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5 July, 2007

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Please find enclosed reviews on the Draft Recovery Plan for the Northern Spotted Owl (2007) from 4 anonymous reviewers, coordinated through The Society for Conservation Biology (North American Section) and The American Ornithologists' Union. These reviews were requested by the USFWS.

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Reviewer #1:

GENERAL COMMENTS

Overall, this document contained a reasonably strong compilation of inference and knowledge regarding spotted owls. The writing style was made awkward by the repetition of material in slightly different form, sO it was hard to know whether it could be skipped over upon second encounter; it would improve the document if material that is common between options could be stated just once, so that differences could be more clearly and efficiently articulated.

Following are some general comments and concerns about biological issues in the document:

1) Pre-eminence of barred owl competition as the greatest threat to spotted owl recovery. The document describes essentially two major threats to spotted owls: a) competition with barred owls; and b) past and present loss and degradation of

habitat due to semi-natural (eg fire) and anthropogenic (e.g. logging) factors. Through the use of italics (e.g. p. 17) and ordering of presentation of these two threats throughout, the document clearly prioritizes the first factor (barred owls) as pre-eminent over the second (habitat loss and degradation). The Executive Summary is even more blunt, stating flatly that competition from the barred owl is "The most important threat facing the spotted owl". However, there is no evidence in Appendix C or anywhere in the main document (or in the peer-review literature) to support this ranking whereby barred owl competition is "more important" than loss of habitat. Furthermore, the dichotomy focusing on barred owl competition instead of habitat loss would be ineffective in the long run; the influx of barred owls into spotted owl range is a result of anthropogenic forest change (loss and degradation) favoring one species (barred owls) at the expense of another (spotted owls). Thus, the long-term solution to the barred owls problem is inextricably bound to the issue of habitat loss and degradation, a point little noted in the draft recovery plan (see p. 17/18 as but one example where barred owl competition is considered to be distinct from habitat loss issues). In reading the document, my impression was that the pre-eminence of the barred owl factor arose from the fact that the Delphi expert panel (p. 17/18) gave the narrowest spread of threat scores to barred owl competition. However, a tight clumping of threat scores would be expected for a perturbation that is discrete and easily solved (such as barred owl invasion) compared to a messy, many-faceted perturbation such as "habitat loss." Also, in the same pages (and elsewhere) it is quite clear that habitat loss and degradation — the factor leading to initial listing of this species — continues to be a problem. Despite the fact that evidence is mostly correlational, I agree that spotted owl recovery is and will be compromised by the presence of invasive barred owls. Although barred owl removal is necessary for spotted owl recovery, it is not sufficient without addressing the habitat loss and degradation issue. Thus, I would recommend that barred owl competition be considered as a subset of the habitat loss / degradation perturbation, such that particular recovery actions could be implemented to decrease the barred owl influence on spotted owls without implying that such actions, by themselves, would be sufficient to recover spotted owls.

2) "Ongoing Actions "for both Options (pages 20 and 26) include the threat posed by the barred owl and addressing fire risk areas, but say nothing about logging. Even though logging has slowed since 1994 (p. 128 and 131), it is still occurring (Table Cl). Habitat loss due to logging was a primary driver of the original listing decision, and new habitat has not regenerated faster than subsequent logging has decreased habitat amount (p. 130), so there is no reason to exclude logging as a major current and future issue of concern to owl recovery.

3) The bolded sidebar on page 59 implies that early seral and non-forest components improve owl productivity and survival, but the science in the document supports that statement only to a limited extent, and only in one limited geographic area, the southern part of the range.

4) Option 2 has the stated potential advantage of being more dynamic, compared to Option 1 (although the extent to which that is so is not clear), but its vagueness makes it susceptible to being fulfilled at a minimal and likely insuffIcient level. For example, the directives would allow the "small habitat blocks" to support just 1 pair (within the 1-19 range). Also, pages 65-66, describing the option 2 rule set, uses non-binding language such as "strive for", "at least one", "whenever possible".

