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# Log it to save it? The search for an ecological rationale for fuel reduction logging in Spotted Owl habitat.

**By Doug Heiken** **Version 1.0 - May 2010**

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## Introduction

Forest management must harmonize several goals which can sometimes be in conflict, including clean water, recreation, fish & wildlife habitat, carbon storage, timber volume, and public safety.[1] Current agency efforts seem to pursue fuel reduction at the expense of other important values. This is not appropriate except in the immediate vicinity of homes and buildings, where fuel reduction efforts are most likely to be effective and least likely to conflict with other public goals. Outside of the "ignition zone" immediately surrounding structures, ecological restoration is a more appropriate objective for federal land management.

The US Forest Service and Bureau of Land Management ("the agencies") are coming to recognize that their primary focus should be restoration of forests and watersheds. This is a welcome change. Now the task is to develop a coherent restoration policy, to ensure that these efforts are well-grounded in science, and to build a portfolio of restoration practices that have a proven record of improving ecological conditions without significant adverse side-effects.

Mature and old-growth forests provide important values such as water quality, recreation, wildlife habitat, and carbon storage. Most mature forests do not need to be actively manipulated to be restored, because the possess the building blocks and the self-organizing capacity to develop and maintain quality habitat if we refrain from ill-considered interventions. All proposed restoration in mature forests must therefore be carefully evaluated and ecologically justified. The agencies unfortunately have a new excuse for widespread logging in mature forests. According to the agencies, mature forests need to be logged in order to be saved from fire.[2]

This paper reviews the ecological rationale for fuel reduction logging, identifies several flaws in the agencies' approach, and shows that fuel reduction is generally not a valid restoration activity in mature forests where we seek to maintain habitat for the spotted owl and other species associated with complex older forests.

The agencies are proposing to save the northern spotted owl from the adverse effects of wildfire by logging the owls' habitat to reduce hazardous fuels. Justifying such logging will require several findings: (1) that wildfire is highly likely to occur at the site of the

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[1] Power, T.M. 2006. Avoiding a New "Conspiracy of Optimism": The Economics of Forest Fuel Reduction Strategies. *in* Wuerthner, G. editor. The Wild Fire Reader: A Century of Failed Forest Policy. Island Press, 2006.

[2] Ray Davis, Wildlife Biologist, USDA Forest Service, Roseburg, OR; Jim Thrailkill, Wildlife Biologist, USDI Fish and Wildlife Service, Portland, OR. 2006. Case Study: A conceptual approach for prioritizing landscapes for fuel treatments in northern spotted owl habitat. USFWS 2006 Workshop Managing Northern Spotted Owl Habitat in Dry Forest Ecosystems. http://www.fws.gov/oregonfwo/ExternalAffairs/Topics/DryForestWorkshop/Documents/2006/PowerPoints/thrailkill_davis.pdf "The paradox facing land managers today is the need to treat northern spotted owl habitat in order to save it (Agee 1992)."

treatment, (2) that if fire does occur it is likely to be a severe stand-replacing event[3], and (3) that spotted owls are more likely to be harmed and imperiled by wildfire than by logging at a scale necessary to reduce fire hazard. Available evidence does not support any of these assertions, which raises serious questions about the need for and efficacy of logging to reduce fuels in western Oregon and other forests lacking frequent fire return intervals.

Fuel reduction logging has complex effects on fire hazard with potential to increase fire hazard, especially when fuel reduction efforts involve removal of canopy trees. Commercial logging is also far from benign in terms of habitat, carbon, and watershed values. Fire events cannot be predicted making it difficult to determine which forests will benefit from treatment, consequently fuel treatments must be extensive and many stands will be treated unnecessarily, thus incurring all the costs of fuel logging, but receiving none of the beneficial effects on fire behavior.

The public appreciates old growth forests and desires to protect threatened & endangered wildlife. People will likely increase their tolerance of fire on the landscape once they understand that: (1) fire has ecological benefits; (2) severe fire is most often a weather-mediated process, so fuel treatments have limited effect on fire behavior; (3) even a marginally effective fuel program will require extensive modification of vegetation with consistent long-term follow-up treatments; and (4) such an extensive program of fuel reduction will require significant amounts of scarce public money and will result in significant adverse effects on soil, water, carbon, weeds, and wildlife, including salmon and spotted owls.

With these constraints in mind, it becomes clear that ecological restoration, rather than fuel reduction, should be the driving motivation for management of federal forest lands.

## A risk assessment framework reveals that the cure (logging) is worse than the disease (fire).

In the public and scientific discourse about "forest health" one often hears the assertion that our forests are at grave danger from wildfire, and that our forests need to be logged in order to save them from this imminent threat. In reality, both logging and fire have meaningful consequences, so the issue really boils down to a comparative risk assessment where "risk is characterized by two quantities:

1. the magnitude (severity) of the possible adverse consequence(s), and
2. the likelihood (probability) of occurrence of each consequence."[4]

Proper consideration of the relative magnitude and likelihood of both wildfire and fuel reduction logging requires a careful evaluation of:

- The probability that fire will occur (and its spatial extent);

[3] Roseburg BLM Collaborative Forestry Pilot Project "Many of these stands have a high likelihood of a stand replacement fire vs. a mosaic burn" http://www.blm.gov/or/districts/roseburg/plans/collab_forestry/files/Major_Glasco_Fuels.pdf

[4] http://en.wikipedia.org/wiki/Probabilistic_risk_assessment

- The magnitude of harm from fire (e.g., fire severity, canopy damage);
- The probability that fuel reduction logging will occur (and its spatial extent); and
- The magnitude of harm from fuel reduction logging (e.g., reduction of canopy habitat, understory vegetation, course wood, and reduced recruitment of dead wood).

| **Framework for Assessing the Risk of Wildfire vs Fuel Reduction Logging** | | | |
|---|---|---|---|
| | Likelihood of event | Magnitude of harm | Net Benefit |
| Wildfire | LOW: Stand replacing wildfire is not common in western Oregon. Fire suppression policy prevails. The chance that any given acre of forest will experience wildfire is low. | LOW: The majority of wildfire effects are not stand replacing. Fire is a natural process to which native wildlife are adapted. There is still a deficit of natural fire processes on the landscape. | Fire is likely less harmful to habitat than fuel reduction logging. |
| Logging | HIGH: To be effective in controlling fire, logging must be very extensive, and sustained. Many more acres would need to be logged than would burn. | HIGH: Widespread logging will have significant impacts on canopy, microclimate, understory vegetation, down wood, and long-term effects on recruitment of large trees and snags. | Fuel reduction logging is likely more harmful to habitat than wildfire. |

This white-paper is structured around the four main boxes in the above risk framework, followed by recommended solutions that may help resolve the apparent conflicts between fire hazard, logging, and habitat, such as applying a landscape strategy that obtains fire safety objectives in younger stands and obtains habitat objectives in older forests.

This paper will show, in spite of what we often hear, that Oregon's forests are not at imminent risk of destruction by wildfire. Fire return intervals remain relatively long, due to both natural factors and active fire suppression policies. Wildfire severity also remains moderate. Most wildfires are not stand replacing. Most are low and moderate severity. Furthermore, logging for purposes of fuel reduction has impacts on habitat that remain under-appreciated, especially the reduction of complex woody structure, and the long-term reduction in recruitment of large snags and dead wood.

Our inability to predict where and when fire will occur means that fuel treatments intended to modify fire behavior must be extensive and permanent, even though fire will be localized and infrequent. Many areas will thus be treated "unnecessarily." In addition, forests with longer fire return intervals provide habitat for a variety of focal species that depend on high canopy cover and abundant snags and dead wood, e.g., spotted owl, flying squirrel, goshawk, pileated woodpecker, salmonids, American marten, Pacific fisher. These species will be adversely affected by treatments that reduce canopy cover and interrupt the processes that recruit dead wood, yet there is little or no off-setting benefits in terms of modified fire behavior where fuel treatments do not experience fire. Thus, there is no compelling rationale for fuel reduction logging in western Oregon's mature forests characterized by intermediate or longer fire return intervals.

## Logging is not needed in all forest types.

It is widely accepted that forests with historically long fire return intervals in the moist areas of western Oregon generally do not suffer as a result of fire suppression and will not benefit from fuel reduction. The 1993 FEMAT Report said "… in the Western Cascades and coastal areas of Oregon and Washington, manipulation of natural stands to reduce fire hazard is generally not necessary (Agee and Edmonds 1992)."[5] Keeley et al (2009) state "In crown fire regimes … fuel accumulation has not been the cause of large fires, and ecosystems are often within their HRV [historic range of variability]; thus there is limited need for ecosystem restoration."[6]

However, not all forests in western Oregon can be characterized as moist forests with long-interval, stand-replacing fire regimes. Southwest Oregon in particular has a complex mosaic of forests that can be considered moist, dry, or intermediate. Fire return intervals and fire behavior are highly variable. There is debate about whether fuel reduction is appropriate in these forests. The Final Recovery Plan for the Spotted Owl says —

> [I]t is unclear how, or if, a landscape-management approach similar to that described for the other dry-forest Provinces is feasible in the Klamath Provinces. … BLM's checkerboard land ownership means the agency generally does not manage more than 50 percent of the land in a given area, so its approach to fire management and spotted owl recovery may differ from that of the U.S. Forest Service. The best approach for spotted owl recovery now appears to be to maintain the MOCAs on BLM land …[7]

The prevalence of "dry" pine and oak forest types, especially near valley margins of western Oregon, is likely an artifact of cultural burning by Native Americans.[8] Such burning has been virtually eliminated. These culturally-created savanna forest types may be able to support higher tree density than they did historically. Even if such forests were not culturally created, current land ownership patterns and fire suppression policies now produce fire return intervals that are moderately long. Consequently, fuel treatments in western Oregon are unlikely to encounter wildfire or modify fire behavior.

The 2008 Northern Spotted Owl Status Review states "the review panel could not agree on a clear direction for managing the dry forests of the Klamath Mountains because of limited information about the natural variability and changes in the landscape ecology of these forests, … Scientists also expressed concerns about a shortage of province-relevant science, relative to fire ecology and owl biology."[9] In spite of these uncertainties, the agencies are planning large scale fuel reduction efforts in mature forests

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[5] 1993 FEMAT Report page IV-35.

[6] Keeley, J.E.; Aplet, G.H.; Christensen, N.L.; Conard, S.C.; Johnson, E.A.; Omi, P.N.; Peterson, D.L.; Swetnam, T.W. 2009. Ecological foundations for fire management in North American forest and shrubland ecosystems. Gen. Tech. Rep. PNW-GTR-779. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. 92 p. http://www.fs.fed.us/pnw/pubs/pnw_gtr779.pdf

[7] U.S. Fish and Wildlife Service. 2008. Final Recovery Plan for the Northern Spotted Owl, *Strix occidentalis caurina*. U.S. Fish and Wildlife Service, Portland, Oregon.

