thinning can be used to move highly plastic dense young stands toward desired old forest characteristics, but there is a lack of evidence that logging benefits older forests where growth rates have slowed and some of the characteristics of old-growth are evident.

The authors of the Northwest Forest Plan decided that 80 years old was a useful cut-off between younger forests (<80 years) that may benefit from careful thinning because the ecological benefits are likely to exceed the ecological costs, versus older forests (>80 years) that should generally be left to develop on their own because the adverse impacts of logging likely outweigh the ecological benefits. Logging unavoidably degrades soil, water, wildlife, carbon storage, spreads weeds, and "captures mortality" which deprives developing forests of the important ecological values associated with large snags and dead wood. To be clear, 80 year-old forests are not classic old-growth (yet), but if conserved, they are best suited to address the current deficit of old-growth forest.

In moist forests with long fire return intervals, conservation of old forests can be "stand-based" (intervention is not needed in older stands), while in dry forests with frequent fire return intervals, conservation of old forests can be more "tree-based." Dry forests often suffer from the effects of fire suppression and can sometimes benefit from the removal of small fuels in order to protect rare large and old trees from fire and drought stress. This *exception* to the principle that logging is inadvisable in older stands must be very carefully handled because research has shown that removal of commercial size logs can conflict with both fire hazard objectives and habitat objectives.

Wildlife and ecological processes know no boundaries, so we need to consider the whole landscape, not just the federal lands. The stark dichotomy that is predicted to develop between federal and non-federal forest landscapes is not desirable, because the pattern and scale of habitat patches are important. Until more non-federal forest managers change their ways and become part of the solution, we must protect more old forests on federal lands to mitigate for the lack of old forests on non-federal lands.

The timber industry posits that more logging is the answer to creating new old-growth forests, but they fail to recognize the creating new old-growth requires two things: (1) *disturbance,* which establishes new stands (but which we already have in abundance in the form of non-federal logging and natural fires), and (2) *time,* i.e. long periods of growth and recovery between disturbances (which we have too little of). Let's give forests what they need, which is time to grow, instead of what they already have in abundance, which is more logging. We can more rapidly fix the old forest deficit if we protect mature forests rather than start at ground zero with new clearcuts. It's better to keep the old forests we have rather than rely on logging to create new ones.

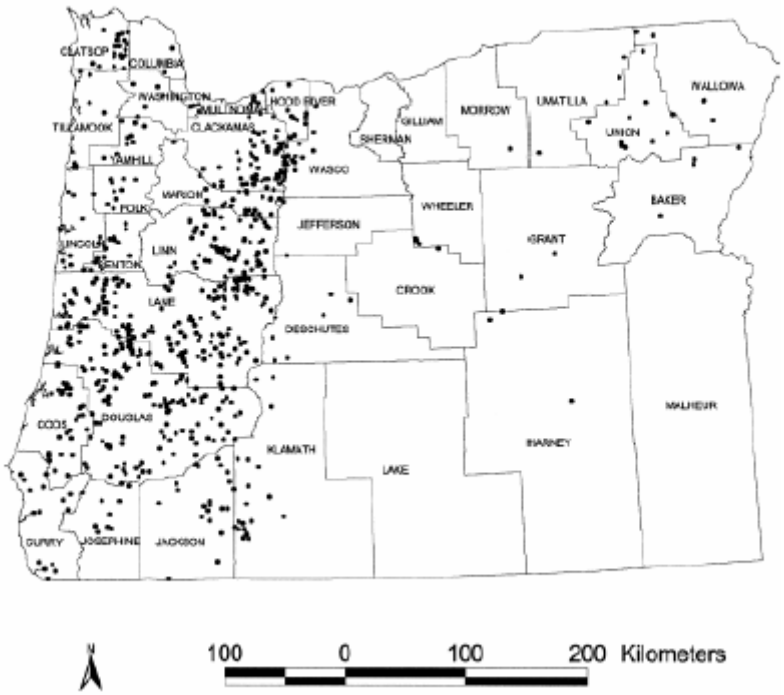
Logging does not mimic natural processes. Professional foresters are not necessarily prepared to manage old-growth forests and all the ecosystem services that the public expects from their forests. Professional foresters who were trained for the job of "tree farming" may need to be retrained for forest restoration.

In light of the barred owl, BLM must protect extra habitat in order to achieve recovery design parameters such as reserves with 20 pairs of spotted owls.

The DEIS too quickly dismisses any relationship between barred owls and habitat. ("[I]t is unclear whether forest management influences the outcome of interactions between barred and northern spotted owls." DEIS p 297) There is an implicit assumption in the WOPR EIS that all suitable owl habitat is available for use by spotted owls. The barred owl's invasion throughout the range of the spotted owl forcefully falsifies this assumption. Recovery must be based on achieving real biological outcomes, not just mechanical implementation of habitat goals. In order to account for barred owls, the reserves MUST be made larger so that they still provide habitat for 20 pairs of spotted owls. In order to mitigate for habitat occupied and defended by barred owls in the matrix, BLM MUST provide higher quality dispersal habitat.

The reserve design criteria being used by BLM generally includes large blocks of habitat capable of providing habitat for 15-20 pairs of spotted owls spaced 7-12 miles apart, with habitat provisions to allow owls somewhat safe passage between reserves. This strategy was developed when the barred owl was not considered a major threat. Now barred owls, which rely on similar old forest habitat and prey, have invaded virtually the entire range of the spotted owl. This is recognized as a significant threat to the recovery of the spotted owl.

Figure 22. Barred owl locations in Oregon through 1998. (Kelly et al. 2003).



In reserves with less than 20 pairs of spotted owls populations are more likely to "wink out." The problem is that barred owl occupy and defend suitable habitat rendering certain areas of otherwise suitable habitat unavailable to spotted owls. In part because real forests are unlike the idealized landscapes used in the models, Noon and McKelvey (1996) now

say that owl clusters should be 30-40 pairs. In particular, significant areas of the large habitat blocks intended for spotted owls are now occupied by barred owls to the exclusion of spotted owls. To mitigate for this unfortunate development BLM must provide much larger habitat reserves in order to fulfill the assumption that viable clusters of at least *n* pairs of spotted owls can live within the reserves. If BLM designs the conservation strategy based on an assumption that all suitable habitat is actually available for spotted owls, then the goal of $\geq$20 pairs of spotted owls per reserve will not be met because the barred owl will be occupying some of the habitat intended for spotted owls.

The barred owl also occupies significant areas of habitat intended for nesting, roosting, foraging, and dispersal in the matrix between the reserves, so these areas are also unavailable for spotted owl use. The matrix was supposed to provide stepping stones of suitable habitat, for instance in riparian reserves. If these stepping stones are occupied by barred owls, BLM needs to provide additional stepping stones in order to meet the same level of dispersal anticipated by the recovery plan design criteria. This should take the form of improved habitat quality in the matrix.

Barred owl competition and displacement are significant concerns emerging in the status review for the northern spotted owl. There are at least four new reports and presentations raising the concern that barred owls could displace spotted owls and adversely affect their survival:

> Robert R. Pearson. **Spotted Owl Habitat Considerations with regard to Barred Owl Presence** http://www.sei.org/owl/meetings/Presentations/March/Pearson.pdf
>
> Kelly, E. G., E. D. Forsman and R. G. Anthony **Is the Barred Owl Displacing the Northern Spotted Owl?**
> http://www.sei.org/owl/meetings/Presentations/December/Kelly.pdf
>
> Robert R. Pearson and Kent B. Livezey. **Distribution, numbers, and site characteristics of Spotted Owls and Barred Owls in the Cascade Mountains of Washington**
> http://www.sei.org/owl/meetings/Presentations/December/LivezeyPearson.pdf
>
> Scott Gremel. **The Effects of Barred Owls on Spotted Owls in Olympic National Park, Washington**.
> http://www.sei.org/owl/meetings/Presentations/December/SEI-SGPres.pdf
>
> Martin Cody, **Assessment of the Potential Threat of the Barred Owl to Northern Spotted Owl.** presentation at the final meeting of the SEI status review panel. June 22, 2004.
> http://sei.org/owl/meetings/Presentations/June/Cody-Barred-Owls.pdf

The 2004 status review panel unanimously identified barred owls as a future threat to the spotted owl. http://www.sei.org/owl/meetings/Presentations/June/Gutierrez-Threats.pdf

An important part of the solution to the invasion of the barred owl is to retain all suitable owl habitat regardless of land allocation then expand and restore the reserves.

> "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://www.eeb.cornell.edu/sdv2/Readings/Gaggiotti&Hanski.pdf From these ecological foundations, one must only realize that the barred owl, by invading and occupying suitable habitat and excluding spotted owls, has reduced the effective size of the reserves that were established in 1994. This has increased the extinction risk for the spotted owl. The most rational way to respond is to protect all 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.

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 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.

It is important to think of the non-equilibrium dynamics of owl populations interacting across time and space. The two owl species are not bound to reach equilibrium like two chemical constituents in a well-mixed beaker. The effect of the spatial dimension in these models is that the spatial dimension acts to dampen the tendency for competitive exclusion. The more space the two owl species could potentially occupy, the less chance that the barred owl will occupy all of it at once which gives the spotted owl a fighting chance to persist in the interstices that are not occupied by barred owls. If, on the other hand, the shared habitat becomes smaller due to habitat loss from logging or other causes, then there is a greater chance that barred owls could accomplish the feat of occupying all of the habitat at once, or at least it increases the chance that spotted owls will be relegated to small patches with small populations that become vulnerable to stochastic variation and eventual extirpation.

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

BLM must avoid trends toward listing. 43 USC 1732(b) says "In managing the public lands the Secretary shall, by regulation or otherwise, take any action necessary to prevent unnecessary or undue degradation of the lands." This can be reasonably interpreted to require BLM to action that would so limit habitat that species might become threatened with extinction, so BLM must avoid listing of new threatened & endangered species.

BLM must carefully review and disclose the consequences of the WOPR looking for the possibility that increased logging and roads will cause trends toward listing. This seems likely for imperiled but unlisted fish, species associated with fishless headwater streams, species that have a limited ability to disperse, species that are associated with the forest floor, species associated with dead wood, species worldwide that are sensitive to climate change, former survey and manage species, and the list goes on.

BLM must recognize the value of redundancy and well-distributed habitat. On Jefferson Exchange radio program the BLM representative talking about the WOPR strategy for spotted owl said that the WOPR would reduce redundancy in the current reserve design. He also said that some of the current reserves were too isolated and not connected enough to sustain owl populations. The basis for these two statements is highly questionable, because (1) redundancy is a good thing. In fact, redundancy is required in any sound conservation program to help hedge bets and spread risks. And (2) allegedly

"isolated" patches of habitat, as part of a comprehensive reserve system, are also "good" because they help maintain "well-distributed" populations and reduce the risk of losing populations due to contagious disturbances or diseases racing through excessively connected habitats. Furthermore, the spotted owl is a threatened species. There is a need to protect all existing habitat and grow more. There are no "extra" birds or extra habitat that we can safely sacrifice.

The EIS must analyze the effects of the WOPR on "functional interconnected late successional ecosystems."

The Northwest Forest Plan recognized that decades of logging had seriously degraded habitat and water quality, and the way to restore these would require more than just mitigating effects while continuing business-as-usual. The Northwest Forest Plan recognized that wildlife habitat quality and watershed health are intimately connected. The Northwest Forest Plan was intended to repair harm to habitat and water quality, not by focusing on the symptoms, but on the underlying causes of mounting ecological problems. Integrated restoration would require "ecosystem management" and recreation of a "functional interconnected late successional ecosystem." The Northwest Forest Plan recognized it would take decades or centuries to achieve that goal. BLM is giving up on ecosystem management way too soon.

The 1994 SEIS concluded that that it would take at least 100 years to reach an ecosystem condition that is within the historic range. And even then, the forest ecosystem will only be at the low end of the historic range. The ecosystem is not likely to reflect the long-term average for LSOG attributes for at least 200 years. As stated in the 1994 FSEIS:

> [N]one of the alternatives achieved a likelihood of 80 percent or greater for Outcome 1[[3]] for any of the individual attributes. ... The results indicate that none

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[3] "Outcome 1" means the long-term average condition. "outcome 1 and 2 combined" means within the hypothesized historic range of conditions but below the average. The range of historic conditions is thought to represent the range of conditions that species evolved under, and conditions they are most likely to persist under.

> Swanson et al. (1994) contend that managing an ecosystem within its range of variability is appropriate to maintain diverse, resilient, productive, and healthy ecosystems for viable populations of native species. Using the historical range of variability, they believe, is the most scientifically defensible way to meet society's objective of sustaining habitat.

Patrick Daigle and Rick Dawson, Extension Note 07; Management Concepts for Landscape Ecology (Part 1 of 7). October 1996. http://www.for.gov.bc.ca/hfd/pubs/docs/en/en07.pdf; *citing* Swanson, F. J.; Jones, J. A.; Wallin, D. O.; Cissel, J. H. 1994. Natural variability--implications for ecosystem management. In: Jensen, M. E.; Bourgeron, P. S., tech. eds. Eastside Forest Ecosystem Health Assessment--Volume II: Ecosystem management: principles and applications. Gen. Tech. Rep. PNW-GTR-318. Portland, OR: U.S. Dept. of Agriculture, Forest Service, Pacific Northwest Research Station: pp 89-106.

> of the alternatives had a 60 percent or greater likelihood of producing a late-successional and old-growth ecosystem with attributes that approximate at least long-term average conditions (Outcome 1) over a timeframe of 100 years. This occurs primarily because 100 years is not long enough for cutover landscapes to return to late-successional conditions that approximate prelogging conditions. Many late-successional attributes require 200 to 500 years to develop.
>
> Some alternatives have an 80 percent or greater cumulative likelihood of achieving an overall ecosystem condition at 100 years that is hypothesized to fall within the typical range of conditions that have occurred over previous centuries (Outcomes 1 and 2 combined). This does not mean, however, that all attributes and stands would meet this condition. Many young forest plantations within reserves are not developing along typical pathways, and fire suppression has and will alter stand and landscape-level processes that are typical in these ecosystems. In general, high rates of logging, forest plantations, fire suppression, ownership patterns, and human population and environmental influences have altered the regional ecosystem on federal lands to the extent that none of the alternatives can provide for a return to conditions that closely match those of previous centuries....

1994 FSEIS vol I p 3&4-45.

The EIS must disclose and consider the effects of the alternatives on the recreation of a functional interconnected old-growth ecosystem. In the FEMAT report and 1994 FSEIS, "The evaluation of late-successional and old-growth forest ecosystems is expressed as an expected likelihood of achieving long-term past conditions based on three attributes that characterize the quantity and quality of the ecosystem." 1994 FSEIS vol I p 2-68. Those three attributes are: (1) abundance and diversity, (2) process and function, and (3) connectivity. The WOPR DEIS must disclose and consider the effects of the action alternatives on these attributes. This will help the decision-maker, the public, and the courts compare the effects of the WOPR against the ecological measures agreed to at the highest levels of our government in 1994.

Abundance

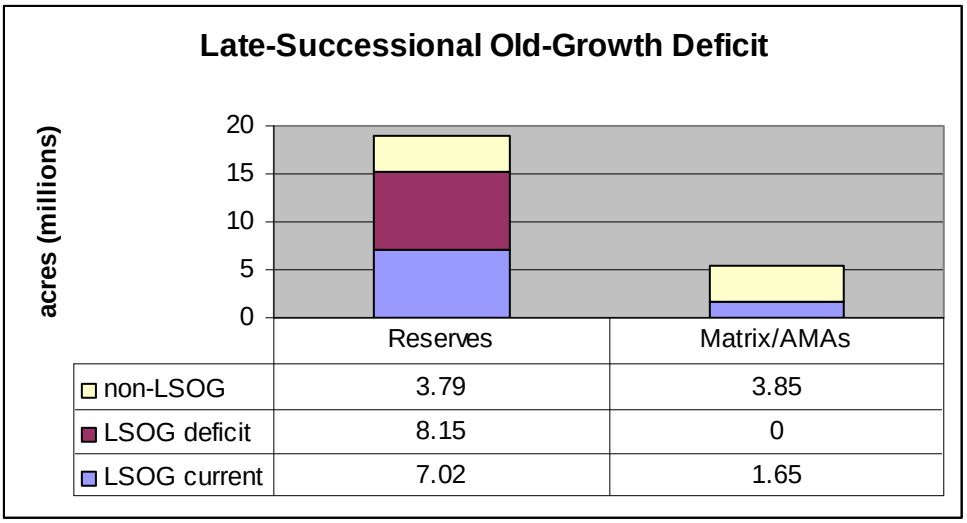
Forest conditions within the range of the northern spotted owl are currently outside the historic range of variability in terms of the regional *abundance* of LSOG. FEMAT p IV-51. "The amount of early-successional forest in the planning area probably is greater than at any time in the past." 1994 ROD p 47. LSOG has been reduced to less than 20% of the entire public/private landscape, FEMAT p IV-76, even though the historic centurial low was probably about 40 percent, FEMAT p IV-51.

Under the Northwest Forest Plan, the long-term expectation is that after decades of growth and recovery the reserves would be 80% covered with late-successional old-growth forests, but currently all the reserves combined are only about 37% covered with LSOG. FEMAT pp IV-54, IV-55. The following table, based on data in the 1994 FEIS and FEMAT, shows that there is an 8 million acre deficit of LSOG in the plan area.

Historic, Current, and Projected Abundance of

Late-Successional Old-Growth Forest on Federal Lands Within the Range of the Northern Spotted Owl.							
[millions of acres]	Total acres[4]	Historic long-term average cover of LSOG (60-70%)[5]	Current Percent LSOG [6]	Current Acres of LSOG [7]	Projected future cover of LSOG in the reserves (80%)[8]	Current Acres of young forest or non-forest.	Acres of LSOG "deficit"[9]
Congressional Reserves	7.3206	4.76	34%[10]	2.53[11]	5.86	4.79	3.33
Late Successional Reserves and MSLRs	7.532	4.90	42%	3.16	6.03	4.37	2.87
Riparian Reserves	2.6275	1.71	31%	.81	2.10	1.82	1.29
Administratively Withdraw Areas	1.4771	.96	35%	.52	1.18	.96	.66
Total Reserves	18.96	12.32	37%	7.02	15.17	11.94	**8.15**
Matrix and AMAs	5.4971	3.57	30%	1.65		3.85	
Total federal lands	24.45	15.89	35%	8.56		15.89	
Total public and private forest			<20%				

[4] Land allocation acres are from the 1994 ROD p 24. Riparian reserve acres have increased slightly since 1994 based on more accurate mapping of stream networks but those changes are minor and are not reflected in this analysis.
[5] "65 percent provides an estimate of the long-term average percentage of the regional landscape covered by late successional forests." FEMAT p IV-51. The figures are derived mathematically from this 65 percentage and for simplicity this percentage applied to all land allocations even though in reality Congressional reserves would have less than 65% and riparian reserves would probably have more.
[6] FEMAT pp IV-54, IV-76.
[7] Derived mathematically from total acres and percent old forest.
[8] "assuming that 12.5 percent of the reserved landscape would be subject to severe disturbance over 50 years … the simulation assumed that partial fire suppression would occur, driving the natural disturbance rotation longer than the pre-settlement regional average… under these assumption, about 80 percent of the reserves on average would eventually be covered by forests older than 80 years." FEMAT p IV-55.
[9] Old forest deficit was derived mathematically by subtracting current old forest from projected old forest. This is how much LSOG appears to be needed to fulfill the purposes of the Northwest Forest Plan to provide a functional forest ecosystem and ensure species viability.
[10] The fact that only 34% of Congressionally designated wilderness and wild and scenic rivers are comprised of LSOG is explained by the fact that Congressional reserves are located disproportionately in high elevation areas covered by "rock and ice" and alpine meadows, so old forest ecosystems are not very well represented by Congressional reserves.
[11] Derived mathematically by subtracting all other reserves from total reserves.



The current abundance of LSOG in the reserves is insufficient to provide a functional interconnected late-successional old-growth ecosystem, so any additional increment of LSOG outside the reserves (such as riparian reserves and survey and manage buffers in the matrix) helps to provide important short-term functionality while the reserves regrow and recover from past logging. The WOPR will sacrifice these principles in the name of maximizing timber harvest.

Diversity

Diversity of habitat types is another important attribute LSOG considered by the 1994 FEIS. The large and small patches of old forest, including survey and manage buffers, help contribute to *diversity* simply because each one is in a unique location outside the reserves. Each physical location has a unique combination of geology, soils, slope, aspect, elevation, climate, and especially history of disturbance, therefore LSOG that is retained in different locations will represent a wider diversity of forest-types.

The scientists' Sept 4, 2001 letter to the RIEC says, "Species, species assemblages, and the genetic structure of populations may vary at relatively fine scales for small organisms (which account for by far the largest share of diversity), raising the possibility that each remaining older forest is to some degree unique in its biological structure."

BLM needs to retain LSOG outside of the reserves in order to protect different locations with different geophysical settings and different stand histories. This will thereby enhance the diversity of habitat types within the overall forest ecosystem.

Function

Large and small patches of old forest, including protection buffers for survey and manage species, clearly contribute to the *function* of the LSOG forest, another important old-growth attribute considered in 1994. "Functions … refer to ecological values of the late-successional and old-growth ecosystem that (1) maintain or contribute to the maintenance of populations of species that use these ecosystems, …" 1994 FSEIS vol. I p 3&4-37. Large and small patches of old forest provide valuable ecological functions. Survey and

manage buffers contribute disproportionately to this attribute of forest ecosystems, because the buffers are not just randomly designated late successional areas; they are areas that have been surveyed and are known to actually harbor "populations of species that use these ecosystems," and not just any species, but rare and uncommon species that the Northwest Forest Plan was intended to protect. The EIS must disclose the functional losses caused by removal of mature and old-growth forests.

The 2000 and 2004 survey and manage FEISs both recognize that if populations of survey and manage species are not maintained well-distributed across their native range there will be a "loss of normal biological function." 2000 FSEIS vol I p 191. 2004 FSEIS vol I pp 119-121. As a result of the Bush administration's attempts to eliminate the survey and manage program, there are now 193 species that will have "insufficient habitat," resulting in some loss of biological function where those species are significantly reduced in population or no longer occur. 2004 FSEIS vol I pp 124-125. The WOPR must disclose the additional functional losses caused by increased logging of mature and old-growth forests under the action alternatives.

