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NSO Recovery Plan
U.S. Fish and Wildlife Service
Ecological Services
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Portland, Oregon 97232

The Wildlife Society appreciates the opportunity to submit comments on the U.S. Fish and Wildlife Service's (FWS) Draft Recovery Plan for the Northern Spotted Owl. TWS, founded in 1937, is an international non-profit association dedicated to excellence in wildlife stewardship through science and education. The Society's membership includes over 7,000 professionals and students with expertise in all aspects of wildlife conservation and management.

The Wildlife Society asked experts in population dynamics, spotted owl ecology, forest ecology and management, and fire ecology to review the 2007 Draft Northern Spotted Owl Recovery Plan. This group included persons who have participated in spotted owl research, planning, and recovery for the past thirty years. Their report is submitted herein as the Society's comments on the 2007 Draft Recovery Plan for the Northern Spotted Owl.

INTRODUCTION

The spotted owl, *Strix occidentalis*, is one of the most studied raptor species in the world. More papers have been written on its habitat relationships than any other raptor (Lõhmus 2004), and the largest mark-recapture population studies ever conducted on an endangered species have been done with the northern spotted owl, *S. o. caurina,* (Anthony et al. 2006). There is no other species listed under the U.S. Endangered Species Act for which such extensive information is available upon which to build a scientifically credible recovery plan. The 2007 Draft Recovery Plan (2007 Plan) does not adequately avail itself of the depth and breath of this information, resulting in a seriously flawed plan for recovery. For the reasons discussed below, neither option presented in the 2007 Plan will lead to recovery of this species. Indeed, the plan would reverse much of the progress made over the past 20 years to protect this species and the habitat upon which it depends.

The northern spotted owl has been managed on public lands by the U.S. Forest Service (USFS) and Bureau of Land Management (BLM) following direction provided by the Northwest Forest Plan (NWFP) (USDA and USDI 1994a and b) and implemented by the relevant Land and Resource Management Plans (LRMPs), since the Plan's adoption in 1994. Courtney et al. (2004) reviewed the status of the northern spotted owl and acknowledged that the current strategy (large and small reserves set in an "owl permeable" matrix) was based on sound scientific principles and that the scientific support for this management strategy has not substantially changed since the species was listed as threatened in 1990. In Appendix A the 2007 Plan correctly notes a declining population trend for the owl on 9 of 13 demographic study areas and the "precipitous declines" on 4 of the most northern study areas. The NWFP appears to have been effective in slowing this decline. The rate of decline for owl populations in the NWFP monitoring areas was about 2.4% per year compared to a rate of 5.8% per year for study areas outside the NWFP monitoring areas (Anthony et al. 2006). This result strongly suggests that a recovery plan for the northern spotted owl should be based on the NWFP and should strengthen provisions of that plan for spotted owls. Therefore, it is perplexing to find a proposed recovery plan that presents 2 options, both of which propose a reduction in suitable habitat available to the owl, a habitat specialist. In addition, these options apparently replace the general concern for habitat conditions with an increased attention to presumed competition between barred owls (*Strix varia*) and spotted owls.

OPTION 1

Option 1 reduces protection of habitat and known owl locations

The 2007 Plan states (Appendix A, p. 117) "the results from the first decade of monitoring do not provide any reason to depart from the objective of habitat maintenance and restoration as described in the NWFP and incorporated into LRMPs." However, instead of retaining or strengthening those measures in the face of declining populations, it reverts to the strategy that was presented in the 1992 draft Recovery Plan for Northern Spotted Owls. Although the 1992 draft Recovery Plan was appropriate given extant data at the time, basing the current plan on the 1992 plan has strongly negative consequences for spotted owl recovery because:

- It reduces, from current standards, the acres of suitable habitat that will be included in owl conservation areas
- It reduces the number of owl locations that will be included in owl conservation areas

The reduction in area conserved by the proposed 2007 Plan compared to the existing NWFP is displayed in Table 1 which compares acres included in land allocations under the existing LRMPs and the proposed Managed Owl Conservation Areas (MOCAs). This table is based on implementation of the 2007 Plan without the additional measures from the NWFP that are included in LRMPs. This assumption is necessary since the 2007 Plan does not base any of its recovery actions on those additional measures in LRMPs.

Table 1. Potential change in acres conserved from current Land and Resource Management Plans

State	Land use allocation from LRMPs[1]	Acres in LRMPs	Acres in MOCAs	Potential reduction in area conserved
Washington	LSR[2]	2,440,182	1,647,741	-792,441 (-32%)
	MLSA[3]	92,100	28,229	-63,871 (-69%)
	RR[4]	466,100	0	-466,100 (-100%)
	AMA[5]	405,326	65,482	-339,844 (-84%)
Oregon	LSR	3,622,155	2,173,074	-1,449,081 (-40%)
	MLSA	0	0	0
	RR	1,362,500	0	-1,362,500 (-100%)
	AMA	542,916	0	-542,916 (100%)
California	LSR	1,649,675	1,215,452	-434,223 (-26%)
	MLSA	7830	7830	0
	RR	798,900	7187	-791,713 (-99%)
	AMA	541,415	4315	-537,100 (-99%)
3 State Total	LSR	7,712,012	5,036,267	-2,675,745 (-35%)
	MLSA	99,930	36,059	-63,871 (-64%)
	RR	2,627,500	7187	-2,620,313 (-99%)
	AMA	1,489,567	69,797	-1,419,770 (-95%)

Data for Table 1, with the exception of data for riparian reserves, were taken from Table F1 in the 2007 Plan. Data for riparian reserves were taken from the Final Supplemental Environmental Impact Statement (FSEIS) for the NWFP (USDA and USDI 1994b). Land allocations considered are Late-Successional Reserves (LSRs), Managed Late-Successional Areas (MLSAs), Riparian Reserves (RRs), and Adaptive Management Areas (AMAs). Congressionally Reserved acres were not included because the conservation provided by Congressional Reserves would not be altered by the Recovery Plan.

Analysis (Table 1) indicates that there would be a range-wide reduction of 35% of acres currently included in LSRs for the NWFP. If other allocations were not retained in the LRMPS, there could be reductions of 64% of acres included in MLSAs, 99% of Riparian Reserve acres, and 95% of AMA acres. Reduction of LSRs and MLSAs would have direct effects on nesting, roosting, and foraging habitat for owls. Reduction in Riparian Reserve acres would be significant to owl conservation as the NWFP considered those areas to constitute key dispersal

[1] Land and Resource Management Plans
[2] Late-Successional Reserve
[3] Managed Late-Successional Area
[4] Riparian Reserve – acres of riparian reserves taken from Northwest Forest Plan
[5] Adaptive Management Area

habitat (see below). Reduction in AMAs would be significant as the AMAs provide for owl conservation in key geographic areas despite their more flexible management guidelines.

We derived rough estimates of changes in owl locations and acres of suitable habitat that would be conserved by applying the percent changes from Table 1 to data on owl locations and suitable habitat for the preferred alternative in the FSEIS for the NWFP. (We recognize that these data are outdated, but direct measures of these changes could not be derived from the scant data provided in the 2007 Plan). These estimates indicate that conservation measures would no longer be applied to over a million acres of suitable habitat currently protected within LSRs. Conservation measures could also be withdrawn from over a million additional acres of suitable habitat in MLSAs, AMAs, and Riparian Reserves. Loss of conservation measures for owl locations could be particularly significant, as it will potentially affect more than a third of those locations currently under a protective land use allocation. (Locations in riparian reserves are not included in this estimate as those data were not available from the FSEIS).

The 2007 Plan provides no justification for reducing conservation measures for northern spotted owls at a time when owl populations continue to decline. Reverting to the design of the 1992 Recovery Plan, with no assurance that other measures in the LRMPs would be retained, is not justified because of the declining trends in owl populations. The changes proposed in the 2007 Plan also would constitute a failure to adequately address a key reason for listing the owl: "failure of existing regulatory mechanisms." Implementing the design of the 1992 Recovery Plan in place of the existing LRMPs would decrease, not increase, the likelihood of recovering owl populations. Although it is somewhat dated, the analysis from FEMAT clearly showed that the 1992 Recovery Plan had substantially lower likelihood of recovering owl populations than did Option 9 that was ultimately adopted as the NWFP. In addition, any reduction in suitable habitat for spotted owls will likely increase the competitive pressure from barred owls, assuming barred owls are a potential threat.