SPECIFIC COMMENTS DIRECTLY RELATED TO RECOVERY CRITERIA

Recovery Criterion 1:

Recovery action 2 (page 28) refers to "risk assessments conducted", but there is no description for how these would be done. Some more fleshing out of details would be useful, because it would affect how and what demographic data on spotted owls and barred owls need to be collected (eg a sensitivity analysis framework could allow focus on just one vital rate, obviating the need to collect intensive information on other vital rates).

Recovery Criterion 2 and 3:

It is erroneous to say (Page 31) that occupancy inventory will "determine if Recovery Criterion 2 has been met". Occupancy inventory will not, by itself, indicate whether a population is stable or increasing. This might be a typographic error where "Criterion 2" was mistakenly used instead of "Criterion 3". I note that on Page 68 occupancy sampling is proposed to fulfill Criterion 3, after trend data are used to determine whether recovery Criterion 2 has been met, a reasonable use of occupancy inventory.

Recovery Criterion 4:

This criterion seeks to provide sufficient habitat for spotted owl recovery. It requires at least 80% of both types of MOCAs have a specified percentage (50-70%; page 33) of "high quality" habitat (defined on p. 32 as similar to that used by 90% of known spotted owl pairs for nesting and roosting in that province). There are several issues here.

First, if a MOCA has entirely suboptimal habitat, then none would be "high quality" even if >90% of spotted owl pairs are using it. In other words, use of a habitat by a preponderance of animals says nothing about quality. The term "high quality" would be more accurately replaced by "representative habitat", a term that is neutral as to quality, which is unknown.

Second, the appropriate minimum "high quality" to be maintained in a province is derived (Appendix D) from a series of graphs plotting X against "% nesting habitat", with the hump in the curves taken to be the optimal % "high quality" habitat to be maintained. No sampling or process uncertainty is accounted for. More fundamentally, it is unclear whether "nesting" habitat, used to derive the percentages in Appendix D, is the same as "high quality" [nesting and roostingj habitat set aside in the recovery criterion. If, for example, spotted owls roost in habitat that is poorer quality, or just different, than where they nest, then incorporating both nesting and roosting habitat into the plots Appendix D with would presumably shift the hump to the right, increasing the specified % habitat. It is critical to operationally define nesting and roosting habitat, and to make sure that the

metric on the x-axis of the Appendix D curves are the same metric as the "high quality habitat" that is applied in Recovery Criterion 4.

Along the same lines, I tried to sort out the confusion as to the relationship between "nesting" and "high quality" habitat by looking at Franklin et al. 2000 and Olson et al. (2004), used to derive the graphs and standards in Appendix D. I couldn't find anything in Franklin et al. 2000 that resembled Figure D.1., nor did I find the metric "nesting habitat" in that paper (core habitat, etc. are used, but not nesting habitat); to facilitate peer review, the document should explain how figure D. 1 was "adapted" from Franklin et al. 2000. Similarly, it was impossible to tell how Figure D.2 was "adapted" from Olson et al. 2004, nor could I find where that document measured "nesting habitat" per se. The only Figure in Appendix D that 11 could track back to the original source was Figure D.3, which does not use nesting habitat on the x-axis, but instead uses "percent old and mid-seral conifer centered on owl activity centers", where an owl activity center includes nest sites, primary roost areas, and nighttimeowl responses (Olson et al. 2004:1042), a considerably broader range of habitats than nesting habitat alone. Again, the terms used for "high quality" habitat in Recovery Criterion 4, and for the Axes in Appendix D used to derive the "high quality" thresholds, need to be operationally defined. If they differ, the approach must be modified to reflect the differences.

A third comment on Recovery Criterion #4 is that there is no justification for the consequences of omitting up to 20% of the MOCAs from recovery planning. On p. 33 it is noted that "The 80% threshold of all MOCAs allows for natural fire and other disturbances that might prevent achievement of this habitat standard in all MOCAs at all times." But is the 20% allowance for "fire and other disturbances" empirically derived? And more importantly, is the remaining 80% sufficient for spotted owl recovery?