The 1993 FEMAT Report also recognized the functional importance of many taxa included in the survey and manage program and the "broad benefits" of retaining even small fragments of LSOG in the matrix.

> Although an important function of the Matrix is to provide for dispersal of organisms, perhaps of greater importance is the maintenance of organisms with key functional roles in the forest ecosystem. Taxa such as fungi, nitrogen-fixing organisms, and arthropods influence natural succession, nutrient cycling, and other ecosystem processes. Maintenance of populations of these organisms in the Matrix is essential to long-term forest productivity, as well as biodiversity.
>
> Old forest patches as small as only a few acres can also provide important refugia for sedentary organisms.... Lichens, fungi, bryophytes, mollusks, arthropods, vascular plants, and the less mobile vertebrates were consistently identified during the expert panel process as benefiting from even small fragments of old forest. <u>Panelists consistently reiterated the important functional roles played by these organisms. Panelists highlighted the necessity of maintaining these organisms well-distributed throughout the ecosystem, not just confined to reserves.</u>
>
> *Summary of mitigation measures having broad benefits*
>
> …
>
> (4) Retain small patches of late-successional or old-growth forest within the Matrix. These small patches can provide important habitat for arthropods, fungi, lichens, bryophytes, vascular plants, mollusks, small mammals, amphibians, and bats. Species that are poor dispersers, narrow in their habitat requirements, have restricted geographic ranges and are sensitive to variation in microclimates will benefit most from retention of these patches of late-successional forest.
>
> …
>
> (6) Survey upland sites for rare, endemic, or sensitive organisms prior to any

disturbance caused by management. Protect sites where these organisms occur (e.g. special habitats such as serpentine barrens, wetlands, rock outcrops)."

1993 FEMAT pp IV-186 to IV-190 (emphasis added). The WOPR EIS must disclose the consequences of increased ecological divergence between the reserves and the timber management areas.

Process

Ecological processes are another important attribute of LSOG considered in the 1994 FEIS. Examples of ecological *processes* provided directly by large and small patches of mature and old-growth forests (and associated species) include capture-storage-release of water/sediment/nutrients, pollination, carbon storage, nitrogen fixation, nutrient cycling (by dead wood, fungi, arthropods, and mollusks), symbiosis (in which fungi provide water and nutrients to vascular plants, including virtually all the dominant trees species in the late successional forest, in exchange for photosynthate produced by the plants). Loss of mature and old-growth forests will lead to reduced benefits related to these processes.

The diversity of functions and processes represented by organisms that live in old forests also enhances the resiliency of the entire forest ecosystem, which is particularly important in the face of climate change and other pressures. This resiliency value of biodiversity also refutes the assertion in the survey and manage EISs that if survey and manage species are truly rare, then they must play only a minor role in ecosystem processes and functions. As the climate changes, species that are rare today could become much more important tomorrow. Conserving older forests and related species helps ensure that ecological processes will continue under changing conditions.

Connectivity

The large and small patches of old forest on BLM lands provide important *connectivity* between larger areas of suitable habitat. The 1994 FSEIS says “Connectivity is a measure of the extent to which the landscape pattern of the late-successional and old-growth ecosystem provides for biological and ecological flows that sustain late-successional and old-growth associated animal and plant species across the range of the northern spotted owl.” 1994 FSEIS vol I p 3&4-38.

The current fragmentation of the landscape is not just *between* the reserves but also *within* the reserves themselves. Under current conditions every bit of old forest is essential. Even small isolated patches act as “stepping stones” that link larger patches of late-successional habitat wherever they occur. The added increment of connectivity provided by patches of old forest on BLM land may be very important for enhancing persistence of rare species while the fragmented forests recover.

The design of the Northwest Forest Plan includes large Late Successional Reserves, managed to protect LSOG habitat for species associated with LSOG, with intervening matrix areas, where more logging is allowed. But the matrix is not a sacrifice zone. There are several standards & guidelines (including survey and manage) to ensure that the matrix plays a role in the ecosystem management scheme of the Northwest Forest Plan.

> [F]orests in the matrix function as connectivity between Late Successional Reserves and provide habitat for a variety of organisms associated with both late successional and younger forests. Standards & guidelines for the matrix are intended to provide for important ecological functions such as dispersal or organisms, carryover of some species from one stand to the next, and maintenance of ecologically valuable structural elements such as down logs, snags, and large trees.

1994 ROD pp B-1 to B-2.

Riparian reserves are also located between the LSRs, and, like the Matrix, they are intended to provide connectivity and dispersal. However, the riparian reserves, even more so than the LSRs, are highly impacted by past logging and construction of roads that follow streams, so they are not currently providing adequate connectivity. The objective is that 80 percent of the reserves will be covered with LSOG, but FEMAT estimated that the riparian reserves were only about 31 percent covered with medium and large conifers (versus 42% for the LSRs). FEMAT pp IV-51, IV-54. While riparian reserves recover from past disturbance, patches of old forest on BLM land clearly help serve an important function for connectivity between the LSRs.

Related to connectivity, there is concern for persistence of many species that live in the planning area in part because of the species' limited dispersal capabilities. See 1994 FSEIS Appendix J2. The scientists' Sept 4, 2001 letter to the RIEC said,

> Studies and modeling over the last few years suggest that many LSOG associates in the PNW may be limited more by dispersal than by the abundance of habitat *per se*, including species of lichens, bryophytes, mollusks, fungi, and invertebrates (Boughton 2001, Sillett et al. 2000). This implies that every remaining piece of suitable habitat becomes an important focus for eventual colonization of the surrounding landscape.

BLM must consider whether increasing logging of mature and old-growth forest will cause trends toward listing of many rare and uncommon species including those formerly covered by the survey and manage program.

<u>BLM must include a full analysis of the WOPR on the assumption made in the last Survey and Manage EIS and ROD.</u>

BLM's prior decisions to eliminate the survey and manage program was based on the assumption that the needs of survey and manage species were provided by the system of Late Successional Reserves and riparian reserves. Since the WOPR reduces the size and extent of both late successional reserves and riparian reserves, BLM must reconsider the abandonment of the survey and manage program. The WOPR represents significant new information that requires a reconsideration of the analysis and conclusions in the 2004 and 2007 Survey and Manage RODs. The WOPR EIS must also include an alternative the mitigates for reduced habitat protection with more thorough wildlife surveys and buffers.

BLM, in designing the size and spacing reserves, must consider and provide for the needs species that cannot disperse as well as the spotted owl: The 7 and 12 mile distances between reserves might make sense for spotted owls, but BLM must provide much larger and closely spaced reserves or much more high quality habitat in the matrix if they are going to meet its obligation to avoid trends toward listing for other species, such as red tree voles, that are not effective dispersers and are highly sensitive to fragmentation.

Sustained Yield: BLM cannot rely on an interpretation of sustained yield that conflicts with its obligation to protect watersheds, regulate water flow, conserve endangered species, maintain and restore water quality, etc. BLM must use a rational definition of sustained yield that is qualified by environmental values. A consensus definition o the term is: "The sustainable yield of natural capital is the ecological yield that can be extracted without reducing the base of capital itself, i.e. the surplus required to maintain nature's services at the same or increasing level over time. This yield usually varies over time with the needs of the ecosystem to maintain itself, e.g. a forest that has recently suffered a blight or flooding or fire will require more of its own ecological yield to sustain and re-establish a mature forest. While doing so, the sustainable yield may be much less." http://en.wikipedia.org/wiki/Sustainable_yield

BLM must also interpret sustained yield in light of current scientific understandings of non-linearity of ecological process that sustain forests.

> SUSTAINED YIELD FORESTRY IN BRITISH COLUMBIA by Lois Dellert is the definitive academic study of SY in B.C. A hard to find masters thesis, Ms. Dellert's highly informative history and analysis of SY is a must read for anyone concerned with forestry in B.C. She describes the evolution of SY from 1900 to 1990 emphasizing the fear of scarcity and the hoped for improvement of timber production by scientific reordering of forests. From MacMillan through Sloan and Pearse to the present her central purpose is to examine the development of forest policy and "explore why it has been so difficult for forestry to achieve conservation in British Columbia."
>
> "Forestry was motivated by scarcity and its goal was to support a forest-based economy by maximizing production and regulating the forest to provide a continuous supply of wood. Its policy of sustained yield was influenced by the scientific movement which believed the world operated according to universal rules and could be efficiently and rationally managed to capture its full potential and re-structured to achieve stability through order. The core ideas were efficiency and stability." - Lois Dellert
>
> The simple Newtonian universe of linear cause and effect and equilibrium dominant when SY was developed no longer exists. Developments in non-equilibrium thermodynamics, in complexity and chaos theory, and in systems thinking about ecology and uncertainty have awoken science from Newton's sleep.

http://www.pacificfringe.net/sustainedyield/ See also, Dellert, Lois. 1998. "Sustained Yield: Why Has It Failed to Achieve Sustainability?" in The Wealth of Forests: Markets, Regulation and Sustainable Forestry. Chris Tollefson, ed., UBC Press, Vancouver, B.C.

Recognizing that sustained yield must be achieved within some social and environmental constraints, the real goal is better conceived as sustainable forest management.

The Forest Service explored the definitions of sustainable forestry in a 2004 report called "National Report on Sustainable Forests—2003" (FS-766):

> The *Dictionary of Forestry* (Helms 1998) offers this description of forest sustainability:
>
> > *….the capacity of forests, ranging from stands to ecoregions, to maintain their health, productivity,diversity, and overall integrity, in the long run, in the context of human activity and use.*
>
> The *Dictionary of Forestry* also states that sustainable forest management is an evolving concept …
>
> > *The stewardship and use of forests and forest lands in a way, and at a rate, that maintains their biodiversity, productivity, regeneration capacity, vitality, and potential to fulfill, now and in the future, relevant ecological, economic, and social functions at local, national, and global levels, and that does not cause damage to other ecosystems–note criteria for sustainable forestry include (a) conservation of biological diversity, (b) maintenance of productive capacity of forest ecosystems, (c) maintenance of forest ecosystem health and vitality, (d) conservation and maintenance of soil and water resources, (e) maintenance of forest contribution to global carbon cycles, (f) maintenance and enhancement of long-term multiple socioeconomic benefits to meet the needs of societies, and (g) legal, institutional, and economic framework for forest conservation and sustainable management.*
>
> …
>
> Other definitions particularly stress the importance of recognizing environmental limits. One example is the following statement (Noss 1993) from the book *Defining Sustainable Forestry*:
>
> > *Since sustainable forest management is only possible within the ultimate constraints and limits imposed by the ecosystem, sustainability should be viewed as the degree of overlap between ecological possibilities and socially desired benefits of forests.*
>
> …
>
> The concept of sustainable forest management is related to but different in significant ways from an earlier concept of sustained yield—the amount of wood that a forest can produce on a continual basis. The concept of sustained yield, dating back to the Middle Ages in Europe, was brought to the United States in the late 1800s by early forestry leaders such as Bernhard Fernow and Gifford Pinchot. It was expanded over time to include the perpetual production of other forest outputs in addition to timber supply, including water, recreation, fish and wildlife,

> and livestock forage—the expanded concept is often referred to as the "multiple-use sustained-yield" principle. This principle was enshrined in law in 1960 for national forests. The concept of sustainable forest management, however, includes managing the forest for more than outputs; it focuses on maintaining processes and seeking to sustain communities, economies, and all the elements of a forest (Floyd 2002).

When one views the multiple objectives of the O&C Act as modified by the Federal Land Policy and Management Act, Endangered Species Act, and Clean Water Act, there is clearly no significant difference between sustained yield, multiple-use sustained-yield, and sustainable forest management.

Complementary Values of Reserves must be recognized and disclosed: The Northwest Forest Plan recognizes that riparian reserves provide important values for terrestrial species by increasing habitat abundance and connectivity. The NWFP also recognizes the value of LSRs for aquatic species by providing core areas of high quality habitat and by including standards and guidelines that reduce the level of management disturbances that could harm aquatic resources (e.g., 1994 SEIS p 3&4-65). The WOPR EIS must describe the loss of terrestrial benefits cased by the reduction of riparian reserves under the action alternatives, and the EIS must disclose the loss of aquatic benefits caused by the reduction of late successional management areas under the action alternatives.

BLM can't rewrite history. In 1994 SEIS for the Northwest Forest Plan found that Alternative 7, involving implementation of BLM's 1992 Draft RMPs, would not reverse the ongoing degradation of aquatic ecosystems and water quality. The FEMAT Report said that Alt 7 would provide only a 10-15 percent chance of achieving well-distributed populations of salmonids. "Option7 was ranked low primarily because of the low amount of riparian areas and the amount of activity that was allowed within them in Bureau of Land Management land management plans and forest plans." 1993 FEMAT p V-68. But the size of the LSRs was also a factor.

WOPR Alt 2 would revert to a form of aquatic and riparian management similar to that analyzed as Alternative 7 of the 1994 SEIS, yet BLM now claims that aquatic resources would be restored. How can this be? Please describe in the detail the similarities and differences between WOPR Alt 2 and 1994's Alt 7 (See 1994 SEIS Appendix B-12 to B-17) and reconcile the aquatic analyses of both.

The BLM's 1992 draft RMPs would have provided larger stream buffers than the WOPR would – generally 105-240 foot buffers on 3rd order and larger perennial and fish-bearing streams. The old RMP buffers would also be measured horizontally, instead of along the slope which would add more protection. And the old RMP would have protected landslide prone area using the TPCC system just like the WOPR. The reason given in the 1994 SEIS is that Alt 7 lacked "explicitly defined" riparian reserves. This problem persists in the WOPR because the WOPR riparian rules provide too much discretion,

allowing BLM to log inside the riparian areas for reasons other than restoring aquatic resources. Please explain the big change in BLM's tune.

BLM must more carefully consider cumulative impacts and how to compensate for non-federal land mis-management. The 1994 SEIS (p 3&4-82, 108) said that achieving Aquatic Conservation Strategy objectives and Clean Water Act standards could be done independently of activities on non-federal lands, EXCEPT in the heavily inter-mixed O&C landscape. This means that BLM must carefully evaluate the cumulative impacts of its logging and roading activities and determine if BLM can do more to mitigate for lack of conservation on non-federal lands.

BLM must not mischaracterize the O&C Act. BLM is limiting the scope of public comment by misleading the public that they are required to maximize logging. The O&C Act gives BLM wide discretion to conserve forests for watershed and water supply purposes and to stabilize communities. The 1994 Northwest Forest Plan was upheld by the courts over the objections of the timber industry because the government reasoned, and the courts agreed, that conserving habitat would avoid future listings of fish and wildlife and thereby help assure stable (though reduced) future timber harvest.

Page XLIII says that the "primary direction" for BLM lands in western Oregon is the O&C Lands Act, but it is more accurate to say that it is the Federal Land Policy & Management Act. FLPMA provides more recent and more comprehensive direction for management of all BLM lands, including the O&C lands. The O&C Act only controls where there is a conflict, and so far no conflict has been found, except in the allocation of timber receipts.

How will the WOPR undermine the assumptions of the Port Orford Cedar ROD? Certain areas should be left unlogged and unroaded in order to minimize the spread of the deadly root disease that is deadly to Port Orford Cedar (POC) trees. Since these trees are quite valuable riparian trees, the WOPR EIS must carefully disclose the effects of POC increased mortality from increased logging and roads which spread the disease.

The DEIS fails to consider a full range of reasonable alternatives including alternatives that would better comply with the Endangered Species Act and the Clean Water Act. There are also a variety of ways to comply with the O&C Act besides maximizing industrial forestry. The old forest ecosystem in the planning area is so degraded that rapid (not retarded) restoration and recovery is needed to help conserve listed species and meet clean water standards. Limiting the range of alternatives to those that increase timber harvest violates NEPA. Case law also hold that agencies must consider all reasonable alternatives even when they would stretch their authorities. This would help inform Congress, the public, and the decision-maker on the full implications of the decision.

BLM's models can't be trusted. The DEIS claims to use more sophisticated models and more and better data than the existing RMPs developed in 1995. Sorry, but you can't make a silk purse out a sow's ear. No amount of fancy modeling can change the fact that

BLM is inappropriate assumptions and applying the wrong standards to this entire planning process, such as assuming that natural disturbance will not occur, assuming that extreme weather events won't occur, assuming that timber must be the dominant use, assuming that the Northwest Forest Plan is illegal; assuming that reduced protection for old forests will still conserve listed species associated with older forests; assuming that reduced protection for stream will comply with the CWA and the ESA; assuming that community economic stability requires BLM to emphasize timber harvest rather than ecosystem services that sustain communities and economies; etc… BLM also failed to conduct sensitivity analysis to show which assumptions are most questionable. BLM failed to disclose at what scale the effects of management are most pronounced.

The EIS must consider and disclose cumulative impacts. BLM has an obligation under National Environmental Policy Act to consider the cumulative impacts of the WOPR alternatives. This requires BLM to answer the following questions:

- What are the thresholds of concern for each resource?
- Considering the type and extent of management on non-federal lands, and considering natural disturbances such as fire, ice, wind, and climate change, how much logging, roading, grazing, can BLM do before crossing those thresholds of concern?
- Are there synergies that amplify and compound the effects of different management activities and natural disturbances?
- What is the total cumulative impact of all past, present, and foreseeable management activities (logging, roads, grazing, mining, OHVs, weeds, etc) on federal and non-federal lands on each resource of concern?

The four-stage structural classification is over-simplified and cannot lead to a rational and informed decision. For instance, the classification system lumps young forests resulting from clearcutting and those resulting from natural disturbance in the same category when in fact they are very different, with long-term consequences that persist well into later stages of development. The subdivision of "establishment" and "young" forests with and without legacies gives too much credit to very low levels of retention, and fails to assign adequate value to abundant natural legacies. Furthermore, the mature forest type is subdivided into single-layer or multi-layered canopy, but this oversimplification misses the differences in other important features such as species diversity, and snag and down wood abundance. This lumping will bias the analysis in favor of logging because unlogged mature forests will have more snags and course wood, while thinned mature forest will capture mortality and remove snags and dead wood which are an essential feature of older forests. Logged stands don't get the demerits they deserve in the analysis.

BLM should not retard recovery of imperiled species or polluted water. All the action alternatives will slow or reverse the rate of recovery of resources that are already in violation of legal standards. This is unacceptable. Page LI has a telling disclosures: First, looking across all land ownerships none of the alternatives will restore historic average forest conditions within the next 100 years, even if no logging at all occurred on BLM lands. Second, looking at BLM lands in isolation, only the Northwest Forest Plan

alternative will restore historic average forest conditions within the next 100 years. Third, all action alternatives will increase habitat fragmentation which is an identified problem for wildlife associated with older forests.

The fact that all alternatives will result in more old forest in the future is not very relevant or reassuring because (a) it merely highlights the vast extent of past degradation. Almost anything we do is better than the irresponsible abuses of the past. And (b) even though all action alternatives will increase older forests over the course of the next 100 years, one alternative stands out as restoring more old growth faster, which is the Northwest Forest Plan. This is what is needed to comply with the Endangered Species Act and the Clean Water Act. Even better would be an alternative that protected and restored ALL mature and old growth forests.

The EIS must account for the cumulative effects of management plus natural disturbances. The vegetation modeling (OPTIONS Model) failed to account for natural disturbances such as fire, wind, insects, etc, that are expected to increase with a warming climate. BLM says this was done to highlight the differences between the alternatives rather than the effects of the assumptions about disturbance. However, the lack of disturbance fails to capture and disclose the true level of uncertainty in the effects of BLM management programs. The lack of disturbance also makes BLM logging look more sustainable than it really is. When fires occur they not only affect mature trees that BLM intends to salvage (as a way to mitigate the effects on the sustainability of the green tree logging program) but fires will also affect extensive areas of non-merchantable trees and those stands will experience delayed maturation and harvest which can have serious consequences on sustained yield in the vegetation model.

Since climate change predicts more fires and more insects, these model-testing disturbances are not only possible but probable. The vegetation model also fails to account for the spatial aspects of contagious disturbances that move across the landscape, such as dense young (hazardous) fuel structures that are abundant on non-federal lands that can facilitate the movement of fire which may degrade rare old forest habitat on federal lands. These problems render the NEPA analysis erroneous and misleading.

The EIS must recognize that lack of economic diversity in general and boom-bust industries in particular tend to destabilize communities. The DEIS economic analysis fails to account for the boom-bust nature of the timber industry and how this affects the stability of communities and industries. The DEIS assumes that logging levels will be stable and continuous leading to a permanent “boom” but this is implausible.

The DEIS fails to recognize the reality that logging remains highly dependent on housing and interests rates which are highly variable. The DEIS failed to consider other alternative management scenarios such as a lower level of logging associated with restoration which would provide a more stable contribution to communities and industries.

The DEIS also failed to recognize that the Northwest Forest Plan protections allow private timber owners to continue logging with fewer environmental restrictions. If BLM disengages from the Northwest Forest Plan, then private logging may have to be restricted. This could cause uncertainty and instability for local communities and industries.

BLM must disclose the adverse effects of fragmentation caused by the action alternatives. Animals appear to adopt smaller body size as an adaptation to habitat fragmentation. Smaller body size can be a sensitive determinant of survival. The DEIS should disclose the implications of this given the heavily fragmented nature of the checkerboard and the increased fragmentation caused by the WOPR action alternatives. See Lomolino. M., Perault, D. 2007. Body Size Variation of Mammals in a Fragmented, Temperate Rainforest. Conservation Biology Volume 21, No. 4, 1059–1069.

> "Body size is perhaps the most important trait of an organism, affecting all of its physiological and ecological processes and, therefore, fundamentally influencing its ability to survive and reproduce in different environments, … Three species (*P. keeni, S. monticolus, and S. trowbridgii*) exhibited significantly different body size among macrohabitats: individuals from fragments were smaller than those in old-growth corridors and those in more extensive stands of old-growth forest [on the Olympic Peninsula, Washington]. Body size of P. keeni was significantly correlated with elevation along corridors, peaking near the medial reaches of the corridors. The effects of anthropogenic transformations of this landscape of old-growth, temperate rainforest, although not universal among the five species, were significant and rapid—developing in just a few decades following tree harvests. Thus, anthropogenic fragmentation may influence not only the diversity, species composition, and densities of local biotas, but also one of the most fundamental and defining characteristics of native species—their body size."