Option 1 makes no provision for dispersal habitat

Recovery Action 34 (page 40) states "No special management objectives are necessary for providing for dispersal habitat." The ISC strategy (Thomas et al. 1990) and the former 1992 Recovery Plan specified that lands outside of reserves were to be managed by the 50-11-40 rule, which specified that 50% of the landscape would be managed to have trees with mean DBH of 11 inches and with at least 40% canopy cover. These guidelines were designed to provide dispersal habitat for owls to move between conservation areas. The NWFP did not implement the 50-11-40 rule, but FEMAT determined that habitat provided by Riparian Reserves, MLSAs, AMAs and retention of 15% cover in harvest units would provide for adequate dispersal habitat in lieu of the 50-11-40 rule. There have been no recent studies to update knowledge of dispersal habitat, and the present plan is seriously deficient in its lack of strategy to adequately address management of dispersal habitat. Such management is necessary because spotted owls do not forage effectively in cutover lands and their survival is poorer in these landscapes.

Priority for barred owl control is questionable, and proposed measures may not be feasible or effective

There is preliminary correlational but not causal evidence linking barred owl occupancy to reduced demographic performance of northern spotted owls. However, focusing on barred owls as the number one threat to spotted owls while at the same time decreasing habitat conservation for spotted owls is not justified from either scientific or conservation perspectives. An approach placing primary emphasis on controlling barred owls is incredibly risky and unlikely to lead to recovery by itself. To rely on untested efficacy of barred owl control to provide sufficient "relief" for spotted owls to prosper despite their current declining populations while allowing a significant decline in their habitat is not biologically warranted.

Efforts to research the possible competitive interactions between barred and spotted owls are appropriate as are controlled removal experiments (Buchanan et al. 2007). Should the barred owl be demonstrated to compete with spotted owls and hence significantly impair the population performance of spotted owls, widespread control of barred owls is one option that could be considered. The most promising strategy to employ, at present, is a combination of habitat conservation and research (removal experiments and autecological/behavior studies of barred owl/spotted owl interactions). Key questions to be answered are not only barred owl effects on spotted owls but also the effects of habitat amount and distribution on both species.

As a minor issue, the projected number of barred owls that will need to be killed in the 18 experimental areas is significantly underestimated. The proposed experiment does not take into consideration that it will be necessary to continue to kill dispersing juvenile and non-territorial barred owls that will continue to infiltrate the experimental control areas.

The presumed barred owl /spotted owl "competition" is being made the focal point of the recovery plan while habitat protection for spotted owls is inexplicably reduced. This action is not scientifically sound and will put spotted owls in additional jeopardy.

Goals for target percentages of suitable habitat are based on faulty science

The goals for the amount (%) of acres of suitable owl habitat to be retained in MOCAs in each physiographic province were established with faulty assumptions and approaches that were not based on sound statistical methods. Development of the goals did not use all of the scientific literature that is available on the topic, and the literature that was used was not intended to be used for management strategies for owls at the scale of a MOCA. Consequently, the goals for habitat capable acres in Recovery Criteria 4 should not form the basis for management of spotted owls. The specific comments below support these statements.

First, the goals for the amount of suitable habitat were based on the results presented in Franklin et al. (2000) and Olson et al. (2004), but FWS ignored, for the most part, the results of Dugger et al. (2005). The results of Franklin et al. (2000) for northern California and Olson et al. (2005) for western Oregon indicated that apparent survival rates and reproduction were positively related to the amount of suitable habitat within the home range, and the amount of edge between older and other forests had a positive effect on reproductive rates. These relationships also showed a quadratic form suggesting that there was some optimal amount of suitable owl habitat within the home range above and below which reproduction and apparent survival declines. We note that Franklin et al.'s (2000) study also showed that apparent survival was high in territories with high amounts of old forest, but that reproduction was not. FWS apparently did not understand this tradeoff. In contrast, the results of Dugger et al. (2005) for southern Oregon (geographically between the other 2 study areas) indicated that reproductive rates and apparent survival of spotted owls increased linearly with increases in the amount of old forest within the core nesting area, and the amount of edge between older forests and very young forests had no effect on either reproductive rates nor apparent survival rates. The results of Dugger et al. (2005) suggest that managers should maximize the amount of older forests within spotted owl nesting territories, not set some minimum amounts. The results of these three studies, therefore, leave a great degree of uncertainty as to how much older forest and edge are optimal to maximize demographic performance of spotted owls. The results of Dugger et al. (2005) should have been given equal weight as those of Franklin et al. (2000) and Olson et al. (2004) in the development of the 2007 Plan. Moreover, Franklin et al.'s study was not interpreted correctly. FWS apparently, incorrectly assumed that the "other" habitat category was young forest, but Franklin et al. (2000) stated the "other" category could be young forest, riparian forest, oaks, or any other category of vegetation that was not old forest. This interpretation was also explicitly stated to the recovery team.

Even the authors of these reports do not support their use for development of management guidelines. Olson et al. (2004:1052) state "we do not recommend that forest managers use our modeling results as a prescription for managing habitat either within the Oregon Coast Range or elsewhere until other similar studies have been conducted." In a letter submitted to the recovery team dated 21 November 2006, Alan Franklin states: "my coauthors and I have repeatedly noted that the monograph represents just a first approximation of these relationships, which form the basis for future studies, but in itself should not be considered definitive." Both statements clearly indicate that their results should not be used for establishing habitat goals for recovery of spotted owls. The selective use of the scientific literature by FWS is not appropriate and leads to erroneous recommendations.

The goals for the amount of suitable habitat in MOCAs in each physiographic province were not based on sound statistical methods for several reasons. First, FWS used only a small subset of the data in Franklin et al. (2000), which pertained to their Figure 10 (see comments in above paragraph), and a small subset of data in Olson et al. (2004), which pertained to their Figure 5. For a statistically sound approach, FWS should have (1) used the entire data set, not a small subset that was provided as an example in the original articles and (2) presented the results of statistical analyses that provided the equation of the lines and the degree to which the lines fit the data. Second, and most importantly, the approach was faulty statistically because the habitat specific lambdas (λ_h) in these three papers are estimates based on modeling of territory-specific estimates of apparent survival and reproductive rates in relation to vegetative characteristics. In other words, the habitat specific lambdas are not the true demographic performance of owls on their territories; they are derived by modeling. Consequently, any prediction of habitat specific lambda (λ_h) based on habitat characteristics is circular in nature and violates the assumption of independence in regression analysis.

The scale of FWS' analyses of the habitat data and application of results to management guidelines for northern spotted owls are inappropriate. Analyses by Franklin et al. (2000), Olson et al. (2004), and Dugger et al. (2005) were conducted at the scale of an individual breeding territory, which is a few square miles, whereas the MOCAs to which the guidelines are being applied incorporate tens to hundreds of square miles. Consequently, the results of these three articles are inappropriately applied to large reserves for management purposes.

In addition, the configuration and dispersion of suitable habitat are equally important as the amount of habitat, and the recovery plan is silent on this topic. Lastly, the specification of the amount of suitable habitat within a physiographic province or breeding territory implies that the remainder of suitable habitat above that goal may be available for harvest at some time in the future (although the 2007 Plan states that this is not the case at the current time). This is a dangerous implication because the 2007 Plan's analyses and assumptions are based on flawed assumptions, improper statistical methods, and selective use of the published literature. In summary, this section is not based on appropriate scientific analysis and inference and should not be applied to recovery goals for the species under either of the options.

Treatment of fire issues in the Recovery Plan is flawed

New science indicates spotted owl use of burned habitat is greater than anticipated

Appendix A of the 2007 Plan acknowledges, "spotted owls may be resilient to the effects of wildfire—a process with which they have evolved." Despite this recognition, the main part of the plan uses "habitat loss" when referring to the impacts of fire. The presumption of "habitat loss" is also central to some of the analyses.

In fact, we are just beginning to understand how spotted owls use habitat that has experienced wildfire. The 2007 Plan does not include the results of recent research on fire impacts on spotted owls. Recently, Darren Clark has studied spotted owl habitat use in the Timbered Rock, Quartz and Biscuit fires in Southwest Oregon, and Bond et al. (2006) have studied spotted owls and fire in the Sierra Nevada. These recent studies are briefly summarized here. More detail can be found in Appendix A (this document).

Clark (Appendix A) found that owls selected intermediate seral forests with moderate severity fire effects (20-70% canopy removal) and late-successional forests with low (< 20% canopy removal), moderate, and high (> 70% canopy removal) severity burned areas disproportionately more than available on the landscape. At least one pair of owls continued to occupy and raise young in a nesting center that had experienced moderate burn severity that the 2007 Plan would probably consider "habitat loss." Spotted owls also selected areas lower in elevation and closer to streams disproportionately to what was available to them suggesting an association with riparian areas. Owls did not use areas that had complete canopy removal over a large area.

