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2010 DRAFT REVISED RECOVERY PLAN FOR NORTHERN SPOTTED OWL

PEER REVIEW

NOVEMBER 15, 2010

The Wildlife Society (TWS) appreciates the opportunity to facilitate the review of and comment on the U.S. Fish and Wildlife Service's (the Service) 2010 Draft Revised Recovery Plan for the Northern Spotted Owl (2010 DRRP). The following comments are the product of a peer review team organized in response to the Service's request for scientific and technical reviews. The Wildlife Society was founded in 1937 and is a non-profit scientific and educational association of over 9,000 professional wildlife biologists and managers, dedicated to excellence in wildlife stewardship through science and education.

The Wildlife Society assembled a team of reviewers to respond to the Service's Statement of Work issued October 7, 2010. The team included experts in population dynamics, spotted owl ecology, forest ecology and management, and fire ecology. Although The Wildlife Society facilitated the following review, the comments herein are of those of the review team; this is not an official statement of The Wildlife Society.

INTRODUCTION

The 2010 DRRP represents the Service's continued effort to develop a recovery plan for the northern spotted owl that is based on the best available science and has a high probability of leading to recovery. Previously the 2008 Northern Spotted Owl Recovery Plan (2008 Plan) was remanded back to the Service for revision and TWS, along with other wildlife professionals and conservation organizations, anticipated that the current revision would show significant improvement over the 2008 Plan. There is a critical need for an effective recovery plan for the subspecies since there is substantial evidence that populations of northern spotted owls continue to decline (Anthony et al. 2006; Forsman et al. in press).

Unfortunately, review of the 2010 DRRP is hindered by the fact that it has not been completed. The Late Successional Reserves (LSRs) from the Northwest Forest Plan (NWFP) are proposed as an interim set of habitat reserves for spotted owls that will be replaced when the modeling efforts are complete and the final recovery plan is issued. In order to comply with the requirement to use the best available science, we believe that the Service will have to find a way to make the final plan with the reserve system available for peer review prior to release of the final plan.

The following are general and specific review comments on various sections of the 2010 DRRP. Based on the request from the Service, there is significant emphasis in these comments on whether the best available science was used and interpreted in a reasonable way in developing the plan.

Positive Elements of the 2010 Draft Revised Recovery Plan:

The reviewers recognize that the 2010 DRRP has many positive features and recommendations that are improvements over the 2007 draft Plan and 2008 Plan. We discuss these improvements because we believe they are important to the recovery of the subspecies, and they should be retained in the final recovery plan. First, we were encouraged that the Service recognizes that northern spotted owls are at considerable risk due to loss of habitat, lack of adequate regulatory mechanisms by the states, and potential threats from barred owls. These risks are also documented in recent studies, which found that northern spotted owls have been declining in many parts of their range during the last two decades (Anthony et al. 2006, Forsman et al. in press). Consequently, it will be incumbent on the Service to identify and alleviate the causes of these declines, if possible, in order to recover the owl.

It is our opinion that the most important elements of the 2010 DRRP are the recommendations to protect all occupied nesting territories and high quality habitat for the subspecies. These two provisions in the 2010 recovery plan recognize that quality habitat is essential for spotted owls, and it is even more important when considering potential competition with barred owls. This represents a shift in philosophy from the 2007 and 2008 Plans because it recognizes that that control of barred owls is not more important than conserving habitat. We support this change in emphasis. However, we do have some concerns about the definition and management of high quality habitat, which we address in a later section.

In general, we are supportive of the recovery criteria to establish a stable and well distributed population of owls, and no net loss of nesting, roosting, or foraging habitat. These criteria are closely tied to the recovery objectives and will be important to evaluate recovery and eventually delist the species. They also address the two major threats to spotted owl populations, the loss of habitat and potential competition with barred owls. We also support the continuation of the demographic studies on spotted owls, which have been conducted over the last 20-25 years (Anthony 2006, Forsman et al. in press). These studies and periodic publication of results are the primary means by which federal agencies assess the status and trends of spotted owl populations. We also believe that the experimental removal of barred owls is appropriate to determine their effect on spotted owls, and this should be carried out as soon as possible. The results of these experimental removals will be valuable in determining the extent to which barred owls are impacting spotted owl populations and any policy decisions that follow. We support the modeling efforts (Maxent, Zonation, HexSim) by the Service and associated groups to evaluate various reserve designs for spotted owls on federal and nonfederal lands. However, because the results of this modeling effort are central to the recovery plan, we believe that this plan is incomplete and cannot be adequately reviewed. We comment on the modeling efforts in more detail later in this review. We are also supportive of the use of outside expertise to guide recovery through the use of advisory groups and working groups, but we are concerned that the membership and advice of the working groups has the potential to take recovery in questionable directions in some instances. This is exemplified by the recommendations of the Dry Forest Working Group, which we are critical of in a section below. The role of work groups is discussed in more detail in a later section of our review. Lastly, we are supportive of the adaptive management approach to recovering spotted owls and managing their habitat. This approach will be most valuable in managing barred owls and developing guidelines for managing the risk of fire in spotted owl habitat in the eastern Cascades of Washington and Oregon. However, we believe the description of adaptive management in the plan was weak, vague, and represented a poor understanding of the process. Consequently, we encourage the Service to develop more comprehensive plans and processes to use adaptive management for implementing the final recovery plan. We also provide some comments on this process later in our review.

Having said the above, we are concerned that the 2010 Draft Revised Recovery Plan (2010 DRRP) does not always represent the best available science and uses unpublished literature to develop some recommendations while ignoring other published literature. Specifically, we are concerned about (1) the recommendations for managing the risk of fire in forests on the eastside of the Cascades; (2) the use of unpublished reports, particularly those that have economic and political ramifications, to recommend active management of owl habitat in western Oregon; (3) the overemphasis of the potential effects of fire and spotted owl habitat; (4) the incomplete review of the literature on the effects of forest thinning on owls and their prey; and (5) lack of communication and coordination between the Service and state foresters who review timber sales on state and private lands in Oregon. We are most concerned that the modeling efforts have not been completed and the draft plan does not provide information on the number, size, and distribution of the reserves for the owl. Consequently, release of the draft plan at this time is premature because key information needed to evaluate the efficacy of the plan is unavailable or not incorporated in the plan. Most of all, it appears that a review of the critical information on the size and distribution of the reserves may not be subject to review before the final recovery plan is released. This is unacceptable for a comprehensive review and makes it impossible for us to evaluate the scientific merits of the recovery plan. These issues and concerns are discussed in more detail elsewhere in the review.

The 2010 DRRP Fails to Define a Conservation Network

As a conservation network for spotted owls, the 2008 Plan proposed to replace the Late Successional Reserves (LSRs) of the Northwest Forest Plan (NWFP) with newly-designated Managed Owl Conservation Areas (MOCAs). Peer reviews criticized these MOCAs on multiple grounds:

- They represented a significant reduction in reserve acreage from the LSRs.
- They provided no reserves in eastside provinces.
- No evidence was presented to demonstrate that they could lead to spotted owl recovery.
- It was unclear how the MOCAs would relate to ongoing implementation of the NWFP.

The 2010 DRRP withdraws the proposal for MOCAs at least “until modeling can help assess its conservation value to the species” (2010 DRRP p. 25). The Service proposes that its ongoing modeling effort will be used to evaluate “various existing and potential reserve scenarios” (2010 DRRP p. 31) and that the evaluation will be reported in the final Revised Recovery Plan and possibly used to inform changes in critical habitat.

We support withdrawal of the MOCA network but is concerned that the 2010 DRRP fails to propose any alternative network. It does recommend that managers continue to implement the NWFP in the Westside provinces on an interim basis but makes no recommendation for a reserve system in the eastside provinces.

There are multiple problems with this proposal. First in eastside provinces there is obvious intent to eliminate any reserve system and proceed with a conservation strategy having no reserves. Problems with the assumptions underlying a no reserve strategy are reviewed in detail later in this document, and we continue to believe that the retention of habitat reserves is important in the management of the eastside provinces (see TWS review of the 2008 Plan). There is also no suggestion in the 2010 DRRP of how a strategy of having no reserves will be analyzed in the ongoing modeling effort, leaving substantial uncertainty about the effectiveness of such a strategy relative to the existing LSRs.