[8] USDA, USDI 1998. South Cascades Late Successional Reserve Assessment. http://www.fs.fed.us/r6/frewin/projects/lsr/227/

[9] USFWS 2008. Final Recovery Plan for the Northern Spotted Owl, *quoting* the 2008 SEI Status Review.

in western Oregon. To justify such efforts, agencies should make a showing that forests are in fact threatened by fire, that fire is likely to occur, that fire effects will be significant and adverse to the values that we seek to conserve, such as spotted owls, and that the comparative effects of proposed fuel reduction logging are more beneficial or more benign than fire. The agencies have not made these showings and available evidence indicates that such a showing cannot be made.

## The likelihood of wildfire in Oregon is overstated.

Calls for increased fuel reduction logging are premised in part on the idea that wildfires are increasing in extent and intensity, but this may not be the case. The extent of fires in the 1920s through 1940s in the western U.S. was relatively high compared to recent periods.

The following figure shows total acreage burned in the U.S. in all vegetation cover types.[10]

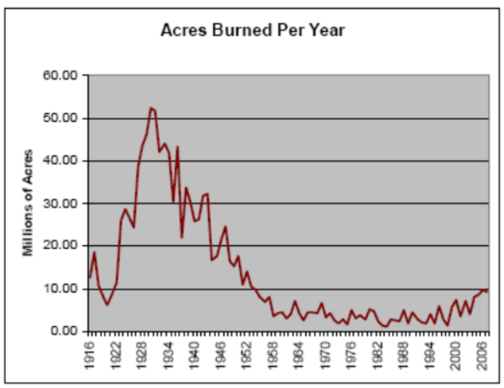



*Figure 1. Total Acreage burned*

Birdsey & Lewis (2002) showed wide decadal variation in the average area of forest land damaged by wildfire in Oregon from 1916-1997. [11]

| **Historic Fire Occurrence in Oregon** (in thousands of acres) | |
|---|---|
| 1916-1938 | 177.9 |
| 1939-1953 | 79.6 |
| 1954-1963 | 36.1 |
| 1964-1977 | 64.9 |
| 1978-1987 | 159.6 |
| 1988-1997 | 136.9 |

[10] USDA 2008. DRAFT National Report on Sustainable Forests – 2010. http://www.fs.fed.us/research/sustain/2010SustainabilityReport/documents/draft2010sustainabilityreport.pdf

[11] Birdsey, Richard A.; Lewis, George M. 2002. Current and Historical Trends in Use, Management and Disturbance of United States Forest Lands. IN: Kimble, John et al. (eds.), The Potential of U.S. Forest Soils to Sequester Carbon and Mitigate the Greenhouse Effect. Boca Raton, Florida: CRC Press. XXX p. [from Table 18a]
http://www.fs.fed.us/ne/global/pubs/books/fslulc2/chapter02.html
http://www.fs.fed.us/ne/global/pubs/books/fslulc2/lu_english/table18a.html

The recent increasing trend in acres affected by wildfire must be placed in historic context. When there is a deficit of fire on the landscape due to fire exclusion, a period of increased wildfire activity is not necessarily adverse to ecosystems that are adapted to fire. Current levels of fire are still less than historic levels of wildfire.[12] And we must keep in mind that some high severity fire is natural and beneficial.[13] See the subsection below about the adverse effects of wildfire being overstated.

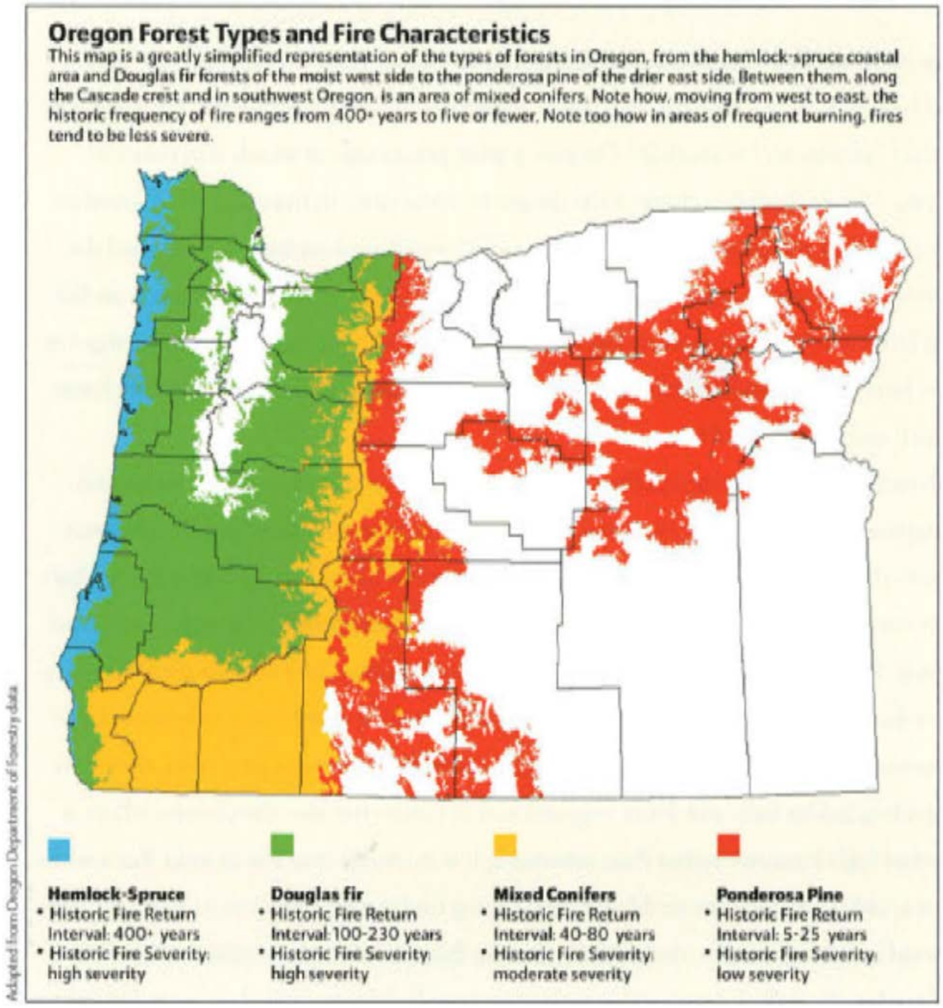
The economic cost of fire suppression activities is clearly increasing and that may be as much a function of increasing population in the wildland urban interface, the fear-based human response to fire, and the fact that financial controls during fire suppression efforts are lacking so there it too little incentive to conserve scarce public money.

### The probability of wildfire occurrence is too low to justify significant logging.

Stand replacing wildfire is a natural process in Oregon's forests and remains a rare event. Western Oregon generally has intermediate or longer fire return intervals. The mere existence of numerous live old trees within a stand is a strong indicator of *de facto* long stand replacing fire return intervals.

[12] Bailey, John. 2010. More frequent fires could aid ecosystems. OSU Press release 2-24-10. http://oregonstate.edu/ua/ncs/archives/2010/feb/more-frequent-fires-could-aid-ecosystems (Fires were more prevalent historically than currently and could be more of a partner in shaping ecosystems, instead of an enemy).

[13] Hutto, Richard L.; Conway, Courtney J.; Saab, Victoria A.; Walters, Jeffrey R. 2008. What constitutes a natural fire regime? Insight from the ecology and distribution of coniferous forest birds in North America. Fire Ecology. 4(2): 115-132. http://www.treesearch.fs.fed.us/pubs/31902; Mark E Swanson, Jerry F Franklin, Robert L Beschta, Charles M Crisafulli, Dominick A DellaSala, Richard L Hutto, David B Lindenmayer, and Frederick J Swanson 2010. The forgotten stage of forest succession: early-successional ecosystems on forest sites. Front Ecol Environ 2010; doi:10.1890/090157.

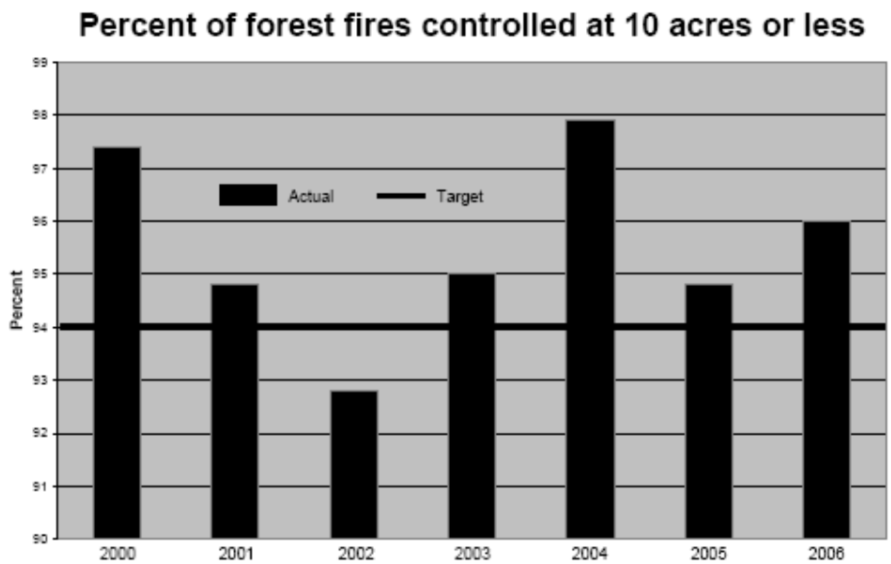



OFRI. Fire in Oregon's Forests.
http://www.oregonforests.org/assets/uploads//Fire_Oregons_Forests.pdf

## Fuel treatment efficacy is related to *actual* fire frequency, not *historic* fire frequency.

State and federal agencies still maintain policies of aggressive fire suppression[14] which continue to modify fire regimes, especially in the checkerboard ownership pattern that covers much of western Oregon. Given this, the probability of a wildfire interacting with fuel treatments in western Oregon is relatively low.

[14] ORS 477.005 "Policy. (1) … the prevention and suppression of forest fires hereby are declared to be the public policy of the State of Oregon. (2) (a) … the primary mission of the State Forestry Department in such a system is protecting forest resources, second only to saving lives. Structural protection, though indirect, shall not inhibit protection of forest resources; …"




The Fire Program seeks to put out 94 percent of all wildfires at 10 acres or smaller. This performance measure has been exceeded six of the past seven fire seasons, including some, such as 2006, with unusually severe fire danger.
http://www.oregon.gov/ODF/PUBS/docs/Backgrounder_Fire_Program.pdf

## The "big flaw" in most existing research is the assumption that fire is a certainty.

Roloff et al (2005) recommend an aggressive landscape scale program of fuel reduction in southwest Oregon in order to protect spotted owl habitat from fire. Unfortunately, instead of estimating and modeling a realistic probability of fire occurrence based on the evidence from local fire return intervals, the authors assumed a 100% chance of wildfire under extreme weather conditions in the time period soon after fuel reduction treatments. Roloff modeled 16 ignition points within the study area which burned 8 hours/day for 5 days, and they "modeled fire behavior under extremely volatile wind and moisture conditions."[15] The adverse effects of thinning versus the benefits of fire hazard reduction cannot be accurately weighed unless the fire affects are properly discounted to reflect their actual likelihood of occurrence.