Finally, a comment on the portrayal of MOCA1s as "large habitat blocks" because they contain 20+ owl pairs. This is said (eg pp 161-162) to be derived from Thomas et al. (1990) and Lamberson et al. (1994), but nothing in the summaries on pages 161- 162 implies that these are in fact "large"; in fact, it seems that 20 owl pairs is "minimal". So I suggest that the implication that MOCA1 s are "large" habitat blocks be changed to reflect that they are "minimal" habitat blocks.

Reviewer #2:

Overall impression: A recent US Fish and Wildlife Service review of the conservation status of the northern spotted owl found that the subspecies still warrants listing as a threatened species under the Endangered Species Act (USFWS 2004). This decision was based, in large part, on estimates of the mean annual rate of population growth from the long-term study of 13 study populations using methods developed by Pradel (1996). For 12 of the 13 study areas, populations were found to be in decline with finite rates of population change < 1.0 (Anthony et al. 2004, 2006). Significantly, these rates of decline were more pronounced than those based on similar analyses conducted in 1998 (Franklin et al. 1999) suggesting a worsening of conditions.

Eight of the study areas evaluated by Anthony and others were part of the Northwest Forest Plan (NWFP) effectiveness monitoring program (Lint et al. 1999). On these study

areas, rates of decline were less than in other areas with a greater amount of private lands. The fact that owl populations on federal lands had higher demographic rates suggests that the NWFP is having a positive effect on the demography of northern spotted owls (Anthony et al. 2006).

Since designation of a late-seral forest reserve system in the NWFP to facilitate recovery of the owl, additional threats have arisen (Courtney and Gutierrez 2004). Most important of these may be the range expansion of the barred owl with the potential to competitively displace spotted owls from otherwise suitable habitat (Pearson and Livezey 2003). If barred owls and spotted owls are competing for nesting sites inside of the MOCAs, then to maintain locally stable spotted owl populations the reserves should be made larger, not smaller. I agree with the recent conclusion by Gutierez and others (Gutierrez et al. 2007) that only carefully designed experiments involving the removal of barred owls from spotted owl territories can test the potential adverse effects of an expanding barred owl population. Until that research is conducted, habitat loss remains the most tenable hypothesis to explain the decline in spotted owl populations.

Given the findings of the recent USFWS-sponsored status review (USFWS 2004, Courtney et al. 2004), the results of demographic analyses (Anthony et al. 2006), and the expansion of the barred owl, it seems that the only responsible response to achieve recovery of the Northern spotted owl is to maintain, or strengthen, current conservation actions. Since the primary action to date has been the setting aside of late seral forest into a reserve system, it is logical to maintain, and perhaps increase in size, the dedicated reserve areas.

In contrast to “best available scientific information” and the results of the NWFP monitoring program (Lint 2005), the Draft Recovery Plan for the Northern Spotted Owl (2007) proposes two options, both of which reduce the amount of habitat set aside in reserves to benefit the spotted owl. As a result, the proposed Plan appears to have ignored, or misunderstood, the most recent scientific findings. The proposed options are not supported by any reasonable interpretation of the best available scientific information.

1. The “rule set” used in Options 1 and 2:
To determine the size and locations of reserve areas, both Options 1 and 2 refer to a rule set developed by the Interagency Scientific Committee (Thomas et al. 1990). The ISC made recommendations for size, spacing, and number of reserves based on a simple, non-spatial metapopulation simulation model developed by Drs. Lamberson and Noon (Lamberson et al. 1994). This model was not applied to real landscapes (in fact, it cannot be) and it only incorporated demographic rates available through 1992 (we now have 15 years of additional demographic data). It was a conceptual reserve-design model used to provide preliminary estimates of size, spacing, and number of reserves to enable the Forest Service and Bureau of Land Management to meet their legal requirements to manage the land so as to maintain the viability of the owl. Demographic monitoring continued and expanded after the ISC Report because of the uncertainties associated with the reserve design criteria. At the time the Lamberson et al (2004) model was developed, it made use of the best available scientific information. However, this model is old and

outdated—it is no longer the "state of the art" and it should not have been used for current reserve design guidance.

