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Re: Scientists' Comments on the Draft Spotted Owl Recovery Plan (Federal Register Vo. 75 No. 178: 56131- 56133 (submitted by email via NSORPComments@fws.gov)

Thank you for the opportunity to comment on the 2010 Draft Revised Recovery Plan (Draft Plan) for the Northern Spotted Owl (NSO). We request that you add our comments to the administrative record and offer the following analysis and commentary with the goal of facilitating and encouraging the creation of an NSO Recovery Plan based upon the best available science as required under the Endangered Species Act and supporting regulations. Our comments are directed mainly at the fire and active management sections as a follow up to earlier drafts of the recovery plan and our published work in the literature (Hanson et al. 2009, 2010). While we note improvements were made to the 2008 final recovery plan that was remanded by the agency because it was not scientifically sound, there are considerable deficiencies in the 2010 draft recovery plan where the Fish & Wildlife Service did not make use of best science, delaying a reserve strategy pending completion of habitat simulation modeling, untested assumptions regarding risks of active management vs. fire, and unpublished literature in assessing forest recruitment vs. late-successional "losses" post-fire.

The Draft Plan should clearly and directly state that Late-successional Reserves should be retained, and expanded

The Draft Plan (p. *x*) is unclear about the Late-successional Reserve (LSR) system for NSOs. The Draft Plan (p. *x*) vaguely references a non-specific "rangewide habitat model" that is "currently in progress but is not complete," and states that this model will be used "to evaluate a number of different habitat conservation network scenarios and present the results of those evaluations in the final Recovery Plan." The publication of a draft recovery plan without a reserve strategy is unacceptable because the in-progress model is not available for review by scientists, and has not gone through the essential process of peer-review and publication in a scientific journal to ensure it is based on best science. If the final model is simply reported in the Final Recovery Plan, it will not have been sufficiently vetted by the public or the scientific community. We note that this same concern was expressed in comments recently submitted to U.S. Fish & Wildlife Service (USFWS) by the scientific societies (The Wildlife Society, Society for Conservation Biology, and American Ornithologists' Union) and conservation groups. The temporary provisions of the Northwest Forest Plan (stated as "interim" in the Draft Plan, p. *x*) implies that the LSRs could be eliminated, as recommended in the 2008 NSO Recovery Plan (excerpted in Appendix D of the 2010 Draft Plan), but no clear indication or intent can be gleaned from this text. Given that the LSRs are the very core of the conservation strategy for the NSO in the Northwest Forest Plan (NWFP), the USFWS should be very clear about its recommendations regarding LSRs as a minimum baseline for recovery actions. Since the USFWS acknowledges that this central aspect of the NSO conservation strategy is being evaluated in an unfinished and untested model, it is clear that the Draft Plan is premature (cf The Wildlife Society, Society for Conservation Biology/American Ornithologists' Union).

Further, given the continuing decline of the NSO and the analysis below, we urge the USFWS to recommend: a) retention of all existing LSRs; b) addition of new LSRs to create greater connectedness across the landscape for owls to move in relation to natural disturbance events, and to allow for greater heterogeneity from natural disturbance as a desired condition within LSRs; and c) greater protections from logging, especially post-disturbance logging (salvage logging) within LSRs, in light of recent court decisions finding few if any limits on Forest Service logging plans in LSRs (*League of Wilderness Defenders v. Allen*, Ninth Circuit Court of Appeals, Aug. 13, 2010, No. 09-35094). We also recommend that the NSO modeling currently in progress include an analysis of the effects of expanding upon existing LSRs, and adding new LSRs, on the persistence of NSO populations. Thus, we conclude that the draft recovery plan for the NSO does not adequately remedy the concerns of the scientific peer reviews of the 2008 final plan; the draft recovery plan does not recognize the importance of the LSRs as a minimum baseline for recovery, nor did it provide additional reserves that build on the protective provisions of the Northwest Forest Plan as recommended in the scientific peer reviews.

High-severity fire patches and insect mortality cannot be equated to NSO habitat "loss"

The Draft Plan makes several significantly inaccurate or misleading statements regarding high-severity fire and NSOs. First, while the Draft Plan (pp. 45, 94) does briefly mention that Bond et al. (2009) found that spotted owls preferentially selected high-severity fire areas for foraging, and acknowledges that "spotted owls may be resilient to the effects of wildfire—a process they have evolved with" (Draft Plan, p. 94), the Draft Plan otherwise repeatedly refers to high-severity fire effects, and areas of insect mortality, as "threats" that cause a "loss" of NSO habitat. See Draft Plan, p. *x* ("ongoing loss of suitable habitat as a result of…uncharacteristic wildfire"), p. 69 ("threats, such as fire and insects"), p. 102 ("Rates of Loss of Suitable Habitat as a Result of Natural Events"), p. 103, Table B3 ("[m]ost natural loss of habitat resulted from wildfires…followed by insects and disease"). Although there remains much to learn about the role of high-severity fire at different spatial and especially temporal scales with regard to NSOs, the Draft Plan's repeated blanket characterization of high-severity fire as something that simply results in a loss of habitat is not based upon sound science, and such references should be removed from the Plan.