Similar methodological problems plague many other studies[16] as well as agency NEPA analyses. In a study about the California spotted owl Lee (2005) said "lethal fire simulations produced a pronounced and lasting negative effect. Our analysis supports the hypothesis that habitat needs for owl reproduction can be incorporated in developing

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[15] Roloff GJ, Mealey SP, Clay C, Barry J, Yanish C, Neuenschwander L. 2005. A process for modeling short- and long-term risk in the Southern Oregon Cascades. Forest Ecology and Management 211(1-2):166–190. This study also used forest "edge," such as that created by logging, as an indicator of prey abundance, which is scientifically debated, and the study focused on owl "core areas" which may have ignored adverse habitat modification outside of owl cores. In short, the authors over-estimated the negative effect of fire and under-estimated the negative effect of logging.

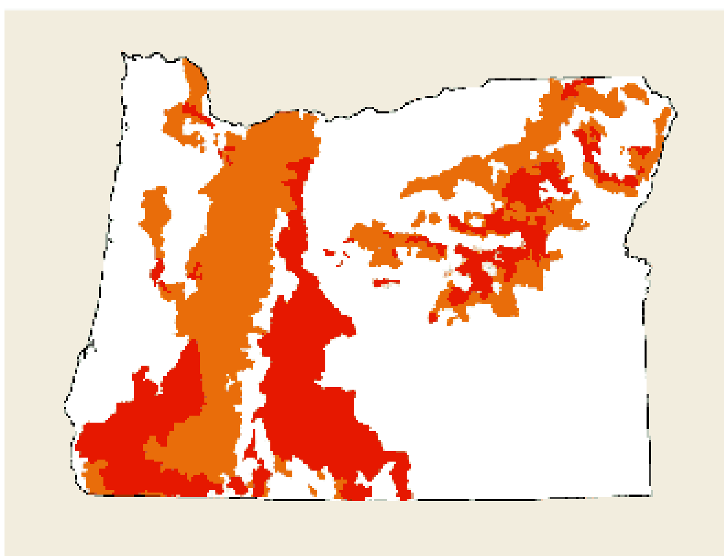
[16] Lee D.C., and Larry L. Irwin 2005. Assessing risks to spotted owls from forest thinning in fire-adapted forests of the western United States. Forest Ecology and Management 211 (2005) 191–209. http://www.srs.fs.usda.gov/pubs/ja/ja_lee010.pdf.

effective fire and fuels management strategies that lessen the chances of uncharacteristic wildfire.” However, this study assumed 100% chance of wildfire in the second decade after fuel treatments, and failed to account for the adverse effects of “captured mortality” on the habitat quality for spotted owls and their prey.

## The threat of fire is overstated.

The agencies often use “Fire Regime Condition Class” (FRCC) to identify areas that are “departed” from historical conditions and therefore at greater risk of losing both human values and resource values.[17] FRCC is a measure of increasing departure from natural disturbance regimes. Departure may be caused by either too much logging or too little fire, but fire in the primary focus of this metric.

According to the Oregon Forest Resources Institute “Nearly a century of fire suppression in Oregon has allowed the growth of a naturally dense understory vegetation–particularly in the pine forests of the drier east side and southwestern corner of the state–and placed them at considerably higher risk of fire today. Some 39 percent of Oregon’s forestlands is at high risk of uncharacteristically intense fire (condition Class 3) [show in red in the figure below]. About 45 percent is at moderate risk (Condition Class 2) [show in orange in the figure below]. Only 16 percent is within or near its historical condition.”[18] “Today, about 10 million acres — more than a third of Oregon’s forests — are at high risk of uncharacteristically intense wildfires.”[19]



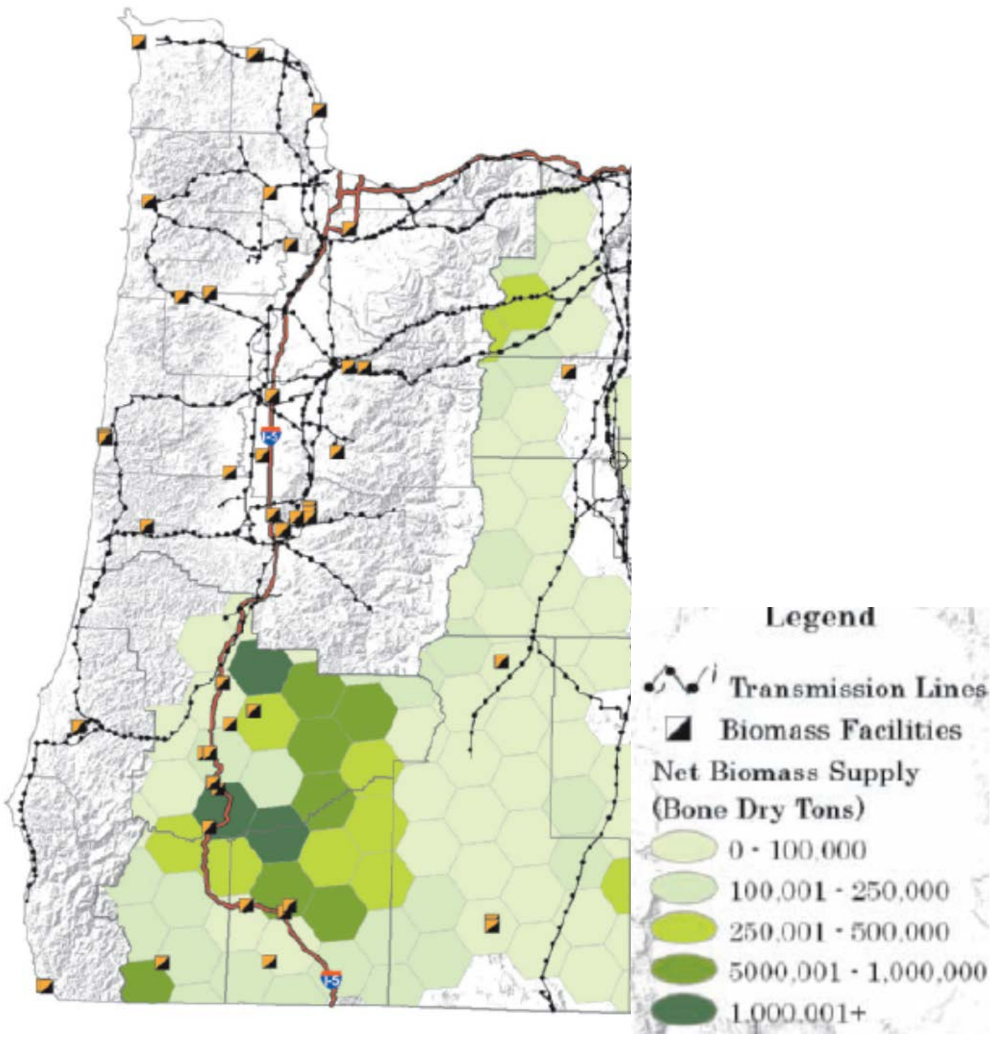
http://factbook.oregonforests.org/Fire/FireRiskClass.html

[17] Interagency Federal Wildland Fire Policy Review Working Group 2001. Review and Update of the 1995 Federal Wildland Fire Management Policy. January 2001. http://www.nwcg.gov/branches/ppm/fpc/archives/fire_policy/history/index.htm. http://www.frcc.gov

[18] http://factbook.oregonforests.org/Fire/FireRiskClass.html

[19] OFRI. Forest Fire Risk & Restoration. http://www.oregonforests.org/assets/uploads//Fire_Risk_Restore.pdf

"An analysis by The Nature Conservancy of the most recent forest health data suggests that, of the 34 million acres of forests and woodlands in Oregon, more than 25 million acres need active treatment - thinning, controlled burning or both - to restore safer and more natural conditions. More than 15 million of these acres are on public land."[20] Some people are describing Oregon as the "Saudi Arabia of biomass"[21] and there seems to be strong interest in fostering a biomass industry in southwest Oregon to extract millions of tons of biomass feedstock from the forest with fire risk reduction as an alleged side-benefit.




OFRI. 2007. WOODY BIOMASS ENERGY - A Renewable Resource to Help Meet Oregon's Energy Needs http://www.oregonforests.org/assets/uploads//Woody_Biomass.pdf

[20] Allyn Ford and Russell Hoeflich. In My Opinion - Restoring Healthy Forests. On common ground in Oregon's forests. The Oregonian. April 2007. http://portland.indymedia.org/en/2007/04/356958.shtml

[21] Joe Brugger. 2009. Power lurks in Oregon forests. The Oregonian. June 25, 2009 *quoting* Ray Wilkeson, spokesman for the Oregon Forest Industries Council.
http://www.oregonlive.com/environment/index.ssf/2009/06/power_lurks_in_oregon_forests.html

# The adverse effects of wildfire are over-stated.

## Areas where fire is excluded are not always at greater risk of fire.

A widely accepted working model of western forests holds that the exclusion of fire causes fuels to build up and fire severity to increase. This hypothesis is widely accepted by the agencies to justify logging to reduce fire hazard. However, fire severity in many forests, including those in the Klamath Province of southwest Oregon may in fact be reduced by forest growth and the absence of fire. This is thought to be a result of the fact that as time passes, forests grow and canopy cover tends to increase which helps suppress the growth of hazardous ladder fuels.[22] With thick bark, high canopies, cool-moist microclimate, and deep roots, older forests have a self-reinforcing tendency to persist, sometimes described as "ecological inertia." Odion et al (2010) found

> … several reasons why forests in the study region become less pyrogenic with TSF [time since fire] and with stand age. Understorey shrubs and small conifers are increasingly excluded by the forest canopy (Azuma, Donnegan & Gedney 2004). Closed forests also have a microclimate that is less favourable to fire (Countryman 1955). Larger trees and fallen logs act as heat sinks during fires (Azuma, Donnegan & Gedney 2004). Biomass that is most available to flaming combustion, canopy foliage and fine wood on the forest floor, may reach equilibrium (Jenny, Gessel & Bingham 1949; Kittredge 1955; Waring & Schlesinger 1985), but support lower fire severity because the height of the canopy above the forest floor increases (Azuma, Donnegan & Gedney 2004). Tanoak and other hardwoods have also been associated with low fire severity in long-unburned stands in the study region (Azuma, Donnegan & Gedney 2004; Odion et al. 2004). Hardwoods in the oak family often have high lignin content and have generally been found to be much less pyrogenic than conifers (Mutch 1970; Williamson & Black 1981; Rebertus, Williamson & Moser 1989; Pausas et al. 2004).)
> …
> … [O]ur results conflict with assumptions regarding fire-prone forested landscapes of the study region (Spies et al. 2006) and western United States of America that fire exclusion leads to more pyrogenic forests, increasing the probability of high-severity fire. Current management based on these prevailing views, such as thinning forest stands, constructing fuelbreaks and establishing plantations after fire, does not address the rapid decrease in fire-dependent sclerophyll vegetation and changes to forests that are caused by fire exclusion in the study region. Addressing the ongoing effects of fire exclusion will require a better understanding of these effects. It will also require that society develop a less adversarial relationship towards fire and adapt to better accommodate its natural role in shaping vegetation and biodiversity (Jensen & McPherson 2008; Baker 2009). Managing for ecological processes, which have shaped vegetation and biodiversity, is consistent with conservation objectives in the Klamath region (Taylor & Skinner 1998; DellaSala 2006) – a renowned centre of vegetation and floristic diversity in western North America (Whittaker 1961; DellaSala et al. 1999).[23]