Second, the 2010 DRRP provides no details about the potential conservation networks that will be analyzed or the criteria that will be used to potentially select one of these networks for use in the revision of critical habitat. We believe that any revision of the existing conservation network (i.e., the LSRs) must be at least as effective for the conservation of spotted owls as the existing LSRs in the NWFP. In other words, the analysis of the LSRs should serve as a baseline for comparing other potential networks. Any network that fails to match the LSRs on one or more critical model outputs (e.g., extinction probability, population size, distribution) should not be considered as a potential replacement for the existing strategy.

Finally, the Service's proposed process for developing a conservation network does not provide adequate opportunity for public or peer review. The proposed network will apparently be presented for the first time in the Final Revised Recovery Plan which will not allow for public or peer review. In our opinion this process is unacceptable.

More Comprehensive Analysis of the Effects of Fire and Forest Treatments on Owl Habitat Is Needed

The 2010 DRRP presents a more balanced and scientific treatment of the effects of fire than the 2007 and 2008 draft Plans; however, the 2010 DRRP still exhibits many of the same problems that peer reviews identified in the 2007 and 2008 Plans. The plan still recommends extensive thinning and patch cutting forest treatments, so, to a large degree, our comments related to fire and forest treatments revisit the same topics we addressed in previous reviews, in which we stress the need for adaptive management and use of the best available science. However, we have added a quantitative framework to explicitly evaluate the risk of fire and effects of forest treatments over time under different scenarios on the amounts of closed canopy forest habitat maintained in the landscape. This evaluation is included in the section below with supporting data in Appendix A.

Assessment of risk of fire in drier forests

The amount of stand-replacing fire that has and will occur in mature, closed canopy forest remains a key question for recovery planning for spotted owls and forest management in general. A major flaw in the 2008 Plan was the use of anecdotal data from one fire that partially overlapped the range of spotted owls to describe fire risk across all the dry forest provinces (TWS 2008). Unfortunately, the Service is now relying on another unpublished and unavailable assessment of fire risk (Moeur et al. in prep). What's more, only a synopsis of this document has been provided to the Service. The synopsis cannot be adequately evaluated because it does not present any information regarding the magnitude of fire that was mapped.

In contrast, existing published research on stand-replacing fire in provinces occupied by northern spotted owls (Hanson et al. 2009, 2010) specified the magnitude of fire that was mapped in terms of basal area mortality of trees. Moreover, it used data from a scientifically credible, peer-reviewed, and comprehensive source (MTBS) that has been developed by federal agencies (MTBS.gov). Numerous peer-reviewed publications have also used this approach and these data. The published analysis using these data by Hanson et al. (2009) focused on stand-replacing fire, and their methods identified areas where about 60 percent or greater basal area mortality of mature trees occurred as stand-replacing fires. Spies et al. (2010) preferred to consider a broader range of high severity fire effects to describe fire risk.

Here we have used the MTBS data to calculate the effect of high severity fire in old forests (based on maps in Moeur et al. 2005) according to the classification provided by MTBS (see MTBS.gov) from 1996-2008. The concept of fire severity has been criticized in the literature because it is poorly defined. On the other hand, it seems to be a reasonable measure to use under the circumstances because the precise fire effects that should be measured for evaluating effects on spotted owls have not been defined. In addition, the classification done by MTBS has strengths that support its use. The classification evaluates each fire separately, accounting for differences in terrain, and tree species and size that can affect accuracy. For 2009 and 2010, fire severity data were not available from MTBS, so we obtained them from the USFS at the RAVG site (http://www.fs.fed.us/postfirevegcondition). For these two years, we defined high severity fire following convention of Forest Service publications (e.g., Miller and Thode 2007), which are used in many of the MTBS burn classifications.

We found that the rate of high severity fire was 3.0 and 1.2 percent per decade in the dry forests of the Klamath and Cascades using the MTBS classification. These rates are higher for the Klamath and slightly lower for the Cascades than previously report by Hanson et al. (2009), which were 1.7 and 1.3 percent per decade, respectively. Importantly, all the rates are several times lower than rates of stand recruitment as best we know. Moeur et al. (2005) reported stand recruitment rates over the NWFP area based on FIA data as 9.5 percent per decade.

The synopsis by Moeur et al. that the Service used in the 2010 DRRP found very little transition from medium to old forest from 1994-2007 in the area affected by the NWFP. This could be because the new remote sensing approach used by Moeur et al. (2005), though good at detecting initial vegetation regrowth after disturbance, may be less reliable than using plot data from the Forest Inventory Assessment (FIA) to describe forest regrowth rates. In addition, as Mouer et al. (2005) point out in their synopsis, the 1994-2007 transition rates are not representative of longer term trends. To address the question of how long it takes for forests to redevelop after fire into potential habitat for spotted owls (closed forest with overstory trees averaging 20" or more dbh) ideally requires specific analyses of plot data that essentially substitute space for time to create the equivalent of a longtime series. The FIA data can be used for this purpose.

Herein, we modeled the amount of closed forest habitat that will be maintained over time given different scenarios of forest regrowth from the literature. The rates of high severity fire are from our MTBS calculations. We used the rates in a state and transition model as described in Appendix A. Under the models for the Klamath and dry Cascades provinces (Appendix A), mature, closed canopy forests increase rapidly in the landscape. By 2050, closed forests occupy about 64 and 57 percent of the landscape in the Klamath and Cascades, respectively (Appendix A, Figures 2-3). With current rates of fire, eventually, mature, closed canopy forests would occupy about 3/4ths of each region. These results are relatively robust to scenarios that slow down redevelopment rate of forests, even by large amounts. Assuming that forests take twice as long to redevelop in the Klamath (120 years) and dry Cascades (210 years) leads to 49 and 44 percent of the landscape occupied by mature, closed forest in the two regions, respectively, by 2050, which is considerably more than today (32.5 %). In the context of regrowth rates, we note that a comprehensive review of data on forest growth rates around the world has found that they are increasing, and the increase is most dramatic in regions with seasonal drought and soils that are not deficient in nutrients, such as the Pacific Northwest (Huang et al. 2008). This is due to increased water use efficiency associated with increased atmospheric $C0_2$. As long as this effect continues, it will operate to compensate for any increases in fire that may occur with climate change. Nonetheless, if we continue our scenario where forest regrowth rates are twice as long, and then double the rate of severe fire by 2050 to consider a strong climate change effect on fire, mature, closed canopy forest would still occupy 45 and 43 percent of the landscape by 2050 and continue increasing beyond that.

In summary, both estimated and worst case scenarios of forest disturbance by fire and regrowth (exclusive of timber harvest) predict an increasing amount of mature, closed forests in the landscape. Only when the ratio of stand-replacing fire to forest regrowth is below 1 do closed canopy forests decrease over time. Fire would have to increase by about 5 times above current rates in the Klamath and 8 times in the dry Cascades before this would begin to happen, or somewhat less if growth rates are much slower than the estimates we used. In light of these findings, the qualitative assumptions of particularly high future fire risk to closed canopy forests that the Service continues to use, which drive the 2010 DRRP's proposed forest treatments, appear considerably overstated.

Lack of Information on Effects of Forest Treatments on Spotted owls and their Prey

Treatments that create more open forests (thinning and patch cutting) are problematic in spotted owl habitat because they may convert suitable habitat to non-habitat by reducing canopy cover below a critical level. Existing research on the impacts of these forest treatments to spotted owls is minimal. We are aware of only three studies on northern spotted owls that have investigated the effects of forest thinning on demography or habitat selection of spotted owls (Meimann et al. 2003, NCASI unpublished) or their prey (Gomez et al. 2005). The study by the National Council for Air and Stream Improvement (NCASI) was a large study with many pairs of owls but a publication from that study is not available. In addition, the studies by Miemann et al. 2003 and Gomez et al. 2005 were conducted on Westside forests and based on small samples so there is a paucity of information on the effects of thinning or patch cutting on spotted owls or their prey for eastside forests. Incredibly, the recommendations for managing spotted owl habitat in dry forests did not acknowledge the existence of any of the above studies nor provide any cautionary advice to the recommendations for active management of these forests. We see this as a major deficiency in the 2010 DRRP.