Second, the studies cited by the Draft Plan to support the characterization of high-severity fire patches as a source of NSO habitat loss are not accurately represented. The Draft Plan fails to distinguish between the effects of mixed-severity wildland fire alone and the effects of post-fire salvage logging. For instance, the Draft Plan (p. 45) states that Clark (2007) found that "owls did not use large patch areas of high-severity burns." This is misleading, given that Clark (2007) makes clear that the study areas had been logged on both public and private lands after the fires, and nowhere in Clark (2007) is there a finding that NSOs did not use large unlogged high-severity fire patches. In contrast, over 97% of the post-fire landscape studied (4-5 years post-fire) by Bond et al. (2009) had not been logged, and these authors found that the owls preferentially selected unlogged high-severity fire areas for foraging. Similarly, the Draft Plan (p. 94) references Gaines et al. (1997), stating that this study found that "spotted owls were present at only one of the six sites 1 year after the fire". However, Gaines et al. (1997) found that *two* sites were occupied by spotted owls one year after the 1994 Hatchery Complex fires, not one site (see p. 126 of Gaines et al. 1997), and this was the same number of occupied sites in the study area when surveys began in 1991 prior to the fire (see Table 2 of Gaines et al. 1997). Gaines et al. (1997) found that there was "no correlation between habitat available within a 2.9 km radius one year post-fire and the site [occupancy] status". The Draft Plan (p. 94) also fails to mention that the King et al. (1997) study pertained to NSOs in an area described as being intensively salvage logged just months after the fire. Further, the Draft Plan (p. 45) references the "loss of 17 of 23 owl pairs on the Sisters Ranger District after significant canopy reductions from a combination of an outbreak of spruce budworm and fire", but cites no scientific source to support the relationship between insect or fire mortality and the claimed loss of 17 owl pairs on the Sisters Ranger District. As discussed in Hanson et al. (2009), this assertion was made in the 2008 NSO Recovery Plan with regard to the 2003 B&B fire on the Sisters Ranger District, but the Forest Service's NSO monitoring data showed that there was only one pair before this fire, and two pairs after the fire. Nothing in the 2010 Draft Plan provides any quantitative evidence of large-scale insect mortality prior to the B&B fire, or any citation establishing a relationship between such mortality and a reduction in NSO occupancy before the B&B fire; nor does the Draft Plan discuss the potential role of mechanical thinning and other logging in the years and decades before the B&B fire. The draft recovery plan needs substantive revision so the text accurately reflects and explains the science.

Third, the Draft Plan (p. 44) states that "no spotted owl nests have been observed on sites burned by high-severity fires", citing Gaines et al. (1997), Bond et al. (2002), Jenness et al. (2004), Clark (2007), and Bond et al. (2009). However, no such conclusion can be drawn from any of these studies, all of which documented spotted owls nesting in territories with significant proportions of high-severity fire, but none of which provided data on the location of the high-severity fire patches relative to the actual nest stands. The Draft Plan (p. 44) correctly notes that "it is not known whether there is a maximum amount of high severity fire within a nesting core that would preclude nesting of spotted owls", but the Draft Plan does not consider the possibility that spotted owls may often shift their territories after wildland fire to best take advantage of the new post-fire heterogeneity, as opposed to occupancy being "lost". This should be rigorously explored, in a manner that is decoupled from post-fire logging effects. Until this occurs, assumptions about losses of owl habitat or occupancy from high-severity fire patches are not grounded in scientific evidence. That spotted owls nest and successfully reproduce in territories substantially or predominantly affected by high-severity fire (Bond et al. 2002, Bond et al. 2009), and in burned landscapes preferentially select unsalvaged high-severity fire areas for foraging—above lower burn severities or unburned areas—indicates that high-severity fire, at some level, provides habitat for spotted owls. The Draft Plan does not accurately represent the existing science when it categorically equates high-severity fire effects with spotted owl habitat loss/threats when in fact it cannot be ruled out that some owls may simply shift territories in response to preferred habitat created by mixed-severity fires. In fact, no statistical evidence currently exists that concludes fire of any severity has a negative impact on site occupancy, survival, or reproduction of spotted owls. The limited evidence to date further underscores the need for protecting all spotted owl habitat (nesting, roosting, foraging, dispersal) as some owls apparently move about the landscape following fires (unpublished data presented to us by Ray Davies, US Forest Service). **Need to comprehensively evaluate spotted owl occupancy and fire.**

Science has a poor understanding of spotted owl occupancy following fire for several reasons: 1. Surveys have not been done rigorously in burned areas 2. Owls have been assumed to leave burned areas, leading to an end of survey efforts. 3. Owls may shift locations in relation to fire but this has yet to be empirically documented. 4. Occupancy may be lost by post fire logging or other management, but the loss has been attributed erroneously to fire.

In the absence of published data on northern spotted owl occupancy in burned areas and because such data are lacking in the recovery plan (to which we submit now this dataset for inclusion in the final plan), we gathered survey data for 39 California spotted owl territories located in and near burned forests before and after 6 major fires in the Sierra Nevada (Storrie, Star, Darby, McNally, Power, and Freds). Our objective was to test whether occupancy decreased due to fire, as presumed for the California spotted owl just as for the northern spotted owl (North et al. 2010). We were not able to explicitly evaluate the proportions of moderate- and high-intensity fire within these territories within the timeframe of this comment deadline, but they generally had mixed-intensity fire effects, and several of the post-fire occupied territories had moderate- and high-intensity fire effects on the majority of the area. To provide an unburned control data set, we also obtained survey data for 27 comparison unburned sites in the Eldorado National Forest, in the central Sierra Nevada, which were chosen because this particular ranger district had conducted relatively good surveys for owls. We used data from territories with ≥2 years of survey data during the time period 1995–2009, and we assumed detection rates (ability to detect present owls in a given area) were similar before and after fire and between burned and unburned sites.