Fire-regime condition-class (FRCC) is typically used by the agencies to justify thinning, by highlighting forests that have missed fire cycles and may be suffering from fire exclusion. In this respect, increasing departure from the natural disturbance regime merely means that the forest has had more time to grow since the last fire, and the

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[22] Odion, D.C., E.J. Frost, J.R. Strittholt, H. Jiang, D.A. DellaSala and M.A. Moritz. 2004. Patterns of fire severity and forest conditions in the western Klamath Mountains, California. Conservation Biology 18(4): 927-936. http://nature.berkeley.edu/moritzlab/docs/Odion_etal_2004.pdf

[23] Odion, D.C., M.A. Moritz, and D.A. DellaSala. 2010. Alternative community states maintained by fire in the Klamath Mountains, USA. Journal of Ecology 98: 96-105. http://nature.berkeley.edu/moritzlab/docs/Odion_etal_JOE_2010.pdf.

agencies assume that this causes fire hazard to increase, which may or may not be true. Forest growth may cause either higher or lower fire hazard.

| **Column A – Factors indicating increased fire hazard as a result of forest growth** | **Column B – Factors indicating to decreased fire hazard as a result of forest growth** |
|---|---|
| Increased tree mortality; Increased surface fuels; Increased growth of shade tolerant ladder fuels; Increased canopy bulk density; Increased fuel continuity. | Taller trees with higher canopies out of the way of surface fire; Self pruning of lower branches that raises canopy base height; Trees with thicker bark; Increased canopy cover that suppresses growth of surface and ladder fuels; Increased canopy cover that reduces temperatures in the understory; Increased canopy cover that reduces wind speed; Increased canopy cover that increases humidity; Increased canopy cover that maintains fuel moisture; Mortality and canopy gap dynamics that increase spatial heterogeneity and discontinuity of fuels. |

If the goal is to reduce fire hazard in stands that are "departed" from natural disturbance regimes and expected to experience uncharacteristically high fire severity, the agencies need to know whether the factors listed in column A and B above effectively cancel each other out, or if the factors in one column outweigh the other. The agencies lack tools to reliably integrate the fire hazard analysis across all these factors.

Those who rely on FRCC to justify logging to reduce fuels and control fire often fail to read the fine print in the FRCC documentation which says that in "highly departed" landscapes disturbance can be "more or less severe."[24] In forests where fire exclusion leads to reduced fire hazard, such as southwest Oregon, the risk of losing forest values to fire is reduced. This significantly undermines the utility of FRCC as a tool to set priorities for fuel treatment.

## When wildfire does occur, it is more likely to be low or moderate severity, rather than high severity.

Wildfire severity can be high, moderate, or low. Fire exclusion and fuel build-up are commonly assumed to increase the severity of future fires. While the effect may be real in some cases, the effect seems to be highly exaggerated. Available evidence shows that low or moderate severity fire continue to be far more prevalent than high severity fire.

A recent study reviewed fire records in conifer forests in dry provinces of the Northwest Forest Plan and found that the proportion of area burned and the severity of fire has not changed significantly over the last two decades. In the Klamath Provinces the percentage of high severity fire in recent decades has remained at or below 25% of the

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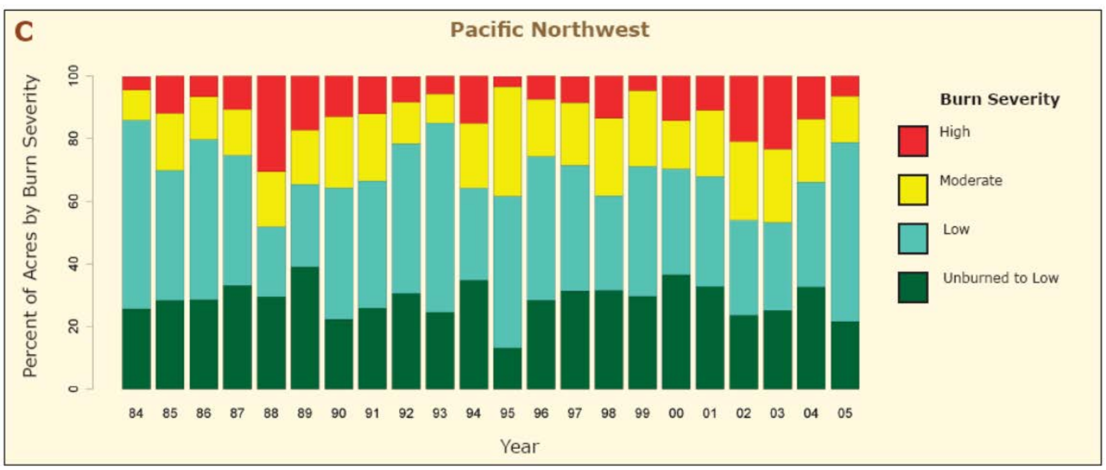
[24] National Wildfire Coordinating Group. 2003. Fire Regime Condition Class Definition http://www.nwcg.gov/teams/wfewt/message/FrccDefinitions.pdf

annual acres affected by fire.[25] A recent US Forest Service review found that under reasonable fire-weather conditions only about 5-15% of the Oregon forest landscape would likely experience active crown fire and therefore "the fuels management challenge may be more tractable than has been assumed."[26]

A government program called "Monitoring Trends in Burn Severity" (MTBS) conducted an analysis of trends in burn severity in the Northwest over the last 20 years found that "there is a [statistically] significant increase in average fire size between 1984-1999 and 2000-2005 [yet] there is still no trend toward higher burn severity… MTBS data does not support the assumption that wildfires are burning more severely in recent years." The majority of fire effects remain low severity and the proportion of high severity fire is not showing an increasing trend, therefore one could conclude that the increased incidence of fire on the landscape is just a re-establishment of a natural process.

> The majority of area burned falls within the unburned to low severity range, with relatively low annual variation in these severity classes. The high and moderate severity classes show higher relative variation between years, suggesting that these classes may be most influenced by variation in climate, weather, and seasonal fuel conditions. …
>
> **Percentage of Area by Burn Severity–PNW & PSW**
>
> • 28 percent—unburned to low severity
> • 36 percent—low severity
> • 21 percent—moderate severity
> • 15 percent—high severity
>
> …




> …
>
> The Unburned-to-Low and Low severity classes are also interesting because their proportions are relatively stable from year to year. The Unburned-to-Low class averages approximately 28 percent of the burned area with only ±6 percent variation from year-to-year (one exception in 1995) for the entire data record. This compares with the high severity class, which averages 15 percent of the area with ±11 percent variation. Also, in 82 percent of the years the combination of the Unburned-to-Low and Low severity classes was 60 percent of the burned area. The lower end of the burn

[25] Hanson, C.T., D.C. Odion, D.A. DellaSala, and W.L. Baker. 2009. Over-estimation of fire risk in the Northern Spotted Owl recovery plan. Conservation Biology 23:1314–1319.

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

> severity spectrum appears to be fairly consistent across the data record and regularly comprises a majority of the burned area.[27]

Low and moderate fire severity still dominate and those fires are essentially thinning from below but without building roads or removing as much ecologically valuable large wood. Natural fire is not a problem, but may be a solution to decades of fire suppression.

## Climate Change has not altered fire behavior enough to justify aggressive fuel treatments.

Global warming is expected to increase evaporative demand, increase seasonal soil-water deficit, likely resulting in longer fire seasons and more wildfire.[28] When and if climate change causes fire to be much more frequent or causes fire severity to significantly increase, then fuel reduction efforts may be more justified, but evidence does not show these effects yet. Scientists should be working to identify the thresholds at which climate effects can be identified and well-considered responses planned.

Forests in western Oregon have for millennia experienced annual dry summers, decadal climate variation, and fire effects that consequently vary on short and long time scales. That these forests maintain relatively high biomass in spite of these dynamics, implies some level of inherent resilience to climate change and modified fire regimes. Fuel reduction decisions should be based on evidence of actual fire frequency and fire behavior, and climate change does not appear to have dramatically shifted fire behavior.

## Owl habitat is not always destroyed by wildfire.

Spotted owls of course evolved with fire and they still use forests that have recently burned. Hanson et al (2009) point out that

> Fire has been incorrectly perceived as a risk to NSO [northern spotted owl] when in fact it may be a key source of habitat heterogeneity required by the NSO in parts of its range (Franklin et al. 2000) … Natural heterogeneity from mixed-severity fires may also offer some insurance against unexpected disturbance or severe effects of climatic change.[29]

Studies show that (1) spotted owls return to sites where the majority of the territory has burned;[30] (2) low severity fire in nesting, roosting, foraging habitat appears to benefit spotted owl occupancy and colonization; and (3) nesting, roosting, foraging habitat is used more frequently than random sites even after it has experienced moderate or high

[27] MTBS: Monitoring Trends in Burn Severity: Report on the Pacific Northwest and Pacific Southwest Fires (1984 to 2005). http://mtbs.gov/reports/MTBS_pnw-psw_final.pdf

[28] Westerling, A.L., H.G. Hidalgo, D.R. Cayan, and T.W. Swetnam. 2006. Warming and Earlier Spring Increase Western U.S. Forest Wildfire Activity. Science 313:940-943.

[29] Hanson, C.T., Odion, D.C., Dellasala, D.A., and W.L. Baker. 2009. More-Comprehensive Recovery Actions for Northern Spotted Owls in Dry Forests: Reply to Spies et al. Conservation Biology, Volume 24, No. 1, 334–337.

[30] 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.

severity fire.[31] Bond et al (2009) looked at the effects of wildfire on California spotted owls and found that they "used all severities of burned forest for nesting, roosting, and foraging during the breeding season 4 years after a large forest fire. … After accounting for distance, spotted owls selected burned areas for foraging over unburned forest, with the greatest selection for high-severity burned areas." Salvage logging would likely erase the benefits or exacerbate the negative effects of fire.[32]

## Logging is a greater threat to habitat than fire.

In their search for timber volume to meet mandated timber targets, the agencies appear to have grand plans to log spotted owl habitat to save it from fire. Examples include:

- Umpqua National Forest's Cow Creek HFRA Project which originally proposed to commercially log up to 6,000 acres of suitable spotted owl nesting, roosting, foraging habitat to reduce the risk of fire;
- Roseburg BLM's Collaborative Forestry Pilot Project which proposes to log suitable owl habitat to reduce the risk of fire and which may be scaled up to produce "substantial timber volume" to meet BLM annual timber targets; and
- Medford BLM's 2008 Biological Assessment indicates an intent to degrade 23,400 acres of nesting, roosting, foraging habitat "[T]erminology has been changed in recent consultations from 'degrade' because 'degrade' erroneously implies a negative change to the habitat … Many of these treatments would have long-term beneficial effects in reducing fire risk and making post-treatment stands more ecologically healthy and sustainable."[33]

A recent multi-agency Biological Assessment for federal forest projects in southwest Oregon says —

> Fuels reductions can have short-term adverse impacts on prey species … Reduction of understory fuels is designed to reduce long-term wildfire risks. … Lower wildfire risk is a benefit to future owl habitat and recovery … The Action Agencies anticipate the removal or downgrade of up to 32,040 acres of suitable spotted owl habitat over the next 3 years … Fuels projects in suitable habitat (12,118 acres, 11,910 from BLM) may also degrade suitable habitat in the short term but may help to maintain the habitat over the long term. … A dispersal stand which resulted from the downgrade of NRF habitat would begin to reclaim the pre-treatment canopy cover within 25-40 years, depending on treatment type, plant association …[34]

[31] 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.