BLM must continue to "coordinate management" by following the Northwest Forest Plan. One of the requirements of FLPMA is to coordinate planning AND management with other federal agencies. (43 USC § 1712(c)(9)). The fact that the Forest Service is a cooperating agency is only step one. BLM must actually coordinate management programs. This was done under the Northwest Forest Plan, but it is being undone by the WOPR. This section of FLPMA also requires "meaningful public involvement" but all we've gotten is excuses for why BLM could not consider our Community Conservation Alternative. All conservation oriented alternatives have been sabotaged by BLM's unreasonable assumptions, such as such high rates of thinning so that they do not look sustainable.

The EIS must analyze the consequences when BMPs are not implemented or effective. As Rich Nawa points out, BLM seems to have written unattainable/impractical BMP's for roads (DEIS:1135) that support the implausible prediction of greatly reduced road sediment production in Alternative 2 sediment modeling (DEIS 759-760). BLM seems to be relying on the old mantra that BMPs guaranteed compliance with the Clean Water Act. In this case, BLM had to stretch the truth and rewrite the BMPs to conform to the requirements of the sediment model. These BMPs are impractical, highly

discretionary, and unlikely to be reliably implemented. The EIS must carefully analyze and disclose the real likelihood of BMPs being faithfully and effectively implemented and the consequences if they are not.

BLM must explain their radical new interpretation of the O&C Act and the Northwest Forest Plan. In Approving the 1994 Northwest Forest Plan, the Secretary of Interior, and in approving the 1995 Medford RMP, the BLM, endorsed the idea that O&C Act objectives were met by protecting habitat in order to avoid additional species listings, and protecting riparian reserves helped achieve O&C Act objectives for watershed protection and regulating stream flow. See October 1994 Medford District RMP FEIS (volume I page 1-5):

> "One of the purposes of the ESA is the preservation of ecosystems upon which endangered and threatened species depend. A forward-looking land management policy would require that federal lands be managed in a way to minimize the need to list species under the ESA. Additional species listings could have the effect of further limiting the O&C Lands Act's goal of achieving and maintaining permanent forest protection. This would contribute to the economic instability of local communities and industries in contravention of a primary objective of Congress in enacting the O&C Lands Act. That Act does not limit the Secretary's ability to take steps now that would avoid future listings and additional disruptions.
>
> Protection of watersheds and regulating streamflow are explicit purposes of forest production under the O&C Lands Act. Riparian reserves, including those established on O&C lands under the PRMP, are designed to restore and maintain aquatic ecosystem functions. Together with other components of the ACS, riparian reserves will provide substantial watershed protection benefits. Riparian reserves will also help attain and maintain water quality standards, a fundamental aspect of watershed protection. Both riparian reserves and late successional reserves will help regulate streamflows, thus moderating peak streamflows and attendant adverse impacts to watersheds."
>
> …
>
> "The level of riparian protection included in the PRMP [option 9] was selected not only to meet current legal requirements, but also to promote the goals of watershed protection contained in the O&C Act and to provide sufficient protection to reduce the potential for listing of aquatic species as threatened or endangered. **Taking into consideration the anticipated benefits to the quality of watersheds in the O&C Act, it does not necessarily follow that the alternative with the least riparian protection allowed by law is the 'most consistent with the O&C Act'"** FEIS (volume III page 10, response to comments).

BLM must explain how Water Quality Management Plans will be successfully implemented after BLM abandons the ACS and undermines the assumptions upon which many of these plans are based. Water Quality Restoration Plans (WQRPs) are

written by the US Forest Service and BLM to comply with section 303d of the Clean Water Act. Most of the WQRPs in western Oregon are based on the Northwest Forest Plan Aquatic Conservation Strategy. For example the Applegate River Sub Basin WQRP states:

> "The recovery of water quality conditions on federal land in the Applegate Subbasin will be dependent upon implementation of the USFS Rogue River and Siskiyou National Forest Land and Resource Management Plans (LRMPs) and the BLM Medford District Resource Management Plan (RMP) as amended by the NWFP (USDA and USDI 1994a)."
>
> "Paramount to recovery is adherence to the Standards and Guidelines of the NWFP (as amended, USDA and USDI 2004b) to meet the ACS."

Other water quality plans are similarly dependent on faithful implementation of the Aquatic Conservation Strategy.

> "The recovery of habitat conditions in Grayback Creek and Sucker Creek will be dependent on implementation of the Siskiyou National Forest Land and Resource Management Plan and BLM Medford Resource Management Plan, as amended by the Northwest Forest Plan (NWFP). Paramount to recovery is adherence to the Standards and Guidelines of the NWFP to meet the Aquatic Conservation Strategy (ACS). This includes protection and culture of riparian areas as reserves and some silvicultural work to reach vegetative potential most rapidly. Some instream large tree placement may be beneficial where there exists conducive channel and riparian conditions."

Upper Sucker Creek TMDL at 31.

> "This WQMP is a procedural step that focuses on Water Quality using elements of the Northwest Forest Plan (NWFP). It tiers to and appends the Grayback Sucker Watershed Analysis. Watershed analyses are a required component of the Aquatic Conservation Strategy under the NWFP. The Record of Decision (ROD) for the NWFP was signed in April of 1994, following extensive public review."

Upper Sucker Creek TMDL at 11.

> "Monitoring has indicated that water quality in Lower Sucker Creek often does not meet state water quality standards. As a result of water quality standards (WQS) exceedances (sic) for temperature, habitat modification and flow modification, three stream segments in the Lower Sucker Creek Watershed are included in Oregon's 1998 §303(d) list.."

Lower Sucker Creek TMDL at 14.

> "The Lower Sucker Creek TMDL/WQMP is based on the Clean Water Act, the Northwest Forest Plan, the Oregon Forest Practices Act, ODOT Best Management Practices, and the Rogue Basin Agricultural Water Quality Management Plan."

Lower Sucker Creek TMDL at 41

The Applegate subbasin TMDL also tiers to the Northwest Forest Plan (Page 4).

The aquatic analyses have several significant flaws. As Rich Nawa observed:

- BLM knows which streams were modeled as "debris flow" streams or "'perennial" but will not illustrate mapped data.
- BLM modeled benefits from wood inputs to streams from all ownerships but modeled sediment only from BLM lands and BLM roads.
- Flow and sediment models developed by Washington DNR(based on data from Westerm Washington) were applied to vastly different BLM lands (e.g. Klamath Province).
- Peak flow thresholds were established as a "2 year" rainfall events having 5 year R.I. flows. This arbitrary threshold has no apparent biological or physical basis.
- All hydrological and fisheries modeling from 1995 BLM RMP or recent EIS's (Timber Rock, Biscuit, Boise Cascade etc) appears to have been tossed in favor of untested deterministic type modeling with no sensitivity analysis or validation from actual BLM watersheds.
- There appears to be a major mismatch between sediment analysis area (10,000-40,000 acres) and actual size of watersheds with spawning populations of coho (order of magnitude smaller).
- Wildlife and timber modeling assumes critical habitat for spotted owls and marbled murrelets will be significantly reduced by USFWS.

The Consequences of Different Definitions of Intermittent Stream Must be Disclosed. As noted by Francis Eatherington: The WOPR computer model assumed the definition of an intermittent stream was a stream that dried up at least 3 months out of the year. The presenter emphasized that the ROD, or individual district managers, could choose their own definition. The more common definition of intermittent stream is one that dries up at least one month out of the year. If the one-month definition is used, many more streams that can be clearcut right over with a 0-foot tree buffer.

BLM must disclose the adverse impact of the WOPR on Costal Salmon Recovery.

> "The aquatic conservation strategy associated with the Northwest Forest Plan should dramatically improve fish habitat, watershed stability, and water quality over time. This is one of the major anchors of the OCSRI restoration strategy. … The Bureau of Land Management and the U.S. Forest Service are involved in funding and implementing the Northwest Forest Plan, which is a critical element of the OCSRI."

OCSRI Executive Summary Pages 10, 12.

> "The Northwest Forest Plan is expected to substantially improve watershed health and salmon production on federal land and in downstream areas. The aquatic conservation strategy and the commitment to monitoring provide a cornerstone to the OCSRI."

OCSRI Volume 1 Page 7.

The state of Oregon salmon recovery plans also rely heavily on the Northwest Forest Plan and the Aquatic Conservation Strategy:

> "Oregon believes that, for federal lands, the Northwest Forest Plan makes significant positive contribution toward meeting ESA and Clean Water Act needs."

Oregon Coastal Coho Assessment (Final)

> "Federal agencies are making substantial investments in salmon and watershed restoration. The Bureau of Land Management and the U.S. Forest Service are involved in funding and implementing the Northwest Forest Plan, which is a critical element of the Oregon Plan."

Oregon Plan Steelhead Supplement.

Comments generated from the WOPR Technical Briefing in Eugene, October 18, 2007:

- BLM must explain why the future will be so very different from the past in terms of public acceptance of logging mature and old-growth forests. The public is passionately opposed to logging older forests and BLM's plans to increase logging of old forests will not result in the predicted harvest increases. This fact must be factored into the analysis of predictable harvest, community stability, county payments, etc.

- Dead wood is an important habitat element in the old forest ecosystems that are of great interest in this and previous EISs. The EIS structural stage analysis needs to account for dead wood. Failure to do so leaves the ecological analysis highly speculative and uncertain. Nonaka and Spies were able to build a model that accounted for these factors, why can't BLM.

- To exclude natural disturbance from the analysis leaves the outcomes highly uncertain. BLM goes to great lengths to show that the harvest level is physically sustainable, but if fire and other disturbances are excluded this finding is completely hypothetical. BLM claims that disturbance is too speculative to analyze. If so, then sustainability is equally speculative and uncertain.

- The WOPR Technical Briefing in Eugene, October 18, 2007, revealed that the analysis assumed that 100% of LSR lands on FS land would grow to become late successional forest. This overestimates habitat values and fails to account for natural disturbance.

- The spotted owl analysis fails to distinguish between high quality and low quality dispersal habitat. As one scientist famously noted … low quality dispersal-only habitat is where spotted owls go to die. Higher quality dispersal-only habitat provides a much higher probability that owls can move safely across the landscape while finding food and shelter and avoiding predators.

- The owl habitat evaluation criteria are too insensitive to accurately describe effects on spotted owls. For instance, snags and course woody debris are coded as present or absent which fails to account for the fact that within the "present" category there is a wide range of abundance which has a wide range of effects on spotted owls and their prey.

- The pie charts showing the proportion of different habitat structural stages within reserves are misleading because they fail to show that the whole pie is smaller in Alt 2 while the pie is much larger under the Northwest Forest Plan.

- The EIS team assumed that there would be no conflict between WOPR Alt 2 and critical habitat for the marbled murrelet because BLM assumed that FWS would redraw CHU to be consistent with the WOPR. BLM would become the *de facto* authors of the CHU boundaries. This reeks of political manipulation of the law. The Endangered Species Act requires that critical habitat be designated by FWS, not BLM.

- The hydrology analysis did not clearly consider the synergistic effects of roads and canopy openings on peak flows.

- The hydrology analysis also failed to consider the effects of extreme events. BLM claims that extreme events overwhelm the differences between alternatives, but this fails to answer another important question: are there cumulative impacts caused by BLM's logging, roading, OHV, and grazing practices that cross unacceptable water quality thresholds when subjected to anticipated extreme weather events and disturbance like fire? Maybe all the alternatives cross the threshold. If so, the decision-maker and the public should know.

- The hydrology analysis failed to address natural disturbances such as fire and large storm events.

- The sediment analysis assumed moderate traffic levels on all roads. This fails to account for high traffic in OHV areas, in areas where private lands are being heavily logged, and where BLM is conducting logging activities. High traffic in these areas will cause significant chronic sediment problems that are not accounted for in the EIS.

- The EIS assumes that road restoration work will proceed under Alt 2 to the same degree as under the Northwest Forest Plan. This is not possible because all the logging anticipated under Alt 2 will require road access in areas that the Northwest Forest Plan designated as reserves and intends to restore. Alt 2 will prevent roads from being decommissioned in some of those areas.

- The fisheries and hydrology analyses need to be conducted at multiple scales in order to reveal the scale(s) that are most sensitive to the effects of the alternatives.

Page - Comment

LII - Figure 2 shows just how unreasonable expectation have become about county payments. The high levels of county payments received under the Secure Rural Schools legislation was based on the peak levels of old-growth clearcutting that occurred in the late 1980s. This level of logging was reach only because of a congressional appropriations riders (§§ 314 and 318) that set aside environmental laws and forced through literally billions of board feet of logging that would never have complied with the Endangered Species Act and the CWA. Figure 2 also shows that the safety net prior to the Secure Rural School legislation was proving a "soft landing" that would rationally align county payments with the Northwest Forest Plan.

LVII- The EIS admits that the habitat needs of species associated with intermittent streams would not be met under alternatives 2 and 3. This would likely violate the Clean Water Act requirement to maintain water quality for aquatic organisms and the Endangered Species Act policy to avoid actions that would cause species to become threatened & endangered. Also, the small intermittent headwaters are hydrologically and ecologically inseparable from the perennial streams that they feed. It will be impossible to met the needs of salmon and other imperiled fish and wildlife if the headwaters are not protected. The larger streams depend on clean water, large wood, and other inputs from the headwaters. The BLM action alternative will not provide that.

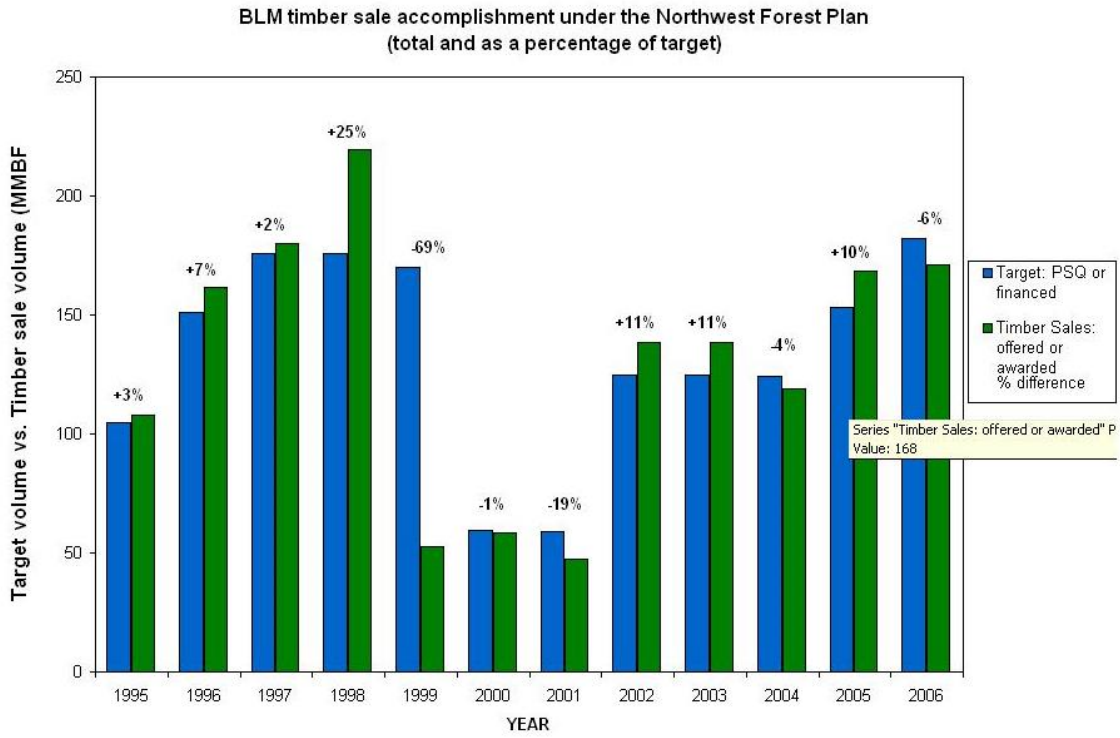
LX- The DEIS arrives at an erroneous conclusion that instream large wood objectives will "nearly reach the maximum potential" in spite of reduced riparian protection and aggressive clearcutting outside of those riparian areas. The DEIS admits that wood is sourced outside of riparian areas but since those areas are poorly protected and aggressively logged they simply cannot provide natural or near-natural levels of large wood input. The DEIS fails to recognize that instream wood piece size and number will both be adversely impacted by increased logging.

3 – The DEIS needs to disclose that the Northwest Forest Plan allowed for the maximum legal amount of logging that was consistent with the law and if any part of the Northwest Forest Plan was not faithfully implemented it would be illegal. This is stated in the NWFP ROD and the Dec 1994 Dwyer opinion approving the Northwest Forest Plan. All of the action alternatives would therefore violate the law.

4 – The stated purpose of the WOPR is to address ESA listed species only. This is inconsistent with the BLM policy to avoid actions that would cause trends toward listing. The narrow focus on listed species is also inconsistent with the current scientific understanding that essential ecological services are put at risk when biodiversity declines.

5 – The DEIS assumes that timber receipts are more stable than Congressional appropriations for county payments. This assumption is unsupported by the facts. County payments have never been more stable than they have while they have been decoupled from timber receipts.

5 - The DEIS assumes that timber volume was the only objective of the Northwest Forest Plan that was not met. This is unsupported; timber volume is just a more measurable criteria. In fact: (a) timber sales offering have closely matched timber targets established by Congressional appropriations, (b) other objectives of the Northwest Forest Plan have not been met, such as spotted owl populations are still declining, survey and manage promises were broken, the ACS was not faithfully implemented at all scales, the 1995 Rescissions Act salvage rider lead to the significant habitat loss inside protected reserves, ecologically harmful salvage logging was implemented within protected reserves, etc.



5 – Oregon Wild scoping letter raised a number of significant issues that need to be covered by this EIS but were excluded from the analysis. No explanation is given for excluding these issues.

5 – The WOPR EIS readily acknowledges that there is an owl recovery process going on, but strangely BLM and the Forest Service have refused to anticipate the effects of the WOPR in its cumulative impacts analyses for ongoing logging projects in owl habitat. The legal standard is if the agency has published a notice of intent to prepare an EIS, then it is reasonably foreseeable and must be included in the cumulative impacts analysis. The fact that the BLM has not yet made a decision is immaterial because BLM has already ostensibly limited its discretion by approving the settlement agreement that requires them to approve a plan revision that meets a narrow (albeit improper) legal interpretation of the O&C Lands Act.

6 – Regulated stream flow and watershed protection must be explicit purposes of this EIS process in order to fulfill the intent of the O&C Act. BLM cannot construe the O&C Act

to create a legal fiction that sustained yield management by definition always ensures regulated stream flow and protected watersheds. BLM must implement sustained yield in such a sway to ensure an objective accomplishment of those objectives, so they must be primary purposes of this WOPR EIS.

7 – The selection of the preferred alternatives reveals the BLM's biases toward timber harvest as the dominant (almost exclusive) value of these forest lands. This reveals a profound misinterpretation of the O&C Act in light of current science, current values, current economic priorities, etc...

9 – BLM provides no rationale for rejecting the previously embraced Northwest Forest Plan "policy goal of protection of the long-term health and sustainability of all federal forests within the range of the owl and the species that inhabit them." BLM needs to harmonize its legal obligations under the O&C Act, FLPMA, ESA, CWA, etc.

10 – The BLM has not given any attention to the O&C Act requirement that they sell timber when prices are reasonable and markets are normal. Neither of these criteria are met, so BLM does not have to sell any timber at all. As one prime and indisputable example, <u>current prices are unreasonable and current markets are abnormal because they do not reflect the carbon storage value of mature and old-growth forests.</u>

11 – The DEIS concludes that FLPMA does not apply to lands suitable for timber production because there is a conflict between the mandates of FLMPA and the O&C Act. This is an unsupported assumption. Before finding a conflict, BLM must first try to harmonize the objectives of these acts, which is what the Northwest Forest Plan did, and there is no reason to conclude that this was an error.

11 – BLM needs to embrace the broader conservation objectives of the Endangered Species Act. The point is not just to save species after they become threatened & endangered. BLM should use its authorities to conservation species and habitat that helps avoid the need to list species in the first place.

11 – The Clean Water Act urges that BLM maintain and restore the chemical, physical, and biological integrity of the nations waters. The CWA goal in fact was to have this task accomplished years ago, so any further delay in the restoration of water quality is a violation of the intent of the CWA. The EIS must give more attention to the rate of recovery of water quality and biological integrity of waterways. The ACS did this by prohibiting actions that would "retard" attainment of ACS objectives. BLM has not justified why it would be acceptable for the action alternatives to slow the rate of recovery of water quality.

13-15 – The DEIS described several alleged conflicts between the O&C Act sustained yield mandate and FLPMA requirements in the areas of ACECs, wilderness management, visual management, and special status species that are not yet listed under the ESA, but BLM fails to explain why these values cannot be harmonized. Sustained yield does not trump these FLPMA values. Sustained yield must be adjusted to ensure that

environmental values are provided. These public goods will be under-produced and wood products will be overproduced, unless BLM intervenes in the imperfect market. The O&C Act implicitly recognized this problem when it said that BLM only needs to sell timber when prices are reasonable and markets are normal.

15 – BLM has not explained why it can only provide protection for state-listed species when there is a cooperative agreement, but not when a cooperative agreement has not yet been approved. BLM should protect all state-listed species and should not approve a plan that assumes non-cooperation.

18 – The EIS needs to respond to scoping comments and public comments on the planning criteria. We pointed out many flaws in the analytic approach before the DEIS was prepared, but BLM failed to take the opportunity to correct these errors when it had the chance. If the BLM uses flawed planning criteria it will prepare a flawed EIS and make flawed decisions.

20 – The proposal to change management adjacent to the Coquille Tribal Forest is an unconscionable attempt to undermine the Congressional intent to maintain consistency between the Coquille Forest and federal forest management policy. Congress intended to provide a floor below which Coquille forest management would not fall, but this proposal would create a new lower floor allowing the Coquille tribe to more aggressively log their lands. BLM also admits that this unique management regime would cause water quality problems, so it should be rejected for that reason too. This proposal would remove an intended constraint on logging on tribal land, and in order to do that BLM will allow public lands to be degraded. This is outrageous and unacceptable. The DEIS must disclose the cumulative impacts of this management regime.