Effects of Forest Treatments on Closed Forest Habitat

On page 33, the 2010 DRRP recommends "that Federal land managers implement a program of landscape-scale, science-based adaptive restoration treatments in disturbance-prone forests." The source of landscape scale treatments the DRRP cites is an unpublished report by Johnson and Franklin (2009). These treatments include thinning trees up to 150 years old and creating patch cuts. The forest canopy would be reduced considerably, and forests would be more open and park-like. This could create habitat in which the understory structural diversity would be below levels associated with spotted owl habitat (except possibly dispersal). Other logging impacts such as ground disturbances, noise, out of season prescribed burning etc. would be present. Trees least associated with quality spotted owl habitat would be favored for retention: ponderosa pine, western larch, sugar pine, incense-cedar, Jeffrey pine along with only one favored species Douglas fir, which would still be frequently cut. True fir, which is often an important component of spotted owl habitat, and many intermediate sized Douglas fir which are favored, would be targeted for removal. Up to 2/3rds of the landscape would be treated, and it is assumed that treatments would be maintained in perpetuity. These are similar to the treatments described in the 2008 Plan which, it concluded, would render treated areas non-habitat for spotted owls. Another scenario that has been recommended is the treatment of 20 percent of the landscape with strategic thinning in an effort to reduce fire severity or extent (Ager et al. 2007). These treatments may also make affected areas relatively unsuited for spotted owls, although there would be much more potential for avoiding such impacts with reduced area treated.

There is a need to address the effects of proposed treatment scenarios. Accordingly, we used the state and transition model described earlier to model the effects on mature closed forest over time. We added an alternative state to the model, open forest. We assumed that both mid- and late-successional forest would be opened by equal amounts (2/3rds or 20 percent of the area of each type for the two scenarios, respectively) (see also Appendix A). Treatments would be completed over a 20 year period, consistent with Johnson and Franklin (unpublished report). We assumed that all open forest created by thinning and patch cutting would have no stand-replacing fire. This is not realistic for fires that are weather-driven, but this assumption has little impact on the modeling output.

The results of running the model with 2/3rds of the landscape treated leads to open forest becoming predominant after a couple of decades, occupying 51 percent of the forested landscape, while mature, closed forest drops to 29 and 24 percent of the Klamath and dry Cascades forests, respectively (Appendix A, Figure 5, shows the Cascades). Treatments that maintain open forests in 2/3rds of the landscape put such a limit on the amount of closed forest that can occur, even if high severity fires were to be completely eliminated under this scenario, there would only be 35 percent of the landscape occupied by closed forests. In contrast, to the extensive treatment scenario, treating only 20 percent of the landscape reduces mature, closed canopy forest by about 11 percent (Appendix A, Figure 6).

One justification for the extensive treatment scenario promoted in the 2010 DRRP is that it is needed because of increased fire hypothesized to occur under climate change. By doubling the rate of high severity fire by 2050 with 2/3rds of the landscape treated, closed canopy forest is reduced to 25 percent in the Klamath compared to 60 percent without treatment and 23 percent in the dry Cascades compared to 54 percent without treatment.

Under what scenario might treatments that open forest canopies lead to more closed canopy spotted owl habitat? The direct cost to close forests with treatments that open them is simply equal to the proportion of the landscape that is treated. This reduction in closed canopy forest can only be offset over time if the ratio of forest regrowth to stand-replacing fire is below 1 (5-8 times more fire than today), and shifts to above 1 with the treatments (and most or all stand-replacing fire in treated sites is eliminated, as modeled here). Another scenario that allows closed forests to increase would be if treating small areas eliminated essentially all future stand-replacing fire, not only in treated areas, but across the entire landscape. This scenario obviously relies on substantially greater control over fire than is currently feasible, and it would increase impacts of fire exclusion if effective.

The 2008 Plan and Appendix D of the 2010 DRRP both suggest that thinning and patch cutting much of the landscape can be consistent with protecting more closed forest habitat because open canopy forests could be allowed to revert to closed canopy forest at any time. This scenario would be better than a scenario where treatments are maintained in perpetuity, but it would still diminish closed canopy forest habitat until treated areas are allowed to recover. Even after treated areas recover, there will be a slight reduction in the amounts of mature, closed forest (Appendix A, Figure 7). However, if one-time treatments are limited to mid-successional forests and they all recover to mature, closed canopy forests within 20 years (i.e., slow ingrowth), there would be almost no effect o these treatments on the long-term amount of mature, closed forest, especially if treated forest experienced any sever fire, for example, during extreme weather. Nonetheless, thinning mid-successional stands makes the most sense of any treatment scenario considered, especially if this caused the treated forests to grow into mature closed-canopy forest faster. In addition, the treatments effects could be achieved by girdling many of the trees identified for removal and leaving them as snags, which would likely improve habitat for spotted owls while still reducing the risk of fire (Simard et al. in press).

In sum, to recognize effects of fire and treatments on future amounts of closed forest habitat, it is necessary to explicitly and simultaneously consider the rates of fire, forest recruitment, and forest treatment over time, which has not yet been done by the Service. Given our results illustrating the tradeoffs in maintaining closed forest using treatments that open them up, we recommend that any silvicultural manipulation of spotted owl habitat (mature closed canopy forests) be conducted slowly on small landscapes with sufficient design, replication, and data analysis from which the effects of such experiments on spotted owls and their habitat and prey can be inferred with an acceptable level of error. This will require a considerable amount of planning and a sufficient amount of funding that is above most research efforts of the agencies in the past. This should be a focus of adaptive management (see below) over several years or decades depending on the results of the initial experiments. This was the type of research and adaptive management that was recommended in the 1992 Draft Recovery Plan for eastside forests, but the agencies never funded or implemented such a program.

Effects of Treatments to Open Forests on Forest Restoration

Active management that reduces closed canopy forests over much of the landscape is not only inconsistent with owl needs, but, new understanding suggests that such treatments are also inconsistent with restoration. Restoration is a major goal of the 2010 DRRP (Pg 32), which states: “disturbance-prone forests should be actively managed in a way that addresses the complementary goals of spotted owl recovery, responding to climate change, and restoring dry-forest ecological structure, composition and processes.” However, the working assumption that open or park-like forests maintained by low severity fire are the restored condition no longer appears accurate, and open park-like forests are not suitable spotted owl habitat.

Hessburg et al. (2007) conducted the largest study of historical forest structure and fire severity ever completed for eastside dry forests. It has significantly changed scientific understanding about historical forest structure and wildfire in these forests. Hessburg et al. (2007) found “low abundance of old, park-like or similar forest patches, high abundance of young and intermediate-aged patches” and showed that “old forests were maintained and influenced by mostly mixed rather than low severity fires.” They also found that “young multistory forest understory re-initiation” was a dominant condition. Thus, extensive creation of park like forest (widely spaced overstory trees with few or no understory trees) and open patches may not be incompatible with restoring historical forest structure and variable-severity fire. In fact, Hessburg et al. (2007) concluded that managers should allow more wildfire and that "restoring resilient forest ecosystems" is not simply a matter of reduction of fuels and thinning of trees to favor low severity fire".

Analogous to the findings by Hessburg et al. (2007), research by Colombaroli and Gavin (2010) from the mid-elevation forests of the Klamath region requires a major reconsideration of historical forest structure and wildfire. They found that "the reduction of fire that has occurred since fire suppression began is not qualitatively unusual in the context of the episodic history of fire during the last 2,000 years." Their study also found that large, high intensity events were quite common, and current fire regimes and conditions are not outside this range of conditions.

In summary, there are conflicting data regarding the historic condition of forests within the range of the northern spotted owl, and there is reason to question whether the forest restoration discussed in the 2010 DRRP and the unpublished report by Johnson and Franklin (2009) are the best way to proceed. The thinning and regeneration harvest (clear-cutting) proposed by (Johnson and Franklin, unpublished) are not directed at improvement of spotted owl habitat and will likely lead to a reduction in the amount and quality of spotted owl habitat. There is serious and valid debate about thinning in mature forests (> 80 years old) and whether it will make them more resilient to wildlife. Consequently, we believe that the Service would be well-advised to take a very conservative approach as opposed to using and unpublished and unproven recommendation from forest restoration. The focus of the recovery plan should be on maintenance or improvement of spotted owl habitat, not forest restoration, which may be detrimental to owls and their prey.