[32] Bond, Lee, Siegel, Ward 2009. Habitat Use and Selection by California Spotted Owls in a Postfire Landscape. Journal of Wildlife Management 73(7):1116–1124; 2009.

[33] Medford BLM District Analysis and 2008 Biological Assessment for Forest Habitat. DA 08 BAFH. http://www.blm.gov/or/districts/medford/plans/files/baoct08.pdf. Medford BLM 2007. Medford BA on Activities that will Maintain Spotted Owl Habitat http://www.blm.gov/or/districts/medford/plans/files/07NLAABA.pdf

[34] Rogue River/Siskiyou NFS, Medford BLM FY 2006-2008 Programmatic Biological Assessment For the Reinitiation of Consultation on Activities that May Affect Listed Species in the Rogue River/South Coast Province, revised August 2, 2006 http://www.blm.gov/or/districts/medford/plans/files/fy0608ba.pdf

The agencies assume that fire is a significant threat to habitat,[35] but in reality more acres of spotted owl habitat are removed by logging than by fire. During the first ten years after the adoption of the Northwest Forest Plan more spotted owl habitat was removed by logging on federal lands (156,000 acres) than was removed by wild fire on both federal and non-federal lands (141,000 acres).[36] In addition, natural successional processes are recruiting mature forest faster than it is being lost to wildfire. Old forest appears to be recruiting at 5-10 times the apparent rate of loss to high-severity fire in the Klamath Provinces.[37]

## Where fire return intervals are long, forests are unlikely to benefit from modified fire behavior.

Fire is inherently unpredictable in terms of its location, timing, and intensity. No one can say whether any given forest stand will be affected by severe wildfire during the relatively short period that fuel treatments may influence fire behavior (before fuel regrows).

The agencies' proposals to log mature forest that offers suitable habitat for the spotted owl is based on a stated intent to protect habitat from fire. However, The efficacy of logging spotted owl habitat to save it from fire does not hold up under scrutiny. Except in areas with frequent fire, the likelihood of habitat benefits from fire risk reduction are low, while the likelihood of harming habitat by logging is high. This issue has apparently not been adequately explored by scientists studying spotted owls and fire, but research in other areas can be instructive.

A recent study by Mitchell & Harmon (2009) attempted to compare the relative carbon emissions from fuel reduction logging versus wildfire while accounting for the carbon "conserved" via reduced fire severity. Their modeling showed, perhaps counter intuitively, that carbon emissions from wildfire in the absence of fuel reduction logging are generally less than the carbon emissions from fuel reduction logging. The exception is when only the smallest fuels are removed from forests with the most frequent fire

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[35] Cori Francis, Silviculturist, USDI Bureau of Land Management, Grants Pass, OR. Powerpoint. Stand Response to Vegetative Treatments Long term owl habitat development and fire risk. FWS Workshop, Managing Northern Spotted Owl Habitat in Dry Forest Ecosystems.
http://www.fws.gov/oregonfwo/ExternalAffairs/Topics/DryForestWorkshop/Documents/2006/PowerPoints/francis.pdf ("Federal land: fire is the #1 threat to habitat.")

[36] U.S. Department of the Interior, Fish and Wildlife Service. 2004. Estimated Trends in Suitable Habitat for The Northern Spotted Owl (Strix occidentalis caurina) on Federal Lands from 1994 to 2003. For Use By: Sustainable Ecosystems Institute for the Northern Spotted Owl 5-year Review. USDI Fish and Wildlife Serv.; 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.

[37] Hanson, C.T., Odion, D.C., DellaSala, D.A., and W.L. Baker. in press. Overestimation of fire risk in Northern Spotted Owl Recovery Plan. Conservation Biology (in press) http://nccsp.org/press/media-releases/Overestimation%20of%20Fire%20Risk%20in%20the%20NSO%20Recovery%20Plan.pdf;. Moeur, M., et al. 2005. Status and trend of late-successional and oldgrowth forest. General technical report PNW-GTR-646. http://www.fs.fed.us/pnw/publications/pnw_gtr646/

regimes).[38] There is a direct and compelling analogy to logging spotted owl habitat to save it from fire. Since the location, timing, and severity of wildfire cannot be predicted, fuel reduction logging would necessarily need to occur on many acres that will not burn during the period before fuels regrow within treated areas. Thus many "extra" acres of habitat will be treated unnecessarily, degrading far more habitat than would benefit from fuel treatments.

Fuel treatments cannot be perfectly timed or located in anticipation of fire, so to assure effective modification of fire behavior fuel treatments must be spatially extensive and ongoing. Modeling shows that for every unit of forest that receives a mechanical fuel treatment, 10 to 100 additional units will be treated but not experience fire.[39] Habitat degradation on the many acres treated unnecessarily, likely far outweighs habitat benefits on the few acres where treatments interact with fire. The agencies need better ways of accounting for these complex trade-offs. The current shortage of old forest is acute and the spotted owl remains threatened, so all remaining habitat needs to be conserved, even forests that have been subject to fire exclusion and may have missed a fire cycle or two.[40]

Even strategically placed fuel reduction efforts will treat many areas unnecessarily with only limited effects on fire. In modeling fire effects in spotted owl habitat in the east Cascades of Oregon Ager et al (2007) "observed a non-linear decrease in the probability of habitat loss with increasing treatment area. Fuels treatments on a relatively minor percentage of the forested landscape (20%) [outside of spotted owl habitat] resulted in a 44% decrease in the probability of spotted owl habitat loss averaged over all habitat stands."[41] This sounds promising, but 20% and 44% are not comparable figures — 20% describes the whole landscape, and 44% describes the probability of owl habitat loss on a fraction of the landscape. Degrading 20% of the landscape through fuel reduction probably represents far more acres and likely far more negative effects on spotted owl habitat than is represented by the 44% decrease in owl habitat loss from fire. This study did not appear to consider the potential benefits of fire or the adverse effects of fuel reduction on spotted owls.

Similarly, fuel breaks may be justified. At a small scale, fuel breaks are ineffective – representing best guesses about where future fires and fire suppression activities might

[38] Mitchell, Harmon, O'Connell. 2009. Forest fuel reduction alters fire severity and long-term carbon storage in three Pacific Northwest ecosystems. Ecological Applications. 19(3), 2009, pp. 643–655 http://ecoinformatics.oregonstate.edu/new/FuelRedux_FS_CStorage_Revision2.pdf. Reinhardt, E., and Lisa Holsinger 2010. Effects of fuel treatments on carbon-disturbance relationships in forests of the northern Rocky Mountains. Forest Ecology and Management 259 (2010) 1427–1435.

[39] Personal communication with John Campbell, OSU Research Associate, April 2010. See also Mitchell et al (2009).

[40] USFWS 2008. Final Recovery Plan for the Northern Spotted Owl. ("The Final Recovery Plan may call for higher levels of dense late-successional and old forest than historically occurred in many dry forest landscapes. … This means that landscape management objectives may target levels of dense old forest that are on average difficult to retain in dry forest environments in the long term (100 years +), even though required by management policy.")

[41] Ager, Alan A., Mark A. Finney, Becky K. Kerns, Helen Maffei. 2007. Modeling wildfire risk to northern spotted owl (Strix occidentalis caurina) habitat in Central Oregon, USA. http://www.fs.fed.us/wwetac/projects/PDFs/Ager_etal_2007.pdf

occur.[42] Fuel breaks are likely unjustified at a large scale because their construction and maintenance would cause unacceptable impacts on soil, water, carbon, weeds, and habitat for fish and wildlife habitat, including the spotted owl and other listed species. The South Cascades LSR Assessment reveals that implementing a network of 400 foot wide fuel breaks in just one Late Successional Reserve on the Umpqua National Forest would involve significant degradation of spotted owl habitat.

> There are approximately 16,000 acres within a 400 foot wide strip centered on the ridges which delineate the recognized subbasins on the Umpqua portion of LSR 222. Full implementation of the fuel break prescription in all high and moderate fire risk acres in that strip would result in a total of approximately 13,500 acres being treated. Of that 13,500 acres of moderate and high fire risk, 7500 acres are currently considered to be suitable NRF habitat[43]

At a time when the spotted owl is facing increasing competition from the barred owl, it is unwise to remove habitat based on such speculative benefits. Reducing habitat will increase adverse competitive interactions and decrease the chances that these two owls can co-exist.[44] The agencies' NEPA analyses should carefully account for the real probability of fire encountering fuel treatments, as well as the full environmental impacts and expense of large-scale fuel treatments.

## Fuel reduction is pointless when fire events are weather-mediated.

Wildfires in western Oregon tend to be more strongly influenced by weather conditions than they are by fuel conditions. Littell et al (2009) showed that

> … year-of-fire climate is the strongest influence on area burned in forested ecosystems, but fire size may be limited secondarily by fuel continuity between or within forest stands … in lower-elevation forests characterized by surface fires, ...
> … The variance explained by climate implies that fuel treatments, for example, might be tailored to specific ecosystems and climate–fire relationships. Recognizing that most ecoprovinces have significant ecological variability, climate-limited ecoprovinces may be less influenced by fuel treatment than fuel-limited ecoprovinces (at least for area burned, if not fire severity).[45]

There is only a small subset of fires that will interact favorably with proposed treatments. Fuel reduction will have little or no beneficial effect on low-severity fires (which are largely controlled by weather favoring subdued fire behavior) or high-severity fires (which are largely controlled by weather favoring extreme fire behavior). The evaluation of proposed fuel treatments must account for the relatively low likelihood that a wildfire that is susceptible to modification by the proposed treatment will occur in the

[42] Graham, R.T., McCaffrey, S., Jain, T.B., 2004. Science basis for changing forest structure to modify wildfire behavior and severity.USDA Forest Service General Technical Report RMRSGTR-120, Fort Collins, CO, 43 pp.