21 – The brief description of scoping issues seem to exclude some important ones such as: non-listed wildlife, climate change, water flow, watershed protection, recreation, community stability.

23 – The status of the 2007 survey and manage ROD is unclear.

24 – BLM claims that they will coordinate with DEQ and EPA on water quality issues, but since ODF is coordinating state input (and they are a classic captured agency and biased toward timber harvest as a result), they are undoubtedly filtering out some important comments and concerns that BLM is not hearing from DEQ.

29 – The DEIS reveals that mitigation would be optional. BLM managers would use loopholes/excuses like “impractical” or “inconsistent with decision” to avoid implementing mitigation. The analysis does not reflect this uncertainty.

30 – Air quality objectives ignore the obvious need to regulate CO_2 to mitigate climate change.

31 – Energy development objectives fail to account for climate change and the over-riding need to leave fossil fuels in the ground and out of the atmosphere.

Biomass utilization objectives should always further restoration objectives, but the EIS views biomass as merely a way of dealing with slash after non-restorative logging. The recent OFRI biomass study shows that the majority of the public and stakeholders expect more form biomass. It should be done for restorative purposes, not just to foster business-as-usual logging.

33 – BLM's total fire suppression policy is arbitrary and capricious. Fire suppression makes future fires more severe, which threatens habitat, community stability, and puts more carbon in the atmosphere in the long term. The adverse impacts of this policy must be disclosed.

34 – BLM's livestock grazing policy must protect biological integrity of waterways including habitat for all fish, not just those listed under the Endangered Species Act.

The DEIS must recognize that restoring stream complexity requires not just instream placement of large wood (which is a short-term stop-gap measure) but more fundamentally requires restoration of the *ecological processes* such as mature forests along streams and natural disturbance that ensure on-going recruitment of large wood.

42 – BLM is too liberal in the granting of access to BLM lands for roads, and communications sites. Road density needs to be limited and special habitat on ridge tops need to be protected. The EIS needs to consider mitigation such as restricted access and denying requests for communications sites.

43 – BLM interprets too narrowly their duty to designate "outstanding natural areas" as ACECs. LSRs, Key Watersheds, CHUs, late-successional old-growth should all be designated and managed as ACECs.

46 – The objective for managing plant species should include maintaining redundancy of ecological functions and ecosystem services, and avoiding trends toward listing additional species.

46 - BLM management objectives for botany must be to conserve all plant species not just those that are AND have recovery plans.

46 – BLM's misconception of sustained yield must not trump the need to conserve plants. The EIS must acknowledge that plants help provide the biodiversity that provides ecosystem services, permanent forest production, watershed protection, community stability, and climate stability.

47 – BLM only intends to protect plants and fungi on non-commercial forest land. This is flawed. The EIS must acknowledge that plants and fungi help provide the biodiversity

that help provide ecosystem services and permanent forest production, watershed protection, community stability, and climate stability.

51 – The EIS must acknowledge that rapid conifer regeneration might make sense from a fiber production standpoint, but truncating succession is ecologically inappropriate because it skips important successional steps that have long-term ecological benefits like pollination, biodiversity conservation, nutrient cycling, nitrogen fixation, etc.

51 – BLM must recognize that wildlife trees with forks and broken tops and non-conifer trees are under-represented and ecologically valuable yet sacrificed when management favors well-formed crop trees. BLM must recognize that favoring conifers over non-conifers has adverse ecological impacts and may be inconsistent with the direction of change (toward broadleaf species) in western Oregon forest ecosystems expected under climate change.

52 – BLM must recognize that "major modification of visual resources" across 2.3 million acres of forest is bad for quality of life and community stability.

57 – BLM should not allow recovery of beneficial uses of water to be slowed down compared to natural rate of recovery. Retarding recovery violates the anti-degradation policy during the period that water quality standards remain unmet due to the delayed recovery.

60 – BLM should conserve all species, even those without recovery plans. The EIS must fully disclose the adverse consequences of this.

61 – BLM should not let the O&C Act trump conservation of big game and state-listed species. The EIS must fully disclose the adverse consequences of this.

63 – The EIS must disclose the adverse consequences that are likely due to the weak protection for administratively withdrawn areas that do not have management objectives of their own and can be managed similarly to adjacent areas.

64 – The stated reasons for the preferred alternative are seriously flawed. Alt 2 would set back recovery of threatened species (esp. owl, murrelet, and salmon) relative to the Northwest Forest Plan. Alt 2 would degrade water quality relative to the Northwest Forest Plan. Alt 2 would increase fire hazard relative to the Northwest Forest Plan. Alt 2 would provide inadequate recreational facilities and cause crowding in recreational areas. Alt 2 threatens the economic stability of local communities by: recoupling counties to the boom-bust timber industry, by increasing local communities dependence on a declining industry, and by reducing the quality of life that helps sustain and grow local economies. The Northwest Forest Plan clearly meets the stated goals of the WOPR better than Alt 2.

65 - BLM gave up their losing court battle to gut the Aquatic Conservation Strategy, so the no action alternative must include the ACS as adopted in 1994.

76 - The action alternatives significantly reduce protection for streams by among other things shrinking the stream buffers. In the existing Northwest Forest Plan the riparian reserves are intended to protect both aquatic and terrestrial species. The proposed reduction in stream protection is based solely on the aquatic values and the plan fails to mitigate for the loss of protection for terrestrial species. Two values are especially impacted: (a) dispersal of organisms between the reserves, and (b) refugia and centers for dispersal for late-successional wildlife in the matrix. Both of these critical functions would be severely degraded.

76 – The proposal to allow salvage in reserves is inconsistent with the objective of developing structurally complex habitat. Since the EIS is not analyzing the effects of fire or salvage logging, the EIS cannot not adopt any binding rules for salvage. See supporting materials on salvage logging and the many values of dead wood.

76 - BLM must disclose that structure-based management is unproven. Without limits on the size and age of trees that can be cut, BLM is essentially adopting structure-based management. The adverse effects of this must be disclosed. See our scoping comments.

84 – BLM lacks the authority to coordinate management of lands adjacent to the Coquille Tribal Forest. In fact, this proposal undermines congressional intent to constrain forest management on the Coquille forest in order to mitigate for adverse effects of logging that would fall below the standards of the Northwest Forest Plan.

103 – The sub-alternatives described in the DEIS are a waste of time. They are not really NEPA alternatives. The tail wags the dog when the rate of thinning is pre-determined by the main clearcutting alternative. There is no reason that thinning must achieve an arbitrary and unsustainable timber target that is based on tree farming instead of real forestry that conserves water, habitat, and carbon. In considering the sub-alternatives, instead of a full NEPA analysis, the EIS asks and answers only limited questions.

The EIS should consider a sub-alternative of the no action alternative that is based on the community-conservation alternative.

Economist Eric Hovee told the Oregon legislature in 2005 that "predictability and management of land was more critical to timber companies than harvest amounts." http://www.sos.state.or.us/archives/legislative/legislativeminutes/2005/house/trade/hted0131.htm so BLM must consider the fact that a low level of thinning of dense young stands better meets the community and economic stability objectives of the O&C Act, because such thinning is relatively non-controversial so is more stable and predictable than old growth logging which is opposed by the public and tends to get caught up in litigation, protests, ESA consultation, Congressional scrutiny, etc.

105 – BLM falsely asserts that managing the forests consistent with the historic range of variability would be inconsistent with the O&C Act. This is unsupported. In fact, a consensus is building that managing consistent with the HRV is necessary in order to achieve true sustainability and would therefore be necessary to achieve watershed

protection, regulated water flow, permanent forest production, and community stability as required by the O&C Act.

107 – If BLM's argument against natural selection logging, is that BLM land is "too rugged" then please explain why clearcutting on such rugged terrain makes more sense.

104 – 109 - Many alternatives were rejected because conservation is inconsistent with the O&C Act. If so, then why does Alt 2 have any reserves at all? BLM would have us believe that Alt 2 is the precisely perfect balance of logging and conservation without subjecting any other combinations to NEPA review and comparison. BLM cannot predetermine that the level of conservation without careful NEPA review of other alternatives.

155 – The WUI map shows how HFRA is being abused. Identification of the urban interface in CWPPs was supposed to help prioritize fuel reduction in places that help protect homes and built infrastructure. If the WUI is expanded to encompass virtually the entire landscape, even in areas without homes and buildings, then the process of prioritization is corrupted and ineffective.

192 – The DEIS says that western Oregon is uniquely suited to growing mature and old-growth trees that are massive and long-lived. This shows how valuable these trees are for carbon sequestration.

194 – The DIES relies on the flawed conclusions about "net in-growth" from the 10-year LSOG monitoring report (Moeur et al 2005). As explained on pages 36-37 of ONRC's scoping comments this report's conclusions about ingrowth are flawed. Most importantly because the modeled growth of trees from 18 or 19 inches dbh in 1994 to cross an arbitrary 20 inch dbh threshold in 2004 is merely an incremental change that cannot be compared on an acre-to-acre basis with regeneration harvest of old forests that is visible from space.

> The NWFP 10-year monitoring effort is alleged to have discovered a net increase of 600,000 acres of medium and large conifers over the last ten years (Moeur et al 2005)[12], allegedly far great than the number of acres of older forest that were lost to logging or fire. There are several reasons that the agency may not justify logging mature and old-growth forests based on the alleged "ingrowth" of medium and large trees.
>
> 1. The analysis of habitat loss is based on satellite data, while the analysis is habitat gain is NOT based on satellite data, but rather modeling. The satellite imagery could capture large clearcuts but could not reveal old-growth damaged by partial harvest. The authors essentially used a foggy lens to look for old forests that were logged, but they used a fine-toothed comb to find the newly developed late successional forests, so the report is comparing apples and oranges.
> 2. The satellite data analysis failed to reveal significant habitat loss of partial removal of habitat. The FWS conducted a study with similar objectives and found far more habitat degradation than the satellite methods, but the authors never attempted to reconcile these disparate results.

[12] Moeur, M, T. A. Spies, M. Hemstrom, J. Alegria, J. Browning, J. Cissel, W. B. Cohen, T. E. Demeo, S. Healy and R. Warbington. *In review*. Northwest Forest Plan—The First Ten Years (1994-2000): Status and Trends of Late-Successional and Old-Growth Forests. USDA Forest Service General Technical Report.

The satellite-based monitoring report indicates that 17,300 acres of old-growth were destroyed by clearcutting. However, we know from the recent spotted owl status review that 156,000 acres of spotted owl habitat on federal lands have been lost to logging (Note: This figure was corrected to minimize over-counting). This same FWS report shows that, in Oregon, owl habitat on federal land has suffered an 8.5% decline over the last ten years, and in SW Oregon, owl habitat on federal land has declined 21.76%. See FWS 2004. Estimated Trends in Suitable Habitat Trends for the Northern Spotted Owl on Federal Lands from 1994 to 2003.

3. The FWS conducted a study with similar objectives and recognized the illogic of comparing apples and oranges so they thought it was inappropriate to make any conclusions about "net" changes in habitat. When presented with a similar question, the US Fish and Wildlife Service concluded that habitat loss and in-growth are not comparable, because of "fundamental differences" between loss of optimal habitat and gain of marginal habitat, and because of differences in methodology. See FWS 2004. Estimated Trends in Suitable Habitat Trends for the Northern Spotted Owl on Federal Lands from 1994 to 2003.
4. The government's analysis assigns equal value an acre of classic 350 year old ancient forest that may be lost to clearcutting as well as an acre of 19" dbh trees that grew to 20" dbh over the last ten years. In other words, the gains are incremental while the losses are catastrophic. These crude methods fail to recognize that many of the old-growth stands that were logged provided optimal old-growth habitat, while most of the so-called "in-growth" is only 80 years old and is of only marginal habitat value. The ISC Report says "Because suitable owl habitat is usually found in mature and old growth, stands between 80 and 100 years old are better regarded as marginal habitat." (ISC Report p 18). "Older second-growth stands on land logged or burned in the late 1800s to early 1900s are approaching old growth in size. Such large second-growth stands generally lack the characteristics of old growth, which are (1) storied canopy including different tree species in the lower levels (fig. 2a), (2) openings that allow light into the forest floor where dense vegetation thrives, (3) presence of snags, (4) coarse woody debris on the ground (fig. 2, c and d), and (5) the absence of major stand-altering disturbance by humans (Franklin and others 1981, Marcot and others 1991)."**Bolsinger, Charles L.; Waddell, Karen L. 1993.** Area of old-growth forests in California, Oregon, and Washington. Resour. Bull. PNW-RB-197. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. 26 p. http://www.fs.fed.us/pnw/pubs/pnw_rb197.pdf
5. Consider this analogy: If 500 people start with $100 and then gain $10, what is the best way to compare that to 100 people who each started with $500 but lost it all? There were 5 times more winners than losers, so there was a net gain of winners, and that is analogous to the "net" gain in acres of old forests. All we really know is that there were more acres that won compared to acres that lost, but the changes are vastly different in magnitude and quality.
6. The analysis failed to account for edge effects and the fact that the absolute number of acres of in-growth of 20" dbh trees are not equivalent to the amount of functional interior habitat gained. See http://gis.esri.com/library/userconf/proc01/professional/abstracts/a768.html
7. The analysis failed to distinguish between ingrowth in the reserves vs. the matrix and AMAs. The habitat gains from tree growth and successional development are not very valuable to spotted owls and other species if such stands are to be logged in the near future as they are slated to be in the matrix. These stands provide only marginal habitat now and are unlikely to develop into optimal habitat before they reach "culmination of mean annual increment" and are scheduled for harvest.
8. There are certainly gains from forest growth and these should be recognized but ten years of growth in a young forest result in only incremental gains in all the things that old forests need to become old growth (e.g. gaps, snags, understory development, etc).
9. The monitoring methods used by the government cannot track the actual development of old-growth characteristics such as the presence of large snags, or unique species such as life-saving Pacific yew, so we don't know if we are getting back old-growth forests of the same quality as those we are losing to logging.
10. One of the reviewers of the Moeur et al. paper was "very troubled by low mapping accuracies in some of the provinces. For example, in the Eastern Washington Cascades province, the

number of older forest acres was dramatically underestimated (<200,000 acres mapped verses >400,000 acres plot estimate). Accuracy for the > 20 inch class is 0% …"

11. The monitoring questions were originally developed in 1998 (Hemstrom et al 1998). Without adequate explanation, this report alters those questions and leaves out some important questions about the effects of logging and salvage on stand structure, ecological processes, and biodiversity.
12. As noted in the March 2004 evaluation report for the 5-year status review for the marbled murrelet: "There are, however, several difficulties in basing the amount of late successional forest and murrelet habitat development expected over the next 50 years on the rate of 600,000 acres (242,812 ha) provided by the USFS and BLM (2004). First, there are no citations or analyses presented by the USFS and BLM (2004) to determine how this value was derived and the validity of the methods used. Second, the NWFP defines late successional forests as >80 years old (USFS and BLM 1994), while stand and tree characteristics suitable for nesting murrelets can take 100-200 years to begin to develop, depending on forest type. Third, there is no information on specific locations where this new late-successional forest might develop. And finally, the NWFP may be revised from its current form." McShane, C., T. Hamer, H. Carter, G. Swartzman, V. Friesen, D. Ainley, R. Tressler, K. Nelson, A. Burger, L. Spear, T. Mohagen, R. Martin, L. Henkel, K. Prindle, C. Strong, and J. Keany. 2004. Evaluation report for the 5-year status review of the marbled murrelet in Washington, Oregon, and California. Unpublished report. EDAW, Inc. Seattle, Washington. Prepared for the U.S. Fish and Wildlife Service, Region 1. Portland, Oregon. page 4-76.
13. The 2004 spotted owl assessment by SEI identified the need to develop improved information including "An improved confidence in our ability to track and validate the suitability of newly developed habitat would be very valuable." S.P. Courtney, J.A. Blakesley, R.E. Bigley, M.L. Cody, J.P. Dumbacher, R.C. Fleischer, A.B. Franklin, J.F. Franklin, R.J. Gutiérrez, J.M. Marzluff, L. Sztukowski 2004. Scientific Evaluation Of The Status Of The Northern Spotted Owl. SEI.
14. The Moeur et al analysis needs to consider what is going on in the larger landscape. Change detection analysis reveals 583,500 acres of owl habitat "losses" due to "regeneration harvest" on non-federal forest lands from 1994 to 2004. Raphael, M.G. (2006). Conservation of listed species: the northern spotted owl and marbled murrelet. Chapter 7 in R.W. Haynes, B.T. Bormann, D.C. Lee, and J.R. Martin (technical editors), Northwest Forest Plan—the first 10 Years (1994–2003): synthesis of monitoring and research results. Gen. Tech. Rep. PNW-GTR. USDA Forest Service, Pacific Northwest Research Station, Portland, Oregon. http://www.fs.fed.us/pnw/publications/gtr651/ p 121.

195 - The DEIS must also recognize that 583,500 acres of owl habitat "losses" due to "regeneration harvest" occurred on non-federal forest lands from 1994 to 2004. Raphael, M.G. (2006). Conservation of listed species: the northern spotted owl and marbled murrelet. Chapter 7 in R.W. Haynes, B.T. Bormann, D.C. Lee, and J.R. Martin (technical editors), Northwest Forest Plan—the first 10 Years (1994–2003): synthesis of monitoring and research results. Gen. Tech. Rep. PNW-GTR. USDA Forest Service, Pacific Northwest Research Station, Portland, Oregon. http://www.fs.fed.us/pnw/publications/gtr651/ p 121.

199 – The EIS does not accurately describe the effects of logging because the vegetation classification does not account for effects on dead wood habitat. The adverse effects of logging are not fully described and incorporated into the analysis. We discussed the important of dead wood on pages 39-42 of ONRC's scoping comments. See also the supporting materials on the many values of dead wood and the adverse effects of logging.

202 – Various limitations of the IVMP tool are not described in the EIS. These must be disclosed and considered in the NEP analysis not incorporated by reference. Apparently the IVMP tool lumps mature and complex forests because they cannot be distinguished at the course scales used by the IVMP. That would be fine if all the mature and old-growth forests were being protected, but since the WOPR intends to increase logging of these forest types, the EIS cannot fully describe the consequences of logging these forests if mature and complex forests cannot be distinguished in the analysis.

213 – The EIS needs to recognize that the fire regime in the Klamath Province is more mixed frequency and mixed severity, rather than high frequency low severity as erroneously stated in the EIS. This recognition must be carried through the NEPA analysis.

216 – The socio-economic analysis must account for non-market values. Non-market economic values are no less real than values sold in markets, its just that non-market values are harder to measure and harder to internalize. BLM must recognize that non-market values like clean water, pure air, healthy biosphere, and a stable climate are fundamental to human survival, and more important than money. The DEIS economic analysis fails to consider non-market values and leads to highly misleading bias in favor of timber harvest and against forest conservation. The O&C Act does not require BLM to ignore non-market values. In fact, the O&C Act's qualification to sell timber only at "reasonable prices on a normal market" are an implicit acknowledgement that BLM must consider non-market factors.

219 – The economic analysis is unacceptably narrow, focusing on payments to counties, plywood industry, and WOPR. There are so many issues that are equally or more relevant to community economic stability in western Oregon.

220 – Table 70 starts to put the economic contribution of BLM logging in perspective. BLM logging contributes less than 1% to the economic performance of state, and logging is a declining fraction of the state's economy, while other sectors are growing relatively faster. The growing sectors of the economy would benefit from forest conservation and the quality of life that it provides. This needs much further analysis.

222 – The EIS needs to look at the wood products "location quotient" over time to see that wood products plays a declining role in Oregon's economy.

229 – The EIS admits that payments to counties were stabilized when they were decoupled from timber receipts. Therefore the EIS must acknowledge that recoupling will have a destabilizing effect, especially because of increased conflict over increased logging of mature and old-growth forests.

234-243 – The EIS fails to disclose the implications of changes in the timber industry. Small logs are becoming a larger part of the wood supply. In western Oregon 1,200 mmbf of logs smaller than 9" dbh were milled in 2003. The EIS admits that only a small fraction of timber harvest is from federal lands. Mills increased their production 37%

over the past few years without significantly increasing employment or payrolls. In fact, 11,000 jobs were lost in the timber industry from 1994 to 2000 even though harvest volume increased during that time. The timber industry is increasingly capital intensive. Investments are being made in larger mills, while smaller mills will face increasing competitive pressure and many will probably go out of business during the current and future downturns. How will the increased wood supply brought by the WOPR be absorbed by the industry? Will small mills in small towns benefit, or mostly a few large mills around Eugene, Roseburg, and Medford? The EIS must acknowledge that the timber industry has an increasing appetite for wood, but it does not result in an increasing or widely shared economic benefits for the citizens of the state. The few capitalists enjoy the economic benefits but at what cost to the quality of life of Oregon? Are we destroying the best asset we have for future economic development?

236 – The DEIS assumes that selling wood at a competitive auction results in a "fair market prices" but that is not the same as a "reasonable prices on a normal market" as required by the O&C Act, because there are significant economic externalities that are not reflected in the price at auction, including clean water, pure air, healthy biosphere, and a stable climate.

282-290 – The EIS says that owl habitat has increased. The DEIS also admits that the implications of the alleged habitat increases are unknown, so the EIS cannot rely on these habitat increases to justify an increase in owl habitat logging.

290 - The EIS needs to disclose and consider the implications of the fact that 583,000 acres of owl habitat were lost on non-federal land during the first ten years of the Northwest Forest Plan.

291 – The EIS plays ignorant about Sudden Oak Death (SOD), claiming it's too uncertain to analyze effects. However, it's effects are not too uncertain to identify potential mitigation such as protecting more owl habitat to compensate for owl habitat that may be lost to SOD. The EIS needs to acknowledge that enough is known about sudden oak death syndrome to be cautious. While there may be uncertainty about the future effects of SOD, the effects are far more likely to be negative than positive, so existing owl habitat is more rare and valuable than before SOD was discovered. This must be accounted for in the EIS.

296 – The EIS needs to consider the inter-relationship between spotted owls, barred owls and habitat. It is a well-established principle of ecology that providing more habitat reduces the competitive pressure between two competing species. The WOPR EIS must mitigate for the barred owl by providing additional old forest habitat which will increases the chances that the two competing owl species can co-exist. See:

> 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://www.reo.gov/monitoring/nso/reports/HJA2002-annual-report.pdf

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.