The Recovery Team was apparently unaware of the modeling of spotted owl habitat and demography conducted by the Forest Ecosystem Management Assessment Team (FEMAT 1993). Prior to the Lamberson model being published in the peer review literature, Dr. Kevin McKelvey (FS Research) was developing a spatially explicit, individual-based simulation model that could be "intersected" with the actual forest landscape through a GIS interface (McKelvey et al. 1993). This model allowed an assessment of owl demographic performance as a function of habitat amount, quality, and spatial distribution, throughout the entire range of the northern spotted owl. The McKelvey model was a significant advance from the Lamberson model because it more accurately represented the biology of the owl and it could be directly applied to real landscapes. As part of the FEMAT process, the McKelvey model was used to evaluate and rank the degree to which various NWFP alternatives meet the needs of the owl (Raphael et al. 1994). In addition, the McKelvey model was used to inform reserve design decisions for the spotted owl on the Olympic Peninsula (Holthausen et al. 1995).

During the time the Recovery Team was in deliberation, it would have been possible to apply the McKelvey model to the current landscape in the Pacific Northwest. The model could have been parameterized with the latest estimates of the vital rates (Anthony et al. 2004, 2006) and it could have been intersected with current habitat maps (see Lint 2005). Unfortunately this was not done—the Recovery Team instead made reference to an outdated rule set and did not use the best available scientific information.

2. Option 1:

Option 1 largely fails because it protects less habitat than under the current NWFP. For reasons discussed above and in light of current data, no rationale argument exists for reducing the amount of protected habitat at this time. In fact, in the context of increasing threats to the spotted owl (e.g., barred owl invasion, West Nile virus) the total area protected in reserves should be increased, not decreased.

This option, as for option 2, makes frequent reference to Thomas et al. (1990) and Lamberson et al. (1994) to justify reserve sizes and spacing. However, the analyses conducted by the ISC and Lamberson and others were based on information that is more than 15 years old. Any evaluation of the adequacy of the current reserve design should have been based on the most recent estimates of the demographic rates and used a spatially realistic model. In fact, based on more recent work using the McKelvey model, it was found that reserve for 20 pairs are only stable if juvenile dispersal is high and edge effects are minimal (Noon and McKelvey 1996).

This option also proposes threshold values for the target amount of late seral forest in the reserves (MOCAs) based on the research findings of Franklin et al. (2000) and Olson et al. (2004). These threshold values range from 50% in the southern part of the owl's range to 70% in the northern part of the range. Using the results from these two studies to set hard thresholds is not supported by the data and incorrectly interprets the precision

of their results. However, the results of these studies do indicate that the relationship between the amount of late-seral forest and the success of nesting spotted owls varies geographically, presumably a consequence of changes in prey base. However, there is no evidence from the southern part of the owl's range that the amount of young forest is limiting and therefore should be the target of management in the reserves. It is much more tenable that nesting habitat (i.e., late successional forest) remains the primary limiting factor.

Finally, option 1 defines as "high-quality habitat" habitat that is used by 90% of the known spotted owl pairs for nesting and roosting in a given province. This is a very broad definition and will surely include sink habitat which cannot support a viable population over the long-term (see Franklin et al. 2000; Olson et al. 2004). The goal of any effective conservation strategy is to manage for source habitat where the focal species experiences positive growth rates. Habitat quality should have been defined much more narrowly.

3. Option 2

Option 2 fails to provide for spotted owl recovery in a number of ways. First, it fails to protect the current amount of suitable habitat in the existing reserve system. The option claims not to be a reserve design strategy (no lines on the map) but at any point in time it would have to be represented by lines on the map—otherwise, the manager would not know where on the landscape activities such as clear-cut timber harvest and road construction could occur. At best it is a spatially shifting reserve design that would require extensive coordination among National Forests, BLM Districts, and agencies.

A second way option 2 fails is that it provides no measurable objectives to assess the owl's progress towards recovery. The relations between owl demographic performance and habitat would not be amenable for study because the exact locations of suitable habitat on the landscape would apparently be unknown. Any land-use decisions made by one manager would have to be coordinated with all other managers throughout the range of the spotted owl. There is little evidence that a single agency, let along multiple agencies, can manage a dynamic reserve structure like that proposed in Option 2. Based on the past management history of the Forest Service and BLM in regards to spotted owls, there is every reason for the public to insist on designated reserves areas and lines on maps. In fact, the reason we have a NWFP is because of past management failures by federal land managers.