Bond et al. (2006) radio-tracked 7 spotted owls 4 years after fire in the Sierra Nevada of California. All burn severities, including high severity, were preferred over unburned areas. The average home range sizes were smaller than reported in the literature for unburned forests. Thus, in this study, it appears the spotted owls were not negatively or neutrally affected by fire, but rather beneficially affected, possibly even by high severity fire. The authors suggest that in this system, fire stimulated much understory plant growth, which may have increased prey populations. In this respect, it is important to note that the study occurred 4 years after fire.

Time-since-fire is likely an important source of variation in the use of burned areas by spotted owls, particularly severely burned areas. Low spotted owl use of burned areas soon after fire, before natural vegetation has had a chance to regenerate and support potential prey, may not indicate low use later.

Together, these results indicate that spotted owls use burned areas, perhaps preferably after a few years of understory regrowth, and such areas do not become unsuitable as assumed in the 2007 Plan (see below). The results therefore support the conclusion in Appendix A of the 2007 Plan that spotted owls are resilient to fire, and that considerable research is still needed due to existing uncertainty. The effects of time-since-fire and spatial patterns of fire and post fire legacies (snags, green trees, vegetation regeneration propagules) are among the many variables that still need to be understood. With the existing uncertainty, the presumption in the plan (outside of Appendix A) that fire is detrimental and leads to habitat loss is not scientifically defensible. An operational hypothesis that fire is neutral appears appropriate given the existing state of knowledge. Consequently, the 2007 Plan's presumption of the need to treat large acreages to reduce fire hazards and potential loss of owl habitat is not based on sound science and may have a negative effect on spotted owls. In addition, the 2007 Plan's assumption that fire renders habitat unsuitable may result in salvage logging of habitat that is actually still suitable for owls.

<u>Measures proposed to reduce fire risk are based on faulty science and may reduce habitat effectiveness</u>

The 2007 Plan makes another fundamental assumption about fire and spotted owls that is not supported by existing science. That is that, unlike fire, the effects of fuel treatments are neutral or beneficial to spotted owls. No published literature describing the response of spotted owls to thinning or prescribed fires used to reduce fuel is cited in the 2007 Plan. This appears to be a major knowledge gap the plan does not acknowledge, making the assumptions mere speculation. While there is research underway to address this, no published results are currently available. Moreover, an unequivocal understanding of owl responses to prescribed fires will require an evaluation of the long-term impacts of the frequent treatments necessary to maintain very low levels of surface fuel. It is quite plausible that the intensity and frequency of treatments needed to maintain fuels at levels that could dependably reduce fire behavior would be directly in conflict with goals for maintaining and recovering spotted owl populations. This is a fundamental question that still needs to be addressed by long-term research.

The 2007 Plan does not define specific treatments that will be used to reduce ladder fuels and fuel loading. As described in Appendix B (this document) ladder fuels are often defined arbitrarily. If treatments are not done very carefully and strategically (using fire, slash cleanup and with adequate maintenance), there is considerable potential to actually increase fire severity. Fire prone understory vegetation can regrow quickly, and within 10 years other surface fuels may approach levels that occurred following a long period of fire exclusion (based on research in National Parks in the Sierra Nevada). Therefore, a long-term landscape planning exercise identifying treatments and a monitoring design is needed concomitant with an economic/feasibility analysis. Because there is little current understanding of the effects of fuels treatment regimes on spotted owls, treatments should be designed to facilitate owl habitat use investigations of treated areas. Initially at least, significant portions of spotted owl breeding/nesting territories should be left untreated, which will minimize impacts on owls and also lessen the monitoring burden. In this context, a goal of management should be to restore ecological processes thus reducing the need for repeated treatments (Fig. 1).

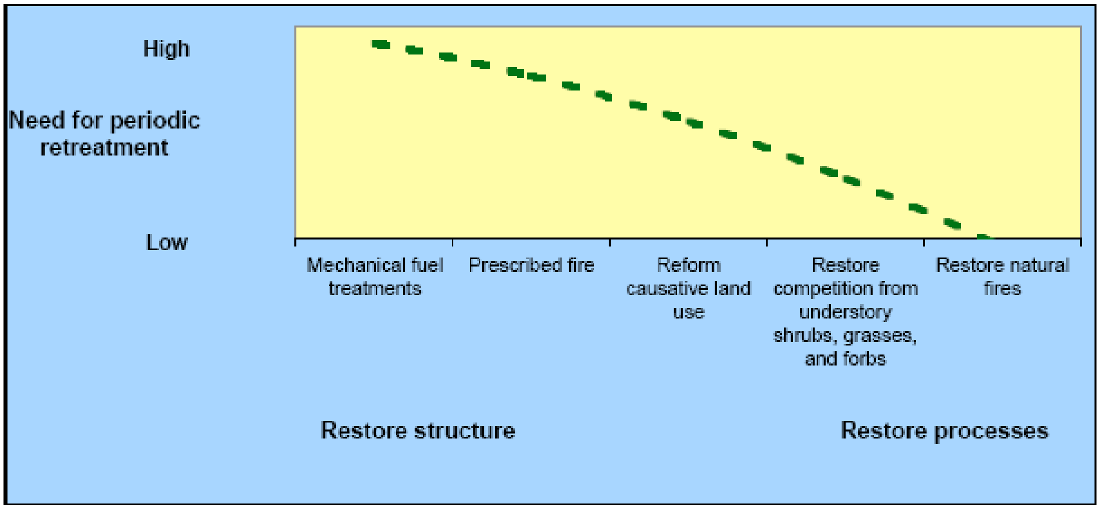

Figure 1. Continuum from structure to process based restoration. Restoring process can be self-sustaining, while structure based approaches require repeated treatments (adapted from Noss et al. 2006, reproduced from Rhodes (2007)).

It must also be recognized that fire is often weather-driven, rendering treatments ineffective. Thus, an important strategy, and one not mentioned in the plan, is to reduce fire risk. In order to reduce fire risk, it is necessary to evaluate the likelihood of a fire starting that will require suppression action (This is not the same as fire hazard, which is focused on fuel quantity and quality. Fire risk is often highest where fuels quantity is low due to flashy fuels like grass). The evaluation would consider the time of year, cause (lightning or human), fuels initially ignited (grass vs. forest), and proximity to road. The results of such analyses can provide many avenues to reduce fire risk. For example, by analyzing lightning ignitions, managers may be able to pre-position personnel and equipment during storms in specific areas because of the historic pattern of lightning fire occurrence. Road and/or area closures during periods of extreme fire weather or increased patrolling on days with high visitor use are common actions on non-federal public lands that are associated with effective prevention of human caused ignitions.

Guidelines for salvage will result in loss of habitat effectiveness

Recovery Action 22 states that "salvage" activities "should retain habitat structure of a quantity and quality so as not to significantly increase the length of time necessary for a spotted owl home range size area to reach the habitat criterion habitat levels." The backup for the logging guidelines is found in Appendix E (2007 Plan): Examples of How Recovery Action 22 Might Be Implemented (options 1 and 2). There are no references in this appendix to support the recommendations, leading to the conclusion that it is not based on any scientific literature. Appendix E provides only an unsubstantiated example of how the logging guidelines would be implemented. In addition, there are unfounded assumptions about burned areas not being owl habitat and about how burned and logged areas can become habitat in a certain amount of time.

There is much research needed, likely over a prolonged time, to answer these questions. The preliminary research by Clark (Appendix A, this document) indicates that areas logged after fire tend to be avoided. This is not surprising because logging removes many of the structural components that spotted owls and their prey are associated with after fire, particularly downed logs, snags, and structural diversity. Because the recovery plan lacks any scientific basis for providing logging guidelines, and burned habitat may be important to spotted owls, these guidelines should be discarded and forest affected by fire should be managed like other habitat that is important to spotted owls.

Recommendations for contributions of nonfederal lands are inadequate

The 2007 Plan was prepared with the understanding that federal lands would play the primary role in achieving recovery of the spotted owl, and this is entirely appropriate. However, there are many areas throughout the owl's range where the amount or distribution of federal lands are inadequate to achieve recovery, so that nonfederal lands must make contributions toward recovery. The Conservation Support Areas in the 2007 Plan apparently were designed to accomplish this task, and FWS is commended for including these areas in the plan. Unfortunately, the number of these areas and the management guidelines for them are inadequate to accomplish this task. Furthermore, there are numerous loopholes that likely will prevent the kind of management that is currently needed. This is especially of concern considering the declining spotted owl populations (Anthony et al. 2006) and presumed threats from barred owls (Buchanan et al. 2007). This is particularly the case for the state of Oregon where only 1 large and 3 small conservation support areas are designated.