325 – The EIS must consider the effects of habitat fragmentation and habitat quality on fishers. The EIS exaggerates the quantity of fisher habitat "available" by failing to account for how fragmented the habitat is and failing to account for the low quality habitat (i.e. habitat that is minimally suitable but not as complex as natural forests should be). This relates back to the DEIS's generally poor analysis of dead wood habitat.

335 – The DEIS needs to give more attention to the current extent and condition of non-listed fish populations and the effects of increased logging and roads on non-listed fish species.

337 – The EIS needs to elaborate on the "major risk factors" for various fish, especially "habitat degradation."

339 – The fish analysis focuses on ecological processes to the exclusion of the current degraded conditions of western Oregon watersheds. However, since so many fish species are threatened & endangered and special status, current conditions are highly relevant and need to be more fully disclosed. Fixing ecological processes in future decades may be too late for some fish. BLM may need to stop logging in some degraded watersheds as a stop gap measure. For instance, wood loading in streams is 1/100th of historic conditions. Any reduction, even a minor reduction or slowing) of the rate of recovery of this habitat attribute is unacceptable.

357 – The EIS must disclose whether the water temperature standard is optimal or minimal. Are fish under thermal stress even when the temperature standard are met? Can BLM do better and help compensate for the poor practices on agricultural and industrial timber lands?

357 – The EIS must disclose the current temperature conditions so that the decision-maker can see how degraded stream conditions really are and how great is the need for restoration and recovery (which should not be delayed by more logging on BLM lands).

358 – The DEIS needs to disclose that global climate change will shift more precipitation from snow to rain and the implications of that for fish and aquatic ecosystems.

359 – The EIS must analyze peak flow effects at multiple scales and disclose what scales are most sensitive to forest management and what biological resources are most at risk from peak flow effects at those scales.

367 – The EIS must recognize that large trees which are valuable for instream structure, tend to grow in less dense stands, but less dense stands provide less shade. This indicates a need for wider riparian reserves to compensate for less dense stands where they may occur now and in the future.

369- Shade zones ignore the canopy density factor.

388 – The EIS needs to consider the cumulative, compound, and synergistic effects of roads and timber harvest on public and private lands. This analysis will reveal problems with peak flows, large wood, sediment, and temperature. The EIS needs to disclose to what extent existing and planned future mid-slope roads on public and private lands are expected to intercept debris flows and prevent recruitment of large wood and spawning gravel. BLM needs to limit management activities in order to compensate for existing conditions and intensive management on non-federal lands.

394 – Reserves are blamed for increasing fire hazard, but this is simply false. Thinning, prescribed fire, and fuel reduction are NOT prohibited within reserves. Young stands can be thinned if necessary, and older stands generally do not need to be thinned to reduce fire hazard. Older stands have many characteristics that make them less susceptible to high severity fire: thick bark, high crowns, cool-moist-less-windy understories, heterogeneous fuel structure.

422 – Please explain why LSRs, CHUs, key watersheds, roadless areas, etc, are not in the NLCS. They should be, if this is not just a token program.

430 – Half of grazing allotments have not been reviewed for compliance with legal standards. NEPA requires that this analysis be conducted and included in the EIS. The EIS must disclose that livestock grazing is generally incompatible with recovery of aquatic ecosystems, development of resilient fuel structures, and maintenance of weed-free plant communities.

431 – Please disclose the extent of grazing allotment fences NOT maintained.

432 – The EIS needs to disclose how OHVs adversely affect wildlife, not just livestock.

438 – The ACEC analysis is inadequate. The BLM never adequately justified its decisions to reject several valid ACEC proposals made by ONRC and others.

439 – The EIS must disclose that ridge-top roads will conflict with cultural resource preservation.

465 – This EIS does not adequately discuss the cumulative impact potential of WOPR logging increases, plus coal bed methane developments, and their impacts on water quality, fish, threatened & endangered species, etc.

466 – The EIS should articulate state and federal policies for water quality, fish & wildlife, global climate mitigation, other resource values. National Energy Policy does not trump these other values. They must be harmonized.

476 – As explained in our scoping comments and planning criteria comments the EIS should not rely on the flawed results on the Northwest Forest Plan 10-year monitoring reports, including: (a) the watershed monitoring report merely confirmed that some restoration activities occurred but did not confirm whether they were effective in terms of improving conditions for fish and other aquatic organisms, (b) Moeur et al's LSOG monitoring report failed to account for the loss of 137,000 acres of old forest degraded by logging but not visible from space and Moeur et al inappropriately tried to directly compare incremental habitat gains and transformative habitat losses, and (c) monitoring has so far failed to consider the landscape view and account for the loss of 580,000 acres of owl habitat from non-federal lands.

477- The DEIS cannot rely on the unfounded assumption that the matrix will provide the same amount and condition of vegetation over time. The WOPR plans to increase the ASQ in the Matrix even under the no action alternative by shrinking riparian reserves. The goal in the matrix is to systematically convert forests from complex native old-growth forest to simplified younger rotation forests. There is lots of complex old forest that remains in the matrix and after it is cut, the plan is not to replace any of those forest with complex old native forests. The Forest Service might allow some matrix forest to

grow into mature forest, but not true old-growth. BLM must account for the significant qualitative difference between artificially established mature forest and complex native old forest.

477- Stand age on non-federal lands are assumed to be static. This is unsupported because (a) non-federal lands still contain stands older than rotation age so the average age of stands across the landscape will be reduced as those stands are converted; (b) harvest rotation age is trending shorter all the time. Page 196 of the DEIS admits that non-federal harvest rotations are shorter than anticipated in 1994. These facts raise significant issues for this analysis. Non-federal lands will not provide as much owl nesting, roosting, foraging habitat or dispersal habitat in the future as they do now or did in the past.

478- The EIS assumes adequate funding for full implementation of all the action alternatives. This assumption is unfounded and unreasonable. BLM has not obtained full funding in recent years and is unlikely to receive full funding for an even more controversial logging program. The consequences of partial funding should be disclosed, especially in terms of timber industry stability and county payments.

479 – "Administrative actions" are undefined and unclear.

483- The DIES artificially limits the scope of analysis. If BLM wants to bite off such a WOPR of a big proposal, they must be willing to take the time to fully comply with the law.

485 – The DEIS must acknowledge that the survey and manage annual species reviews were invalidated by court which found them to be in violation of NEPA.

486 – BLM must analyze effects at multiple scales in order to reveal the scales at which various physical and ecological resources are most sensitive to the effects of increased logging and other management activities.

487 – Fire is a major stressor on already rare habitats. The NEPA analysis is not complete unless this stressor is considered in the cumulative impacts analysis. Other analysis have made an effort to predict and consider the natural level of disturbance such as Tom Spies and Etsuko Nonaka, so BLM can and must do so as well.

487 – The DEIS cannot consider salvage logging as part of the proposed action without fully disclosing and considering the effects of that action. Future salvage logging NEPA analyses cannot tier to this EIS unless the effects are disclosed and considered. See supporting materials.

488 – The DEIS should consider additional effects of natural disturbance including density control, snag creation, and temporal "snag gaps" that are created when fires kill so many trees that future recruitment is adversely affected for a time period after most of

the post-fire snags fall and before the new stand begins to recruit large snags. See supporting materials.

Look at the "Snag Gap" with Open Eyes.

One of the most significant and lasting effects of stand replacing fire is to bring the process of snag recruitment to a virtual standstill for many decades. Snags created by the fire fall down over time but few if any snags are created. This results in a "snag gap" that has serious adverse consequences for habitat and many other ecological processes.

In Congressional testimony in July 2004, Jerry Franklin said:

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

Dr. Jerry F. Franklin, Professor of Ecosystem Studies, College of Forest Resources, University of Washington. July 15, 2004. TESTIMONY FOR THE RECORD ON OVERSIGHT HEARING ON "RESTORING FORESTS AFTER CATASTROPHIC EVENTS" BY HOUSE COMMITTEE ON RESOURCES, SUBCOMMITTEE ON FOREST AND FOREST HEALTH. http://resourcescommittee.house.gov/archives/108/ffh/07_15_04.htm

1. The agency must recognize the asymmetric nature of snag dynamics after fires. High rates of snag fall would be expected in the decades following fire, while low rates of snag recruitment would be expected in the decades following a fire. This unavoidably results in a serious deficit of snags at some point in the future.
2. In order for the NEPA analysis to fully address the snag habitat issue it must look carefully at the snag gap from both ends.
    a. The snag gap begins when too many of the current snags are gone. So the snag gap is exacerbated on the front end by salvage logging which removes too many large snags.
    b. The snag gaps ends when the next stand grows to the point that it contains large trees and some of them die, so the snag gap is exacerbated on the back end if there is a significant delay in tree regeneration.
3. The agency has a tendency to focus on the back end of the snag gap which is more speculative and ignore the effect of salvage logging on the front end of the snag gap (which is concrete and unavoidable).
4. Salvage logging which retains only enough snags to meet snag requirements after harvest will not meet snag requirements in a few years after those few retained snags fall.
5. Both the RMP and the Northwest Forest Plan (p C-13) require that snags be maintained through time, so our goal must be to manage snags to minimize the time period that there is a deficit of snags.
6. The NEPA analysis must account for snag fall rates and figure out how to minimize the snag gap. Every day that the "snag gap" is lengthened by salvage logging is a violation of the RMP. Models that may be used to analyze snag dynamics can be found here: http://www.for.gov.bc.ca/hre/deadwood/DTmod.htm

7. There is a strong correlation between the size of the snag and the length of time it is likely to remain standing, so salvage must be designed to retain all the large snag and only remove trees from smaller size classes.

8. Consider this example: Assume that the stands currently have 30 large trees/acre and 24 of those will be removed via salvage logging while 6 trees/acre will be retained for snag habitat. Further assume that in 50 years 2 percent of the large snags will remain standing as snag habitat. Two percent of 6 trees/acre is FAR LESS than 2 percent of 30 trees/acre, so there is a virtual statistical certainty that salvage logging will exacerbate the snag gap.

9. The snag gap is really exacerbated by salvage logging in three ways — first by the removal of any snags, second by targeting removal of the largest and most persistent component of the snag population, and third by the acceleration in the fall-down rate of the remaining snags. New science from Idaho reveals that Ponderosa pine snags last longer in unlogged areas. See Russell, R.E., Saab, V.A., Dudley, J.G., and J.J. Rotella. 2006. Snag longevity in relation to wildfire and postfire salvage logging. Forest Ecology and Management 232 (2006) 179-187. http://www.fs.fed.us/rm/pubs_other/rmrs_2006_russell_r001.pdf ("The predicted half-life of a ponderosa pine snag was 7-8 years in salvage logged plots and 9-10 years in unlogged plots.")

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

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

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

Lofroth, Eric. 1998. The dead wood cycle. In: Conservation biology principles for forested landscapes. Edited by J. Voller and S. Harrison. UBC Press, Vancouver, B.C. pp. 185-214. 243 p. http://www.for.gov.bc.ca/hre/deadwood/DTrol.htm

An example of how salvage would lengthen the period that a forest remains inhospitable to wildlife is provided by the following study, Payer, D.C., and D.J. Harrison. 2000. Structural differences between forests regenerating following spruce budworm defoliation and clear-cut harvesting: Implications for marten. Canadian Journal of Forest Research 30(12): 196572. ("Summary: The authors looked at the use of clearcuts and areas where spruce budworm has caused mortality in relation to the American marten. When establishing new territories, martens avoid clearcuts but do not avoid stands with a history of extensive tree mortality caused by eastern spruce budworm. Although live tree basal area was similar between stand types, the results showed that the vertical structure provided by large snags can offset the limited availability of live trees for the marten, particularly where coarse woody debris and understory vegetation are plentiful.") http://rparticle.web-p.cisti.nrc.ca/rparticle/AbstractTemplateServlet?journal=cjfr&volume=30&year=&issue=&msno=x00-129&calyLang=eng

488 – The DEIS incorporates by reference the Biscuit Fire Salvage and Timbered Rock Fire Salvage NEPA analyses. The entire administrative records and judicial records for these projects must be incorporated, not just the EISs.

489 – The EIS must consider the following adverse effects of salvage logging:

- Salvage logging move small fuels from the canopy to the ground and increases fire hazard;
- Salvage logging retards vegetative recovery by disturbing seeds, soil, seedlings, removing protective canopy cover;
- Salvage logging exacerbates the "snag gap" by removing large snags that are the most likely to last longest and persist into the snag gap caused by stand replacing fires;
- Salvage logging significantly increases the risk of introducing and spreading weeds;
- Salvage logging compounds and amplifies the ecological harms caused by the fire itself such as erosion, peak flows, habitat loss;
- Salvage logging threatens the climate by increasing biological respiration, reducing wood piece size, and reducing carbon storage;
- Salvage logging makes a bad situation worse for big game by removing what little cover remains after fire;
- Salvage logging removes habitat for species that rely on snags including birds, insects, fish, and others.
- Salvage logging deprives the newly developing forest of the complex structural legacies. Salvage logging converts complex young forest (which are extremely rare and valuable) into simplified young forests (which are already vastly over-represented).
- For a more detailed explanation of the harms of salvage logging, please see the supporting materials on the many values of dead wood and the adverse effects of salvage logging and read ONRC's comments on both the Biscuit fire Salvage EIS and Timbered Rock EIS, which BLM has already incorporated by reference.

491 – The EIS must address climate change as a significant issue. Climate change is an issue so big that every major public policy decision must consider it. This decision even more so because mature and old-growth forests store such vast amounts of carbon and logging releases most of that carbon to the atmosphere.

491 - The O&C Act says that BLM only has to sell timber when there are "reasonable prices on a normal market." BLM's NEPA analysis failed to recognize that prices are unreasonable and markets are not normal because current markets and prices do not reflect the true adverse environmental costs of logging mature and old-growth forests in terms of loss of biodiversity, degraded water quality, loss of climate stability, etc. The recent UK Stern Report said that climate change is being caused by the greatest market failure in history because those who conduct activities that emit carbon (such as logging mature and old-growth forests) do not pay the full cost of the global impacts of those emissions.

491 - Climate change itself is a threat to the very forests that are the subject of this EIS. Climate change is a new stressor that must be considered in combination with other stressors such as habitat loss. As recognized by the imperiled status of indicators species like the spotted owl, western Oregon forests are imperiled. In the face of a new threat such as climate change, BLM should compensate by reducing other stressors such as habitat loss caused by logging.

491 – The DEIS says it is unclear whether climate change is already affecting fundamental ecological processes. This is not the issue. It does not matter whether climate change is affecting Oregon forests right now, though there is a lot of evidence that it is, but climate change will clearly do so in the near future and BLM must address it. This EIS has many references to effects occurring in 100 years. This time frame makes climate change highly relevant.

491 – The EIS says that climate change could have effects on hydrologic processes but the effects of climate change on precipitation are too uncertain to analyze. The certainty that temperatures will increase over-rides the uncertainty about precipitation. Water yield will decrease regardless of how precipitation changes because the heat causes evaporative water demand to increase. These hydrological impacts are directly relevant to the O&C Act mandate to manage forests so as to regulate water flow and protect watersheds. BLM must consider an alternative to conserve mature and old-growth forests and restore younger forests in order to mitigate climate change and help regulate stream flow in the face of a warming climate.

> Please review the report on "Forests, Carbon & Global Warming" prepared by Oregon Wild. The report explains how climate change is likely to affect Pacific Northwest forests as well as how forest conservation and restoration (including sensible changes to this project) may help mitigate climate change. The report also helps debunk some of the flawed arguments used by logging advocates. http://tinyurl.com/2by9kt
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> > "Studies here [at the Winder River Canopy Crane] also proved it doesn't make sense from a global-warming perspective to cut older forests and replace them with seedlings, which grow faster and had been thought to absorb more carbon dioxide. Old forests are storehouses for such vast amounts of carbon that it would take many decades for new forests to catch up on the carbon balance sheet."
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> Sandi Doughton. Trees giving bizarre clues to climate change. Seattle Times. Nov 27, 2007. http://seattletimes.nwsource.com/html/localnews/2004037053_trees27m.html
>
> GAO's recent report finds that federal resource agencies including the Forest Service and BLM have not done enough to incorporate climate change mitigation and adaptation into their management. Out of 155 National Forests and 20 National Grasslands only 12 have land management plans that address climate change. GAO urged that all forest plans be amended to address climate change. GAO. 2007. CLIMATE CHANGE — Agencies Should Develop Guidance for Addressing the Effects on Federal Land and Water Resources. GAO 07-863. http://www.gao.gov/new.items/d07863.pdf On July 10, 2007 Forest Service Chief Kimball responded to GAO asserting that —
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> > "Forest Service field managers address the effects of climate change by managing for resilient ecosystems that sustain the production of goods and services in the face of uncertain future conditions. … [and] Climate change mitigation and adaptation strategies will be included in future [forest plan] revisions. [and] the Four Threats emphasize two immediate consequences of climate change for land management agencies: forest fire and

> invasive species. [and] Forest Service researchers are firmly established as world leaders in forest-carbon measurement and carbon accounting. [and] USDA's Global Change Program Office was established to ensure that climate change issues are fully integrated into research, planning, and decision-making."

http://www.gao.gov/new.items/d07863.pdf It's time for the Forest Service to walk the talk and do the things it claims to be doing. Climate change represents significant new information that should trigger immediate re-evaluation of forest plan provisions allowing carbon stored in large old forests to be removed through logging.

The NEPA analysis should recognize that logging has several adverse consequences in terms of greenhouse gases.

1. Logging kills growing trees that would otherwise continue to capture and sequester carbon through photosynthesis. Killing the trees also stops them from pump carbon into the soil where a lot of carbon is stored. Forests deliver massive amounts of carbon into the soil as photosynthate that supports a vast below-ground ecosystem and as course woody debris. Logging kills the food supply for the below-ground ecosystem and
2. Logging accelerates the rate of decomposition of wood through several mechanisms.
    a. Logging raises soil temperature thereby increasing the rate of decay of woody debris and the rate of decay of the below ground ecosystem, which converts carbon to gaseous form (CO2).
    b. Logging decreases the average piece size, and increases the surface area of the wood, thereby increasing the area exposed to biological decomposition.
    c. Logging debris is often burned, or as hog fuel, biomass, etc.
3. Some argue that logging is helpful because carbon is sequestered in wood products, but this is inaccurate:
    a. Of all the carbon that is killed and/or exposed to accelerated decay in a logging operation only a small fraction ends up as durable goods and buildings -- most ends up as slash, sawdust, waste/trim, hog fuel, and non-durable goods like paper.
    b. Much of the wood products which can reasonably be considered "durable" are in fact less durable than leaving it safe inside an old-growth tree that might live to be hundreds of years old. Most of our wood products are disposable. It turns out that well-conserved forests on average store carbon more securely than our "throw-away" culture and economy does.

The Forest Service has established a small-scale carbon off-set program on National Forest lands that includes replanting forests after disturbances. This program is a clear admission that small efforts at the stand-scale can help address the climate problem at a global scale. See "The National Forest Foundation and U.S. Forest Service join forces to combat climate change with projects on National Forest lands that are funded through the Carbon Capital Fund"
http://www.carboncapitalfund.org/news/news-59.html

On August 1, 2000 the US government submitted it's position on land use and forestry as it related to carbon sequestration and it "Proposes strong incentives to remove carbon from the atmosphere through sound land management and to **protect existing reservoirs of carbon, for example those in mature forests**." The submission also: "Strongly supports rules -- including definitions of key terms such as reforestation -- that help protect forests and avoid creating "perverse incentives" (for example, to log old growth forests)."
http://www.state.gov/www/global/global_issues/climate/fs-000801_unfccc1_subm.html

> "... unmanaged forests at a comparatively late stage of successional development can still act as significant carbon sinks with large implications for forest management practice and negotiations about biological sinks within the Kyoto Protocol."

A. Knohl et al. Large carbon uptake by an unmanaged 250-year-old deciduous forest in Central Germany. Agricultural and Forest Meteorology 118 (2003) 151–167.
http://www.gl.ipw.agrl.ethz.ch/docs/Knohl_AgMet_2003_copy.pdf

> "In contrast to the sink management proposed in the Kyoto protocol, which favors young forest stands, we argue that preservation of natural old-growth forests may have a larger effect on the carbon cycle than promotion of regrowth. ... [I]ncreasing life-span of the stand, proportionally more carbon can be transferred into a permanent pool of soil carbon (passive soil organic matter or black carbon)... [R]eplacing unmanaged old-growth forest by young Kyoto stands ... will lead to massive carbon losses to the atmosphere mainly by replacing a large pool with a minute pool of regrowth and by reducing the flux into a permanent pool of soil organic matter."

Ernst-Detlef Schulze, Christian Wirth, Martin Heimann. CLIMATE CHANGE: Managing Forests After Kyoto. Science 22 September 2000:
Vol. 289. no. 5487, pp. 2058 - 2059. http://academic.engr.arizona.edu/HWR/Brooks/GC572-2004/readings/schulze.pdf

> "aging forests were long perceived to be in a state of decay that releases as much carbon dioxide as it captures. But it turns out that the soils in undisturbed tropical rain forests, Siberian woods and some German national parks contain enormous amounts of carbon derived from fallen leaves, twigs and buried roots that can bind to soil particles and remain there for 1,000 years or more. When such forests are cut, the trees' roots decay and soil is disrupted, releasing the carbon dioxide. Centuries would have to pass until newly planted trees built up such a reservoir underground."

World Rainforest Movement. Climate Change Convention: Sinks that stink. New scientific findings: tree plantations may accelerate global warming. October 2000.
http://www.wrm.org.uy/actors/CCC/sinks4.html

> There is growing recognition in northwestern North America that forested landscapes need to be managed for multiple services. … [F]orest managers should consider carbon management as just one of a range of ecosystem services for which they can manage and from which they can potentially benefit.

John L. Innes and David L. Peterson. Proceedings Introduction: Managing Forests in a Greenhouse World – Context and Challenges *in* Climate Change, Carbon, and Forestry in Northwestern North America: Proceedings of a Workshop. November 14 - 15, 2001 Orcas Island, Washington. PNW-GTR-614. April 2004 http://www.fs.fed.us/pnw/pubs/pnw_gtr614.pdf (p 6).