The 39 territories that experienced fire at some point from 1995–2009 had a mean *annual* post-fire occupancy rate of 75% (95% Confidence Interval = 64-78%), and the 27 territories that did not burn during this time period had a mean annual occupancy rate of 71% (95% Confidence Interval = 69-81%). These occupancy rates are not significantly different, as the confidence intervals of the means overlap.

When territories known to have been salvage logged after fire were removed from the data set, as well as those with survey data extending less than 4 years post-fire, the mean annual post-fire occupancy in the resulting 17 burned territories (Storrie, Star, and McNally fires) was 87%.

Another interesting finding is that two burned territories were unoccupied the year following fire but were subsequently occupied the next year, suggesting that surveys should be conducted for a minimum of 2 years after fire to adequately determine occupancy status. Finally, 7 territories were confirmed as unoccupied during pre-fire surveys but were subsequently occupied post-fire.

Further, of the 7 territories that were most heavily salvage logged, 5 were confirmed to be occupied after fire but before logging but were not occupied after logging; 2 of the 7 logged territories were never re-surveyed after logging so effects on occupancy are unknown.

One recent fire that has been held up as an example of negative impacts of fire on spotted owls is the 2007 Moonlight fire in the southern Cascades on the Plumas National Forest (North et al. 2010). We were not able to obtain complete data for the owl territories in or overlapping with the burn area. However, private timberlands comprised nearly 1/3 of the fire area, were distributed throughout the fire area, and were heavily clearcut after the fire, beginning within weeks of the cessation of burning. Of the 20 owl territories in this fire area, post-fire clearcutting occurred immediately, or within several months, within 19 of them. In 18 of the 20 territories, the Protected Activity Centers (PACs) directly abutted extensive post-fire clearcutting on private lands, often on two or more sides of the PACs (PACs are 300-acre areas surrounding the nest trees). Additional post-fire logging began 1 year after fire, and continues on National Forest lands in the fire area. A report by the Forest Service indicated that, even though pre-fire occupancy was somewhat unclear, within this heavily salvage logged landscape owl occupancy declined dramatically within the fire perimeter, with only one territory occupied by 2009 (USDA 2010). Interestingly, this remaining occupied territory was the only territory that had no private lands salvage logging, and it was occupied in both 2008 and 2009, one and two years post-fire, despite >80% moderate- and high-intensity fire effects (USDA 2010). This Forest Service study included one additional fire area (Cub Complex fire) in the southern Cascades of California—

one that was not salvage logged—and in this unlogged fire area post-fire occupancy thus far is similar to occupancy in unburned forests (USDA 2010). In fact, although high-intensity fire comprised <20% of this unlogged fire area, all three of the confirmed post-fire pairs are nesting on the edges of high-intensity fire patches, and one of these three has mostly high-intensity fire effects within a 700 m radius of the nest site (USDA 2010 [Fig. 14]) (we do not include these results in our analysis above since post-fire occupancy data has been gathered for only one year thus far).

A full statistical analysis of available spotted owl survey data is needed. However, the preliminary evidence suggests that fire (in the absence of logging) has no effect on territory occupancy in the Sierra Nevada, and that post-fire logging reduces occupancy. Moreover, the published literature indicates that fire does not significantly reduce survival or reproduction of spotted owls, and may even enhance productivity under certain circumstances. Additional research is certainly warranted, but we recommend that the Recovery Plan undertake a comprehensive analysis of the effects of fire on site occupancy that accounts for salvage logging effects, and where and how long post fire surveys were conducted. Conclusions in the draft Plan do not account for these factors, and data that do, from California spotted owls, do not support the hypothesis that fire leads to greater levels of site abandonment.

The Draft Plan relies upon inaccurate and unpublished information for its conclusion that the rate of high-severity fire is outpacing the rate of old forest recruitment in dry forest

The Draft Plan (p. 43) does briefly discuss the published findings of Hanson et al. (2009, 2010)—i.e., that the rate of old forest recruitment in NSO dry forests is outpacing the rate of high-severity fire in old forest by 5.5 to 14 times currently. However, the Draft Plan (p. 46) then improperly relies upon factually inaccurate conclusions from an unpublished U.S. Forest Service report, Moeur et al. (2010), to suggest that the opposite is now true (cf The Wildlife Society, SCB/AOU comments that had similar concerns). There are several significant problems with this unpublished study.

Moeur et al. (2010) is a powerpoint presentation and summary handout given to USFWS on August 10, 2010. It has not been peer-reviewed or published, and should not be referenced or relied upon in the NSO Recovery Plan. It may not even qualify as gray literature at this time and therefore does not meet the stated intent of the Service to base the recovery plan on best available science.