Spotted Owl use of early successional habitat created by fire

Our previous comments explained how the earlier drafts of the plan incorrectly presumed that spotted owls did not use areas created by fire and therefore presumed that all fire disturbances equated to habitat loss. The 2010 DRRP presents a more balanced and scientific treatment of fire effects; however, it still contains text left over from the previous drafts that suggest that moderate to severe fires result in near complete habitat loss for spotted owls.

The present draft discusses recent studies by Bond et al. (2009) and Clark (2008) in a more objective way. Unfortunately, these are the only studies that have investigated the use of recently burned areas by either California or northern spotted owls, so much more research is needed on this aspect of the spotted owl's ecology. The study by Bond et al. (2009) found that California Spotted Owls occupying burned forests preferentially foraged in severely burned forests more than other categories of burn severity (e.g., 4 years post-fire) specifically unburned forests within about 1.5 km of a core-use area. This counterintuitive finding suggests that at least some spotted owl prey increase rapidly in resource rich early successional environments (Lawrence 1966). Bond et al. (2009) recommended that burned forests within 1.5 km of nests or roosts of California spotted owls not be salvage-logged until long-term effects of fire on spotted owl and their prey are more fully understood. Clark (2008) investigated demography and habitat selection of northern spotted owls in three burned areas in the Klamath province of southern Oregon. The major areas of his study were on or adjacent to BLM lands that were interspersed with private lands, which were salvage logged shortly after the fires. Data on demography and habitat selection of owls were also available for owls prior to the fires. Occupancy of nesting territories declined rapidly following the Timbered Rock Fire when compared to unburned landscapes of the southern Cascades. Abandonment of nesting territories (extinction rates) increased in a curvilinear manner as the amount of unsuitable habitat within the core nesting area increased, and colonization of nesting territories was influenced by the amount of nesting, roosting and foraging habitat that burned with low severity. Average sizes of home ranges of spotted owls were larger after the fire than before. Nesting, roosting, and foraging habitat with low, moderate, or severe fire was selected by spotted owls in recently burned landscapes, and roosting and foraging habitat with moderate severity burns was also selected. Although salvage logging of private lands compromised the ability of Clark (2008) to assess the effects of the fire, the combination of severely burned areas plus the salvaged logged areas reduced the amount of suitable habitat on the study areas. Clark (2008) also recommended against the use of salvage logging after fire because it reduced the overall habitat suitability of the area.

The finding that burned forest habitat is preferred by foraging owls (Bond et al. 2009) provides background evidence for a testable hypothesis that some degree of early successional habitat created by fire in a territory may enhance short-term owl fitness, as long as sufficient old forest habitat is also present for nesting, roosting, and foraging. Further evidence for the development of this hypothesis and for longer term beneficial effects of fire disturbances is from Franklin et al. (2000) who documented higher fitness in territories with an optimal degree of older forest habitat interspersed with other earlier successional types in various stages of development. Additional research within the context of the adaptive management program described in the 2010 DRRP should focus on both short- and the longer-term effects of fire on demography and habitat selection of spotted owls as well as on their prey. Management that reduces this burn heterogeneity could eliminate the benefits of foraging in burned areas. Until such information is available, the Service and land managers should take a conservative approach to managing forests to reduce the risk of fire. Unfortunately, this does not appear to be the approach that is recommended by the Service to manage owl habitat in dry forests of the eastern Cascades, where as much as 70% of the landscape might be treated to reduce risk without a well designed and funded research and monitoring program to evaluate the effects. We believe this is a major deficiency of the recovery plan and the strategy that evolved out of the Dry Forest Working Group. We think this working group overemphasized the risk aspects of forest fires without sufficiently considering the potential effects of forest restoration (i.e. thinning operations) on spotted owl habitat and their prey.

Management of Burned Forests and Guidelines for Salvage

Despite uncertainty about the effects of fire on Northern Spotted Owls, the evidence suggests that to reduce risk to owls, forests affected by fire should be managed like other habitat that is important to spotted owls. We previously presented comments on this topic, concluding that the 2008 Plan was deficient with respect to wildfire and salvage because it lacked specific guidelines for salvage logging and because burned habitat may be important to spotted owls. These comments are relevant to the 2010 DRRP, which suggests that the issue needs to be addressed through adaptive management and research. We agree that research and monitoring of the effects of logging in owl habitat after fire may be important, but we are concerned that the 2010 DRRP currently provides no guidelines on salvage and management of burned forests. We urge caution in implementing adaptive management research on post-fire logging, and suggest that this is not a priority for recovering the species. Instead, protecting as much burned habitat as possible from logging appears particularly appropriate based on current data. Protection of burned habitat is also needed at other times. It is now common practice for fire suppression forces to burn islands of green forest within wildfire perimeters, reducing heterogeneity created by fire. Since these practices may eliminate habitat that is important for nesting and roosting within areas where foraging habitat is improved, they may be particularly detrimental. It has been known for some time that northern spotted owl nest in stands that are often remnants (unburned islands) of forests that survived stand replacing fires (LaHaye and Gutiérrez 1999).

Recovery Action 22 regarding salvage in the 2007 draft Plan was deleted from the 2008 Plan, which we criticized in the prior TWS review, and it has not been added to the 2010 DRRP; therefore, we are reiterating our criticism of the issue. The only mention of salvage after fires is included in Appendix D: Habitat Restoration and Salvage, which was copied from the SEI (Sustainable Ecosystems Institute), report (SEI 2008). This appendix attempts to relate the issue of salvage to habitat restoration in order to provide some guidelines for such activities, but it does not provide any concrete guidelines for salvage. It basically avoids the issue and says "the salient issue regarding salvage is whether it will enhance spotted owl conservation by restoration of habitat or reduction of risks." Such ambiguous statements do not provide sufficient guidance for management agencies to determine an appropriate approach for salvage of dead trees after fires or other natural events. Guidelines for salvage were included in the 1992 Draft Final Recovery Plan and the Northwest Forest Plan, but these guidelines have been ignored by the Recovery Team. The 2010 DRRP is deficient with respect to the issue of salvage because it lacks specific guidelines for salvage logging and because burned habitats are often used by owls (Clark 2008, Bond et al. 2009) and are likely important to their recovery.

The DRRP Fails to Provide a Recommendation for Dispersal Habitat

Dispersal is a particularly stressful time in the life of young spotted owls. Nearly half of all juveniles die during this period, mostly from starvation or predation (Forsman et al. 2002:18). In western Oregon, Miller (1989) found that 12 of 18 dispersing young spotted owls utilized old-growth and mature forests more than expected based on availability. However, because of the obvious need to manage for other resources on federal lands besides owls, the provisions for dispersal habitat in the ISC report and in the NWFP were a compromise that did not require the retention of old forests as dispersal habitat. Instead the recommendation for dispersal habitat in the ISC report was the "50-11-40 rule," which recommended that federal agencies should manage forests outside of designated reserves so that at least 50 percent of every quarter township would be covered by trees with a mean diameter at breast height ≥ 11 inches and canopy closure ≥ 40 percent. Based on the language on page 41 of the draft recovery plan it appears that the Service is recommending that federal land managers continue to follow the 50-11-40 rule, at least until the Service completes their range-wide modeling process. However, this is different from the definition of dispersal habitat in Table 1, page 26. In this definition the Service left out the part that specifies that 50% of the landscape should be comprised of these types of forests (Table 1, page 26), so that it has no landscape criteria to the rule. We suspect this was simply an oversight, but we cannot determine this with certainty.

The Service does not provide a recommendation for dispersal habitat; therefore, we cannot evaluate this aspect of the plan until the analysis is done and decisions are made regarding the amount, distribution, and characteristics of dispersal habitat. Given the importance of dispersal to recovery of the owl, we think this is a critical component of the recovery plan, and we encourage the Service to obtain a scientific review of their final dispersal recommendations before releasing a final recovery plan.