> Over a century of timber harvest in the Northwest has contributed large amounts of CO2 to the atmosphere.
>
> …
>
> Several potential forest management strategies for sequestering carbon exist. These strategies present risks to forest managers, but maintaining the status quo is also risky given our knowledge about the extent of climate change over the past century and the predicted changes in climate in future decades. In order to increase carbon sequestration, the following strategies could be adopted: increased rotation lengths, increased residual material left in the forest after harvesting, and use of the most productive land for the most intensive forestry practices. The first two of these have a number of secondary benefits, including the conservation of biological diversity. The third strategy has a number of advantages, including the potential to set aside reserves of old-growth forest, given that forest productivity elsewhere is being increased. This latter strategy is of particular importance in areas where significant areas of oldgrowth forest remain.

Final Workshop Summary and Scientific Conclusions *in* Climate Change, Carbon, and Forestry in Northwestern North America: Proceedings of a Workshop. November 14 - 15, 2001 Orcas Island, Washington. PNW-GTR-614. April 2004 http://www.fs.fed.us/pnw/pubs/pnw_gtr614.pdf (p 117).

Recent research in China reveals that old growth forests may continue absorbing and sequestering significant amounts of carbon longer than previously ackowleged. Guoyi Zhou, Shuguang Liu, Zhian Li, Deqiang Zhang, Xuli Tang, Chuanyan Zhou, Junhua Yan, Jiangming Mo. 2006. Old-

Growth Forests Can Accumulate Carbon in Soils. Science 1 December 2006:Vol. 314. no. 5804, p. 1417. http://www.sciencemag.org/cgi/content/full/314/5804/1417 ("Old-growth forests have traditionally been considered negligible as carbon sinks because carbon uptake has been thought to be balanced by respiration. We show that the top 20-centimeter soil layer in preserved old-growth forests in southern China accumulated atmospheric carbon at an unexpectedly high average rate of 0.61 megagrams of carbon hectare-1 year-1 from 1979 to 2003.") But let's not forget that mature and old-growth forests are valuable carbon reservoirs. Even if the reservoir is not getting any bigger, we should not drain the reservoir!

Forests should also be viewed as ecological bulwarks against the ravages of climate change. Trees have long generation times so forests exhibit significant ecological inertia and resistance to rapid change.[13] If we manage our forests to be resilient to disturbance, forests should continue to provide ecosystem services well into a new climate regime. If we conduct regeneration harvest, we may accelerate the onset of vegetation response to climate change.

The climate effects of forest cover changes are actually quite complex. The agency should consider these factors:

What are the climatic effects of deforestation?

Carbon cycle effects

1. Warming due to carbon release
2. Potential loss of CO2-fertilization in trees
3. Increased ocean carbon uptake

Biophysical effects

4. Cooling due to albedo change
5. Warming due to reduced evapotranspiration (via reduced cloudiness)
6. Decrease in roughness length (climate effect unknown)

Will afforestation strategies help mitigate global warming? G Bala, K. Caldeira, E Wickett, T J Phillips, D. Lobell, Christine Delire. Fall AGU meeting. December 2006.

Consider the economic consequences of continued carbon emissions. The 2006 "Stern Review" from the UK Treasury concluded that each ton of carbon dioxide emitted will cause $85 worth of damage to the world's economy. http://www.hm-treasury.gov.uk/independent_reviews/stern_review_economics_climate_change/sternreview_index.cfm Please consider and disclose the amounts of carbon emitted due to logging, slash, fuel treatment, impermanent wood products, increased soil respiration, etc...

The Agencies' Failure to Address Climate Change is a Human Rights Issue

The agencies' continued liquidation of carbon-rich forests and soils fails to take necessary steps to mitigate climate change and threatens the basic human rights of humanity. The agency must address this as part of it NEPA analysis.

> It is widely recognized that the earth's climate is undergoing some fundamental changes. I argue that these changes undermine several core human interests - including, interests in (i) decent health, (ii) economic necessities, and (iii) physical security. Building on this, and after taking into account the kinds of duties required to protect these
>
> interests, I argue that persons have a right to the protection of these vital interests. These rights, I argue, are held by future people as well as contemporaries. I further explore how one specifies the level of protection that is required by these rights. The paper then proceeds to examine two kinds of challenge to this position - an extreme challenge

[13] Iverson, Schwartz, Prasad. 2004. How fast and how far might tree species migrate in the eastern United tates due to climate change? Global Ecology and Biogeography 13:209-219.

> (which denies that future people have rights) and a moderate challenge (which claims that a positive social discount rate should be applied to the rights of future generations). Neither kind of challenge is found persuasive.

Simon Caney, "Climate Change and Human Rights"
http://depts.washington.edu/ponvins/ecc/abstracts.html

Consider the cumulative and compound effects of climate change plus human disturbance. Climate change is a new and significant stressor that is facing our forests and aquatic ecosystems. The agency must consider and disclose the cumulative effects of climate change and all other human induced stressors from roads, logging, grazing, fire suppression, weeds, OHVs, etc… The agencies should consider that fish and wildlife populations (especially rare and uncommon species) may be better able tolerate climate change if human disturbance is limited. For example, salmon and trout depend upon abundant cold water but climate change is expected to cause earlier spring snowmelt, which will likely harm fish by reducing summer flows and increasing stream temperatures. Various land management activities like logging, roads, and grazing can increase stream temperatures, increase erosion and sedimentation, and change stream structure which will add cumulatively to the stresses caused by climate change.

The IPCC recently reported that,

> "The resilience of many ecosystems is likely to be exceeded this century by an unprecedented combination of climate change, associated disturbances (e.g., flooding, drought, wildfire, insects, ocean acidification), and other global change drivers (e.g., land use change, pollution, over-exploitation of resources). … For increases in global average temperature exceeding 1.5-2.5°C and in concomitant atmospheric carbon dioxide concentrations, there are projected to be major changes in ecosystem structure and function, species' ecological interactions, and species' geographic ranges, with predominantly negative consequences for biodiversity, and ecosystem goods and services e.g., water and food supply."

IPCC 4th Assessment Report, Working Group II, Summary for Policymakers, April 6, 2007. http://www.ipcc.ch/SPM6avr07.pdf The agency should consider to what extent the proposed action contributes to these cumulative and compound threat to ecosystems. If the proposed action would accelerate the release of carbon from forests or further stress wildlife population viability, there is almost certainly a significant cumulative impact involved.

Examples of new and additional stresses caused by CO_2 enrichment climate change that should be included in the NEPA process include:

1. Plant species have different responses to CO_2 enrichment which will likely lead to change in changes in community composition.
2. Isoclimes will shift north and toward higher elevations. Species will have different capacities to migrate with the shifting isoclimes which will lead to changes in community composition and species abundance and habitat bottlenecks.
3. Biomes will need to move with the shifting isoclimes, but biotic communities will not move as intact units. They will disassemble and reassemble. The biotic community's passage through this process is very likely to lead to significant changes in community composition and relative abundance of species.
4. The ranges of many species will be reduced as shifting isoclimes encounter barriers to migration such as human development, altered and fragmented landscapes, geographic barriers, and shrinking land masses (e.g. mountains that get smaller with elevation).
5. Many types of disturbance are expected to increase, including flood and mass movement, fire, wind, insects and disease.
6. More precipitation is expected to fall as rain instead of snow, snow is expected to melt earlier in the spring, evaporation and transpiration are expected to increase with temperature, so water shortage will adversely affect fish and many other species. F. Richard Hauer, Jill S. Baron, Donald H. Campbell, Kurt D. Fausch, Steve W. Hostetler,

George H. Leavesley, Peter R. Leavitt, Diane M. Mcknight, Jack A. Stanford. Assessment Of Climate Change And Freshwater Ecosystems Of The Rocky Mountains, USA And Canada. Hydrological Processes. Volume 11, Issue 8 , Pages 903 – 924.

7. Trees will be stressed by insects and disease because mild winters are expected to increase the ability of insect pests to overwinter. Longer growing seasons are expected to allow insect pests to readily reproduce.
8. Humans will react to climate change in some ways that may compound impacts to species. Examples of potentially troubling human reactions include dams or other waterworks to store water and control floods, fire suppression, increased or intensified use of land to grow biomass fuel.
9. Disturbance and shifting isoclimes and human disturbance and vectors will invite increased invasive species that will compete with, prey upon, parasitize, infect, or modify the habitat of native species.
10. Climate change will alter the synchrony between plants and pollinators, and between animals and plant foods, between predators and prey. The timing of migration events will also be altered which will have repercussions for species that migrate and the species who rely on them.
11. Mild winters may inhibit the ability of some plants and animals to remain dormant during winter making them more vulnerable to cold snaps.
12. CO_2 fertilization may decrease the nutritional value of plants eaten by animals.
13. Long hot summers and drought will lead to heat stress in plants and animals.
14. All the above influences will increase the interannual variability of wildlife populations which can increase the stochastic vulnerability of populations. Christopher C. Wilmers, Eric Post, and Alan Hastings. A Perfect Storm: The Combined Effects on Population Fluctuations of Autocorrelated Environmental Noise, Age Structure, and Density Dependence. Am. Nat. 2007. Vol. 169, pp. 673-683.
15. There are cascading effects of all the above that will further compound the adverse impacts of climate change and human disturbance.

Restoration efforts also need to be adjusted to account for climate change. Expected increased drought stress would indicate the need to reduced livestock grazing, allow wild and prescribed fires to maintain forests below their water-limited carrying capacity. Expected increase winter rainfall indicates a need to close and remove more roads and restore the structural complexity and integrity of stream and riparian systems. The capacity of soil and watersheds to capture store and release water should also be a priority.

493 – Table 149 appears to mix annual and decadal activity levels.

494 – Ecology “key points” says that structural stages over 100 years would change by only 1% among all the alternatives. This shows that the analysis is insensitive and fails to reveal significant differences in things like dead wood habitat elements.

499 – The EIS must consider more than one development scenario for coal bed methane. A single alternative cannot support tiering in subsequent NEPA analyses.

499- The EIS should assume additional Endangered Species Act listings because WOPR places more species at risk and several ESA determinations made during the last 14 years may need to be reconsidered in light of the WOPR fundamentally changing the assumptions of the Northwest Forest Plan. For instance, FWS or NMFS relied on the NWFP to either not list a species or exclude areas from critical habitat, including decisions not to list the northern goshawk, Lower Columbia River/SW Washington ESU

of coastal cutthroat, and Siskiyou Mountains and Scott Bar Salamanders, as well as a decisions to exclude basically all federal lands from critical habitat for Bull Trout and the marbled murrelet. These and other decisions will need to be reconsidered. See attached spreadsheet.

499: The DEIS acknowledgement that "strongly dichotomous landscapes may pose a risk to species and ecological processes." This risk needs to be clearly defined, quantified and analyzed then carried throughout the analysis, including cumulative impacts.

500-501 – The DEIS says that extensive logging under Alt 2 would push late-successional old-growth ecosystems further from the historic range of variability and delay the recovery of historic conditions. This would be inconsistent with recovery of threatened & endangered species that depend on this habitat type.

507: The contention that "57% of old forest would remain unharvested" is refuted by the admission on page 511 that salvage could occur in late successional management areas.

509: Only 350,000 acres out of 2.6 million are *currently* comprised of "old forest" That's 1/8th of the land base! And BLM wants to log at least 43% of the remaining 1/8th! This cannot but have significant adverse impacts, conflict with recovery of threatened species, and cause trends to toward new listings.

513 – The DEIS must disclose and consider ecological conditions on BLM lands within a context of all ownerships. Conservation of BLM lands is essential to compensate for intensive forest management on non-federal lands.

519-520 – The DEIS shows that the action alternatives will make a bad situation worse in terms of patch size and connectivity of mature and old-growth forests. This is inconsistent with recovery of threatened & endangered species that rely on this habitat type.

527 – Figure 157 is misleading. It needs to show structural stage abundance across all ownerships. A larger context would make increased timber harvest on BLM lands appear unwise.

528 – BLM assumes that other ownerships would be static in terms of structural stage abundance. Does CLAMS and other information provide the basis for more sensible and accurate assumptions? Please review and summarize the range of reasonable assumptions about non-federal lands and choose the most probable.

529: Again, assumptions regarding reserves do "not account for natural disturbances." Also see Jerry Franklin's Biscuit fire comments for how to build resiliency and redundancy into a reserve system when you know natural disturbance will occur.

538 – Figure 158 shows that economic objectives are adequately provided on non-federal lands, and the highest and best use of BLM resources is to try to repair the significant

landscape scale deficit of mature and old-growth forests. Even if we stopped all logging on BLM land, there would still be lots of timber harvest on non-federal land and there would still be a large deficit of mature and old-growth forest in 100 years. Lets consider a compromise that allows restoration activities on federal lands to accelerate repair of the old forest deficit while providing wood products as a by-product of restoration.

534 – The chapter on socioeconomics is grossly inadequate and biased in favor of timber harvest. Given all we know about Oregon's changing economy and culture, this analysis does not pass the laugh test. See our scoping comments.

534 – It is unreasonable to assume that BLM would get a 60% increase in its budget in order to implement a highly controversial increase in old-growth logging. BLM must consider the consequences if this assumption does not pan out. County funding and wood products industries would be back on the gut wrenching boom-bust rollercoaster.

534- BLM chooses to ignore industries other than wood products and non-market values of forests because they are hard to measure. Though harder to measure, they are no less real, so BLM cannot ignore them.

534: The claim that recreation receipts ($1.2 mil/yr) won't vary by alternative is unsupportable.

535 – The EIS should add a new measure for comparison of alternatives. This new measure would account for the value of forest conservation, and the social and economic stability provided by such protection.

535 – The EIS admits that increased logging on BLM land would cause log prices to fall BLM must disclose and consider the social harms caused by falling log prices. Wood is already far too cheap because prices do not account for the carbon value of forests. This price imperfection causes wood to be over-produced and causes protected forests to be under-produced.

535 – The DEIS says that increased logging on BLM land would somewhat reduce logging on non-federal lands. BLM must recognize the reduced harvest on non-federal land has relatively less ecological value that reduced harvest on BLM land because the average increment of forest on non-federal forest is of lower habitat value than the average increment of forest on BLM land. In other words, as harvest shifts from private to public lands, the forest saved is less ecologically valuable than the forest harvested.

536-541 – The DEIS discusses payments to counties as if the county payments program is no longer in effect. In fact, decoupling is still in effect and Congress is working on long-term renewal of county payments legislation, so the DIES must accurately disclose this fact. The DEIS assumes that county payments has permanently lapsed and will not be reauthorized. This is not a well-founded assumption. The DEIS must disclose what would happen if county payments is reauthorized.

539- In order to put things in proper perspective, EIS discussions of employment and income must consider the PNW wood products industry as a whole and the PNW economy as a whole.

542 – The EIS discusses multiplier effects without disclosing that there are credible opposing viewpoints about the economic base model that multipliers are derived from.

Krone, Haynes, Reyna. 1999. Different Perspectives on Economic Base. Research Note PNW-RN-538. April 1999. http://www.fs.fed.us/pnw/pubs/rn_538.pdf

Limitations of Economic Base Models

Among the drawbacks of using an economic base model to describe the current level of economic welfare in an area are the following:

1. A simple measure, such as the number of jobs or amount of labor income, reveals little about the **quality of jobs** in the various industries. In other words, even though one sector may have more employment or higher wages than another sector, it may have **higher safety risks, less chance for advancement, and embody fewer job skills** easily transferable to other sectors.

2. Economic base models tend to focus on the industries that export physical goods and leave out those that **export services** or attract people who then consume local services. A classic example of this second type of industry is recreation and tourism.

3. The role of nonbasic industries in stopping leaks from an economy through **import substitution** is not adequately addressed.

4. The importance of **nonlabor income** to an area is not captured. Rasker (1995) found that nonlabor income accounted for 34 percent of personal income in the project area in 1993.

5. Implicit in the economic base model is the assumption that people follow jobs; in other words, people locate in an area because of the job opportunities available in that area. An alternative assumption is that **jobs follow people.** This is the assumption behind the quality of life model, which holds that **people locate in high-amenity areas based on quality of life considerations and that industries follow**, believing that workers will accept lower wages in order to remain in these high-amenity areas.[fn 5] This second thesis regarding the genesis of employment opportunities is not addressed in economic base models.

6. The **externalities** (costs not borne by the producers or consumers of a good or service) associated with various industries are not captured; for example, if an industry generates a large amount of pollution, the economic benefits of increasing employment in this industry may be outweighed by increased degradation of the environment or the increased costs of maintaining a given quality of the environment.

Because the economic base is essentially a static portrayal of current conditions, while economies are inherently dynamic, base models fall short for planning purposes or for predicting the future economic structure of a region in the following respects:

1. Base models do not reveal the relative volatility of industries; for example, **some industries may be sensitive to external forces such as macroeconomic cycles, interest rates,** world prices, and even weather conditions. In contrast, other industries may be insulated from these influences.

2. A single snapshot of the basic sectors in an area does not incorporate the dynamics of these sectors in the larger context. A county having a large amount of its base employment in an **industry that is**

waning, may want to undertake a very different development strategy than a county with most of its base employment in an expanding industry.

3. General trends, such as labor-saving **technological change, increasing importance of education** in determining wages and income, and changing demographics, may influence the number and types of jobs created (lost) in the future when a particular industry expands (contracts). Because such trends are not reflected in economic base models, predictions based on these models may be skewed.

[fn 5] Niemi and Whitelaw (1997) use the phrase "the second paycheck" to represent "the value to residents of the various amenities contributing to the quality of life in the area, including access to social, cultural, and environmental amenities, access they would not enjoy if they lived elsewhere" (p. 31).

542- The DEIS says that loss of county payments will result in the loss of one-third reduction in regional earnings. This statement lacks context. One third of what? The whole economy? What region?

543 – Table 158 needs to show the total number of jobs in each county and in the regional PNW economy.

545- The DEIS excludes Multnomah County form the economic impact analysis. This leads to a misleading picture of the economic impacts of the WOPR, making it seem more significant than it really is in relation to the economy as a whole.

549 – The DEIS must be consistent. The EIS assumes that Congress will never reauthorize county payments legislation to provide popular county services like schools and libraries, while on the other had the EIS assumes that Congress will approve a 60% increase in BLM budget to facilitate a controversial program of old-growth logging. These assumptions are not only inconsistent but unjustified. The economic effects of these assumptions lead to improbable outcomes. Because these assumptions are wrong, the real economic effects of the WOPR might be very different than described in the EIS.

550 – BLM needs to consider the net present value of BLM forests protected and managed as carbon offsets at prices that reflect the true future scarcity of carbon offsets and using a very low or zero discount rate to reflect the virtually irreversible nature of climate change.

557 – The DEIS mistakenly asserts that the O&C Act requires the annual sale of the annual productive capacity of the O&C lands. This is only true when prices are reasonable and markets are normal. Since carbon and other ecosystem services are not reflected in timber prices, these conditions do not hold so the asserted requirement vanishes. The O&C Act also requires that annual productive capacity and sustained yield timber harvest be adjusted to reflect the objectives to protect watersheds, regulate stream flow, provide recreational facilities, and stabilize communities and industries. The timber analyses in the EIS must reflect these realities and harmonize all these objectives.

560-561 – The analysis of the sub-alternatives is contrived. BLM does not even try to make the thinning levels sustainable. They select the harvest rate based on one silvicultural tool, and then apply a different silvicultural tool. Of course it won't be

sustainable. BLM can't use arbitrary and biased analysis that makes their preferred alternative look good and disfavored alternatives look bad.

566: BLM claims that "better mapping" will reduce riparian reserves from 552,000 acres to 364,000 acres even under the no action alternative, which would increase the ASQ by 32% to 268 mmbf. So even the No Action Alt. increases harvest by 32%. This increase in ASQ will require more logging of old forest. However, this cannot be reconciled with the fact that BLM will be unable to increase logging of old forest due to conflict and controversy. The concept of ASQ based on liquidating old forest should be abandoned because it's based on wishful thinking of logging proponents. The socio-political reality will not allow fulfillment of the ASQ based on logging old forests.

567- The non-harvest alternative should not be just a reference alternative but should receive honest consideration as a full-fledged alternative consistent with carbon storage and stabilizing the climate to achieve the objectives of the O&C Act, including permanent forest production, regulated water flow, and reasonable prices on a normal markets. Plus the Endangered Species Act, the Clean Water Act, and Clean Air Act.

568: The DEIS claims only 3 mmbf/year from non-programmed thinning in reserves in the Medford District under the Northwest Forest Plan. Far more RR and LSR volume than that is coming off Medford currently. Also, the sweetheart settlement that lead to the WOPR calls for higher levels of logging in reserves. We even see the settlement referenced in LSR project purpose and need statements! The 3 mmbf figure is unsupportable.

571-572 - The DEIS reveals that Alt 2 would involve a 9-fold increase in harvest *volume* from logging the oldest age class of forests (>200 years old). Pages 579-581 reveal a 7-fold increase in the *acres* of 200+ year old forest affected by regen harvest under Alt 2. Page 588 shows that the action alternatives would eliminate virtually all stands 200 years and older in the timber management areas. Logging these stands would be the most controversial of all activities under the WOPR. One of the main reasons the BLM has not been successful under the Northwest Forest Plan is because the Northwest Forest Plan leaves a million acres of old forests unprotected and each proposal involving these older forests brings conflict and controversy. The EIS must disclose the conflict and controversy that this would engender. Does this kind of controversy stabilize communities?

578- The DEIS shows a high proportion of regeneration harvest in the Medford District. This is inconsistent with the mixed severity fire regimes in this ecoregion.

581: Alt 2 regenerates 12% of the harvest land base in the first decade (which puts us at about a 85-year rotation) the bulk of the volume coming from >200 y/o peelers. And virtually ALL coming from >100 y/o large diameter. The flow of large logs will not be sustained. Followed by smaller diameter rotations...If BLM is going to embrace sustained yield maybe they should try sustaining the flow of all sizes of logs including large logs consistent with forests that meet the historic range of variability.

593: The DEIS discloses a moderate risk of local extirpation for some species in conifer forest habitat group. If this occurs, Forest Service will not be able to successfully implement the Northwest Forest Plan on their land.

596 – The DEIS shows 335,100 acres of direct effects on plant communities in the first decade. Plant communities and wildlife are even more threatened by the introduction and spread of weeds that will emanate from these direct disturbances.