USFWS provided us with a copy of the Moeur et al. (2010) powerpoint presentation and summary hand-out (given to USFWS on August 10, 2010). The Moeur et al. (2010) presentation stated that, since the Northwest Forest Plan (NWFP) of 1994, 184,000 acres of old forest have been "lost" due to high-severity fire and only 80,000 acres of old forest recruitment occurred from 1994 to 2007 out of the approximately 14.6 million acres of non-old-forest in the NWFP

(Moeur et al. 2010). However, satellite imagery was used by Moeur et al. (2010) to detect transition from non-old-forest (defined as quadratic mean diameter less than 20 inches) to old forest (defined as quadratic mean diameter of 20 inches or greater)—an extremely subtle distinction for remote sensing, especially over such a short time period. The result was that very little transition from non-old-forest to old forest was detected, which was cited in the draft recovery plan (p. 43) to imply that old forest recruitment is nearly non-existent, even though Moeur et al. (2005) found high rates of old forest recruitment. There are several problems with Moeur et al. (2010). First, the conclusion that only 80,000 acres of the 14,600,000 acres of non-old-forest recruited to old forest over the 14-year study period equates to an average old forest recruitment rate of only 0.55% over 14 years, 0.39% per decade, or 3.9% per century. Something is wrong with this estimate because, if this recruitment rate were extrapolated over time as a constant rate, it would require over 2,500 years on average to go from stand initiation to a mean overstory diameter of 20 inches! Our analysis (below) of FIA data shows that this is clearly wrong, as it does not take anywhere near this long for stands to grow from seedlings to a mean overstory diameter of 20 inches (see analysis below). An equally significant problem with these figures from the Moeur et al. (2010) powerpoint presentation is that the Draft Plan does not account for the age class distribution or structure of current stands. For example, due to the high rate of clearcutting on federal lands in the Pacific Northwest during the 1950s, 1960s, and 1970s, significant portions of the landscape are not currently old forest, but may soon reach a quadratic mean diameter of 20 inches. Assessing old forest recruitment over short periods of time may, therefore, produce misleading results—a problem that could be substantially exacerbated by the failure to use readily-available Forest Service plot data (cf comments from The Wildlife Society for an analysis of this issue using the distribution of early-successional, mid-successional, and late-successional (old forest) stands across the landscape).

New analysis using FIA plots shows there are no problems with recruitment rates

In an earlier analysis, Moeur et al. (2005) used re-measurements from fixed Forest Service field plots (including Forest Inventory and Analysis [FIA] plots) to accurately determine actual old forest recruitment rates in the NWFP, finding an actual old forest recruitment rate range of approximately 10% to 20% per decade. If high-intensity fire rotations are consistent over time, this could be considered the equivalent of about 50 to 100 years to go from stand initiation to overstory mean quadratic diameter (QMD) of at least 20 inches, which is the Forest Service's definition (Moeur et al. 2005) of old forest.

Hanson et al. (2009, 2010) used these field-based data from Moeur et al. (2005) to conclude that old forest recruitment is greatly outpacing the rate of high-severity fire in old forest within NWFP dry forest provinces, indicating that old forest is experiencing a net increase and that fire is not a threat to the maintenance of old forest.

It is unclear why reliable on-the ground plot data that definitively determine old forest recruitment rates were not used in the Moeur et al. (2010) analysis, and much less accurate remote-sensing data were substituted, but this surprising change has apparently led to the inaccurate findings in Moeur et al. (2010).

To test the Moeur et al. (2010) findings, we obtained current U.S. Forest Service raw data for all FIA plots in the NWFP dry forest provinces that had data for: a) time since stand initiation; b) diameter at breast height of all live trees; and c) crown class position of each tree. We limited our analysis to plots on USFS lands in montane conifer forest, corresponding to "Ground Land Class" codes 120, 141, and 149 in the Forest Service's FIA manual; we excluded ground cover types unrelated to the NSO, including marshes and meadows, foothill gray pine and oak woodland, and subalpine vegetation. This yielded a sample size of 548 plots for the Klamath dry forest provinces (Oregon Klamath and California Klamath) and 142 plots for the east Cascades dry forest provinces (eastern Washington Cascades, eastern Oregon Cascades, and California Cascades). The Forest Service's FIA manual separates individual trees into crown class categories. We calculated the quadratic mean diameter (QMD) of dominant and codominant trees (overstory trees) following methods in Moeur et al. (2005). Dividing the plots into age classes, representing increasing time since stand initiation, we found that, in both the Klamath and east Cascades dry forests, it took approximately 80 years from stand initiation for stands to reach a quadratic mean diameter of at least 20 inches (the old forest threshold) (see Tables 1 and 2 below). Our approach is consistent with the Forest Service's old-forest definition in Moeur et al. (2005 [Table 2]) as stands with a QMD of at least 20 inches in dominant and codominant ("overstory") trees and with prior definitions of late-seral forests published by FEMAT. Further, our figures are conservative—actual rates might be somewhat faster, given that we did not exclude lodgepole pine forests, which spotted owls generally do not inhabit, and which cover a significant portion of the East Cascades, but which rarely exceed 20 inches in average diameter. We also included dry pine, knobcone pine forests and Jeffrey pine savannas on serpentine in the Klamath, all of which likely have smaller average diameters at a given stand initiation date than the values shown in Table 1.

Table 1. Quadratic mean diameter (QMD, inches) of dominant and codominant trees, as a function of time since stand initiation, in montane conifer forests on Forest Service land in the Klamath dry forest region (n = 548 plots).