Third, Option 2 is so poorly described in the Draft Plan that it is impossible to understand how much habitat will be conserved for the spotted owl and how this acreage compares with the amount of habitat conserved under the NWFP. It is probably a safe deduction that the amount of protected late successional forest is less than what is currently protected.

4. Threat environment

The Draft Recovery Plan recognizes three primary threats and ranks them from most to least important as: 1) barred owl range expansion; 2) fire; and 3) habitat loss from

logging. Lack of regulatory safeguards and habitat loss are the two primary threat factors that led in 1990 to the listing of the spotted owl under the Endangered Species Act. Habitat loss from timber harvest remains the sole threat for which there is extensive supporting scientific information. In contrast, little scientific information on potential adverse effects of barred owl range expansion is currently available. Primary emphasis on the barred owl is misplaced at this time because of the lack of supporting evidence.

One tenable hypothesis not explored by the Recovery Team is the possible synergism between timber harvest and barred owl range expansion. The barred owl is much more of habitat generalist than the spotted owl—it is able to successfully exploit all but the youngest of forest types including late successional forest (Kelly et al. 2003, Pearson and Livezey 2003). Its range expansion may well be facilitated by current timber harvest practices that facilitates range expansion by a generalist species.

Summary: The Draft Recovery Plan is unacceptable because:

- In Options 1 and 2, habitat protections for the owl are lessened from current NWFP protections at a time when they should be strengthened.
- The Recovery Team failed to make use of the best available science and, in fact, appears to have selectivity cited from the available science to justify a reduction in habitat protection.
- The Recovery Team was apparently unaware of the combined habitat-demography modeling that was done to evaluate various alternatives under the NWFP. As a result, they put too much emphasis on an outdated model.

- Based on current information, far too much emphasis is placed on the adverse effects of barred owl range expansion.
- The administrative complexity associated with the implementation of Option 2 renders it unworkable.

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Reviewer #3:

General Comments:

While the writing is generally clear, the topical coverage reasonably comprehensive, and the tone of many sections of the draft plan reasonable, I found that where this plan diverges substantively from previous conservation plans some of these changes are likely to result in reduced conservation efforts for owls and their habitat. For a species where continued evidence of population declines is so strong (and based on what is arguably the best demographic data set ever collected for a wild animal), these changes give me concern.

In particular, despite real reductions in logging on federal lands, there is strong evidence that demography of northern spotted owls across their range remains insufficient to maintain stable populations. Further, owl habitat is continuing to decline at the rate of 2.1% per year on federal lands (Table 2.1, page 128). In light of these trends, I would argue that conservation efforts should be strengthened not weakened.

Northern spotted owls are at risk because old growth forests have been logged and are largely gone, therefore any strategy to recover owls has to focus on conservation and recovery of these old growth forests. To me, that means that the amount of old growth forest must be increased either by conserving existing old growth (unlikely) or managing younger forests so that develop quickly into old forests (more likely). I suspect that if the amount of old growth forest were increased throughout the range of the owl, the risk of owls going extinct would very likely be reduced appreciably. Although other factors affect spotted owl populations adversely, they are at risk of extinction because of habitat loss.

The plan's authors clearly recognize the relationship between owls and habitat loss, and they do a fine ofjob of reviewing the available information on the history of forest harvest in the region. Nonetheless, I am not completely confident that if and when the prescribed Recovery Criteria are met that owls would truly be recovered. Some of my reasons follow.

Old-Forest Targets and Spatial Arrangement of Habitat and "Non-Habitat"

I thought that the role of early- and mid-seral stage forests in spotted owl habitat was overstated throughout the document. Spotted owls inhabit structurally diverse forests within which small-scale disturbances, such as tree death and wind throw, create small openings in forests; in the more mesic portions of their range, medium-scale openings can be added to that list due to ground fires. The early seral conditions in these patches surely provide habitat for some species of owl prey. Although hunting and reproductive success of owls with access to the patches might be higher, the size (small) and spatial arrangement (dispersed) of these younger patches among a larger matrix of old forest are integral to their role in owl habitat.