[43] USDA, USDI 1998. South Cascades Late Successional Reserve Assessment. http://www.fs.fed.us/r6/frewin/projects/lsr/227/

[44] Welch, Craig. 2009. The Spotted Owl's New Nemesis. Smithsonian Magazine. January 2009. http://www.smithsonianmag.com/science-nature/The-Spotted-Owls-New-Nemesis.html?c=y&page=2. 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

[45] Jeremy S. Littell, Donald McKenzie, David L. Peterson, Anthony L. Westerling (2009) Climate and wildfire area burned in western U.S. ecoprovinces, 1916–2003. Ecological Applications: Vol. 19, No. 4, pp. 1003-1021.

treated stand during the relatively brief 10-20 year time period that fire behavior is presumed to be modified. If fire does occur, there is no assurance of a good match between the actual forest type, the actual fuel treatment (as modified by subsequent regrowth), and the actual weather conditions during the fire.[46]

# Fuel reduction logging is not benign.

## Logging for fuel reduction will degrade, not enhance, spotted owl habitat values.

The agencies' preferred approach to fuel reduction almost always involves reducing canopy fuels, which just coincidentally happen to be associated with commercially valuable trees. For instance, Roseburg BLM's suggested approach to fuel reduction includes "reduction of continuous canopies."[47] The objective of commercial thinning in mature forests in the Forest Service's Cow Creek Project is to "increase canopy spacing to decrease the risk of crown fire being carried through treated stands…" and "[p]roportional thinning would be applied to initiate or perpetuate the uneven aged structure…"[48] The Willamette National Forest's Oakridge/Westfir Thinning and Fuel Reduction Project would remove Douglas fir trees up to 30 inches dbh in order to "make stands more resistant to wind-driven crown fires by reducing canopy density."[49]

In the fuel science literature, canopy fuel reduction is not the highest priority to achieve effective modification of fire behavior.[50] Focusing on canopy fuels also raises the prospect of conflicts between financial incentives and habitat objectives.

To highlight the potential conflict between fuel reduction objectives and owl habitat objectives, consider that "fuel" is just another word for "habitat," especially when those fuels are found in mature forests that provide suitable habitat for late successional species like the spotted owl, pileated woodpecker, goshawk, Pacific fisher, and pine marten. Surface fuels provide habitat for owl prey species. Ladder fuels provide habitat for spotted owl roosting and hunting perches. Canopy fuels provide nesting and roosting habitat. Removing fuels is essentially removing habitat. Agency scientists have already

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[46] William L. Baker, Jonathan J. Rhodes. 2008. Fire Probability, Fuel Treatment Effectiveness and Ecological Tradeoffs in Western U.S. Public Forests. pp.1-7 (7). The Open Forest Science Journal, Volume 1. 2008. http://www.bentham-open.org/pages/gen.php?file=1TOFSCIJ.pdf

[47] http://www.blm.gov/or/districts/roseburg/plans/collab_forestry/files/RSBRG_Collaborative_Forestry_Pilot.pdf

[48] http://www.fs.fed.us/r6/umpqua/projects/projectdocs/cow-creek-ts-haz-fuels-red/fuels-treatment-descriptions.pdf

[49] USDA Forest Service 2009. Oakridge/Westfir Thinning and Fuel Reduction Project EA. http://www.fs.fed.us/r6/willamette/manage/nepa/current/owtfr/owtfr-ea-1.pdf

[50] Rutherford V. Platt, Thomas T. Veblen, and Rosemary L. Sherriff. 2006. Are Wildfire Mitigation and Restoration of Historic Forest Structure Compatible? A Spatial Modeling Assessment. Annals of the Association of American Geographers, 96(3), 2006, pp. 455–470. See also, Jim Agee. Risk Assessment for Decision-making Related to Uncharacteristic Wildfire, Conference Portland, Oregon Nov 17-20, 2003 http://outreach.cof.orst.edu/riskassessment/presentations/ageej_files/v3_document.htm ("Compared with the original conditions, a closed canopy would result in a 10 percent reduction in the area of high or extreme fireline intensity. In contrast, an open canopy has the opposite effect, increasing the area exposed to high or extreme fireline intensity by 36 percent. Though it may appear counterintuitive, when all else is equal open canopies lead to reduced fuel moisture and increased midflame windspeed, which increase potential fireline intensity.")

discovered that fuel reduction logging that targets commercial sized trees may conflict with both habitat objectives and fire risk reduction objectives.[51]

## Logging removes important habitat features including snags and dead wood.

In recent decades the important role of dead wood in forest ecosystems has gone from highly under-appreciated to merely neglected. Several of the definitional attributes of old-growth forests are comprised of dead wood — large snags, large down wood, and "large trees with broken tops and other indications of decadence."[52] Dead wood is important to a wide variety of focal species that live in northwest forests, including the spotted owl and its prey, salmon & trout, American marten, Pacific fisher, bats, salamanders, woodpeckers, and myriad other species that use the cavities created by woodpeckers.[53] An unavoidable effect of commercial logging is to reduce habitat values associated with snags and dead wood.

A large number of spotted owl prey species have some association with snags and down wood either as sites for denning or as substrate supporting fungal food supplies. Fuel reduction will reduce recruitment of dead trees and down wood resulting in a long-term simplification of forest structure. The Cottage Grove District's Holland Moonsalt Timber Sale EA involved more than 1,000 acres of commercial thinning of 40-50 year old stands retaining 40-90 trees per acre. The following four figures from the EA clearly show the adverse effect of logging on large and small snags and down wood and spotted owl prey species.[54]

**Table 25. Snags at 80% tolerance levels for NSO prey species**

| Species | 80% Tolerance Level<br>Number of 10 inch DBH snags per acre |
|---|---|
| Bushy-tailed wood rat | 24 |
| Douglas squirrel | 19 |
| Northern flying squirrel | 19 |
| | **80% Tolerance Level<br>Number of 20 inch DBH snags per acre** |
| Northern flying squirrel | No Data |
| All Species | 14 |

[51] U. S. Fish and Wildlife Service. 2006. Workshop Report. Silvicultural Practices Supporting Northern Spotted Owl Habitat in Dry Forest Ecosystems. November 2006. (Appendix G. Structural Component Matrix.). http://www.fws.gov/oregonfwo/ExternalAffairs/Topics/DryForestWorkshop/Documents/2006/Workshop-Report.pdf. PNW Research Station. 2006. Seeing The Bigger Picture: Landscape Silviculture May Offer Compatible Solutions To Conflicting Objectives. Science Findings. July 2006. http://www.fs.fed.us/pnw/sciencef/scifi85.pdf

[52] http://www.reo.gov/library/reports/old_growth_definitions.htm

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

[54] Umpqua NF 2009. Holland Moonsalt Timber Sale Project EA. Cottage Grove Ranger District. May 2009. http://www.fs.fed.us/r6/umpqua/projects/projectdocs/holland-moonsalt-thin/00-ea.pdf.

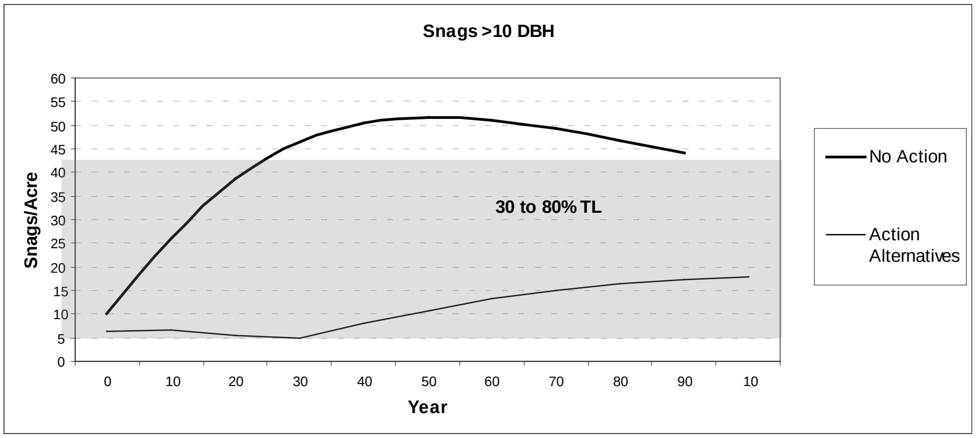


**Figure 18. Short and Long Term Changes to ≥10" Snags (Snags/Acre by Year)**

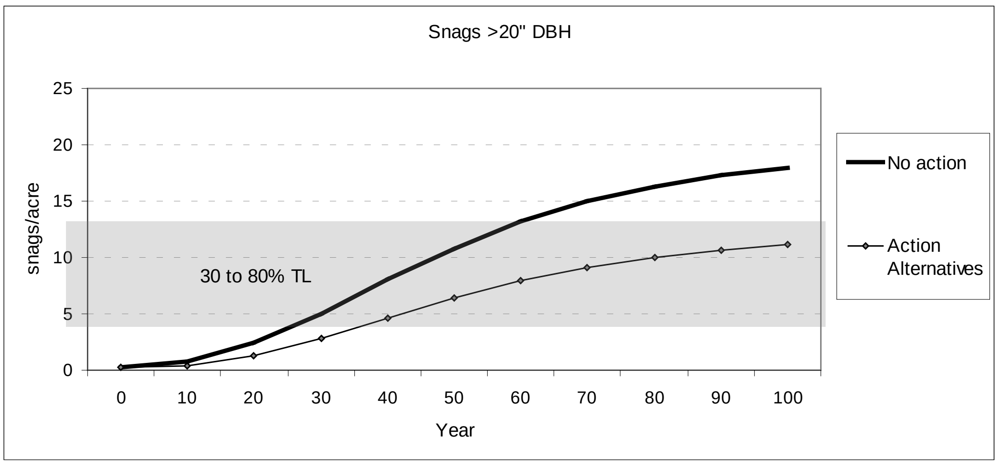


**Figure 19. Short and Long Term Changes to ≥20" dbh Snags (Snags/Acre by Year)**

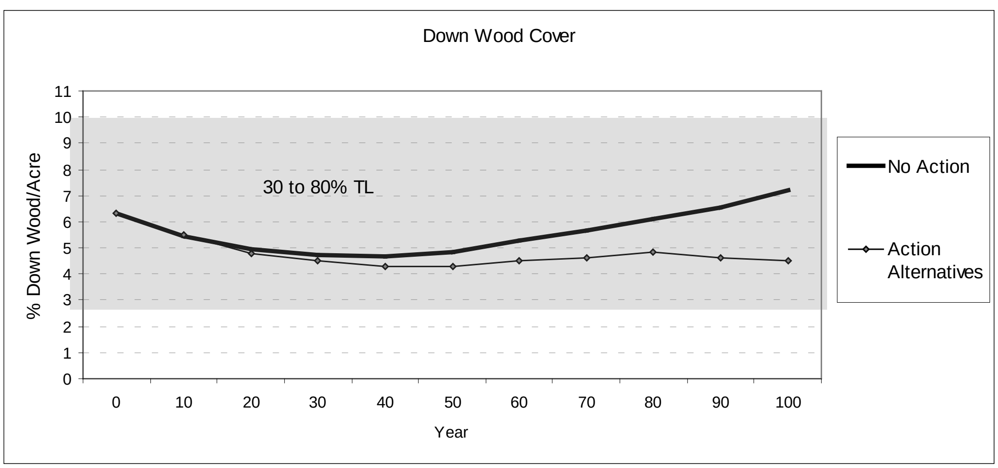


**Figure 20. Short and Long Term Changes to ≥ 6" Diameter Down Wood**

Andy Carey says that "Numerous patches of low foraging quality can have negative impacts on owl demography and behavior (Carey et al 1992)"[55] yet this is precisely what fuel reduction logging will do - "capture mortality" and degrade current and future habitat for owl prey thus reducing foraging opportunities.