Years since stand initiation	QMD (inches) of overstory trees
21-40	11.0
41-60	13.0

61-80	18.4
81-100	22.0
101-125	24.2
126-150	26.4

Table 2. QMD (in inches) of dominant and codominant trees, as a function of time since stand initiation, in montane conifer forests on Forest Service land in the East Cascades dry forest region (n = 142 plots).

Years since stand initiation	QMD (inches) of overstory trees
21-40	12.7
41-60	12.0
61-80	18.3
81-100	21.5
101-125	20.5
126-150	25.8

To compare rates of recruitment to rates of high-severity fire, we then updated the analysis of high-severity fire rotation described in Hanson et al. (2009, 2010) with RdNBR satellite imagery fire severity data for the years 2006-2010, which were not available for Hanson et al. (2009, 2010). These RdNBR fire severity data were available from U.S. Forest Service websites at www.mtbs.gov and http://www.fs.fed.us/postfirevegcondition/. We used federal categorical mapping of high-severity fire, available through 2008 (www.mtbs.org), and the Forest Service's RdNBR data for 2009 and 2010 from http://www.fs.fed.us/postfirevegcondition/. In Hanson et al. (2009), we used an RdNBR threshold of 800 to define high-severity fire. Spies et al. (2010) recommended an RdNBR threshold of only 574, but Hanson et al. (2010) determined, based upon a comprehensive analysis of the Forest Service's field validation plots for the RdNBR system, that 574 corresponds to only about 41% basal area mortality of overstory trees, while 800 corresponds to about 60% basal area mortality of overstory trees. For the years 2009 and 2010, for which MTBS.gov has not yet produced final categorical high-severity mapping, we used an RdNBR value of 641 to broadly define high-severity fire, consistent with previous Forest Service publications (Miller and Thode 2007), while recognizing that use of this threshold will include many moderate-severity fire effects as well (Odion and Hanson 2008). Using this approach, and using the Forest Service's old-forest mapping as described in Hanson et al. (2009), we determined that the high-severity fire rotation in old forest since implementation of the NWFP is 338 years in the Klamath dry-forest provinces and 853 years in the dry Cascades provinces (Washington eastern Cascades, Oregon eastern Cascades, and California Cascades). Thus, in the Klamath, high-severity fire in old forest is occurring at a rate 4.2 times slower than it takes stands affected by high-severity fire to develop into old forest. In the eastern Cascades, high-severity fire in old forest is occurring at a rate 10.7 times slower than it takes stands affected by high-severity fire to develop into old forest. This updated analysis supports the earlier conclusion of Hanson et al. (2009, 2010) that the rate of high-severity fire is not currently a threat to NSO habitat. We request that you include this updated analysis in the final recovery plan as supplemental information (to Hanson et al. 2009, 2010) on the rates of old forest development relative to the rate of high-severity fire in old forest.

The Draft Plan makes unfounded and inaccurate assumptions, or uses information selectively or misleadingly, to draw its conclusion that wildland fires are "uncharacteristic" or are getting more severe

The Draft Plan implies (p. *x*) that current wildfires in the NWFP area are "uncharacteristic", but provides no citation to any primary scientific data to support this. The peer-reviewed, published scientific literature is clear that, prior to fire suppression and logging in dry forests of the Pacific Northwest, natural fire regimes were comprised of a mix of low-, moderate-, and high-severity effects, including ponderosa pine and other conifer forest types with frequent fire (Wills and Stuart 1994, Hessburg et al. 2007, Klenner et al. 2008, Whitlock et al. 2008, Bekker and Taylor 2010). A recent study using a 2000-year sediment core record from charcoal and pollen found that current wildland fires, including the very large 2002 Biscuit fire, are not unprecedented in the Oregon Klamath dry forest province, and are within the natural range of historical variability in presettlement times (Colombaroli and Gavin 2010). Bekker and Taylor (2010) found that, in an unmanaged area of the Cascades in California within mixed-conifer forests, the fires burned mostly at high-intensity historically, with some high-intensity fire patches being thousands of acres in size. Bekker and Taylor (2010) concluded that "high-severity fire was important in shaping stand structure" historically. Hessburg et al. (2007), in a study of historical fire patterns in the eastern Cascades of Washington, found that historical fires were of mixed severity in all forest types within this dry forest province. High-severity effects were "more widespread" than surface fire in the relatively more mesic mixed-conifer areas of the eastern Cascades and, even within the dry mixed-conifer forests, high-severity fire comprised approximately one-third of fire effects (Hessburg et al. 2007). Hessburg et al. (2007) found that "evidence for low severity fires as the primary influence…was lacking in both the dry and moist mixed conifer forests", recommending that instead of trying to further suppress natural high-severity fire patterns, land managers should "managed for them". Hessburg et al. (2007) concluded that "[r]estoring resilient forest ecosystems will necessitate managing for more natural patterns…and fire regime area, not simply a reduction of fuels and thinning of trees to favor low severity fires." In the eastern Oregon Cascades, historical high-severity patches thousands of acres in size were mapped by the U.S. Geological Survey in the late 1800s in mixed-conifer and ponderosa pine dry forests (Leiberg 1900), and the ponderosa pine-dominated old forests of the Lookout Mountain Unit of the Pringle Falls Experimental Forest on the Deschutes National Forest in the eastern Oregon Cascades are the result of vigorous natural conifer regeneration following a high-severity fire area several thousand acres in size occurring in 1845 (USDA 2009). Reconstructions of fire regimes in the California Klamath and California Cascades indicate historical high-severity fire rotations of less than 250 years (Wills and Stuart 1994, Bekker and Taylor 2001). Similar historical high-severity fire rotations can also be inferred from Hessburg et al. (2007) for the eastern Washington Cascades, given the high proportions of high-severity fire effects on the landscape, and the old forest recruitment rates discussed above. Current high-severity fire rotations in NWFP dry forests, over the past two decades, are much longer than this (Hanson et al. 2009), indicating substantially less high-severity fire.