I found little mention of spatial arrangement of "habitat" and "non-habitat acres," and I suspect this could affect the quality of habitat quite a bit. For example, a 10,000 ha block divided into two homogeneous pieces, one 65% "habitat" and the other 35% "non-habitat," is very different in its value to spotted owls relative to a block where the 35% non-habitat is dispersed as a series of small-scale openings throughout the block. In the stylized image in Figure 1 (page 35 and 50), for example, it's clear that the forested and non-forested blocks within a MOCA are homogeneous. I suspect this arrangement does not reflect the intent of the team; nonetheless someone could use this figure to argue otherwise.

The amount of early seral-stage forest or clearings within old forests has become even more of an issue given the increase in barred owls. Areas surrounding spotted owl nests that were harvested to some degree were more likely to be abandoned by spotted owls; further, these small-scale reductions in the amount of old forest seems to have facilitated displacement of spotted owls by barred owls (Pearson and Livezey 2003). To me, this suggests that the target percentages need to be established very carefully, and if we are to err, we need to err in a way that is conservative; that is, to overestimate the percentage of old forest necessary. I'd argue that these percentages were underestimated.

Although there may well be something to the information presented in Figure D. 1 (page 134), the curves would be difficult to justify given the sparse information (I'll assume that the Y axis is for survival too). In particular, survival of adults in areas where the "percent nesting habitat" ranges from about 58-78% is essentially flat. Given these data, there just seems no way to justify predicting an inflection point. I understand that these are the best data available for California and that something needs to be set; however, I'm uncomfortable with setting these values at the visual center of some imaginary relationship; instead, I'd argue the levels for this very important element should be set quite a bit more conservatively. I also struggled with how some of the accounting would

work (see Specific Comments, below).

Barred Owls

I found the degree of emphasis on barred owls very surprising. I (and others) have assumed that this threat resulted as an artifact of fragmenting old forests, which created conditions that favored barred owls. At this point in time, whether or not this is the mechanism by which barred owls accessed these areas doesn't much matter.

On page vi of the Executive Summary, the authors state that "The most important threat currently facing the owl is competition from the barred owl. . ." That may be true in those locations where the spotted owl is still extant; however, this bothers me because spotted owls are likely vulnerable to competitors because they inhabit only a small proportion of their original range. In my view, the primary issue threatening the continued persistence of the owl remains the original loss of habitat through logging that prompted the original listing.

Consequently, my impression is that the threat posed by barred owls, while real, inappropriately dwarfs habitat loss in the draft plan. For barred owls to be the appropriate primary focus, we would have to be convinced that the strategy outlined for conserving habitat is sufficient to overcome the documented demographic problems identified throughout their range. That is, it seems likely that existing habitat-based conservation efforts might be insufficient to stem declines in spotted owl populations. If this is true, management of barred owls might, at best, only serve to slow the rate of decline.

Calling for research into the explanation as to why barred owls supplant spotted owls, while interesting, doesn't seem especially critical to me. Barred owls do displace spotted owls from areas where they co-occur, so if barred owls are removed, spotted owls should eventually reoccupy those areas. The focus of research then, as with any type of biological "invasion," might be to understand how to most effectively prevent barred owls from expanding their distribution into additional areas occupied by spotted owls (perhaps it is too late). If there is no existing habitat differentiation between the species, then "controlling" barred owls will require a tremendous long-term effort no matter the reason for their superiority.

Option 1 or 2?

One obvious question is whether the conservation strategy proposed in Option 2 (dynamic boundaries for lands to conserve owls) might offer some advantage over Option 1 (fixed boundaries for these lands), the way in which these plans are usually done. Although I could never quite glean exactly how Option 2 would be implemented (perhaps I missed it), I am skeptical that it would work in practice. One reason is the inherent time-scales that recovery of old forests require which is on the order of hundreds of years. The bookkeeping along in this sort of dynamic accounting worries me, especially when the accounting needs to be accomplished across multiple agencies.