597- Alt 2 would cause trends toward ESA listing because 41% of rare plants in the conifer habitat group are at risk from logging.

598: The basis for only implementing conservation measures where there are 20 or fewer populations (BLM special status species) is murky at best.

599- The DEIS cannot rely on an assumption that plants will benefit from logging disturbance because logging does not mimic natural disturbance, and weeds brought by logging and roads will erase any alleged benefit from disturbance.

600: New road construction in the Klamath province has the potential to affect more BLM sensitive and assessment plan species relative to other provinces because of the higher density of such plant populations in this province. Yet the effects of such road building are not documented or quantified in the DEIS.

601: The DEIS fails to justify rejecting BSS conservation measures for mining NOTICES.

610: Only 1% of the 865,800 acres in the Medford BLM District contain BSS. Why can't BLM restrain itself to the other 99% of its land base?

610-611 – The EIS analysis of both botanical resources and invasive species fails to consider the cumulative and synergistic adverse impacts of WOPR activities, climate change, non-federal logging, salvage logging, and fire. The EIS must disclose and consider this and scale back harmful activities accordingly. As climate stresses increase, logging stresses must be reduced.

633- The presentation of Key Points for the Wildlife chapter requires comment:

- Alt 2 would merely maintain the current level of spotted owl habitat, a level of habitat which has left spotted owls threatened with extinction, and Alt 2 would decrease the amount of dispersal habitat between reserves. This is inconsistent with legally required conservation and recovery of listed species.
- The DEIS says that Alt 2 would not increase the quality of owl dispersal habitat, but the analysis of structural stages is insensitive to dead wood habitat which owl rely on to support a healthy prey base, so the DEIS very likely underestimates the adverse impacts on the quality of owl dispersal habitat.

633 – The action alternatives lack protection for large and old trees in the reserves. This is an open invitation for logging that places economics above ecosystem services even in reserves. There are perverse incentives in place that reward BLM managers for logging and punish them for conserving forests, so the lack of clear and bright lines protecting large and old trees will lead to degradation of the very values that the reserves are intended to protect.

633- BLM has surveyed for spotted owls for many years and knows where most of the owls live, yet the DEIS fails to incorporate analysis of the consequences of the action alternatives in light of this readily available and highly relevant information. The WOPR must account for the "take" of many hundreds of owl that live in the TMAs.

633: Alts 2 and 3 would decrease suitable NSO habitat in the Rogue-Umpqua "Area of Concern" for the next 50 years." This is inconsistent with recovery.

633: And Alts 2 and 3 would decrease suitable murrelet habitat for the next 50 years. This is inconsistent with recovery.

634- The DEIS fails to analyze effect to spotted owl *populations* (only looks at habitat). This violates FLRMPA, NEPA and the ESA. The EIS needs to discuss the effect of alternatives on spotted owl populations AND spotted owl habitat, not just one or the other. Habitat is not the only issue, there are other factors affecting the spotted owl populations such as bared owls, West Nile virus, and possibly wetter spring weather due to climate change, so BLM may need to provide additional habitat to mitigate for these other stressors while still meeting its conservation and recovery obligations under the ESA. Fundamentally, BLM cannot assume a direct connection between habitat and spotted owl populations because the barred owl will occupy some but not all of that habitat. There is a partial disconnect or decoupling between owl habitat and populations. The EIS cannot just compare alternatives and how much habitat they provide in a vacuum, the EIS must answer the question "Is BLM providing 'enough' habitat to recover spotted owl populations, given all the other stressors?"

634- The DEIS acknowledges that the barred owl is an important threat to the spotted owl, but the DEIS completely misconstrues the role of habitat as it relates to the competitive conditions between these two species. BLM dismisses the barred owl by saying that the relationship between habitat and barred owl is unknown. What BLM fails to recognize is that the fundamental principles of ecology give us strong clues as to the relationship, that is, more habitat means less competition and a greater chance of co-existence between the two owl species, and less habitat means more competition and less likelihood of co-existence. This was explained in our previous comments on the NOI and the planning criteria.

635 – Figure 216 shows that the Northwest Forest Plan is a compromise that retards recovery of owl habitat relative to the no harvest reference condition. Given the new threats to the spotted owl, and the ESA mandate to use all their authorities to conserve

threatened & endangered species, how can BLM justify anything short of the natural rate of habitat recovery?

639 – The EIS acknowledges that BLM lands can only provide large blocks of habitat in concert with non-federal lands, but non-federal lands are unlikely to help in that regard. This highlights the importance of considering the cumulative effects of non-federal land management and what BLM can do to mitigate for non-federal habitat mis-management.

640: Footnote 9 is interesting. "Using mature and structurally complex forest structural stage classification as a surrogate for suitable habitat likely overestimates the amount of suitable habitat …" If BLM will use this proxy for designing the reserve system, they must use more accurate suitable habitat data that includes information on abundance of dead wood, not just presence/absence.

642: Contention that 99% of LSMA (capable) will be suitable habitat by 2106 is arbitrary and capricious. This shows the flaws in assuming natural disturbances out of existence. Usually the agency doesn't predict that over 70% will be suitable. See FEMAT and LSRAs. Also, the WOPR will increase fire hazard and further questioning this assumption.

648: The DEIS acknowledges importance of scattered NRF habitat but this fact is not carried through the analysis and selection of the preferred alternative.

649: The WOPR EIS team should review, disclose, and consider the analyses from the LSR Assessments and Watershed Analysis which have good information on the value of conservation in specific areas. We incorporate by reference all the LSRAs and Watershed Analyses prepared during the course of the Northwest Forest Plan.

649 – The DEIS would allocate only 8% of BLM lands in the west Cascades province to LSMAs. There is a high concentration of municipal drinking watersheds in the West Cascades serving among others, Salem, Albany, Eugene, Roseburg, and suburbs of Portland. BLM's overly optimistic water quality analysis notwithstanding, the EIS must recognize that this high concentration of timber management allocations would sacrifice drinking water quality, because (a) extreme weather events will happen, especially under climate change, and (b) the WOPR gives to much discretion to managers and overly aggressive timber targets so BLM managers will be compelled to log and build roads in inappropriate places.

654- Map 34 shows the spacing of LSMAs under Alt 2. Compared to the Northwest Forest Plan the WOPR creates significantly increased concern for dispersal of spotted owls in several areas. All the big valleys, the Willamette, Umpqua and Rogue, become larger black holes for owl dispersal under Alt 2. Three new gaps are created in the Coast Range as well, two in the North Coast (both NW and SW of Salem) and one near Coos Bay.

Consider EPA's comments about the impact of the WOPR on the assumptions in the survey and manage EIS and Annual Species Reviews.

> The red tree vole is a good example of a late-successional old growth (LSOG)-associated species that has benefited from the NWFP reserve network and management guidelines. As noted on page 51 of the DEIS, the large size of the Late Successional Reserves and the connectivity provided by Riparian Reserves results in a high likelihood of providing sufficient habitat for stable vole populations in the Mesic zone. It is worth noting that the population stronghold created by the reserve network is key given the unstable vole populations in the Xeric Zone and the northern Cascades and north coast portions of the Northern Mesic Zone (2006 SEIS). It should also be noted that changes in the reserve network were not envisions in the outcomes of past ASR decisions or actions. As such, any changes to the existing reserve strategy may require revision of the habitat outcomes predicted for survey and manage species in this and previous SEIS documents.

660-661 – The EIS need to give more consideration to quality dispersal habitat. The EIS does not even define dispersal habitat, nor disclose that minimum dispersal habitat is generally where spotted owls go to die.

660 - BLM admits that structurally complex forests develop old forest conditions twice as fast as structurally deprived initial conditions. This is a compelling indictment of both salvage logging and clearcutting. If a large fraction of the landscape will eventually be logged via these two methods and short rotations prevail then restoration of a functional old forest ecosystem will be effectively precluded.

The EIS needs to go further and distinguish between traditional thinning and variable density thinning while "managing for decadence" and the consequences of each ecological processes including spotted owls and their prey. See supporting materials about variable density thinning (VDT) and the need to use VDT and "management for decadence" to provide for high quality dispersal habitat throughout the landscape, not just in reserves.

666- The EIS needs to disclose and consider additional Areas of Concern for the spotted owl, including all the big interior valleys, the Willamette, Umpqua and Rogue, which become larger black holes for owl dispersal under Alt 2, and the three new dispersal gaps created in the Coast Range as well, two in the North Coast (both NW and SW of Salem) and one near Coos Bay.

666: The DEIS says "there are no explicit thresholds for habitat conditions within the areas of [NSO] concern below which owl movement would be disrupted." Why is this? Please describe and justify thresholds of concern.

668, 670, 672: Only the Northwest Forest Plan alternative "would not decrease total dispersal habitat from current conditions over the next 100 years" in the (1) South

Willamette/North Umpqua, (2) Rogue-Umpqua and (3) Ashland, NSO Areas of Concern.

670 – The EIS needs to disclose the adverse effects of salvage logging on ecological conditions in reserves, including habitat quality for spotted owls and other late successional species. Explain any deviations from Northwest Forest Plan objectives and requirements. See supporting materials about the many values of dead wood legacies for developing complex forest habitat and adverse effects of salvage logging on late successional wildlife including spotted owls and their prey.

674- The EIS needs to disclose and consider impacts to marbled murrelet populations AND habitat, not one or the other. The EIS merely asserts that factors other than habitat are involved in determining murrelet populations. So what? BLM has an obligation under NEPA and the ESA to consider all those factors and what role habitat plays in the scheme of things. BLM must consider what they can do with habitat protection to mitigate for other factors that may be outside of our control. Experts have long held that ocean conditions are important for murrelets, and that we can help mitigate for bad ocean conditions by providing abundant nesting habitat. BLM has ignored this issue.

674 - The EIS should consider the final rule designating critical habitat for the marbled murrelet which placed the conservation burden on federal land so that non-federal lands could enjoy more regulatory stability. How will the WOPR action alternatives affect this scheme?

> The majority of lands included in this proposal are federally- managed and fall within the various special management categories for Federal forests established under President Clinton s recently- approved Northwest Forest Plan. For example, of the 4,453,200 acres proposed as murrelet critical habitat, 3,383,200 acres are already designated as late-successional reserves under the Forest Plan, where harvest of old-growth stands of timber is restricted.
>
> The proposal also limits its effect on state and private landowners by focusing principally on Federal forest lands.

http://www.fws.gov/pacific/news/1996/r19549.html

674 – Alt 2 would not require pre-logging surveys to determine the presence of absence of marbled murrelet in suitable habitat. This is a violation of one of the core purposes of the Endangered Species Act, to avoid take of listed species.

676- The EIS says that Alt 2 would decrease marbled murrelet nesting habitat. This is inconsistent with recovery obligations under the ESA.

676- The EIS must consider the cumulative effect of marbled murrelet habitat loss under the action alternatives, plus habitat loss on non-federal lands.

678- The EIS needs more discussion and disclosure of marbled murrelet recovery plan objectives which assumes that the Northwest Forest Plan LSRs will be protected and restored, and 15% of the largest and oldest trees in matrix will be retained, and wider riparian reserves will be available, etc. Alt 2 will clearly violate BLM's recovery obligations under the ESA.

679 – Figure 233 shows that marbled murrelet habitat would decline for several decades before slightly increasing in the later part of the century. This points out a big issue with the WOPR – BLM seems to put a lot of stock in the development of complex forest in the distant future, for marbled murrelet, spotted owls, landbirds (p 705), and complex stream structure, etc. In fact, distant future projections of forest conditions and processes are highly speculative given uncertainties such as climate change. BLM must recognize that uncertainties accumulate over time. For instance, climate change could significantly alter these conclusions because, for instance, it is expected to increase drought stress and disturbance by fire.

682 – The final paragraph of the marbled murrelet discussion deserves greater emphasis. Alt 2 is expected to decrease patch size, and reduce effective habitat availability even more than the absolute habitat reductions attributable to timber harvest.

683, 689- The EIS needs to provide a map of deer and elk management areas.

684: Loss of deer cover and deer foraging habitat will be bad for recreation and community stability.

685- The EIS needs to disclose that salvage logging and artificial replanting that truncates succession will have an adverse impact on big game cover and forage.

686, 692- The EIS must disclose that new roads will make a bad situation worse for big game.

687: The WOPR calls for exceeding road density standards in 18 deer management units.

688: Alt 2 would exceed road densities in every Medford BLM deer management unit. This is bad for recreation and community stability.

688- Please justify the assumption that winter forage is the only limiting factor for deer populations.

693: The DEIS assumes (without support) the efficacy of seasonal road closures (and elk wintering habitat). See Deadman's Palm EA and comments for BLM acknowledgment that gating doesn't work.

694 – The EIS needs to disclose the cumulative and compound impacts of logging, roads, mining, grazing, OHVs on big game.

696- The EIS needs to disclose the cumulative adverse impacts of the WOPR on bald eagles, including smaller late successional reserves and riparian reserves, salvage logging, OHV disturbance, lower fish prey abundance, etc...

697- Bald eagles use trees as small as 14" dbh. Please justify choosing 40" dbh trees as mitigation.

698- The action alternatives will cause trends toward listing for Pacific fishers which are already warranted for listing under the Endangered Species Act. Fishers are associated with structurally complex forests and riparian areas. The EIS needs to conduct an analysis of impacts on the fisher that is more sensitive to the abundance and complexity (not just presence-absence) of dead wood as well the disproportionate value of generous riparian reserves. The EIS also needs to disclose the adverse impacts of salvage logging and roadside hazard tree removal (along dense road networks) on fishers.

698: In concluding that Fisher natal habitat would increase under all alternatives, the DEIS ignores/misleads concerning short term (50 years) impacts on fisher.

701 – The DEIS analysis of fishers says, "BLM-administered lands play a significant role at the provincial scale by linking the physiographic provinces and the U.S. Forest Service lands within them." This is a profoundly important aspect of the WOPR decision-making process, not just for fishers but many other species as well. This fact bears repeating in the analyses concerning spotted owls, marbled murrelet, landbirds, botanical resources, aquatic species, and all other wildlife. This fact must be carried through the analysis and the decision-making rationale in the ROD.

702: "Decreasing patch size, mean core area size, and connectivity would lead to decreasing [Fisher] populations under Alt 2 and 3." This will cause trends toward listing.

703 - The BLM must do more to protect and restore habitat for migratory birds. This will even help maintain permanent forest production ("[N]uthatches and chickadees act as tree protectors, keeping in check the insects that can have deleterious effects on forest vigor." Chickadee, Nuthatch Presence In Conifers Increases Tree Growth, Says CU-Boulder Study. Aug. 1, 2007. http://www.colorado.edu/news/releases/2007/282.html) and community economic stability ("Migratory birds are of great ecological and economic value to this country …" Executive Order 13186 of January 10, 2001; http://frwebgate.access.gpo.gov/cgi-bin/getdoc.cgi?dbname=2001_register&docid=fr17ja01-142.pdf).

703 – BLM needs to justify reliance on the Partners In Flight benchmarks for management of habitat for landbirds. (A) These benchmarks have not been subjected to NEPA analysis, including consideration of alternatives, consideration of opposing viewpoints, and disclosure of consequences. (B) Other experts have recommended greater protection than the PIF benchmarks. For instance, PIF recommends "no net loss" of eastside complex old forest, and for conifer forests west of the Cascades, PIF recommends retaining 15% of each province as old-growth forest, but others recognize

that both eastside and westside old forests are far outside the natural range of variability and recommend large-scale restoration of these forest types, far more than 15% retention or no net loss. See ICBEMP Record, incorporated by reference.

703: The DEIS shows severe impacts to landbird habitat in the Klamath Falls Resource Area. Current 80% habitat capable reduced to 30%. Added to the stresses of climate change, fire, etc., this level of habitat loss is simply unacceptable.

707- Table 203 compares snag retention by alternative. BLM provides no scientific support for these figures. These snag retention levels look similar to out-dated standards based on "habitat capability" or "potential populations." These methods have been discredited in the scientific literature. New snag retention standards have not been developed in conformance with NEPA and FLPMA. Current science indicates that the snag retention levels in Table 203 are inadequate to provide for healthy populations of snag associated wildlife and other ecological processes. See supporting materials concerning new information about snag retention to support the many values of dead wood.

707- Dead wood is recognized as an under-appreciated forest resource with importance for fish, wildlife, hydrology, nutrient cycling, carbon storage/climate mitigation, etc. The EIS needs to disclose the impacts of WOPR alternatives on ecological processes and species closely associated with snags and dead wood, such as primary cavity excavators and secondary cavity users.

The action alternatives retain too few green trees to assure a long-term supply of snags and structural complexity. Nonaka and Spies et al showed that the coast range had high amounts of dead wood. BLM's approach will make even more of the Coast Range look like private lands that have already pushed the system far outside the historic range of variability.

The action alternatives retain too few snags and too small snags. Snags don't last as long as live trees. They need to be replaced. Two to six snags per acre is far less than needed to support viable populations of native wildlife, including the scores of species that depend upon snags and dead wood. The "potential population" method of snag retention has been discredited. More snags need to be retained to meet wildlife objectives and other ecosystem services such as soil stability, soil nutrient buffering and cycling, etc...

The action alternatives call for retaining less down wood in stands of smaller trees. This makes no sense ecologically. In a natural system, small trees would likely be the result of disturbance that would produce large amounts of dead and down wood and carry those large structural elements through to the next stand of small trees. This being the case, stands of small trees should retain more dead wood, not less.

The action alternatives allow salvage logging that will harm natural recovery processes including: structural retention and continuity; soil stability and soil nutrient buffering and cycling; slow and patchy regeneration by diverse vegetation; unique habitat for species

that are adapted to post-disturbance snag patches; pulses of dead wood and sediment for stream structure and spawning material; etc. Restoration of complex old forests is best achieved if we start with complex young forests, but salvage logging will simplify young forests and make the restoration effort more difficult or impossible. See the supporting material concerning the many values of dead wood and the harms of salvage.

707: Why does table 203 indicate 0 residual trees in LSMAs for Alt 2? What does this mean?

713-717 – Table 205 reveals several serious analytic errors:

- Species Group 3 lists a number of species such as woodpeckers and the flammulated owl and bats that are associated with snags and the EIS falsely asserts that they were addressed in the landbird section. This is not true. They were not addressed.
- The EIS says that effects to red tree voles and other "survey and manage" species are similar to effects for the spotted owl. This is erroneous, because voles cannot fly and disperse like spotted owls, making them even more sensitive to habitat fragmentation than owls.
- Species group 4 – Those species that are closely associated with small streams will trend toward ESA listing because protection for small streams will be greatly reduced under the action alternatives.
- Species group 5 – species closely associated with the forest floor will face trends toward listing as a result of extensive and intensive logging under the action alternatives.

BLM must consider the results of the "additional species analysis" conducted as part of the 1994 SEIS. BLM must review, consider, and disclose the conclusions in the 1994 FSEIS which discloses serious adverse consequences of Alternative 7 (similar to WOPR Alt 2) for mollusks, fungi, lichen, etc.

716 - Consider EPA's comments about the impact of the WOPR on the assumptions in the survey and manage EIS and Annual Species Reviews.

> The red tree vole is a good example of a late-successional old growth (LSOG)-associated species that has benefited from the NWFP reserve network and management guidelines. As noted on page 51 of the DEIS, the large size of the Late Successional Reserves and the connectivity provided by Riparian Reserves results in a high likelihood of providing sufficient habitat for stable vole populations in the Mesic zone. It is worth noting that the population stronghold created by the reserve network is key given the unstable vole populations in the Xeric Zone and the northern Cascades and north coast portions of the Northern Mesic Zone (2006 SEIS). It should also be noted that changes in the reserve network were not envisioned in the outcomes of past ASR decisions or actions. As such, any changes to the existing reserve strategy may require revision of the habitat outcomes predicted for survey and manage species in this and previous SEIS documents.

The action alternatives are likely to significant increase trends toward listing for the red tree vole, especially the dusky subspecies in the Northern Coast Range. This could threaten regulatory stability for non-federal forest operations in western Oregon, especially the northern Coast Range where the dusky subspecies lives. See June 18, 2007 Petition to List the Dusky Tree Vole (*Arborimus longicaudus silvicola*) as Threatened or Endangered under the Endangered Species Act. http://www.biologicaldiversity.org/swcbd/SPECIES/DuskyTreeVole/DTV-petition.pdf Consider also, the range of other species that could be imperiled by the WOPR combined with aggressive management of state and private forest lands. See Noah Greenwald and Amanda Garty. 2007. Species of Concern of the Tillamook Rainforest and North Coast, Oregon. http://www.biologicaldiversity.org/swcbd/library/TillamookReport.pdf

720 – The DEIS confirms the inadequacy of streamside forest protection but fails to acknowledge that this will cause trends toward listing for species closely associated with small streams such as salamanders. The EIS even makes an unsupported assertion that 4,000 acres of logging per decade near small streams will not have affects on species assemblages and their connectivity at the 5th field watershed scale. BLM needs to back this assertion up and BLM needs to consider the effects at all spatial scales and disclose at what scale(s) the effects are most pronounced.

720 - The EIS needs to disclose the severe reduction in populations of sensitive species on non-federal lands and the role of BLM lands in compensating for that fact.

722- The EIS needs to disclose the effects of forest fragmentation on forest floor species that have limited dispersal capabilities. Endemic forest floor organisms are predicted to decline. With several rare salamanders and mollusks in the planning are, how can BLM purport to be in compliance with the Endangered Species Act policy of conserving habitat that rare species depend upon in order to avoid trends toward listing.

723- The EIS needs to disclose the adverse effects of salvage logging on aquatic objectives. See supporting materials on the importance of retaining abundant snags to meet aquatic objectives.

723- The fish effects analysis is flawed. BLM erroneously assumes that landslides will not cause problems because extreme weather events won't happen, slide prone areas will always be accurately identified, and slide prone areas are always protected in spite of excessive administrative discretion and excessive pressure to meet artificially high timber targets. These assumptions are not supportable.

723- The large wood analysis failed to account for "captured mortality" that would reduce AND retard recovery of instream large wood. See supplementary material regarding the "snag gap" and consider the analysis below which shows that thinning causes a decades long delay in the recruitment of large snags.