The Draft Plan (p. 32) states that the "objective for active forest management is to restore ecosystem structure, composition, and processes so that they are…resilient". In light of the foregoing, including the findings and recommendations of Hessburg et al. (2007) discussed above, active forest management for ecological restoration and resilience should seek to restore high-severity fire patterns and the important, and highly biodiverse, natural early-successional habitats that such fire creates (Swanson et al. 2010)—patterns and habitat attributes that are not mimicked by clearcutting (Lindenmayer et al. 2004, Hutto 2006, Swanson et al. 2010). As Franklin et al. (2002) noted, "Post-disturbance conditions following clearcutting differ greatly with those following most natural disturbances in terms of the types, levels, and patterns of structural legacies."

The Draft Plan (p. 45) also misleadingly and inaccurately characterizes the scientific data regarding trends in fire severity in NSO habitat, citing Westerling et al. (2006) and Miller et al. (2009) as evidence that "fire severities" have increased. However, Westerling et al. (2006) simply did not address fire severity at all, only overall fire extent and length of the fire season, and Miller et al. (2009) pertained to the Sierra Nevada, not NSO forests, and excluded 40% of the available fire severity data and much of the high-severity fire occurring in the earlier years of the study period (by excluding forest that burned at high severity and was reclassified as montane chaparral). All other studies investigating fire severity patterns in the Sierra Nevada have found no increase in severity (Collins et al. 2009, Lutz et al. 2009 [16% high severity currently, and 16% high severity projected in future]), and the U.S. Geological Survey's assessment of all vegetation, including forests, concluded that no increase in fire severity has occurred in California, or in Oregon and Washington, since 1984 (Schwind 2008). Inexplicably, the Draft Plan nowhere mentions that Hanson et al. (2009) investigated this very question in dry forests of the NWFP and found that fires have not become more severe in either the Klamath or the eastern Cascades since 1984.

With regard to trends in overall future fire activity (all severities), the Draft Plan (p. 72) cites information selectively and misleadingly. The only study cited by the Draft Plan (p. 72) regarding the future overall extent of wildland fire is Littell (2009), the published version of which is Littell et al. (2010). The Draft Plan (p. 72) asserts that this study projected that, "[b]y the 2040s, the mean area burned in forested ecosystems in the …eastern Cascades is projected to increase by a factor of 3.8 compared to 1980-2006". This is inaccurate. The models used in Littell et al. (2010) projected that fire would increase by a factor of 3.8 in all forested regions combined (mostly from the Blue Mountains). In the eastern Cascades specifically, the models in Littell et al. (2010) projected an annual increase from 63,000 hectares in the period 1980-2006 to 90,000 hectares in the 2040s (see Fig. 7 of Littell et al. 2010)—a modest increase from the current era of ongoing and widespread suppression of natural wildland fire (the presentation of Fig. 7 in Littell et al. (2010) is somewhat confusing, but Fig. 6 of that study clarifies that the figures presented for current versus future fire area are annual figures for each time period). Also, the Draft Plan fails to discuss the fact that other projections estimate that fire activity will be significantly reduced in many forested areas of the western U.S. by the 2040s, including projected reductions in the Klamath region and eastern Oregon (Krawchuk et al. 2009). Further, the Draft Plan fails to discuss studies documenting a significant decline in fire over the past century in Canada's forests, as climate has become both warmer and wetter (summer precipitation) (Cyr et al. 2009, Girardin et al. 2009). Though some models are based upon the assumption of decreasing future summer precipitation (Littell et al. 2010), actual data indicate a trend of increasing summer precipitation in the Pacific Northwest, including eastern Oregon and eastern Washington (Mote 2003). Monitoring of actual patterns will be important, and the limitations of forward-looking modeling projections, and the assumptions upon which they are based, must be fully understood and acknowledged.

The Final Plan should have as a recovery action that post-fire logging should not be allowed in NSO habitat, territories, or LSRs

The Draft Plan (pp. 52-53, Recovery Action 11) makes a vague suggestion that "post-fire silvicultural modifications should concentrate on spotted owl habitat restoration". What does this mean (also cf The Wildlife Society comments for similar concerns)? Is the USFWS suggesting that post-fire salvage logging "restores" spotted owl habitat? If so, no citations to any scientific studies are provided specifically to support the assertion that post-fire logging enhances or restores spotted owl habitat; nor would such an assertion be supportable scientifically, given the discussion above. The Draft Plan (p. 53) vaguely recommends the conservation of "spotted owl habitat elements that take the most time to develop or recover (e.g., large trees, snags, downed wood)" but this is so general and ambiguous that it means little. For example, such a statement could be interpreted by the Forest Service to mean that a couple of large snags and large trees per acre should be retained in areas that are otherwise heavily salvage logged and nearly clearcut, and then replanted with conifers (this, in fact, is a standard Forest Service salvage logging prescription and has occurred even in LSRs such as those on the Siskiyou National Forest following the Biscuit fire 2002). The NSO Plan must address the potentially significant threat posed to NSOs from post-fire salvage logging. The Plan should clearly and unequivocally recommend that no post-fire logging be allowed to occur in NSO habitat, territories, or LSRs (see Bond et al. 2009, recommending no post-fire logging within a 1.5-km radius of spotted owl nest sites or core-use areas).