The 1992 draft Recovery Plan identified areas of special interest where recommendations for nonfederal lands were specified to provide habitat for nesting owls and dispersal habitat. These areas are comparable to the Conservation Support Areas in the present plan but the present plan specifies many fewer areas, and the guidelines for these areas are vague or completely lacking. This is particularly perplexing because the status and trends of owl populations are much more precarious (Anthony et al. 2006) than they were in the early 1990s (Forsman et al. 1996). For example, the 1992 draft Recovery Plan identified supplemental pair areas, habitat for clusters of nesting owls outside of conservation areas, and guidelines for protective management in the areas of special management significance on nonfederal lands. The 2007 Plan is basically silent on these topics, leading to the assumption that there will be less habitat for nesting pairs, fewer recommended guidelines for management, and much lower contribution for recovery on nonfederal lands under this recovery plan. For example, the Elliott, Tillamook, and Clatsop State Forests in the Coast Range of Oregon were identified in the 1992 draft Recovery Plan as state-owned lands that should contribute habitat for nesting owls; however, these lands are neither mapped nor even mentioned in the 2007 plan. In fact, the acreage of the Conservation Support Areas in Oregon (575,385 acres) is considerably less compared to that of Washington (2,159,449 acres) or California (1,028,721 acres), and they are comprised mostly of federal lands (see page 166). In addition, the function for these lands in Oregon is mostly for dispersal habitat that is a much lower standard or requirement than that for nesting habitat. Consequently, the extent and function of the Conservation Support Areas in Oregon are inadequate. The state of Oregon should contribute to recovery commensurate with the states of Washington and California.

Most importantly, all of the guidelines for the Conservation Support Areas are "voluntary" or "encouraged" (see pages 39 and 40), which historically has been a prescription for decline in habitat and populations of spotted owls. The guidelines for the Conservation Support Areas should be mandatory until populations of spotted owls are fully recovered, and the extent of the areas protected under the current plan should equal or exceed that in the 1992 draft Recovery Plan, particularly when considering the current status and trends in owl populations (Anthony et al. 2006). This section of the plan needs to be revised and upgraded considerably to improve the contributions of nonfederal lands to conservation of the spotted owl.

OPTION 2

Because Option 2 purports to use the same "rule set" as option 1, all comments on Option 1 apply to Option 2 as well. The following sections describe weaknesses of Option 2 in addition to those already identified for Option 1.

Acreage of habitat reserves for spotted owls is further reduced

While not explicitly stated, all large habitat blocks were limited in acreage to accommodate a maximum of 20 pairs of owls. This significant change from Option 1 is obscured by the statement that Option 2 uses the same rule set as Option 1. In Option 1 many MOCAs were sized to accommodate more than 20 pairs following the example of the ISC Report and the1992 draft Recovery Plan. Because of the nebulous nature of Option 2 (see below) it is impossible to directly compare acreage in MOCAs versus acreage in large and small habitat blocks. However, a sense of the acreage reduction in Option 2 can be derived by comparing total acreage in individual MOCA1s in Table F2 of the 2007 Plan (pp 146-153) with "Calculated size of 20-pair habitat blocks (acres)" in Table F3 (p 163). For instance, if in the Western Oregon Cascades large habitat blocks were located in the same areas and in the same numbers as MOCA1s there would be a reduction from the 1,461,180 total acres in MOCA1s to 720,000 acres in large habitat blocks – a 50 percent reduction while purporting to use the same rule set. Nowhere is the magnitude of this reduction made evident in the 2007 Plan. Except for the example map offered in the Plan, it is impossible to anticipate what the assortment of small habitat blocks might offer in terms of either acreage (pairs potentially accommodated) or arrangement as this is left to future decisions by local managers. Note that the small block size could be as small as that which would only accommodate 1 pair of owls; such small blocks would contribute little to recovery of the species.

Other changes in the rule set for establishing reserves would have negative consequences

While Option 2 purports to use the same rule set as Option 1, there are a number of significant prescriptive differences between the two:

1. <u>Olympic Peninsula Has No Large Habitat Blocks Except For National Park Service Land</u>
Option 2 calls for only small habitat blocks of unspecified minimum size on US Forest Service lands on the Olympic Peninsula in Washington State. Such an approach will exacerbate an already precarious situation for the owl on the Olympic Peninsula.

2. No Provision For Connectivity Of Olympic Peninsula To Other Provinces

Option 2 mandates no connectivity from the Olympic Peninsula to other provinces (areas of appropriate habitat within the region). The spotted owls on the Olympic Peninsula are the most isolated of any current group, yet this option actually mandates no connectivity with other provinces. Again, there are no analyses or data presented to support the absence of connectivity.

3. No Provision For Connectivity Using Federal Lands In Coast Province Of California

Same concerns as in 2 above.

4. Eliminates Distance Limits For Habitat Blocks In Coast Province Of California

This provision will significantly weaken habitat conservation in the province.

In sum, the above four differences represent particularly damaging actions that increase the jeopardy of the spotted owl in many of the very geographic locations where its status is currently most vulnerable.

No Provisions for Coordination or Oversight Among Local Management Units

Option 2 does not provide adequate mechanisms for producing a coordinated range-wide set of large and small habitat blocks and Conservation Support Areas that will result in recovery of the northern spotted owl. Rather, the size and arrangement will be left to the local federal forest management entities to establish via their LRMPs. It is simply unrealistic to expect this approach to result in a credible reserve system while each management unit applies its own interpretation of the "rule set" to achieve multiple and varying land use goals. Indeed, dependence on such a management system in the 1980s was one of the reasons for the owl's listing ("failure of existing regulatory mechanisms"), and the need for coordination would not be adequately addressed by the 2007 Plan. Coordination of reserve design between all state and federal agencies is especially critical in these times of emerging new threats. The need for a consistent and coordinated management approach is even more evident should barred owls, West Nile Virus, or other factors such as changes stemming from global climate change impact spotted owls. For each federal forest management unit to devise and implement its own response to emerging challenges is a recipe for a chaotic approach to spotted owl recovery, and a subsequent "failure of existing regulatory mechanisms."

GENERAL COMMENTS

Composition of spotted owl working group

Both options call for formation of a spotted owl "working group" to facilitate and coordinate recovery efforts. To be both credible and effective this inter-organizational group needs representation of managers, owl scientists, forest ecologists, and others with expertise needed to resolve specific challenges. This should be explicitly stipulated.

Population monitoring

Recovery criterion 2 and recovery action 13 are both necessary and appropriate. Population monitoring of spotted owls currently involves well-distributed demographic study areas and yields scientifically credible estimates of population trends at considerable expense. Recovery action 13 indicates that other statistically valid monitoring methods may be possible and should be tested. The new methods that are being tested are based only on monitoring occupancy of sites by owls (presence or absence) whereas the current approach is based on estimation of occupancy, age specific fecundity, age specific survival, and annual rate of population change. Consequently the current methods provide more detailed information on the population dynamics of the species. That is, they provide the opportunity and data to understand the dynamic changes within the population, whereas occupancy analysis alone obscures the underlying process of population change. Thus, adaptive management will be a less obtainable goal using occupancy alone. Adoption of new monitoring methods also would break the continuous population data set exceeding 20 years that would confound interpretation of population trends for a significant time. At the very least any new method should be conducted concurrently for 10 years with existing monitoring to allow sufficient time to "calibrate" the results and confirm their interpretation. The current demographic study area-based population monitoring also provides the base data for a variety of current and proposed spotted owl research efforts. Among these are various barred owl/spotted owl investigations including experiments on the potential for removal. Departure from the current monitoring program is unwise in the foreseeable future.

Absence of ecosystem considerations

It is widely acknowledged that the habitat conservation measures for the northern spotted owl provided by the NWFP also provide much of the conservation security for the marbled murrelet, salmonids, and a variety of other species associated with old forest systems. However, neither option in the 2007 Plan considers the impact of the proposed actions on other old forest associated species. This lack of an "ecosystem approach" invites species by species-management actions, which is a highly inefficient and potentially problematic conservation strategy.

Peer review

It seems inappropriate to only have submitted a small portion of the 2007 Plan (Appendix A) for peer review prior to distribution of the draft 2007 Plan.