Recommendations for Management of "High Quality" Habitat Should Be Improved

On page 25 of the draft recovery plan the Service recommends the retention of "…all occupied sites and unoccupied, high quality spotted owl habitat on all lands to the maximum extent possible." On page 26 they define high quality habitat as "Older, multi-layered structurally complex forests that are characterized as having large diameter trees, high amounts of canopy cover, and decadent components such as broken-topped live trees, mistletoe (sic), cavities, large snags, and fallen trees. This is a subset of suitable habitat and may vary due to climatic gradients across the range."

As stated earlier, we agree that it is a laudable goal to protect all high quality habitats for spotted owls, but we think there are two problems with the way this objective is presented in the draft. First, the inclusion of the words "to the maximum extent possible" at the end of the first quote above is so vague that it is impossible to assess the implications of this statement with respect to actual protection of habitat, especially on non-federal lands, where resistance to this recommendation is likely to be high. Therefore, we recommend that the clause "to the maximum extent possible" be omitted from the recommendation in the final draft. Second, by limiting the definition of high quality habitat to a fairly narrow range of habitat conditions, management agencies will be able to justify thinning or commercial harvest in a broad range of naturally regenerated stands. Most of these naturally regenerating stands originated from fire and usually are suitable spotted owl habitat; therefore, they are not likely to be greatly "improved" by management. In western Oregon and Washington such stands are typically comprised of large trees that are 80-160 years old, and include scattered (i.e., residual) old-growth trees that survived wildfires. These stands may not meet the strict definition of high quality habitat, but they are often the best remaining habitat in the heavily harvested or burned landscapes that are managed by the Bureau of Land Management and Forest Service. They often occur in small patches, isolated among large areas of young forest within these disturbed landscapes, and they often serve as nest sites for spotted owls as well as refugia for species such as flying squirrels and tree voles, which are important prey of northern spotted owls. Because of the high timber volume in these stands there is intense pressure to log them. Commercial thinning is often recommended as a prescription to reduce risk of fire or improve forest conditions for owls in these stands, despite the fact that it is usually unclear if thinning will either improve these forests as habitat for owls or accelerate their transition from suitable to high quality habitat. This uncertainty was one of the reasons that the Northwest Forest Plan included recommendations to restrict thinning in naturally regenerated stands over 80 years old in western Oregon and Washington. This restriction should be retained in the 2010 DRRP. Third, there are situations (e.g., in the Klamath province) where age is less important than is the structural complexity, which suggests an expansion of the definition of high quality habitat is warranted (see below).

Therefore, we recommend that the Service use a more inclusive definition of high quality habitat that would encompass a variety of late-successional forest types (i.e. mature and old-growth forests) in which spotted owls nest, roost, and forage. We also recommend that the Service take a more conservative approach and not recommend thinning in naturally regenerated stands over approximately 80 years old, especially when those stands include remnant old-growth trees. These stands will be the spotted owl nesting habitat of the future (if they are not already), and thinning them will most likely represent habitat loss for spotted owls and their prey, both in the near and long term. Such habitat loss will be in conflict with the Service's recovery criteria and delisting objectives as stated in the recovery plan.

Recommended Contributions of Non-Federal Lands Are Inadequate

The 2010 Draft Revised Recovery Plan for the Northern Spotted Owl was prepared such that federal lands will play a major role in achieving recovery of the subspecies. However, as noted in the plan, there are many areas within the range of the northern spotted owl where the amount and distribution of federal lands are inadequate to achieve recovery, so nonfederal lands must contribute to this effort. Because populations of the northern spotted owl continue to decline (Forsman et al. in press), and the threat of competition from barred owls is increasing, we believe that increased attention to the contribution of non-federal lands to recovery is more important than ever. The 2010 DRRP appropriately recognizes the potentially more important recovery role for State, private and Tribal lands and recommends retaining all occupied sites and unoccupied, high quality spotted owl habitat on non-Federal lands "…to the greatest possible extent" (page 50). We support this recommendation, but the language in the recovery plan is too vague regarding what exactly will be contributed by non-federal lands that we cannot evaluate whether non-federal lands will be required to contribute to recovery in a meaningful way or not. This is especially the case in Oregon where state forest practices regulations are weaker than those in Washington and California and where state foresters who review timber sales on state private lands do not notify the Service if there are possible conflicts between proposed harvest areas and sites occupied by spotted owls.

The 2008 Plan identified Conservation Support Areas to support the conservation efforts on federal lands. Unfortunately, these CSAs have been eliminated from the present plan. We suggest that Conservation Support Areas should be mapped and added to the final recovery plan to identify and prioritize areas of particular concern where Federal lands are insufficient or the owl's status precarious. The 1992 Draft Final Recovery plan identified areas of special concern where nonfederal lands should provide habitat for nesting owls and dispersal. These areas of special concern should be evaluated thoroughly in the present modeling of spotted owl populations as described in Appendix C. Otherwise, it is difficult to evaluate the likelihood of recovery in many parts of the range of the subspecies.

Recovery Actions 14 and 15 in the 2010 DRRP focus on voluntary and financial incentives to enlist non-federal landowners in habitat conservation to benefit the spotted owl. We support these efforts but question how effective these efforts have been in the past, especially in Oregon where there is little communication between the Service and state foresters responsible for reviewing proposed timber sales on state and private lands. There is no information in the draft regarding contributions that Habitat Conservation Plans (HCP) or Safe Harbor Agreements have made to recovery in the past, and we are concerned that the HCPs have not been monitored effectively in Oregon since the owl was listed. Recovery Action 15 recommends the formation of a non-federal landowners working group to create incentives for landowners to contribute to recovery. We agree that this is an important recommendation, and we suggest that the Service should lead such a working group to ensure that the group functions as anticipated and all members have a chance to contribute equally.

The role of nonfederal lands in recovery is also addressed under Listing Factor D: *Inadequacy of Existing Regulatory Mechanisms* and recommends Recovery Actions 17, 18, and 19. We think these recovery actions are important because regulatory mechanisms are not currently applied consistently among the states. In particular, Recovery Actions 18 and 19 specifically address deficiencies in the Oregon Forest Practices Act and recommend working with the State of Oregon to make the state's contribution to recovery at least commensurate with that of

Washington and California. The Oregon Forest Practices Act has not been changed to any great extent since the subspecies was listed, and the on-going review to finalize the rules for protecting spotted owl sites has not been completed. The Oregon Forest Practices Act provides for protection of only a 70-acre core for occupied spotted owl nest sites on nonfederal lands, and does not require surveys to determine if spotted owls are present in areas proposed for harvest on private lands. In addition, the Oregon Department of Forestry does not notify the Service when harvests are scheduled within the proximity of known spotted owl nest sites. Unless this situation changes, we think it is unlikely that private lands will contribute significantly to recovery of spotted owls. It is our assessment that this situation is a prescription for elimination of spotted owl nesting on nonfederal lands in Oregon. Recovery Actions 18 and 19 address some of these deficiencies in the Oregon Forest Practices Act, which we support, but it is unclear from the language in the revised draft whether the Service will actually change this situation by becoming more actively involved in the management of spotted owls on non-federal lands in Oregon. We encourage strong action by the Service in Oregon because Oregon's regulations are much weaker than those in Washington and California.

The Service's Proposal for Experimental Removal and Potential Management of Barred Owls is Appropriate

As noted in the 2010 DRRP, there is increasing evidence that barred owls represent a serious threat to the recovery of the spotted owl. We agree with this concern, and fully support the emphasis on this issue in the draft. We also support the recommendation to continue the barred owl working group that was formed subsequent to the 2008 Plan. This work group was instrumental in helping the Service develop recommendations for research to assess the effects of barred owls on spotted owls and will be needed to continue this effort in the future.