The Forest Service and BLM give lip service to snags and dead wood, but their current standards are outdated. Rose et al (2001) conclude that "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."[56] Typical agency NEPA analyses still mistakenly claim that logging is beneficial to dead wood habitat in spite of compelling evidence to the contrary. This flawed and overly optimistic view of the effects of logging on dead wood permeates many facets of the agencies' NEPA analysis including recruitment of large wood into streams, snag recruitment, and effects on spotted owl prey and management indicator species. [57]

The Scientific Panel on Ecosystem Based Forest Management explained:

> The fact that dead trees and logs are as important to ecosystem function as living trees challenges traditional forestry models that treat such materials as waste, fire hazards, and mechanical impediments. To move away from ecologically simplistic models, new forest management regimes must address questions such as: How much coarse woody debris is needed? and: How many snags in various stages of decay are required? to fulfill important ecological functions.[58]

Once these questions are answered, the next question is how to provide the target level of snags and down wood when nearly all forest management activities are adverse to snag recruitment, including regen harvest, thinning, sanitation and salvage logging, fire suppression, and hazard tree removal. The answer is to make explicit plans to leave enough areas untreated (unlogged) in order to recruit natural levels of snags in certain areas in order to mitigate for logged areas where mortality is captured and diverted to economic uses.

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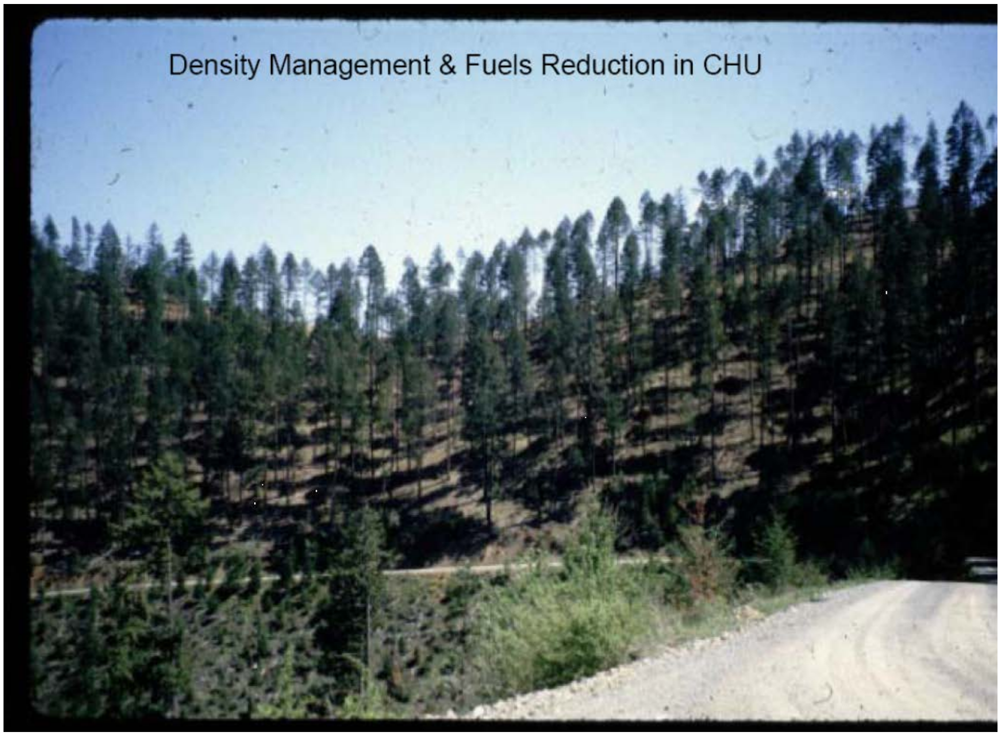
[55] Carey, A. 2004 Relationship of Prey and Forest Management. Appendix 5 pp 3-24, 3-25 *in* Courtney, SP; J A Blakesley. 2004. Scientific evaluation of the status of the Northern Spotted Owl. http://www.sei.org/owl/finalreport/finalreport.htm

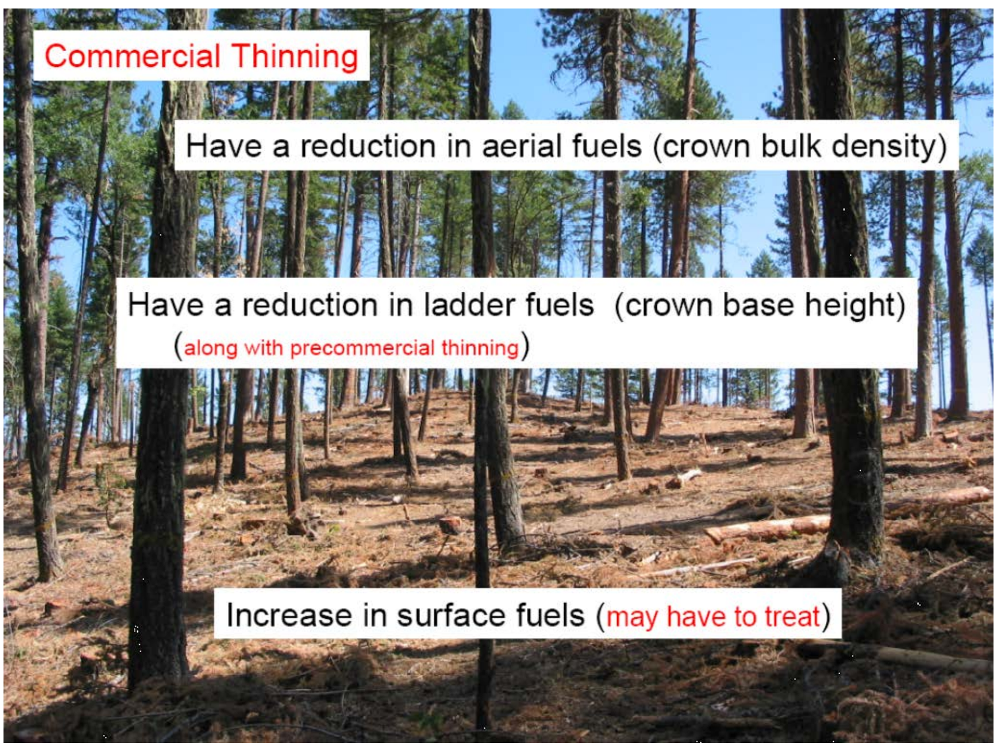
[56] PNW Research Station, "Dead and Dying Trees: Essential for Life in the Forest," Science Findings, Nov. 1999 http://www.fs.fed.us/pnw/sciencef/scifi20.pdf. Rose et al (2001).

[57] Willamette National Forest 2009. Oakridge/Westfir Thinning & Fuels Reduction Project. http://www.fs.fed.us/r6/willamette/manage/nepa/current/owtfr/owtfr-ea-all.pdf Salem BLM 2010. Highland Fling Thinning Project. http://www.blm.gov/or/districts/salem/plans/files/highland_fling.pdf, Umpqua National Forest 2010. Upper Cavitt Timber Sale. http://www.fs.fed.us/r6/umpqua/projects/projectdocs/upper-cavitt-ts/index.shtml

[58] Franklin, J.F., D.A. Perry, R. Noss, D. Montgomery and C. Frissell. 2000. Simplified Forest Management to Achieve Watershed and Forest Health: A Critique. National Wildlife Federation, Seattle, Washington. http://www.coastrange.org/documents/forestreport.pdf (citations omitted). See also Heiken, D. 2009. The Case for Protecting Both Old Growth and Mature Forests, Version 1.8. Oregon Wild. http://dl.dropbox.com/u/47741/Mature%20Forests%2C%20Heiken%2C%20v%201.8.doc

**Stands subject to fuel reduction logging like that shown in the following photos provides low habitat value for spotted owls.**




Greg Chandler, Fuels Management Specialist, USDI Bureau of Land Management, Medford, OR. Treatments and methods to manipulate stand structure.
http://www.fws.gov/oregonfwo/ExternalAffairs/Topics/DryForestWorkshop/Documents/2006/PowerPoints/Chandler.pdf

### Logging has complex effects on fire hazard and can in fact make forests more susceptible to damage by wildfire.

Due to inadequate funding and misaligned agency incentives, fuel reduction logging tends to remove commercially valuable medium and large trees which generally do not present a significant fire hazard, while leaving behind the tree tops and branches that pose the greatest hazard. Canopy removal has several problematic effects on fire hazard. It tends to dry out fuels; make the stand hotter, dryer, and windier; move small fuels from the canopy to the ground where they are more available for combustion; and make more light, water, and nutrients available to stimulate the growth of future surface and ladder fuels.[59] All these effects tend to counteract the alleged benefits of fuel reduction but they rarely receive adequate attention by the agencies during project analysis.

Among all the common fuel treatments, canopy fuel reduction via commercial thinning is the least justified. Relatively high canopy cover is typical of older stands and helps reduce canopy damage during wildfires. In the 2002 Biscuit Fire, forests with lower canopy density suffered greater canopy losses than forests with higher canopy density.[60] Mature forests experienced the lowest levels of stand replacement (32%) during the Biscuit fire, while young forests experienced the highest levels of stand replacement (>80%).[61] BLM even acknowledges that “The more canopy that would remain, the less effect wind would have on drying fuels and surface fires. This reduction in mid-flame wind speed would reduce flame length, which can lead to a reduction in tree mortality. … A lower probability of mortality equates to greater fire resiliency.”[62]

## SOLUTIONS: Fuel reduction efforts in western Oregon should focus near structures and in young stands.

### Treating dense young stands is a higher priority than treating older forests.

In forests with long fire return intervals, fuel treatments are unlikely to encounter fire regardless of stand age or condition, but there may be sound ecological justification for thinning dense *young* stands, and those treatments may have ancillary benefits in the event of wildfire. Treating fuels in dense young forests will have relatively greater effect on fire hazard and relatively less adverse ecological impacts compared to fuel reduction logging in older forests. The agencies need to develop methods of weighing the relative ecological benefits of fuel treatments minus the adverse side-effects of treatments (and compare that result to alternative approaches such as hand piling and prescribed fire), so

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[59] 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 (“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. …”).

[60] Jonathan R. Thompson, Thomas A. Spies 2009. Vegetation and weather explain variation in crown damage within a large mixed-severity wildfire. Forest Ecology and Management 258 (2009) 1684–1694.

[61] Tom Spies. Reported during the Early Seral Forest Conference at OSU, April 2010. (*in press*).

[62] BLM. 2008. Western Oregon Plan Revision FEIS, pp 810-811.

that they can identify treatment methods and locations that are most likely to result in net ecological benefits.