Weakness of the Plan's Presentation

The 2007 Plan precludes objective evaluation because there is rarely a clear presentation of either the scientific basis for the plan or novel analysis/data to support its framework/recommendations. It is clear that the proposed management in both options substantially reduces the acreage managed to provide suitable habitat currently called for in the LRMPs. Yet, the 2007 Plan provides no straightforward way to compare current land use management allocations (per NWFP and LRMPs) with either the proposed Options 1 or 2. Neither does the 2007 Plan offer comparisons with the 1992 draft Recovery Plan. Tabular data are required along with appropriately scaled maps for quantitative and visual comparison of these plans with the NWFP. The maps on pp. 119-124 lack sufficient size and detail to permit meaningful comparison even between Options 1 and 2.

The 2007 Plan departs from the previous management plans in that it does not provide estimates of either current owl pairs or projected future pairs for the MOCA system (Option 1). A critical component for the public's understanding of the plan is impossible to provide for Option 2 because habitat blocks will only be delineated at some future date by local managers. Both options should provide estimated numbers of owls in proposed reserves at the current time and in the future when fully occupied.

The times to accomplish and costs associated with recovery actions are, at best, difficult to determine. It appears, however, that both the time and costs involved are significantly underestimated. How these two very different options arrive at identical estimates of cost and time to recovery is puzzling at best. It suggests that either the cost estimates or Option 2 were ad hoc exercises.

Errors

In the map of Option 2 (Appendix B, p122) for Washington, the entire Olympic National Park is mapped as a habitat block without regard to elevation constraints.

It appears that tabular presentations may not have been "error checked" as on page 147, Table F2 last row "Washington Total" MOCA type (1 or 2) should read 10/39 versus 7/42.

SUMMARY AND RECOMMENDATIONS

Northern spotted owl populations continue to decline across the range of the species at a rate of about 3.7% per year (Anthony et al. 2006). Declines in the state of Washington are so significant that populations in the state might justifiably be considered endangered rather than threatened. The Northwest Forest Plan appears to have been effective in slowing general decline of this subspecies across its range. This result strongly suggests that a recovery plan for the northern spotted owl should be based on the NWFP and should strengthen provisions of that plan for spotted owls. Instead, the 2007 Plan substantially weakens virtually every provision that is already in place for northern spotted owls.

Option 1 reduces protection of habitat and known owl locations, makes no provision for owl dispersal habitat, proposes potentially ineffective barred owl controls, proposes new targets for % of suitable habitat in conservation areas without scientific justification, makes faulty assumptions about the value of burned habitat to owls, proposes fuel and salvage treatments that are likely to reduce habitat effectiveness, and provides inadequate recommendations for the contribution of nonfederal lands to recovery. Apparently the proposed barred owl control program is expected to offset the significant reduction in habitat protection currently afforded by the NWFP, but that is a scientifically unjustified assumption even if barred owls are shown to be a significant threat to spotted owls (note that spotted owl populations were declining across their range prior to the NWFP, even in areas where there were no barred owls (Forsman et al. 1996)). Finally, an important criterion for listing the northern spotted owl was "failure of existing regulatory mechanisms." The discussion of this issue under both options reflects either a misunderstanding of the nature of the problem identified during listing or an assumption that returning to the era of maximum flexibility in land management will no longer result in a direct threat to the owl. Under the strategies proposed, the weakness of regulatory mechanisms will remain as a primary threat to spotted owls.

Option 2 appears to be an ad hoc effort to reduce protection of the owl from the standards applied in Option 1. In addition to the flaws identified in Option 1, Option 2 drastically reduces protection for owl habitat and maximizes flexibility given to land managers by allowing them to operate under a series of nebulous rules. This option will lead to direct loss of owl habitat through logging. It suggests a desire to return to the era of failed government conservation plans developed in the 1980s, which ultimately led to the owl's listing. In essence, the assessment by Thomas and Verner (1992) that economic considerations drove the lack of effective conservation plans seems particularly evident in Option 2. Furthermore, with decreased protection of suitable habitat, Option 2 retains the same (and overly optimistic) recovery estimates of time and identical expenses as Option 1. Even more perplexing are the contradictory assertions in the document that both options are the "best" option.

In short, either option presented in this recovery plan, if accepted and implemented, would represent a significant step backward for a species that is clearly still in trouble.

We are drawn to the conclusion that Options 1 and 2 will not achieve the basic interest of spotted owl conservation. We come to this conclusion because the spotted owl is one of the most studied species ever listed under the ESA, yet there is no reliance in this plan on the breadth and depth of the information available to create a scientifically credible plan or to even address reasons why the owl was listed in the first place (i.e. declining populations and failure of existing regulator mechanisms).

Because this draft plan falls so far short of the measures that are needed to recover spotted owls, it should not be used as a basis for a final version of the recovery plan. Instead, the Fish and Wildlife Service should start over with a fundamental commitment to using the best available science and finding real solutions to threats faced by spotted owls. In doing so, the Fish and Wildlife Service should reconstitute the membership of the recovery team so that it emphasizes biologists and ecologists with extensive expertise in the biology of the spotted owl and the ecology and management of Pacific Northwest forests. It is apparent that much hard work was done to produce this draft recovery plan and that there were biologists and others both on the team or supporting the team who had the requisite expertise. But, a recovery team should have the strongest representation from the relevant wildlife and forest ecology/management disciplines. Such a team would not exclude land manager or environmental representation, but rather would recognize that comprehensive biological and scientific assessments by relevant experts are the most likely path to development of a credible, effective recovery plan. With such a team in place and appropriate commitment, the Fish and Wildlife Service should produce a plan that provides high likelihood of owl recovery.

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Appendix A

Post-Fire Habitat Selection of Spotted Owls (*Strix occidentalis*): A Summary of a M.S. Thesis Research Project

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Introduction

Scientific research in post-fire landscapes with spotted owls has been extremely limited. Bond et al. (2002) found minimal evidence of short-term (1 year) changes in survival, reproduction, mate and site fidelity following wildfire. Furthermore, Mexican spotted owl (*S. o. lucida*) occupancy and reproduction at burned territories was determined to be marginally less than unburned territories (Jenness et al. 2004). Spotted owls on the east side of the Cascade Range in Washington shifted habitat use outside of burned areas following wildfire and occasionally used low intensity burns, but sample sizes were limited (Bevis et al. 1997). Although research in burned landscapes is limited, the large body of spotted owl research in unburned landscapes allow for general predictions regarding the post-fire habitat use of spotted owls. Following wildfire, spotted owls selected the oldest and most structurally diverse forests as preferred habitat, as seen in previous research in unburned landscapes (See review in Thomas et al. 1990, Carey et al. 1992, Glenn et al. 2004). Spotted owl habitat use was hypothesized to decline with increasing fire severities because forest stands that received high severity burns no longer provide sufficient overstory canopy cover, structural complexity, and downed wood (Mills et al. 1993, Buchanan et al. 1995, North et al. 1999, Herter et al. 2002). Furthermore, as understory vegetation and downed wood debris are consumed by fires, the total abundance of prey may decrease, which may cause owls to shift habitat use to areas of more abundant prey (Carey and Peeler 1995, Ward et al. 1998).

Post-Fire Habitat Use of California Spotted Owls

During the summer of 2006, 7 California spotted owls (*S. o. occidentalis*) were monitored with radiotelemetry during the breeding season in the Sierra Nevada Mountains at the McNally Fire (Bond et al. 2006). Preliminary analysis of habitat use indicated that owls in this study used low severity burns disproportionately more than was available (Table 1). Moderate and high severity burns were used slightly more frequently than available and surprisingly spotted owls used unburned habitats less frequently than their availability.

Table 1. Breeding season, chi square habitat use analysis of 7 California spotted owls at the McNally fire during the summer of 2006.					
Burn Severity	Proportion Available	Expected # of Points	Observed # of Points	Difference	χ^2 Probability
Unchanged	31%	73	26	-47	<0.001
Low	30%	71	107	36	<0.001
Moderate	26%	61	69	8	<0.001
High	14%	32	35	3	<0.001

Post-Fire Habitat Selection of Northern Spotted Owls

From September 2004 through August 2006, 13 northern spotted owls (*S. o. caurina*) were monitored with radio-telemetry at the Timbered Rock Fire in southwest Oregon (Clark 2007). Spotted owls were observed using a wide variety of habitat types (Figure 1), including high and moderate severity burns, but habitat use was dominated by late-successional forests receiving a low severity fire. Habitat selection was analyzed with logistic regression by determining selection or avoidance of cover types over a reference habitat (Rosenberg and McKelvey 1999). Early seral habitat was used as a reference for comparisons of odds ratios because it is commonly available and is not a preferred habitat of spotted owls (Thomas et al. 1990). The best habitat selection model included a large number of variables including several abiotic factors (Table 2).