Specific Comments

In the "Habitat Requirements" section of the executive summary, only the first sentence covers the owl's needs so far as old forests go, which is the critical need; the remainder of the section focuses on what I would consider to be relatively minor elements of habitat that support the owl's life history. The statement that dispersing owls traverse fragmented forests and other land-cover that might never provide nesting habitat is not surprising; nearly all animals have much wider habitat tolerances during natal dispersal. Similarly, as I mentioned earlier, the last section has a somewhat misleading flavor in that it suggests in too simplistic a way that mid-seral stage forests benefit owls.

Although merely symbolic, I want to renumber Recovery Criteria 4 as Recovery Criteria 1 to reflect the important connection between this criteria and the original reason for listing.

Page 20, I am not able to keep the bookkeeping straight for the middle two bullets. For bullet 2, does the 80% in suitable-habitat condition include the percentage of the area allowed to be in early seral stages? If so, then the proportion of the MOCA that is in old-forest condition could be considerably less than 80% when the target is met. For example, assume 80% of an area is in suitable-habitat condition; if 30% of that 80% is in early seral condition, then the percentage of the MOCA in old-forest condition is closer to 50%, barely meeting the "suitable habitat" target for Recovery Criteria 4 listed in bullet 3.

Page 31. The "5 consecutive years" target seems extremely short.

Page 33, second sentence. The word "Cutting" here is just too ironic; consider replacing with "Reducing."

Page 64. I think some of the language in the "Rule Set to Guide the Designation of Habitat Blocks" is clear (12 miles and 7 miles, for example) but other language needs to be made more specific as these rules represent a very important element of this option. For example, in 3) what does "whenever possible" mean? Is that a simple function of following Rule 4a-c? I ask because 4b asks that blocks be as "compact" as possible. I would think that under Rule 3), they should be made as large as possible.

Page 136. Why was the habitat threshold set at 60% when Olson et al. (2004) estimated the maximum at 67%? Further, if their curve correctly represents this relationship, lambda would be the same at about 60% and 80%. Frankly, if I were making this decision, I would suggest 80% as a target given that we are always likely to be below these targets rather than above them.

Lastly, and this is something of a pet peeve, but the word "habitat" is used throughout the draft to represent any number of things that are not habitat, such as landscape composition, vegetation structure, and so on. I suggest substituting a more appropriate

word when habitat is used to represent anything but the place where a species lives out its life history; modifiers (breeding, foraging, dispersing) are all fine. If an area is habitat for a species, by definition, it is suitable; that is, there is no such thing as "unsuitable habitat;" that is simply not habitat.

Reviewer #4:

My overall impression of the recovery plan is that it borrows substantially from previous efforts, such as the Interagency Scientific Committee's (ISC' s) analysis and the Northwest Forest Plan (NWFP), and retains their general emphasis on the conservation of adequately large and well-spaced blocks of owl habitat. I believe such a habitat emphasis is consistent with all the scientific thinking about spotted owl conservation for nearly two decades. However, in many key details this plan appears significantly weakened from previous ones, in particular in its lessened emphasis on late-seral forest, and the broad discretion it allows forest managers to conduct such activities as salvage logging within conserved owl areas. These changes may in part reflect new information, such as some evidence that mixed seral stages provide superior habitat for the owl in some parts of its range, but it's hard not to conclude that they also may result from pressure to relax restrictions on logging. Specific comments follow.

1. Size and spacing of conserved areas

Both options borrow from the size and spacing prescriptions outlined in the ISC and NWFP documents. Option 1 retains the specific conserved areas identified in the NWFP, while Option 2 retains the "rule set" but allows managers to pick the specific areas. Neither option acknowledges the shortcomings that were identified in the ISC plan, relating in particular to edge effects, the efficiency of juvenile search behavior, and the possibility of extinction during the transition period following implementation of the plan.