### The most effective way to reduce the threat of wildfire to communities is to treat fuels in the immediate vicinity of homes and buildings.

The Congressional Research Service reports that -

> the probability of a home igniting by radiation depends on its distance from the flames. Researchers found that 85%-95% of structures with nonflammable roofs survived two major California fires (in 1961 and 1990) when there were clearances of 10 meters (33 feet) or more between the homes and surrounding vegetation.[63]

It may be appropriate for fuel hazard reduction to take priority over other resource values within 200-300 feet of buildings, but outside this structure-ignition zone ecological goals should take priority. Forest Service scientist Jack Cohen says that

> [E]ffective fuel modification for reducing potential W-UI [wildland-urban interface] fire losses need only occur within a few tens of meters from a home, not hundreds of meters or more from a home. This research indicates that home losses can be effectively reduced by focusing mitigation efforts on the structure and its immediate surroundings.[64]

### A landscape approach can resolve conflicts between fire hazard and spotted owls.

Logging in spotted owl habitat uses limited resources that could be better spent on higher priority fire hazard mitigation or more fruitful restoration efforts. It may not be possible to simultaneously meet objectives for both threatened species and fuel reduction in older forests that provide habitat for spotted owls and their prey. As explained earlier, reducing stand density to meet fuel objectives will seriously undermine owl habitat values. This apparent conflict may be resolved and we may be able to meet both objectives by using a landscape approach that emphasizes fuel objectives in younger stands while emphasizing spotted owl objectives in older stands. [65] This is sensible because young stands are less important to the spotted owl and tend to be relatively more hazardous, while older stands are essential to the spotted owl and are not particularly hazardous.

### Young forests represent a greater fire hazard than older forests.

In young forests, canopy fuels are more continuous and closer to the ground, the canopy is not developed enough to provide cool-moist microclimate benefits, tree bark is not yet thick enough to effectively insulate the trees' living tissue when exposed to fire, and young roots are not yet unable to reach water in deep soil layers. After several fires in

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[63] Gorte, R.W. 2008. Forest Fire/Wildfire Protection. Congressional Research Service Report for Congress. http://assets.opencrs.com/rpts/RL30755_20080117.pdf *citing* Jack D. Cohen, "Reducing the Wildland Fire Threat to Homes: Where and How Much?" Proceedings of the Symposium on Fire Economics, Planning, and Policy: Bottom Lines (San Diego, CA: April 5-9, 1999), Gen. Tech. Rept. PSW-GTR-173 (Berkeley, CA: USDA Forest Service, Dec. 1999), pp. 189-195.

[64] Cohen, Jack D. 1999. Reducing the Wildland Fire Threat to Homes: Where and How Much? USDA Forest Service Gen. Tech. Rep. PSW-GTR-173. 1999 http://www.firewise.org/resources/files/WUI_HIR/Reducingfirethreat.pdf

[65] USDA PNW Research. Science Findings, Issue 85. http://www.fs.fed.us/pnw/sciencef/scifi85.pdf

2002, the Umpqua National Forest documented the disproportionate adverse fire effects in young managed stands compared to 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" while "[t]he pattern of mortality in the unmanaged forest resembles historic stand-replacement patch size and shape.[66]

## Public policy favors fuel treatments in young forests, not older forests.

The NW Forest Plan says "risk-reduction efforts [in Late Successional Reserves] should generally be focused on young stands."[67] The NW Forest Plan EIS also says that

> [A]ctivities in older stands may be appropriate if: (1) the proposed management activities will clearly result in greater assurance of long-term maintenance of habitat, (2) the activities are clearly needed to reduce risks, and (3) the activities will not prevent the Late-Successional Reserves from playing an effective role in the objectives for which they were established. …[68]

Based on the analysis in this paper, all these findings will be difficult or impossible to make. Due to the general infrequency of fire in western Oregon, treatments are unlikely to modify wildfire, so commercial logging for purposes of fuel reduction will degrade far more acres of habitat than it will benefit through modified fire behavior.

The Final Recovery Plan for the Spotted Owl includes recommendations for dry forest provinces east of the Cascade crest such as:

> Recovery Action 7: Manage lands in these Provinces outside of the high quality habitat patches to restore ecological processes and functions, and to reduce the potential for significant losses by stand-replacement fires, insects, and disease. …
> [Appendix E:] This notion of spatial isolation of late-successional forest structure embedded in a matrix of more fire tolerant forest structures forms the underpinning of our later recommendations. … [R]educe the risks of Northern Spotted Owl habitat loss by isolating habitat patches and reducing the spread of wildfire into habitat patches. … [69]

The 1992 Draft Recovery Plan for the Northern Spotted Owl says, "High surface fire potential during early succession in Douglas fir was identified by Isaac (1940) as a 'vicious cycle' of positive feedback..."[70] The Spotted Owl Recovery Plan says "fuel management may be desirable in plantations"[71] and offers suggestions for increasing fire resilience in young stands:

> The fire tolerance of existing plantations can be increased by actively manipulating species composition, reducing density, promoting spatial heterogeneity in forest structure (avoiding large

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[66] March 2003 Wildfire Effects Evaluation Project for the Umpqua National Forest. http://www.fs.fed.us/r6/umpqua/publications/weep/weep.html

[67] 1994 Northwest Forest Plan ROD p C-13.

[68] 1994 Northwest Forest Plan FSEIS Vol II pp B-74-75.

[69] U.S. Fish and Wildlife Service. 2008. Final Recovery Plan for the Northern Spotted Owl, *Strix occidentalis caurina*. U.S. Fish and Wildlife Service, Portland, Oregon.

[70] USFWS 1992. Draft final recovery plan for the northern spotted owl. USDI Fish and Wildlife Service, Portland, Oregon.

[71] 1993 FEMAT p IV-35.

areas of homogeneously fire-prone plantations), treating surface fuels, and favoring the development of large, fire tolerant trees. This may be accomplished through large scale thinning operations (that include treatment of activity fuels and increasing spatial variability at the multihectare scale) in plantations outside of owl habitat (where plantations are generally concentrated), or using a larger regional landscape strategy that prioritizes the risk of high severity fire outside of owl habitat.

## Fuel reduction efforts in low elevation ponderosa pine forests may yet have a compelling rationale.

This paper mainly focuses on forest conditions and fire hazard in western Oregon. Eastern Oregon may be different, especially where the federal agencies control large blocks of habitat and are willing to reintroduce natural fire regimes. In forests with frequent fire return intervals fuel treatments are more likely to affect wildfire and treated sites are more likely to benefit from modified fire behavior.

Fire return intervals of course depend on whether fire continues to be actively suppressed and/or actively reintroduced. It's not so much the historic fire return interval that matters, but the real *de facto* fire return interval as modified by human activities. There is little point in trying to restore pre-fire-suppression forest *structure* if the agencies remain unwilling to restore natural *processes* like fire that will renew and maintain those structures. If fuel treatments can be justified at all, they must be used as a way of re-establishing natural fire regimes, not as a way of perpetuating the out-dated and ecologically flawed policy of fire exclusion. Reinhardt & Holsinger (2010) point out that in areas where wildfires are fuel limited —

> Fuel treatments can be expected to function best if they are designed to restore forest ecosystems so that fire can play its natural role … [F]ire exclusion is not a sustainable option for forests of the Interior West. Similarly, if fuel treatments are designed to exclude fire from western landscapes, then the … inevitable result is … higher carbon emissions, greater losses to biodiversity, and larger threats to communities and homes.[72]

In addition, thinning for fuel reduction in forests with naturally frequent fire regimes has fewer negative effects on habitat. Species such as the white-headed woodpecker probably benefit in both the short-term and long-term from open park-like stand conditions resulting from carefully designed fuel treatments. These same circumstances are not present in forests with historically longer fire return intervals, harboring species that prefer dense forest conditions and abundant dead wood.

## Additional restoration concepts.

Even though fuel reduction efforts outside of high frequency fire regimes (and outside of the structure-ignition zone) is generally not ecologically justified in western Oregon, there may be other restoration concepts that have a sound ecological basis. Sound restoration concepts include:

- Creatively managing wildfires to optimize ecological benefits and social costs;
- Reintroducing fire in suitable landscapes;
- Variable thinning of dense young stands;

[72] Elizabeth Reinhardt, Lisa Holsinger. 2010. Effects of fuel treatments on carbon-disturbance relationships in forests of the northern Rocky Mountains. Forest Ecology and Management 259 (2010) 1427–1435.

- Culturing legacy trees such as long-needle pine, oak, Douglas fir, and larch;
- Restoring unique forest types like aspen, oak, and savannas (where doing so will not adversely affect protected fish and wildlife);
- Rescaling and storm-proofing the overbuilt road system;
- Rehabilitating streams;
- Removing invasive species;
- Culturing decadence features; and
- Controlling other destructive activities like grazing, mining, and OHVs.

These activities will keep the agencies busy for decades and some of them will provide jobs and wood byproducts.

## Conclusion

Smokey Bear taught us to fear forest fires. We often hear that fuel is bad and logging is good because it removes fuel. We now recognize that fires are not only natural but necessary to create and sustain healthy forests. We have also come to understand that dead wood is an essential and defining element of high quality forest habitat. We need to stop casting fire and dead wood in a negative light and learn to embrace their natural beneficial role in forest ecosystems.

The alleged ecological rationale for logging mature & old-growth forests to reduce fuels fails to withstand scrutiny. Such logging degrades habitat and fails to provide off-setting benefits. We're essentially asking spotted owls and other wildlife to buy fire insurance at an exorbitant price that no rational person would pay. Consider this — if the annual cost of fire insurance for your house was equal to 15% of the value of your house, and the chance of fire was 2%, or once every 50 years, a rational person would not buy fire insurance. However, if the price of insurance was 15% of the value of the house and the probability of fire was 100%, then a rational person would of course buy fire insurance. This latter scenario (where fire is a virtual certainty) is the one that many advocates of fuel reduction logging are asking us to accept, but fire of course is not so certain to occur.

Consider the same calculus for spotted owls. Thinning is a great idea and provides important habitat benefits as long as the near-term probability of fire is near 100%, even if the habitat degradation caused by fuel reduction is substantial, but if the chance of fire is low, then the rational spotted owl would rather take its chances with fire (which is unlikely), instead of suffering the effects of logging to control fire (which is certain to degrade habitat).

Fuel reduction logging in western Oregon will continue the long tradition of sacrificing ecological values in favor of economic values. This approach has harmed our public forests for too long. Our public forests provide many valuable ecosystem services that should be carefully conserved, including clean water, carbon storage, habitat for fish & wildlife, and recreation. We must explore ways of meeting economic objectives that will not sacrifice ecological values.

Instead of using fear of fire as an excuse to log older forests far from communities, federal land managers should focus instead on protecting people and communities with treatments located nearest homes and structures. Outside the "structure ignition zone," the agencies should embrace comprehensive ecological restoration with particular emphasis on dense young stands where the ecological benefits are most likely, and ecological costs are least likely. Variable thinning of dense young forests may provide benefits to ecosystems and possible fuel benefits, while providing jobs and wood by-products.