The 2010 DRRP includes 12 recovery actions that address the potential threat of barred owls to spotted owls. Two of these are new and one has been revised since the 2008 Plan. The first and 33rd recovery actions (Recovery Action 20) are newly added to the 2010 plan. These are the proposed implementation of barred owl control and the convening of a group to examine multiple interactive factors affecting the conservation of spotted owls, including barred owls. The Service proposes the first action only after experimental studies on the effect of barred owl removal on spotted owl population dynamics are completed and there is a demonstrated feasibility for implementation of control (the experiments were proposed as a recovery action in the 2008 Plan). The structure of experiments to investigate such feasibility is not specified, but it is evident from the plan that such experiments would likely occur on existing northern spotted owl demographic study areas. Moreover, the Service reiterates that control should only be proposed after it is demonstrated that control would benefit spotted owls and recommends a cautious approach before implementing any control program. The Service's recommendation for experiments and continued study of barred owl/spotted interactions are consistent with a joint statement made previously by The Wildlife Society and the Society for Conservation Biology recommending an experimental approach to barred owl control. We agree with this recommendation and with the sense of urgency regarding research on relationships between Barred Owls and Spotted Owls.

Recovery Actions 21-32 were present in the 2008 Plan, but action 32 in the 2008 plan was modified and now mainly stresses maintenance of older or more structurally diverse forests, which are necessary as habitat for spotted owls, regardless of the presence of barred owls. That is, it is an action designed to exacerbate the combined effects of habitat loss and the influence of barred owls. This seems reasonable, as do the remaining recovery actions, which address a variety of issues related to barred owls.

In summary, we think the emphasis on the barred owl threat in the draft 2010 DRRP is appropriate, and that there is an urgent need to initiate research and experiments to determine if this threat can be ameliorated.

The Modeling Efforts for Evaluating Reserve Designs and Proposed Use of the Model Need Further Disclosure

As mentioned above, we cannot evaluate the entire modeling efforts of the 2010 DRRP until we see the final results and have an opportunity to compare the different reserve options or designs that the Service considered. Consequently, this critique is focused only on the tools and process that the Service is using to conduct the modeling. We will look forward to reviewing a more complete description of the modeling results and the reserve design that the Service chooses.

The modeling effort is being conducted by a Modeling Team under the advice of an Advisory Group to "use population viability as a criterion for recommending a habitat conservation network for the spotted owl." The Service appears to have assembled a competent group of wildlife biologists and population modelers to conduct this effort, and we support the use of these individuals. The modeling effort is a three-step process that includes (1) creation of a habitat suitability map for the owl (MaxEnt), (2) development of a series of habitat networks based on the suitability map (Zonation), and (3) population modeling to test the effectiveness of the network to recovery of the owl (HexSim). The modeling is being done on 11 regions that reflect differences in forest type, elevation, climate, prey communities and other factors. The modeling framework looks reasonable on paper but there is not enough detail and clarity in Appendix C to thoroughly evaluate the process. First, it is not clear what kind of a map the Service is using to delineate the amount, quality, and distribution of spotted owl habitat throughout the subspecies' range. We cannot tell if they used the IMVP map, GNN map, or some other satellite map. What is the accuracy of the map in terms of its ability to identify quality habitat versus marginal habitat versus nonhabitat? The modeling effort is highly dependent on the quality, accuracy, and resolution of the map being used, so these characteristics need to be described in more detail.

The modeling is being done on 11 regions, which have very different boundaries than the 13 modeling regions used for the Northwest Forest Plan (NWFP). Why are the modeling regions for the recovery plan different than the ones used for the NWFP? In particular, it seems odd that the north coast of Oregon is combined with southwest Washington and the Olympic Peninsula, since these areas are quite different ecologically and have very different ownership patterns. This needs to be explained. The 11 regions also split lands administered by the BLM into two different areas: Oregon Coast and East Klamath-Siskiyou. The BLM lands in Oregon are somewhat unique in their distribution, forest types, and history of management, particularly the management of the alternating blocks of federal and nonfederal lands. Has the Service considered separating those lands out into a separate modeling region? Models were developed from expert panels of owl biologists and then tested by the program MaxEnt to identify the characteristics of forest structure that best describe owl territories based on the location of current or historic nest sites. Territories were modeled at the scale of 500-acres on a sample of 4,000 nesting locations. Unfortunately, the reader cannot evaluate this step in the process because the description of the models and variables in the models is incomplete and inadequate.

For example, what are the models and variables in the models for each of the zones? The reader needs much more information on this step to evaluate the process. The Service also states that the models were "rigorously evaluated and found to provide reliable, robust predictions of habitat suitability". How were the models tested? What were the results? More information is needed to evaluate this stage or the reader gets the impression that we just need to trust the Modeling Team and Service and these results.

The Service used the Zonation model to map a series of alternate areas for conservation of spotted owl habitat within each of the modeling zones, which allowed them to identify specific areas of the landscape that represent a specific percentage of the total estimated "habitat value" in that region. The Service chose the top 30, 50, and 70% of the total habitat value in this hierarchical ranking but they do not provide the reasoning behind this choice. In addition, it is not clear if these different areas are mutually exclusive or subsets of each other. This needs to be described in more detail. Several maps of these areas are provided but the scale is too small to really discern the differences in the areas and the location of the Late-Successional Reserves from the NWFP. We did like the subdivision of the areas into all lands regardless of ownership, public lands only, and federal lands only because this will be valuable in determining the extent to which federal or public lands can provide the network of reserves needed for recovery. We encourage the use of these subdivisions throughout the modeling process.

The Modeling Team is using the various conservations networks from Zonation as inputs into the HexSim population model, which is designed to simulate the population's response to various spatial patterns of habitat and how they influence owl survival, reproduction, and their ability to disperse around the landscape. HexSim is a spatially explicit, individual based life history model that evaluates the size and distribution of the different reserve networks for the owl based on population performance. The objective of the HexSim simulations is to evaluate the population response of owls to variation in the reserve design, trends in habitat change, and the effects of barred owls. We are supportive of this approach and the objectives but there is not enough information about HexSim to truly evaluate the process. For example, it is not clear what kinds of data are used for input into HexSim. Are you using the latest information on demographic rates of spotted owls from the recent meta-analyses (Anthony et al. 2006, Forsman et al. in press)? How was the model tested, validated, and revised accordingly? If results from the demographic studies were used as input data into the model, how well do the simulations predict the trends in populations on the different demographic study areas or modeling regions? What are the assumptions and limitations of the HexSim modeling effort? What are the parameters that the Service will use to evaluate the different outputs from HexSim and reserve designs (i.e. population size, probability of extinction, regional distribution of territorial owls?) We also need to see the results from the different simulations and network designs in order to evaluate them against what we know about the reserve design for the NWFP.

In summary, we wholeheartedly support the modeling effort and most of the processes that are components of it, particularly the use of MaxEnt, Zonation, and HexSim to compare the performance of different reserve designs in achieving recovery. However, the description of the process is deficient and poorly done, and it leaves a number of important questions unanswered. This plus the fact that there is no reserve design to evaluate makes it impossible to evaluate the modeling process and the future contributions to owl recovery.

Adaptive Management

The 2010 DRRP is predicated, in part, on the implementation of the adaptive management paradigm. Adaptive management is mentioned throughout the plan and in 5 recovery actions (actions 6, 8, 9, 12, and 29); two of these are new (actions 8 and 9) and one is revised (action 12) from the 2008 Plan. Adaptive management was proposed in recognition of the uncertainty in many management actions and could (as noted in the 2010 DRRP) take many forms. Thus, we think it is an important recognition by the Service that land management is fluid and land managers must be responsive to either positive or negative effects of land management on species or natural resources of concern.

We also recognize, as stated in the 2010 DRRP, that recovery plans are not regulatory documents; therefore, the plan cannot be prescriptive, but rather it provides guidance to action agencies. However, we note that adaptive management often fails or is misapplied. Thus, it is critical that specific guidance be given in the recovery plan about what the Service will consider an adequate adaptive management framework because one of the major reasons for the original listing of the northern spotted owl was the "failure of existing regulations." Misapplication or failure of adaptive management plans designed to "benefit" the owl or its habitat would, it seems, be a failure of existing regulatory mechanisms.

Adaptive management plans can fail for a variety of reasons and often are not even implemented when proposed in planning documents. A few reasons for their failure or lack of implementation are lack of commitment to a specific plan of coherent management treatments (lack of planning); insufficient funding, which is often exacerbated by poor planning; changes in management philosophies or personnel; either insufficient or no monitoring (sometimes monitoring is started but discontinued and sometimes monitoring data are not analyzed); and lack of a coherent feedback mechanism that allows changes to be made in land management actions with sufficient time to prevent degradation of the system or impacts on a species.