> Using data from stand exams modeled through FVS-FFE (West Cascades variant) the Umpqua NF found that the actual effect of thinning is to capture mortality and *delay* recruitment of large wood

for up to 60 years. WOPR EIS must include an honest disclosure of thinning impacts on snag habitat similar to that found in the Cottage Grove District's Curran Junetta Thin EA:

> There is currently an excess of forested land in this area without snags (roughly 5 times higher than what DecAID recommends) and a deficiency in areas with high snag densities (roughly 12% of what DecAID recommends). Management prescriptions should allow for these extremes because they are ecologically important (White et al. 2002, Mellen et al. 2005). Common natural disturbances that produce areas with high levels of dead wood include wildfire, insects and disease, and wind (blow down) events.
> …
> The action alternatives cause a decrease in stand levels of snags and down wood caused by incidental falling of snags for logging or safety reasons, and consumption of down wood during the fuels reduction treatments. Thinning would then reduce the amount of suppression mortality within the thinned portions of stands, indirectly affecting future recruitment of CWD. Existing snags and logs would be protected to the extent practical and safe. However, it is probable that the action alternatives would lower levels of these structures (to approximately one to two snags per acre) through mechanical disturbance from tree falling and harvesting. … To mitigate for effect on large snags, the action alternatives would include the inoculation of two trees per acre on 857 acres and five snags per acre on 379 acres (within CHU OR-20) with locally collected native heart rot fungus. Inoculated trees begin to develop heart rot within five years as they continue to grow (Duncan, 1999), eventually producing larger trees with cavities and future snags that remain standing longer than if girdled. Inoculation is a management tool being used to offset the reduction of suppression mortality caused by thinning and to maintain a component of decadence within these managed stands. Additional snag mitigation would occur within CHU OR-20; six snags per acre would be created by fire during fuels reduction activities. In unit seven, mitigation would occur by girdling trees (>15 inch dbh or largest trees available) to achieve six snags per acre within the thinned portions of the unit.
> …
> Large snag (≥20" DBH) densities within the stands are currently below the levels advised for in DecAID (4.7 snags/acre – 30% tolerance level). Under the no action alternative this level of snags would not be achieved for another two decades (Figure 15). The action alternatives would delay reaching this level by an additional 10 to 30 years (10 years for units thinned to 70 to 90 trees per acre, 30 years for units thinned to 40 to 60 trees per acre).
> …
> **Cumulative impacts**
> Substantial adverse impacts to levels of CWD at both the stand and landscape-scale have resulted from past clearcut timber harvesting, road building, roadside salvage and fire exclusion. The Layng Creek inventory showed an overabundance of land area with no snags, and a deficit of land area with high snag densities (caused by fire exclusion). It would take several decades to restore snag and log conditions to within the ranges advised for in DecAID at these two extreme ends of the range of CWD.

USDA Forest Service. 2007. Curran Junetta Thin EA. Cottage Grove Ranger District, Umpqua National Forest. June 2007. http://www.fs.fed.us/r6/umpqua/projects/projectdocs/curran-junetta-thin/index.shtml

This graph from the Curran Junetta Thin EA shows that heavy thinning delays by more than 60 years the attainment of habitat objectives for large snags (i.e. mid-point of the gray band representing 30-80% tolerance level).

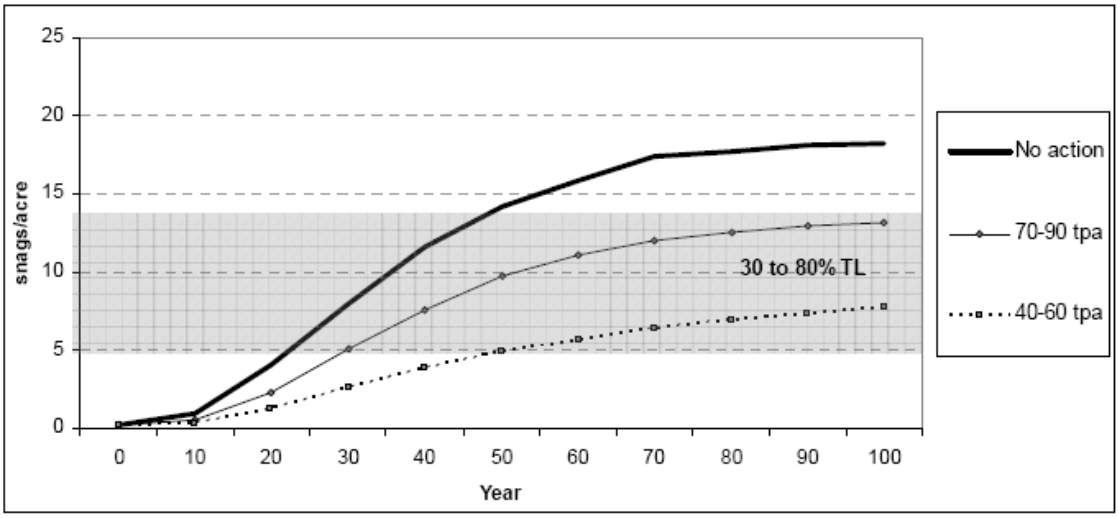

Figure 15. Short and long-term changes to ≥20" dbh snags.

This analysis is likely transferable to any thinning project, though the DecAID tolerance levels might be different for different forest types. The agency must come up with way to manage for decadence in order to mitigate for the fact that thinning captures and delays mortality. Data free analysis that concludes that "thinning grows big trees faster to create big snags faster" does not cut it anymore.

723 – The large wood analysis relies on an abstract concept of "mean annual large wood contribution" which is not an actual prediction of instream conditions. This needs to be translated into something meaningful at the spatial and temporal scale that are relevant to fish survival and hydrology in our streams.

723 – The EIS needs to distinguish between the action alternatives that allow thinning in riparian areas to meet silvicultural objectives and the Northwest Forest Plan which allows thinning in riparian reserves only if "needed" to attain aquatic objectives. If properly implemented, the Northwest Forest Plan is better than the EIS lets on, because it would more often prevent harmful logging that captures mortality and retards attainment of aquatic objectives.

726 – In describing the effects of the WOPR on the restoration of instream large wood the EIS needs to account for the effect of (a) salvage logging, (b) mid-slope roads that intercept debris flows (and recruitment of spawning gravel), and (c) the lack of large trees on non-federal land upstream from BLM stream reaches. See supplemental material on the need to retain abundant green trees and snags to meet aquatic objectives.

730- The DEIS fails to recognize the significant contribution of large wood adjacent to intermittent and non-fish bearing streams in natural watersheds.

730 - The DEIS conclusion that Alt 2 would have little effect on large wood is unsupportable. The DEIS undermines it's assertion that most wood comes from within 100 feet of large streams. It cites several studies that found meaningful levels of large

wood coming from >100 feet of streams. Please consider that site potential tree height is a good indicator that a falling tree might hit the stream. And steep slopes move fallen trees down hill to the stream.

731 – Figure 255 needs to show that the action alternatives allow heavy thinning along perennial and fish streams, and this figure shows too many trees along intermittent streams for Alt 2 which would provide only one tree every 175' (at 10 tpa).

732- Figure 256 is misleading. It needs to show large wood input to intermittent and non-fish streams.

733- The methodology behind the fish productivity index is not disclosed.

738 – The EIS fails to disclose all the many values of large wood instream. The EIS needs to disclose that large wood is still very important in non-High-intrinsic-potential streams (and non fish-bearing streams) because:

- Non-HIP areas provide connectivity between HIP areas;
- Non-HIP areas help supply the ocean ecosystem with valuable large wood input;
- Non-HIP areas provide refugia during storms and high water;
- Non-HIP areas provide valuable habitat for organisms other than salmon;
- Non-HIP areas provide ecological and hydrological values, other than fish production,
- Large wood in non-fish bearing streams provides important values such as habitat for non-fish organisms, energy dissipation, stream bank protection/stabilization, and sediment capture/storage/release.

740- Figure 262 shows some areas in the central and southern Coast Range that are obvious ACECs because they provide valuable habitat for all three fish: Chinook, Coho, and steelhead. We nominated these areas and BLM has not justified rejecting them.

741- The EIS needs to disclose that the action alternatives would change both the quantity of nutrient inputs AND the quality.

741-742 - The DEIS needs to disclose the adverse impacts of chronic sediment delivery caused by logging, road construction, and road use. The EIS needs to disclose the significant differences between the alternatives in terms of road use and the sediment consequences of that.

741- The EIS needs to disclose that best management practices are not always effective at controlling non-point source pollution.

743- The peak flow analysis needs to disclose and consider the cumulative compound effects of logging, roads, and climate change.

743 – The EIS reveals a probable violation of the Clean Water Act caused by temperature increases in water-quality-limited streams adjacent to the Coquille Tribal Forest.

745 – Table 211 does not include clearcuts on non-federal land. The peak flow analysis must consider the vast extent of stand establishment forest in non-federal lands. The action alternatives are very likely to push watersheds over thresholds of concern for peak flows.

746 – The EIS peak flow analysis must disclose and consider the synergistic influence of logging plus roads on all ownerships.

746 - The peak flow analysis must also include extreme weather events which are likely to become more common due to global warming and the acceleration of the global hydrological cycle.

746 – BLM peak flow analysis must conduct sensitivity analysis using a range of different assumptions to see if the conclusions are sensitive to the assumptions chosen by BLM. BLM must disclose the scales at which watersheds are most sensitive to the effects of BLM management.

746 - Current road densities are contributing to water quality violations and there is a general recognition that road densities must be reduced to meet objectives for water quality and fish & wildlife habitat. The action alternatives will increase road construction and preclude implementation of the needed reduction of road density. The DEIS analysis does not address this conflict between the road construction necessary to realize timber goals and the road removal necessary to meet legal objectives for salmon and water quality.

749 – The EIS peak flow analysis must include the effects of not only new roads but also existing roads on public and private lands. BLM needs to disclose how much road would need to be built on non-federal lands to facilitate the planned increase in logging. Such roads are connected actions and the impacts must be disclosed.

754 – The DEIS describes an exception which makes no sense. There might be a typo or a clarification needed.

755 – The water quality analysis needs to consider the cumulative and compound effects of increasing stream temperatures from increased logging and roads, reduced large wood input, increasing chronic sediment from additional logging and roads, and increase stream temperature as a result of climate change that is expected to bring prolonged heat waves.

755 – The stream temperature analysis needs to account for blowdown along skimpy stream buffers and the hard edges of new clearcuts.

756 – The proposed exceptional (in a bad way) management adjacent to the Coquille Tribal Forest undermines Congressional intent that management of these lands (formerly

governed by the Northwest Forest Plan) would remain consistent with the Northwest Forest Plan.

757 – Assumptions listed on this page will not necessarily be met. BLM must consider the consequences of these assumptions are not met.

- Treatments may not be well distributed. BLM usually concentrates management in particular areas.
- More than half of shade producing riparian areas may be thinned. High levels of discretion and intense bureaucratic pressure to meet timber targets will cause more thinning in riparian areas.
- The third assumption makes no sense. Please clarify.

759 – The BLM should not rely on vague optimistic assumptions such as new roads would be located away from streams "where possible" and would "most likely" not deliver sediment to streams. Please disclose what happens when these ideals are not met.

760 – The EIS needs to consider cumulative impacts from non-federal activities, and whether small increases in sediment might push waterways over thresholds of concern.

764- BLM cannot rely on the unsupportable assumption that grazing will meet proper functioning condition standards.

765- The fire and fuels analysis must recognize the many fuel reduction activities are actually counter-productive and will make fire hazard worse instead of better. PNW Science Finding report that when fuel reduction activities are expected to be profitable, the consequent removal of large trees conflicts with both fuel reduction objectives and habitat restoration objectives. Removal canopy trees cause fire hazard to increase because larger trees create more slash; and because removing canopy trees makes stands hotter, dryer, and windier. Canopy removal also makes more light, water, and nutrients available which increases the growth of future ladder fuels. The EIS must consider that logging, even well-intentioned logging, makes fire hazard worse.

765 - The action alternatives encourage clearcutting that creates dense young forests that are more susceptible to severe stand-replacing fire which can threaten communities, homes, and habitat. The DEIS fails to account for the increase fire hazard as part of its community economic stability analysis.

765- The EIS acknowledged that environmental conditions such as wind, temperature and humidity can have a significant effect on fire behavior, but the fuel model they used is based entirely on fuel structure and ignores that fact that logging has an influence on the environmental conditions that influence fire. The EIS must consider not just the fact that logging changes fuel structure but also the fact that logging increases fire hazard by making forests stands hotter, drier, and windier. See supplemental materials concerning fuel management (in)effectiveness.

766- The DIES makes overly optimistic assumptions about fuel treatments. The EIS must recognize that fuel treatments are not always done and when they are done they are rarely fully effective.

767- Table 213 needs to disclose another important “principle of fire resiliency” which is that an ample canopy cover helps provide cool, moist and less windy conditions and helps suppress the growth of ladder fuels.

The EIS also needs to recognize that there are opposing viewpoints to the idea that time since fire causes fir hazard to increase. In some forest types, long periods between fires helps to grown dense canopies that suppress ladder fuels and increase stand resilience. This implies that less logging is better if the goals include permanent forest production, community stability, watershed recovery, regulating water flow, and species recovery. See supplemental material concerning different fire regimes in SW Oregon.

768 – The EIS needs to disclose and consider the fact that timber management areas will have more young and stand establishment forests which are unfavorable from a fire resiliency standpoint and these timber areas will threaten the long-term viability of the late successional management area especially as the climate warms and drought stress increases.

768 – Figure 272 needs to disclose time periods.

768-769 – The EIS needs to disclose the increase logging will increase fire hazard and conflict with community economic stability and the national fire plan.

769: The Northwest Forest Plan would contribute more to community stability because it "would result in the most decrease [in fire hazard] reducing the acres of high severity fire when wildfires occur and fire hazard to less than one half of the current condition in 100 years. Alt 2 would have the least decrease maintaining the acres of high severity fire when wildfires occur and fire hazard at only slightly less than the current condition." 769: For the K-Falls RA Fire haz would increase under Alts 1 and 2.

770- The DEIS assumes that retention trees will be distributed instead of clumped under Alt 3. This is unfounded. Under the Northwest Forest Plan operational convenience too often trumps ecological goals, so retention trees are very often clumps along the edges of logging units where they are far less effective at mitigating fire hazard.

770 – The EIS fire and fuels analysis needs to draw a more clear distinction between the Northwest Forest Plan and Alt 3. Alt 3 will establish dense young stand under a sparse overstory.

775– The EIS recreation analysis admits that recreational facilities will not keep up with demand and crowding will occur. This is an example of a public good that is under-produced and requires market intervention (e.g., less logging in wild areas and old forests) in order to correct market imperfections.

779 - The EIS fails to consider increases in recreation demand beyond the first ten years of the WOPR. Increases is recreation demand are more than speculative. It is worth noting that in the current housing market, home prices are declining in large cities throughout the country with the exception of Portland and Seattle. The northwest's reputation for old-growth forests, healthy streams, and high quality of life is likely significant factors leading to in-migration that maintains home values. The EIS should consider the consequences of the WOPR eroding the Oregon's reputation for quality of life.

779 – BLM should consider the "front country" and "rural" designations as more accurate proxies for wildland urban interface. Please provide a map of these areas.

779 – Please explain how the Northwest Forest Plan (with less logging and roads) has less "primitive" areas than the action alternatives (with more logging and roads).

781 – The BLM cannot rely on the erroneous assumption that logging will have only "short duration" modification of naturalness levels. Most people would prefer to recreate in natural older forests than in artificial plantations.

782 – The EIS fails to account for increasing recreational demand when it concludes that the action alternatives will cause only "small changes" in recreational opportunities. As demand increases, and supply decreases, crowding and competition increase and with it the quality of recreational experiences. The WOPR will increase scarcity of recreation opportunities and will be inconsistent with the O&C Act mandate to provide recreation facilities.

784, 789 – The EIS summary of key points for the wilderness section and the visuals section fail to include the Northwest Forest Plan in the comparison of effects, so the best alternative is not even mentioned. This is unacceptable and misleading.

785- The EIS failed to disclose other values of wilderness such as hydrology, ecology, and carbon storage, and the EIS must disclose how those values are put at risk by BLM management.

785- Three Medford District wilderness eligible areas would get logged: Berry Creek, Whisky Creek and Wellington Mt. Alt 2 would log 13,000 out of 26,000 acres of wilderness eligible lands across all districts. In other words, the BLM is unwilling to have 26,000 out of 2,500,000 acres remain undisturbed.

786- The EIS needs to disclose the "scarcity" of roadless areas relative to roaded areas as required by FLPMA.

788- The EIS says that flush cutting stumps would mitigate for logging in roadless area. This is nonsense. Flush cutting stumps might appease uninformed recreationists but it

would conflict with other significant values of roadless areas, such as habitat and carbon storage.

793 – LSRs, CHUs, Key watersheds, roadless areas should be part of the National Landscape Conservation System.

793: All alts allow for logging 73,338 acres of eligible scenic or recreational rivers. This is a significant sacrifice of recreational facilities in violation of the O&C Act.

794- The EIS soils analysis fails to disclose and consider the effects of climate change on nutrient and carbon cycling. Increased canopy removal under the action alternatives will increase soil warming and soil respiration which will increase carbon releases to the atmosphere.

794- The "key points" about soils is uninformative because fails to compare the alternatives. If the analysis cannot show that the Northwest Forest Plan is superior to the action alternatives, then it is a insensitive analysis.

797 – The EIS cannot rely on the unsupportable assumption that OHVs will not increase erosion. It's absurd. OHVs are notorious for bypassing efforts to control them so they can disturb soil, especially near and in water.

807- BLM is rejecting ACEC proposals in violation of FLPMA, based on a false conflict between FLPMA and the O&C Act. In fact, there is no conflict. ACECs provide permanent forest production, watershed protection, regulate water flow and recreation opportunities. These laws can be harmonized by protecting ACECs and the various O&C Act objectives inside and outside the ACECs.

807- BLM is actually changing its interpretation of their legal responsibilities because BLM has in the past included some O&C lands within ACECs. Now it says it cannot do so, but provides no compelling rationale for that significant policy change.

815- The EIS should propose to mitigate for cultural resource impacts by conducting extensive purposeful surveys for cultural resources after all fires when cultural resources are most visible.

817- BLM must consider whether developing coal bed methane, including permanent roads and drill pads will violate O&C Act mandates for permanent forest production and watershed protection.

817- The EIS should mitigate biomass extraction by requiring that it be conducted as part of a comprehensive restoration program, not as a way to treat slash from business-as-usual clearcutting. According to the OFRI Biomass Report, the public expects biomass to be restorative, not destructive.

WOPR APPENDICIES:

D-967- The DEIS uses an unreasonable assumption that logging old-growth forests is not controversial. Timber sales were included (calculated) "regardless of award and execution or litigation." This rewards illegal behavior and counts offering an illegal project as contributing the goals of the agency.

Their botany appendix doesn't reflect the findings of last year's monitoring report that *g. Fritelaria* populations are declining all over the district.

G-1027: Says **existing LSRs** are insufficient "to reverse the decline and maintain a well-distributed population" of murrelets, so smaller reserves are even less likely to conserve and restore threatened marbled murrelets. BLM would be shifting even more of the conservation burden to non-federal lands. What will be the effect on economic stability?

G-1042-43: Alts 2 and 3 decrease the amount of suitable NSO habitat in CHUs. NA would increase the amount of suitable NSO habitat in CHUs.

M1317-1321: All Alts drop Baker Cypress, Hole in the Rock, Iron Creek, Jenny Creek, Pilot Rock, Long Gulch, Moon Prairie, Sterling Mine Ditch and Tin Cup ACECs. French Flat, King Mt. And Upper Klamath ACEC would lose the O&C portion of their designation. Check page 3-67 of the Medford RMP EIS (vol. 1) for good descriptions of the resource values that these ACECs currently protect. Also see page 2-42 of the RMP EIS volume 1 for language specific to the Brewers Spruce ACEC. BLM can't assume that the O&C Act forces them to ignore the FLPMA mandate to protect ACECs.

Thank you for carefully reviewing an meaningfully responding to these comments and the supplemental and supporting materials attached.

Sincerely,

Doug Heiken

Attached:

- Supplemental Materials (submitted via orwopr@or.blm.gov)
- Additional supporting documents for the record (submitted as digital files on a CD sent via US Mail Jan. 7, 2008)
- Spreadsheet of ESA findings that rely on the Northwest Forest Plan.

ESA findings that rely on the Northwest Forest Plan

Scientific	Common	FINDING: date	FINDING: cite	FINDING: result	FINDING: type	Reliance on NWFP
Accipiter gentilis atricapillus (Western DPS)	**northern goshawk**	28-Jun-98	63 FR 35183	Negative	12-month	FWS relied on NWFP and other regional plans to conclude that "the nature and rate of decline in mature forest habitats on Federal lands has slowed significantly during the past decade," which formed part of the basis for their conclusion that the goshawk did not require protection.
Plethodon asupak	**Scott Bar Salamander**	25-Apr-06	71 FR 23886	Negative; revised under court order and now positive	90-day 1	Negative 90-day finding substantially relied on NWFP, noting "the rate and extent of timber harvest has declined dramatically on Federal lands within the Northwest Forest Plan area." This finding was overturned by a federal court and a status review is now being conducted. WOPR likely to contribute to need for federal listing.
Plethodon stormi	**Siskiyou Mountains Salamander**	25-Apr-06	71 FR 23886	Negative; revised under court order and now positive	90-day 1	Negative 90-day finding substantially relied on NWFP, noting "the rate and extent of timber harvest has declined dramatically on Federal lands within the Northwest Forest Plan area." This finding was overturned by a federal court and a status review is now being conducted. WOPR likely to contribute to need for federal listing.

	Marbled murrlet			Proposed new CH for the murrelet would exclude virtually all federal land in reliance on the continued implementation of the Northwest Forest Plan.
Oncorhynchus clarki clarki	**Coastal cutthroat trout**	Jan-99	NMFS Status Review	NMFS Status Review concluded that Oregon Coast and Southern Oregon and California Coast ESUs do not warrant protection, but did not directly rely on NWFP. Review concluded that Lower Columbia River/SW Washington ESU did warrant listing. NMFS later proposed listing, only to have FWS take over jurisdiction and withdraw the proposal. The withdrawal did rely on NWFP.