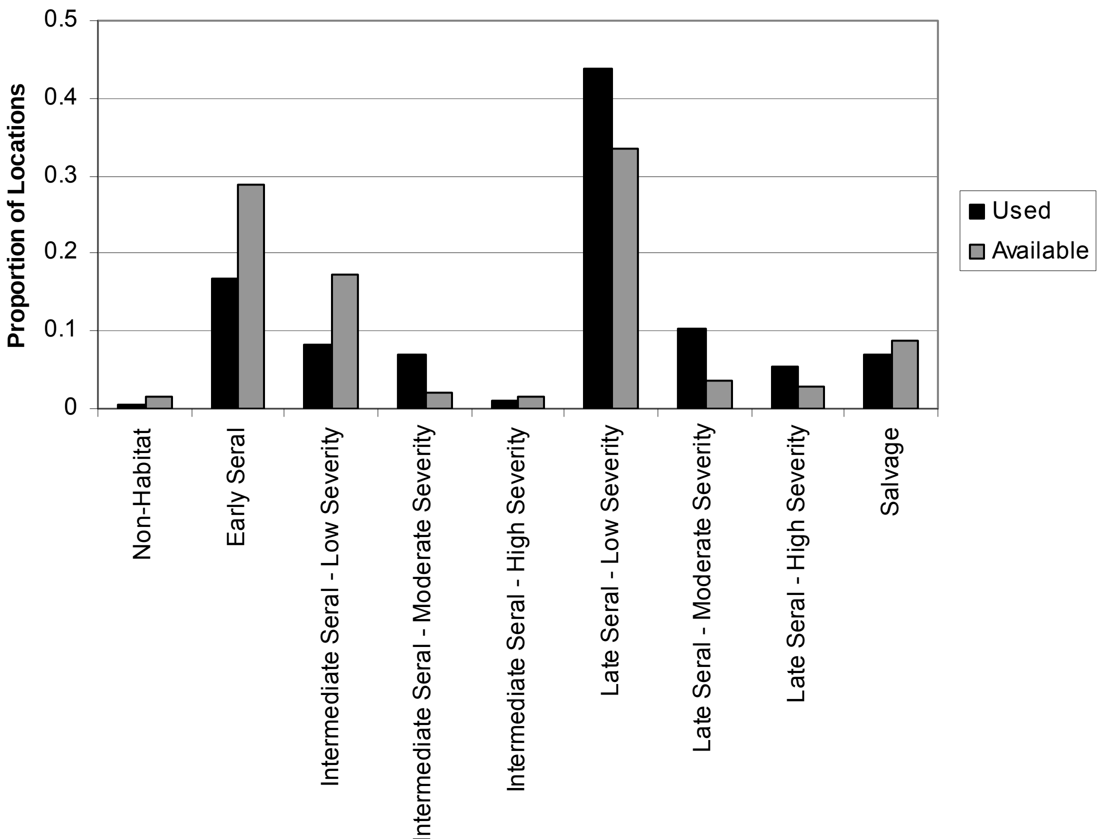

Figure 1. Proportions of used and available habitats for northern spotted owls residing within the boundaries of the Timbered Rock Fire from September 2004 to August 2006.

Table 2. Parameter estimates for the best model explaining landscape habitat selection at the Timbered Rock Fire, for radio-tagged owls within the fire boundaries.

Parameter	Estimate	SE	p-value	Odds	95% C.I. Odds Ratio
Intercept	0.27	0.16	0.09	NA	NA
Non-Habitat	-1.18	0.36	0.00	0.31	0.15 - 0.62
Intermediate Seral - Low Severity	-0.23	0.12	0.05	0.79	0.63 - 1.00
Intermediate Seral - Moderate Severity	1.42	0.14	0.00	4.15	3.15 - 5.48
Intermediate Seral - High Severity	0.01	0.28	0.98	1.01	0.58 - 1.76
Late Seral - Low Severity	1.17	0.09	0.00	3.23	2.73 - 3.81
Late Seral - Moderate Severity	1.50	0.12	0.00	4.48	3.52 - 5.69
Late Seral - High Severity	1.28	0.15	0.00	3.58	2.67 - 4.80
Salvage	0.46	0.13	0.00	1.58	1.23 - 2.02
Stream	0.00	0.00	0.00	1.00	0.99 - 0.99
Road	0.00	0.00	0.00	1.00	0.99 - 0.99
Elevation	0.00	0.00	0.00	1.00	0.99 - 0.99
Aspect	0.00	0.00	0.00	1.00	0.99 - 1.00
Hard edge	0.00	0.00	0.00	1.00	0.99 - 0.99

Habitat selection results indicated that spotted owls avoided non-habitat areas and intermediate seral forests with low severity burns. Intermediate seral forests with high severity burns (>70% canopy removal) were used in a similar manner to early seral forests throughout the landscape. Several habitats were selected by spotted owls following wildfire including: intermediate seral forests with a moderate severity burn (20 – 70% canopy removal), and late successional forests with low (< 20% canopy removal), moderate or high severity burns. Spotted owls also selected areas lower in elevation and closer to streams than at random. Furthermore, owl locations were closer to edge habitats than at random throughout the landscape.

Post-fire Habitat Use Summary

Results from recent telemetry studies indicated that spotted owls are capable of using a wide variety of habitats following wildfire. Similar to previous results of spotted owl habitat use (Forsman et al. 1984, Carey et al. 1992, Glenn et al. 2004), the oldest and most structurally diverse forest stands with the least amount of fire damage were used disproportionately more by spotted owls following wildfire. Spotted owls selected late-successional forests that had greater than 70% of the over-story canopy removed by wildfire (Clark 2007) and high severity burns in central California (Bond et al. 2006), which indicated that spotted owls are capable of using areas previously thought of as unsuitable habitat following wildfire. Furthermore, California spotted owls were observed using moderate severity burns more frequently than available (Bond et al. 2006), and intermediate and late-succesional forests with 20 – 70% of the overstory removed by wildfire were selected by northern spotted owls (Clark 2007). This indicates that spotted owls will use the best available habitat disproportionately following wildfire, but will also utilize habitats that were previously thought of as unsuitable.

Spotted owls used areas closer to streams and lower in elevation than random throughout the landscape, indicating disproportionate use of riparian areas (Clark 2007). Riparian areas in post-fire landscapes may benefit spotted owls through decreased fire severities (Reeves et al. 2006), and these areas often possess the vertical structure components of forest stands that spotted owls prefer. Clark (2007) found spotted owls using areas closer to hard edges than at random throughout the landscape. Hard edges were defined as the interface between suitable (intermediate and late seral with a low or moderate severity burn) and unsuitable habitats (non-habitat, early seral forests, high severity fire, and salvage logged areas). It has been hypothesized that spotted owls use hard edges disproportionately because prey are more abundant in early seral forests (Carey and Peeler 1995, Franklin and Gutierrez 2002), particularly woodrats in southwest Oregon and northwest California (Zabel et al. 1995, Ward et al. 1998).

In summary, spotted owls typically use the highest quality habitat remaining following wildfire, but are capable of using a wide variety of habitat types. Moderate severity burns are selected by spotted owls over early seral forests and likely provide important habitat features. Furthermore, riparian areas provide high quality owl habitat as demonstrated by spotted owls disproportionately using these areas. Low severity fires are the least detrimental to spotted owls, but moderate severity burns are capable of providing suitable habitat to spotted owls as well. Late successional forests with high severity burns are selected by spotted owls over early seral forests, but are detrimental to spotted owls if large tracts of suitable habitat are lost to high severity fire, which may force owls to emigrate.

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Appendix B

Northern Spotted Owl Recovery Plan: Evaluation of Fire management issues

There are five fire-related issues raised in the plan that are not adequately treated using the best and latest science. As a consequence, the fire-related management proposed in the plan has significant potential for conflict with recovery of the northern spotted owl through degradation of its habitat.

1. Fire and Northern Spotted Owl Habitat

Fire does not cause habitat loss as described in the body of the plan and assumed in the management proposed. As mentioned in Appendix A of the plan (Background), "spotted owls may be resilient to the effects of wildfire—a process with which they have evolved." Conflicting with this, the narrative portion of the plan uses "habitat loss" in reference to effects of fire. The presumption of "habitat loss" is also central to some of the analyses. There is no map or explanation of what fire effects constitute habitat loss. Therefore, a wide range of conditions and spatial patterns created by fire may be included under sweeping generalizations about "habitat loss" due to fire.