The Draft Plan (pp. 52-53) does not adequately or accurately represent the strong and overwhelming weight of scientific opinion that unmanaged post-fire habitat from high-severity fire is highly biodiverse, rare, and ecologically important (Hutto 1995, Lindenmayer et al. 2004, Hutto 2006, Hutto and Gallo 2006, Hutto 2008, Donato et al. 2010, Malison and Baxter 2010, Swanson et al. 2010, USDA 2010), and that post-fire logging of such habitat is ecologically destructive and should be avoided (Hutto 1995, Lindenmayer et al. 2004, Hutto 2006, DellaSala et al. 2006, Donato et al. 2006, Noss et al. 2006).

The Draft Plan appears to recommend landscape-level thinning without adequately addressing effects on NSO habitat quality

The Draft Plan's assessment of thinning on NSO habitat quality is inadequate for several reasons. First, the Draft Plan (p. 42) recommends "consideration" of thinning of stands over 80 years old in LSRs "as recommended by Johnson and Franklin (2009)", ostensibly in order to "accelerate the development of suitable owl habitat", and further recommends that "overstocked" stands in LSRs be "considered" for thinning "if it will benefit spotted owl recovery." The Draft Plan does not explain how or why such thinning would accelerate the development of suitable owl habitat or improve owl habitat quality and contradicts prior science and recommendations for protecting stands >80 years from thinning proposed by FEMAT and adopted by the Northwest Forest Plan (cf comments by The Wildlife Society). Once again, the Draft Plan is too vague, leaving it open to many interpretations, including an interpretation by the Forest Service that this ambiguous language is a recommendation for landscape-level mechanical thinning.

Moreover, if any meaning can be gleaned from this reference to Johnson and Franklin (2009) on page 42 of the Draft Plan, it appears to focus mainly or exclusively on the growth rate of the few largest live trees per acre, but fails to cite to any scientific studies indicating that the growth rate of the few largest live trees per acre is more important in determining suitable spotted owl nesting/roosting habitat than all other key habitat factors identified in the scientific literature, such as overall live tree basal area, large snag basal area, large downed log density, and a multi-layered stand structure—most or all of which would be reduced by stand density reduction from thinning. In addition, the reliance on the unpublished report by Johnson and Franklin (2009) for the recommendations regarding thinning to improve owl habitat quality is absent any risk assessment of thinning effects on spotted owls, prey, or barred owls (cf comments by all 3 scientific societies).

Further, the Johnson and Franklin (2009) report did not address, or cite, several key recent studies that refute their central assumptions, including: a) Hessburg et al. (2007), finding that historical high-severity fire was much more important in east Cascades dry forests, and dense regenerating stands were far more common, than assumed by Johnson and Franklin (2009); b) Hanson et al. (2009), finding that, within the Klamath and east Cascades dry forests, the ratio of old forest recruitment greatly outpaces the rate of high-severity fire in old forest currently, contrary to the core assumption in Johnson and Franklin (2009) about the "catastrophic" threat of fire; and c) Donnegan et al. (2008) and Christensen et al. (2008), regarding the current significant deficit of large snags in dry forests of Oregon and California, contrary to the assumption in Johnson and Franklin (2009) of "catastrophic" tree mortality in dry forests due to "overstocked" conditions (note: Johnson and Franklin (2009) did cite Donnegan et al. (2009) in one section, but on a separate issue).

Second, the Draft Plan does not adequately discuss the potential degradation of NSO habitat quality that could result from large-scale thinning by: 1) reducing forest canopy cover; 2) reducing basal area of trees comprising the forest canopy; 3) reducing stand density, thereby reducing competition between trees and minimizing the potential for future recruitment of large snags and downed logs; and 4) preventing natural heterogeneity from wildland fire and insect mortality within NSO territories—heterogeneity from which spotted owls could otherwise benefit (Bond et al. 2009). This heterogeneity created by fire may not be provided in an equivalent way by mechanical treatments, as Seamans and Gutierrez (2007) found that degradation of >20 ha of high quality habitat from logging within spotted owl territories was associated with decreased territory colonization and increased breeding dispersal. Likewise, Franklin et al. (2000) mention the importance of heterogeneity in spotted owl territories in northern California and they distinguish between natural heterogeneity important to owl foraging and nesting versus commercial logging that does not yield similar benefits.