Therefore, it is critical that the recovery plan provide guidance to avoid these pitfalls if it is to succeed in fostering the recovery of the northern spotted owl. Because there is an inordinate reliance in the revised draft plan on, as yet unknown, habitat relationships modeling, we feel it prudent that the Service provide explicit guidance about the acceptable parameters of an adaptive management program. We believe this can be done in a way that not only does not impinge on the creativity of land managers but also makes it easier for the Service to monitor the structure, function, and outcomes of any proposed adaptive management plans.

For example, among the elements that should be considered part of an adaptive management program are 1) proper experimental design, 2) potential to gain sufficient statistical power (sufficient treatments identified in the design structure), 3) an adequate plan for data gathering, storage, and management, 4) an adequate monitoring plan (perhaps even by neutral third parties), 5) a plan for data analysis and reporting, 6) an explicit method for determining *a priori* thresholds of response that would result in modification of plans, and 7) an explicit organizational structure including how feedback mechanisms operate. By its nature and the nature of the questions of most concern for northern spotted owl recovery, adaptive management will be a long process, so identifying the costs and the transition plans of a long-term project when personnel turnover occurs will also be important. It would be the Service's responsibility to determine that agreed upon adaptive management programs are carried on to completion while minimizing risk to the species. Thus, we believe the NSO plan needs to be much more specific about how adaptive management will be implemented. Further, we caution that adaptive management plans should not be so radical as to result in irreparable harm to the owl or its habitat in the short term.

In the case of dry forest provinces where thinning of trees is often proposed to reduce the risk of fire, the 2010 DRRP leaves the entire development of adaptive management programs to the Dry Forest Working Group. Will this group really be suited to design adaptive management and monitoring programs? On the one hand the idea of compartmentalizing and remanding these issues to working groups is good; on the other hand, the working groups that are assembled must include a sufficient number of individuals specifically trained to design, monitor, and analyze adaptive management experiments or they will fail. These working groups cannot be composed entirely of individuals who are not experts in this area. We suggest that the Service provide guidance to agencies on the type of expertise that should be included on working groups and how they expect any adaptive management program to function and report to them on success or failure of the program (see also above).

Two of the main areas in the 2010 DRRP where adaptive management will most likely be employed are research and management of barred owls and forest manipulation. The barred owl threat seemingly represents, at least at the level of adaptive management and experimental design, the more straightforward of the two issues. It is experimental by design and will be integrated with the existing owl demography studies so the experimental design, monitoring, and feedback components are identified. It is much less clear how forest manipulations will occur, at what scale, and at what frequency. Forest manipulation can range from thinning in dry forests to reduce fire risk to thinning in young wet forests to enhance recovery of size and stand structure typical of spotted owl habitat. Our concern is that guidance needs to be clear in terms of expectations and time frames that are reasonable and do not result in loss of habitat.

Recommendations for Use of Working Groups

We are supportive of the Service's use of outside expertise to guide recovery efforts through the use of advisory groups and working groups. Use of this outside expertise to help with research on barred owls, management of dry forest on the eastside of the Cascades, management in the Klamath Province, and descriptions of spotted owl habitat will likely be valuable in recovering the owl. However, we do recognize some potential pitfalls in using working groups to formulate management strategies for spotted owls or spotted owl habitat. First, the guidelines for creating working groups and their charters are much too vague or nonexistent, so that work groups can become autonomous for the most part. The final recovery plan or appendices should provide more specific guidance for the creation of working groups, how they should function (charter), and how they will be subject to oversight by either the Service and/or the Science Review Committee. There is enough uncertainly in the 2010 DRRP regarding the formation, operation, and authority of working groups that there is no assurance that the appropriate management strategies will be designed and implemented. This is exemplified by the recommendations of the Dry Forest Working Group, which left spotted owl ecology as a secondary consideration in their deliberations. In contrast, we were favorably impressed with the recommendations from the Barred Owl Working Group, which contracted for an outside report (Johnson et al.2008)) and addressed the barred owl issue in an objective and pragmatic manner. A second negative feature of working group concept is that it is impossible to predict the direction that any one of those groups may take, the recommendations they develop, and how such recommendations will affect owls and recovery efforts. This makes for a challenging task in terms of evaluating the 2010

DRRP and what it will accomplish for recovery over the next 5-10 years. Consequently, the Service needs to carefully consider the membership of working groups and review their actions and management recommendations closely. The Service needs to provide strong oversight to the working groups both by agency personnel, other professionals, and by the Science Review Committee. It is our perception that the Science Review Committee has not been used to any extent, particularly regarding management of forests on the eastside of the Cascades or more recent proposals to thin mature forests on the Westside of the Cascades. The Service is ultimately responsible for recovering the species so they should accept, reject, or modify recommendations of working groups as deemed necessary or based on recommendations from the Science Review Committee.

Use of the Best Available Science to Develop the Plan

The Service states that they used the "best available science" in developing the 2010 DRRP (Pages 20, 27 and elsewhere). We commend the Service for this intent but there are very clear cases in some parts of the Plan where the best available science was not used. We illustrate some of these cases in the following paragraphs.

1. The 2010 DRRP uses an unpublished report (Johnson and Franklin 2009) in two important parts of the Plan. First, the report is used to justify very active management in forest stands > 80 years old in western Oregon, contrary to the guidelines for management of Late-Successional Reserves in the Northwest Forest Plan. The report is proposing heavy thinning for Westside forests to reduce the risk of fire and insect infestations in these stands, yet the 2010 DRRP states that these risks are not significant in Westside forests (see Appendix D). Second, the report by Johnson and Franklin is the primary document referenced that provides specific treatment protocols for dry forests on the eastside of the Cascades, and it recommends treating up to 2/3s of the landscape.

   While we recognize that some of the recommendations in the Johnson and Franklin report may have merit, the paper has not been subjected to an anonymous peer review, and we are aware that many of the assumptions and recommendations in the report are subject to considerable debate among scientists. The recommendations in the Johnson and Franklin report would subject suitable spotted owl habitat to commercial thinning throughout much of the subspecies' range without the knowledge of the effects of such activities on them and their prey base. The recommendations in the Johnson and Franklin report obviously were not designed to maintain or improve spotted owl habitat because it was written with a strong emphasis on increasing the volume of timber available for harvest on federal lands. If the Service intends on using the best available science in the final recovery plan, it should not be compromised by using unpublished literature that was designed for reasons other than owl recovery.

2. The 2010 DRRP relies on another unpublished report to assess fire risk (Moeur et al.) and a research proposal (Kennedy et al. no date) as a basis for dry forest management. We requested to see the Moeur report and were told it was unavailable. Moreover, the Service had not even seen it and was relying on a synopsis of said report. We received the synopsis, which did not provide sufficient information to evaluate the methodology. The final recovery plan should not rely on unpublished, non-peer reviewed and unavailable literature in lieu of existing science.

3. The evidence presented in Hanson et al. (2009) on fire risk is from a scientifically credible, peer-reviewed, and comprehensive source. It was cited, but not used in the section on "Current Rates of Loss of Suitable Habitat as a Result of Natural Events" (p. 102-103), which reports data on "habitat loss...from data as recorded in Biological Opinions and Biological Assessments used in Section 7 consultations" (p. 102). If the Service intends to use the best available science, existing science should be presented and its implications should be discussed in detail in this section.

4. The section on habitat recruitment (p. 104) reports the findings of Moeur et al. (2005) regarding the rates of recruitment relative to rates of loss to stand-replacing wildfires, but does not report more recent, peer-reviewed data on the ratio of recruitment to high-severity fire (Hanson et al. 2009). Nor is there any mention of the increased growth rate in forests around the world, particularly those exposed to seasonal drought, due to increased efficiency of water use associated with increases in atmospheric CO_2 as described in a recent comprehensive review (Huang et al. 2008). This has important implications for rates of forest recruitment. The recent data and peer-reviewed literature related to forest growth and recruitment should be used in the section on habitat recruitment.