Also mentioned in Appendix A of the plan is the need for more research on how spotted owls use habitat affected by fire. Clarke (2007) summarizes the most recent research on northern spotted owls and fire, including his own recent studies. Clark (2007) found that owls selected intermediate seral forests with moderate severity fires (20-70% canopy removal) and late-successional forests with low (< 20% canopy removal), moderate, and high (> 70% canopy removal) severity burned areas disproportionately more than available on the landscape. Spotted owls also selected areas lower in elevation and closer to streams than what was available to them. At least one pair of owls continued to occupy and raise a young in a nesting center that had experienced moderate burn severity that the plan apparently considers "habitat loss." Owls did not use areas that had complete canopy removal over a large area in a landscape in which logging occurred in a checkerboard fashion in such areas after fire. See Clarke (2007) for further details.

Bond et al. (2006) radio-tracked 7 spotted owls in the McNally burn area in the Sierra Nevada 4 years after fire. This was a large fire that, like much of today's cumulative burned area in fire-prone provinces, burned in a landscape where fire had been long excluded. There was a mixture of high, but mostly low and moderate burn severity. High severity fire was patchy within a matrix of less severe fire. The landscape was also largely unaffected by logging. During 2006, Bond et al. monitored how spotted owls used areas burned at varying severity compared to unburned areas. All burn severities, including high severity, were preferred over unburned areas. The average home range sizes in the McNally Fire were also smaller than reported for unburned forests. Thus, in this study, it appears the California spotted owls were not negatively or neutrally affected by fire, but rather beneficially affected, even by high severity fire. The authors suggest that in this system, fire caused a lot of understory plant growth, which may have increased prey populations. In this respect, it is important to note that the study occurred 4 years after fire. Habitat use may have been much lower prior to growth of understory vegetation, and it may not have been possible to predict initially after fire. Time-since-fire is likely an important source of variation in the use of burned areas by spotted owls. Although the study was done on the California spotted owl, it is noteworthy that the same assumptions regarding fire have been applied to this subspecies as have been applied to the northern spotted owl. The work also occurred in a fire-prone region in which fire has been long-excluded, much like fire prone areas where the northern spotted owl occurs.

The results of both studies are generally consistent in supporting the conclusion in Appendix A of the plan that spotted owls are resilient to fire. They suggest that it is not possible to conclude without additional evidence that fire, even stand-replacing fire, is necessarily detrimental. Thus, the operational hypothesis in the plan, that fire is detrimental, and necessarily leads to habitat loss, does not appear scientifically defensible. An operational hypothesis that fire is neutral, and that burned habitat is, on average, similar in value as unburned, appears scientifically defensible in the absence of additional data.

In this context, it may be worth noting that there does not seem to be a spatial association between fire at a landscape scale and a decline in owls. In fact, in almost all the provinces in which the owl is stable or increasing (exception is Wenatchee), there have been significant fires in recent years, but this does not seem to be the case where the owl is declining. Though fire is rare compared to historic rates, perhaps existing fires are helping creating landscape and habitat heterogeneity that is beneficial in the landscapes it is affecting. If fire is a threat, as described, there should be a pattern of decline associated with fire at the landscape scale. Instead, it appears that there is more of a north-south pattern, with owls declining more as a function of latitude. These spatial patterns in relation to fire deserve further attention in evaluating how fire may be affecting spotted owls.

It is also noteworthy that timber harvest is affecting critical habitat more than fire (0.68 percent of habitat downgraded versus 0.62), and the former is known to lead to habitat degradation, which cannot be said for most fire. The majority of fire is low and moderate in severity.

In addition, it should be noted that with rates of burning in the last decade, which include anomalously large fire years, severe fire is occurring at a rate that is about 1/7th the rate that forests redevelop. According to Davis and Lint (2004), 1.3 percent of habitat rangewide was affected by stand-replacing fire from 1995-2003. This is a rotation interval of 692 years (i.e. 9/.013). This is the population mean fire frequency for stands or points in the landscape. This compares with about 100 years for forests to redevelop. With these rates the landscape will be predominantly dominated by forest (86 percent), compared to regenerating forest. At these rates, mature forest will continue to increase and regenerating forest decrease because some fire will occur in regenerating forest, decreasing the transition from mature to regenerating forest. In addition, forest regeneration in productive regions like the Klamath may only take 50 years (Odion et al. 2004). Clearly, fire is not a major threat to the spotted owl rangewide, especially considering that regenerating forest may function as habitat.

A more cautious and conservative approach that considers fire and possibly other natural disturbances that spotted owls evolved with to have effects that are not negative and threatening would be appropriate for the recovery plan. This would have important implications:

- Fire alone (i.e., without logging or seeding, etc.) would no longer be considered one of the threats to the northern spotted owl. Logging or other degradation of burned habitat would be threat in a similar way to logging of green forests.
- The definition of habitat quality based on the spotted owl's use of habitat (habitat quality similar to that used by 90 percent of the known spotted owl pairs nesting or roosting in that province) is potentially biased against fire because burned habitat is not effectively considered due to its relative rarity as a result of fire exclusion. Additional research at the sub-province scale in landscapes with burned and unburned areas can help define habitat quality in a way that better accounts for burned habitat.

2. Guidelines for Logging Burned Areas

Recovery Action 22 states that "salvage" [6] activities "should retain habitat structure of a quantity and quality so as not to significantly increase the length of time necessary for a spotted owl home range sized area to reach the habitat criterion habitat levels." The backup for these logging guidelines is found in Appendix E: Examples of how Recovery Action 22 might be Implemented (Options 1 and 2). Unfortunately, there are no references in this appendix to support the recommendations, so they are apparently not based on any scientific literature. Appendix E provides only an example of how the logging guidelines would be implemented with no justification or assurance that it would work for spotted owls. In addition, there are unfounded assumptions about burned area not being owl habitat (discussed above) and about how logged habitat can become habitat in a certain amount of time using approaches that are unspecified and apparently unproven. There is much research that needs to be done over a long period of time to answer these questions. The preliminary research by Clark (2007) indicates that areas logged after fire tend to be avoided. Also, logging removes many of the structural components that spotted owls and their prey are associated with after fire, particularly downed logs, snags, and structural diversity. The plan does not seem to recognize the need for these habitat features. Moreover, logging and replanting after fire has been found to increase subsequent fire severity where studied empirically (Thompson et al. 2007). More generally, the plan does not recognize that compounding fire with intensive disturbances such as logging is predicted from ecological principles to reduce biodiversity and ecological complexity by eliminating legacies and heterogeneity associated with disturbance, and by creating stress that many organisms cannot tolerate (Odion and Sarr 2007). Since the recovery plan lacks any scientific basis for providing logging guidelines, and burned habitat may be important to spotted owls, it would be more appropriate to consider that burned forest be managed like other habitat that is important to spotted owls. The guidelines in the 1992 draft Recovery Plan or those in the NWFP would also be preferable to those in the 2007 Plan in terms of the fate of spotted owls.

3. Managing Fire Risk

Notwithstanding that fire may benefit spotted owls, a management goal of continuing to maintain historically unprecedented, low rates of fire will remain for the foreseeable future. Completely overlooked in the plan is that any management approach to prevent fire should involve first and foremost fire management planning. In particular, managing ignitions is a key to effectively

[6] The more descriptive phrase "post-fire logging" is preferred in a biological context when discussing logging after fire because "salvage" has a misleading connotation in terms of ecological effects.

reducing fire. Effective planning is can also be a cost-efficient strategy, especially compared to the great cost of proposed vegetation manipulations (at $2,000/acre it would cost $2.4 billion to treat 20 percent of MOCA's alone, the area to be treated around MOCA's would cost more than twice this, for a rough total of $10 billion).

In order to reduce fire risk, it is necessary to evaluate the likelihood of a fire starting that will require suppression action (this is not the same as fire hazard, which is focused on fuel quantity and quality. Fire risk is often highest where fuels quantity is low due to flashy fuels like grass). If fire risk reduction is a goal, the plan needs to present management options based on an analysis of ignitions. The analysis would consider the time of year, cause (lightning or human), fuels initially ignited (grass vs. forest), and proximity to road. The results of such analyses can provide many solutions to effectively reducing fire risk. For example, by analyzing lightning ignitions, managers may be able to pre-position personnel and equipment during storms in specific areas because of their historic pattern of lightning fire occurrence. Similarly, areas with human ignitions may be controlled by limiting access via gating or road closure (or decommissioning, which has additional habitat benefits for spotted owls). Road, and or land area closures during periods of extreme fire weather or increased patrolling on days with high visitor use are common actions on non-federal public lands that are associated with effective fire prevention.