Third, the Draft Plan mentions in several places the importance of an abundance of large snags to spotted owls, but fails to divulge that the Forest Service has concluded, based upon thousands of FIA field plots, that there is a significant deficit in large snags in all forested regions of Oregon and California, with generally less than 2 large snags per acre in forests currently, and far lower densities in eastside forests (Christensen et al. 2008, Donnegan et al. 2008). Donnegan et al. (2008) concluded that "management may be necessary to produce a greater density of large snags", suggesting active snag creation (Donnegan et al. 2008 [pp. 47-48]). Nowhere does the Draft Plan address the importance of, or potential for, snag recruitment, or active snag creation, as an aspect of active forest management. Rather, the Draft Plan generally appears to envision that active management simply equates to removal of trees. In forests with current deficits of large snags and downed logs, management that reduces stand densities and inhibits future recruitment of large snags and logs is unlikely to improve NSO habitat quality. Stated differently, we are unaware of ecological evidence indicating that a medium-sized or large stump is more ecologically valuable to NSOs or other rare wildlife species than is a live tree, snag, or downed log of the same diameter. The Plan should address the option of snag and downed log creation as part of active management by including specific provisions.

Fourth, the Draft Plan (pp.51, 69) seems to imply a need for landscape-level thinning (though, like many aspects of the Draft Plan, this is not clear either). There are significant problems with this, in terms of impacts to the NSO, which the Draft Plan simply does not address. As discussed in Rhodes and Baker (2008), due to vegetative regrowth, thinning is only effective in reducing potential fire severity (assuming, for the sake of argument, that such thinning actually does reduce potential fire severity in the immediate timeframe) for at most 10-20 years, at which point they will have returned to the pre-thinned state and would need to be thinned again in order to maintain a reduced potential for higher-severity fire (see also Agee and Skinner 2005). Thus, as Rhodes and Baker (2008) discuss, unless wildland fire affects 100% of the area in question every 10-20 years, any thinned area would need to be re-thinned every 10-20 years over and over again for many decades, even centuries, in order to have even a 50% chance of actually reducing fire severity, given the extremely low probability of high-severity fire occurrence in any given stand in a given decade or two. Thus, when the Draft Plan suggests landscape-level thinning, either this only includes areas thinned for the first time, in which case it fails to divulge the far greater acreage of re-thinning per decade, or it includes both first-time thinning as well as re-thinning, in which case the great majority of the thinned areas, at any given time, would be ineffective in reducing potential severity of fire should a fire occur (Rhodes and Baker 2008). In the former case, the Draft Plan fails to divulge and analyze most of the impacts of thinning on the habitat quality of NSOs. Alteration of mature-forest habitat as a result of timber harvest resulted in decreased colonization of territories and increased probability of breeding dispersal by California spotted owls in the central Sierra Nevada; i.e., owls chose not to remain in or colonize such territories after >20 hectares (over 49 acres) of mature conifer forest was degraded by logging (Seamans and Gutiérrez 2007). Repeated thinning, every 10-20 years, of an ever-increasing acreage in the NWFP would have potentially profound, and highly adverse, impacts to the quality of NSO habitat and populations, due to continued reduction and suppression of canopy cover, forest density (e.g., basal area) and snag recruitment. In the latter case, the great majority of the thinned areas, at any point in time, would be ineffective in reducing fire severity, which raises a serious question about the purpose and significant costs of such thinning operations. Thus, FWS cost estimates for thinning are seriously underestimated and new costing should be provided to determine the true cost of thinning operations over multiple stand entries.

Fifth, the Draft Plan does not address how the "effectiveness" of thinning would be evaluated in the NWFP with regard to wildland fire and NSO habitat. This is important, given that recent studies have promoted the effectiveness of thinning in reducing tree mortality from wildland fire without divulging that the combined mortality from the thinning itself and the subsequent fire was substantially greater than the mortality from fire alone in the unthinned areas (Prichard et al. 2010). This is a common problem on national forest lands, and it is one that should be addressed in the NSO Plan.

Conclusions

The USFWS prides itself on the application of best science in development of recovery plans and implementation of recovery efforts as required under the Endangered Species Act. Clearly, the agency needs to make much progress in relation to the spotted owl as the draft recovery plan unfortunately has carried over many of the same criticized active management measures and a lack of a comprehensive reserve design that were concerns of the public and scientific societies. For the final plan to be based on best science, we request: (1) LSRs be clearly called out as a baseline for owl recovery from which additional reserves and protections are added, including larger and a greater number of reserves to accommodate shifts in owl response to fires and other natural disturbance events; (2) additional studies on spotted owl response to fires while controlling for the confounding effects of post-fire logging and barred owl competition; (3) seasonal road closures and road obliteration to reduce the risk of uncharacteristic fire ignitions (see Hanson et al. 2010); (4) a rigorous experimental design to quantify risks of thinning on spotted owls, prey, and barred owls for paired watersheds as the Service is assuming such risks outweigh the risks of "fire losses" without any empirical evidence to back this assumption; (5) stronger prohibitions on post-fire logging, which may pose significant risks to spotted owls, by restricting this activity in owl habitat that burned; and (6) incorporation of more rigorous recruitment rates for old forests and unpublished data on owl response to fires such as those provided herein. Given that it was impossible for us to evaluate whether the current strategy is optimal for owls as the HexSim models are not currently available, we conclude that the draft recovery plan, at a minimum, is deficient as a recovery plan for the owl, as it did not address the need to increase habitat protections through the addition of reserves as recommended in the previous peer reviews. Such additions should encompass the full range of habitat used by owls and not just nesting/roosting habitat, so as to accommodate anticipated shifts in owl territories in response to fire and other natural disturbance events.

We thank you again for the opportunity to provide these comments and look forward to reviewing a Final Plan. Please do not hesitate to contact any of us with questions.

Sincerely,

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