According to two of the scientists who crafted the ISC plan, "Subsequent modeling suggests that reserves with a carrying capacity of 20 pairs are stable only if juvenile search efficiency is high and edge effects are minimal. To achieve local stability within the constraints of real landscapes, more recent modeling suggests that carrying capacities of perhaps 3 0-40 pairs per HCA are needed. In addition, a few large reserves (>100 pairs) significantly safeguard against population extinction. For these reasons, the original reserve design proposed by the ISC represents a minimum sustem, with greater risks to persistence than originally envisioned." (B. R. Noon and K. S. McKelvey, 1996. Management of the spotted owl: a case history in conservation biology. Annual Review of Ecology and Systematics 27:135-162.)

2. Emphasis on competition with barred owls

The earlier plans (ISC, NWFP) considered the possibility that the barred owl posed a threat to the spotted owl through competition, predation, and/or hybridization. The present recovery plan reviews some new evidence suggesting that competition with barred owls adversely affects the behavior and/or demography of the spotted owl. The

recovery plan acknowledges that there is far from unanimous agreement by spotted owl experts that barred owls are a greater threat to the spotted owl than habitat loss. Yet the rest of the plan explicitly assumes this to be the case, placing barred owls ahead of habitat loss on the list of threats and recovery actions. This emphasis seems out of proportion to the certainty of the evidence. Also, an important possibility that needs to be considered are that forest fragmentation exacerbates the barred owl problem either through effects on the prey base (about which amazingly little is still known) or through effects on owl behavior. The research outlined in Recovery Actions 4 and 5 is essential to figure out the magnitude of the barred owl problem and whether it bears any relationship to forest fragmentation. With the massive amount of demographic data that exist for the spotted owl, it must be possible to test whether its decline is associated with habitat loss, barred owls, both, or an interaction between the two. (It would also be worth asking if barred owls have invaded the ranges of the Californian and Mexican spotted owls, both of which are also declining.)

3. Decreased emphasis on conserving late seral forests

The recovery plan calls for 50-70% suitable nesting habitat, in other words late-seral forest, in the blocks of habitat conserved for the owl. This is a departure from the earlier plans which called for these areas to consist — eventually — of virtually 100% late-seral forest. The rationale for this change can be found in Appendix D, which discusses new evidence that lambda (the annual rate of population growth) for the owl is maximized at intermediate values of late-seral habitat, supposedly because prey are more abundant in earlier seral stages.

Reviewing the studies that have attempted to link spotted owl demography to forest characteristics, Noon and Blakesley (2006) draw a different conclusion: “Some general demographic patterns have emerged from these detailed studies and the meta-analyses. That is, reproductive rates generally show extensive annual variation that is strongly related to climatic variation. In contrast, annual survival rate shows little temporal variation, but the spatial variance component is most strongly related to the amount of old-growth forest within the vicinity of the nest or primary roost sites.” (B. R. Noon and J. A. Blakesley 2006. Conservation of the northern spotted owl under the Northwest Forest Plan. Conservation Biology 20: 288-296.)

It is of critical importance to determine whether there is indeed any “optimal” level (below 100%) of late-seral habitat for the owl. Statistical confidence around any such peak value is extremely important since it may translate into tens of thousands of acres reserved from logging or not.

4. Managerial discretion

The recovery plan allows managers significant leeway in determining whether to conduct logging (including salvage logging) in protected owl areas, and how to “use silvicultural methods to restore suitable habitat.” Option 2 goes considerably further than this by delegating to the forest managers the task of designating the core habitat blocks for the

owl. While managers would use essentially the same “rule set” that was used to identify the existing, mapped units (HCA/DCA/MOCA’s), the implementation could be quite a bit different under this second option. The document needs to explicitly address the perceived advantages and disavantages of Option 2 relative to Option 1. The Introduction strongly implies that Option 2 will be better because it will “recognize the dynamic nature of forest ecosystems” and allow land managers to be sensitive to local variation in “provincial, ecological and management situations” — but this is very vague. In what ways was such variationnot accounted for in the HCA selection process? Alternatively, couldn’t the provisions for flexibility in this recovery plan end up leaving managers unguarded against local pressures and demands that will undermine the owl’s recovery?