By not describing these actions in support of its goal of reducing fire or its effects, the plan appears to overlook ecologically benign fire management actions in favor of activities that are not benign. These activities potentially conflict with goals for both fire and spotted owls, as described in the next two sections.

4. Fuel Treatments and Northern Spotted Owls

The 2007 Plan appears to make another fundamental assumption about fire and spotted owls that is not supported by existing science: that the effects of fuel treatments are neutral or beneficial to spotted owls. No published literature describing the response of spotted owls to thinning or prescribed fires that may be used in an effort to reduce fuel is cited. This appears to be a major knowledge gap that the plan does not mention. While there may be research underway to address this currently, results are not yet available. Moreover, there will be a need to evaluate the long-term impacts of frequently repeated treatments necessary to maintain low levels of surface fuel. It is quite plausible that the intensity and frequency of treatments needed to maintain fuels at levels that could dependably reduce fire behavior would be directly in conflict with goals for maintaining and recovering spotted owl populations. This is a fundamental question that still needs to be addressed.

5. Fuel Treatments and Fire

The plan does not define what the treatment of ladder fuels and fuel loading will consist of. The term ladder fuel is now commonly used in an arbitrary manner in management and policy arenas, and some forestry and ecological literature. It is rarely if ever used among fire physicists. The ladder idea is often misused to refer to biomass that is presumed necessary to "allow" a fire to reach the canopy of a forest. This is misleading. If overstory tree crowns are sufficiently heated from below, a function of windspeed and interrelated surface fire intensity, they can easily bridge a considerable fuel gap and burst into flame. Fire does not have to climb a hypothetical ladder to affect crown fire. There is also much uncertainty about the minimum foliage density needed to propagate fire vertically (which will depend on the chemical energy of the foliage and its surface to volume ratio) and what size trees are ladders. In addition, ladder fuel concepts do not recognize that crown fire requirements are modeled based on live foliage, not on other canopy biomass, an important distinction. Thus it is not clear what constitutes a "ladder" fuel, or, similarly, the base height of tree canopies, and the concept has been overgeneralized to other biomass. This has not been recognized in models the agencies employ to predict crown fire (Flammap, Nexus)(Cruz et al. 2004). These models appear to significantly underestimate the importance of windspeed as a control, while overestimating the importance of "ladders" and crown base height (e.g., Cruz et al. 2004).

Treatments need to be carefully designed to focus on surface fuels to reduce heat output required for canopy ignition (Stephens 1998). If treatments are not done very carefully and strategically (using fire and with adequate maintenance) there is considerable potential to actually increase fire severity. For example, "ladder fuel" treatments consisting of commercial thinning increase surface fuel, which then must secondarily be treated to prevent an increase in fire risk. Fire prone understory vegetation can regrow quickly after treatment, and other surface fuels may approach levels that occurred following a long period of fire exclusion within 10 years (based on research in National Parks in the Sierra Nevada). Therefore a long-term landscape planning exercise identifying fire treatments to reduce surface fuel and a revisit design is needed; this needs to be accompanied by an economic/feasibility analysis because fire use is limited. The great expense of treatments estimated in the plan, the need for frequent maintenance, and the low likelihood of stand-replacing fire in the range of the spotted owl (i.e. only once in 692 years on average with current rates, see above), further emphasizes the need for strategic planning. Risk assessments are needed to identify areas where the greatest likelihood of excess fire effects may be expected. This will be in landscapes where ignitions are escaping and high severity fire can be linked to fuel and is not mostly driven by weather and climate, which cannot be managed. This planning needs to be much more strategic than existing Condition Class or Landfire approaches, which identify most forested area at high risk due to fire without considering existing low rates of fire. Such approaches target long-unburned areas. These by definition may have the lowest fire risk based on rates of burning. In addition, in closed forests, counter to the prevailing assumptions, long-unburned old-growth forests may exhibit the lowest fire severity in a landscape (Azuma et al. 2003, Odion et al. 2004), and lower than managed forests (Weatherspoon and Skinner 1995, Stephens and Moghaddas 2005). Azuma and Christensen (2003) use Forest Service Forest Inventory and Analysis (FIA) data from the Biscuit Fire area to describe how long-unburned old-growth structural characteristics are conducive to the lowest landscape fire severity.

Because there is little current understanding of the effects of fuels treatment regimes on spotted owls, treatments should be designed to accommodate owl habitat use, thus promoting adaptive management. Initially at least, core spotted owl habitat areas should be left untreated, which will minimize impacts on owls and also lessen the revisit burden. In this context, a goal of management should be to restore ecological processes thus reducing the need for repeat treatments (Fig. 1).

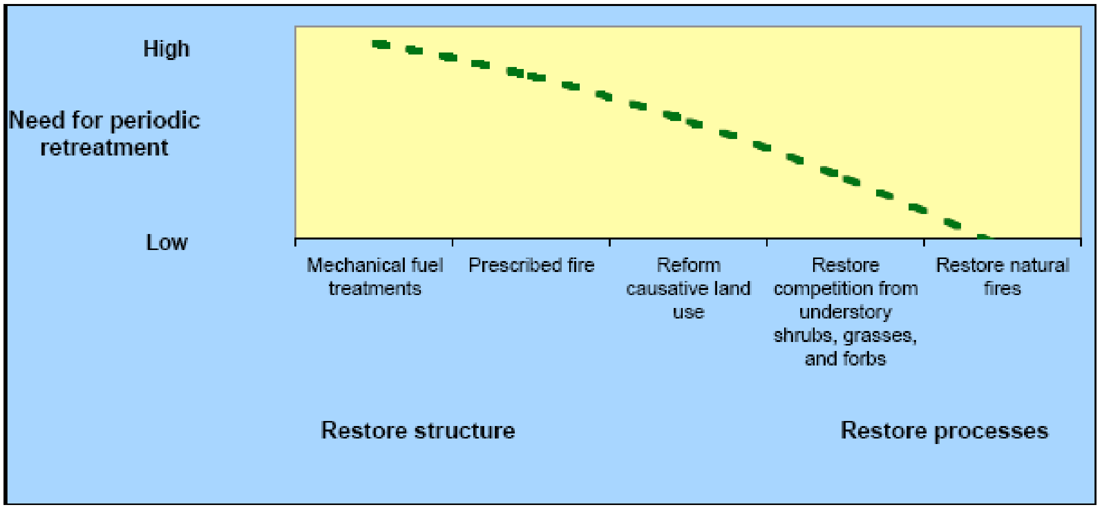

Figure 1. Continuum from structure to process based restoration. Restoring process can be self-sustaining, while structure based approaches require repeat treatment (adapted from Noss et al. (2006), reproduced from Rhodes (2007)).

In short, treatment of "ladder fuels" and unspecified fuel loading by partial harvesting as employed in practice is not a cure-all for reducing fire risk. Agencies have admitted this in a similar case involving an extensive landscape. The revised Sierra Nevada framework (USDA 2004) calls for extensive thinning of ladder fuels and commercial trees. It estimates that only 1,000 acres of high severity fire would be prevented with treatment of 114,000 acres. This estimate is based on existing models that, again, appear to overestimate the effects of ladders (trees up to about 32 inches dbh) and underestimate windspeed influences that may be increased by removing such trees. A major weakness of the 2007 Plan is to call for extensive treatments of ladders in lieu of more strategic efforts.

There are steps that can be taken to reduce fire risk in a very strategic manner; first and foremost, those described in number 3 above. Prescribed burning can also be employed and wildland fire "use" expanded in conjunction with better community planning and fire safety. Reducing subsequent fire risk may require treatment of grasses like cheatgrass that may invade some dry conifer forests, especially after prescribed burns (Kerns et al. 2006). Other activities that promote grass invasion should be limited. Thickets of small understory trees with dense foliage can be removed. These increase understory fire intensity, and ignition of overstory tree crowns is directly related to this. Whatever treatments are to be employed to tangibly reduce fire risk and severity, it must be recognized that they will need to prevent surface fuels (including grass) from accumulating sufficiently to allow fire spread, so they will need to be intensive and repeated every few years. As described above, these treated areas cannot be assumed to function as spotted owl habitat.

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