5. Appendix D contains excerpts from SEI (2008), which reports on fire history and fire ecology. We think much of this information is outdated and should be revised significantly because it no longer provides the best available science.

6. Hessburg et al. (2007) was the largest study of historical forest structure and fire severity ever completed for eastside dry forests. It is cited by the 2010 DRRP, but not accurately portrayed. This study presents a very different model of past forest structure and dynamics than previous studies have but this new information was not accurately incorporated in the 2010 DRRP.

7. Odion et al. (2010) analyzed patterns of fire in the Klamath region and found that forests in that area are not at risk. They found a very low incidence of severe fires in closed forests that have not burned since 1920. This was because flammable understory fuels were shaded out and less flammable hardwoods have become dominant. This has important implications for presumed fire risk, especially the assumption that it increases with time-since-fire. This paper should be included and discussed in detail.

8. The 2010 DRRP states that fire frequency is expected to increase due to climate change, but cites only select literature, some of which is inappropriate. Westerling et al. (2006) is an insufficient treatment of this complex scientific topic. Westerling et al. (2006) did not study trends in fire severity, nor is it a complete study of trends in burned area in spotted owl habitat, as their study did not include much of the owl's geographic range. The trends described by Westerling et al. (2006) were not found in most of the Pacific Northwest. There are many other studies of climatic change and fire which are more relevant and are not cited or used. Perhaps 20 or more published peer-reviewed studies are available on this topic, but were not used in the Plan. This is an inadequate review of the available science, which together suggest a different future than is suggested by the select literature the plan cites. For example, Krawchuck et al. (2009) predicted that fire could decrease in the drier parts of the Pacific Northwest due to vegetation and precipitation changes. In addition, there is no discussion of the key role of the Pacific Decadal Oscillation (PDO) in northwestern wildfire, or that the PDO entered a negative phase in 2007 that is likely to

reduce wildfire over the next 2-3 decades. If the Service intends to use the best available science, this climate-wildfire topic should be covered in depth.

9. The article by Meimann et al. (2003), which describes the effects of commercial thinning on home range and habitat use by a male spotted owl in second growth forests of the Oregon Coast Range, was not cited. In this case study, commercial thinning resulted in an expansion of the nonbreeding home range of a territorial male spotted owl, a significantly reduced use of the thinned area during and after the harvest, and a shift of the core use area away from the thinned stand. The results suggested that the commercial thin had an immediate effect on home range and habitat use patterns of this individual owl. The results have implications for the recommendations for active management of forests on the eastside of the Cascades and should have been discussed.

10. An article by Gomez et al. (2005), which describes the influence of commercial thinning of Douglas fir forests on population parameters and diet of northern flying squirrels, the spotted owls primary prey species in much of its range, was not discussed. This study was conducted in the Oregon Coast Range in second-growth forests with an experimental design of control and treatment stands with 4 replications. Although they found only minor evidence of an effect of commercial thinning on density, survival, and body mass of flying squirrels, they found that the abundance of fungal sporocarps had a positive influence on abundance and survival of the species. Their results also have important implications for thinning of forests on the eastside of the Cascades to reduce the risk of fire. Their results emphasize the importance of hypogenous fungi in the symbiotic relationship with conifer forests and the fungi-small mammal-spotted owl food chain (North et al. 1997). This food web should be a focus of the effects of commercial thinning and forest restoration in the eastside of the Cascades. However, a publication from conifer forests of the Sierra Nevada that describe negative effects of thinning and prescribed fire on hypogenous fungi and flying squirrels (e.g., Meyer et al. 2007) were also not referenced. Impacts of current and proposed management on food webs should be reviewed if the plan intends to use the best available science to analyze impacts of management.

11. The potential impacts of fuel treatments on spotted owls are not considered. Even though we know little about these impacts other than the above mentioned displacements of owls and loss of resources for spotted owl prey, failure to address this topic is a scientific oversight and is inconsistent with the Service's claim of using the best available science. We also know little about the impacts of fire, yet this has been treated as a major threat, leading to proposing more fuel treatments. However, it is uncertain at this time which is a bigger threats, fires or treatments to reduce risk of fires. (see section on fire for comparison of the two threats). Fuel treatment logging that reduces canopy cover and structural diversity to levels that may be unsuitable for spotted owls has affected enormous areas of the Pacific Northwest in recent years, and this is not mentioned as having impacts to spotted owls. There is no quantification of the area affected within the range of the owl. If the plan intends to use the best available science to describe ongoing impacts to spotted owl habitat, information and literature about disturbances to reduce fuels should be included.

12. The 2010 DRRP states (page 33): "Given the need for action in the face of uncertainty, we recommend that Federal managers implement a program of landscape-scale, science-

based adaptive restoration treatments in disturbance-prone forests." The first part of this statement about action in the face of uncertainly conflicts with the use of adaptive management as the best approach for developing management actions in the face of uncertainty. In the same section, in reference to adaptive management, the 2010 DRRP states "formal scientific inquiry...is not the only means of implementing adaptive management and acquiring new knowledge." If the 2010 DRRP is to use the best available science, it should avoid proposing non-scientific methods of adaptive management (we discuss adaptive management needs elsewhere).

In summary, we commend the Service for their intent to use the best available science in developing the 2010 DRRP for the Spotted Owl; however, we found strong evidence that this was not the case throughout much of the Plan. The Service should make a comprehensive effort to base their recommendations and guidelines on the best available science so that they are in compliance with Secretarial Order #3305 issued by Interior Secretary Salazar on September 29, 2010 and the Presidential Memorandum of Scientific Integrity.

SUMMARY

There are many positive features in the 2010 DRRP, some representing clear improvements over the 2008 Plan. We were particularly encouraged by the recommendations to protect all occupied nesting territories and high quality habitat. While we believe that each of these recommendations can be improved, we welcome their inclusion in the plan.

The effort that the Service is devoting to modeling the reserve system also is a positive development that responds to some of the peer reviews that they received on the 2008 Plan. Unfortunately, the release of the 2010 DRRP prior to actual completion of the modeling process makes it impossible to evaluate the performance of the models and their potential effectiveness as a tool for developing a reserve system. Moreover, documentation of the model given in the 2010 DRRP is inadequate for a complete understanding of model structure, parameterization, validation, and proposed use. We believe that FWS must provide further opportunities for peer review of their modeling efforts to ensure that it represents best available science.

We also support some parts of the 2010 DRRP that have not been changed significantly from the 2008 Plan. These include the recovery criteria, the continuation of demographic studies, and the experimental removal of barred owls with the objective of better understanding their effect on spotted owls. The use of adaptive management and work groups is also positive, although both proposals can be improved.

Other aspects of the 2010 DRRP are flawed and many are not based on best available science. The lack of a permanent proposal for a reserve system is a major problem that prevents full review of the 2010 DRRP. We believe this will necessitate further peer review prior to finalization of a recovery plan. The Service's strategy for no reserves in dry forests in the eastern Cascades is exacerbated by the proposals for aggressive management of these dry forests because the treatments will reduce the amount of closed canopy forests in the landscape and reduce the amount and suitability of habitat for the subspecies. These proposals are not based on a complete review of the available science and they rely on unpublished reports. In addition, there has been no formal accounting of how closed canopy forests can be maintained with the widespread treatments that are being proposed. Management actions, which are not based on good science, in dry forests with no reserves will likely lead to failure to achieve recovery criteria.

Recommendations in the 2010 DRRP for contributions of non-federal lands to recovery are weak and represent a step backward from the 2008 Plan. The inadequacy of these recommendations is likely to result in failure to achieve recovery criteria. The Service has also needs to provide a meaningful recommendation for dispersal habitat. While such habitat may be present in many places on the landscape, the 2010 DRRP fails to provide a concrete recommendation for its management to achieve the recovery criteria.

In summary, there are areas of improvement of the DRRP over the 2008 Plan but on balance the 2010 DRRP still falls far short of being an adequate recovery plan for northern spotted owls. The lack of a recommended habitat reserve system is the most striking flaw of the 2010 DRRP. This system is an extremely critical component of the plan and must be developed and peer reviewed before the plan can be considered final. The failure to use best available science in developing other recommendations, most notably the recommendations for management of dry forests, will likely undermine the achievement of recovery criteria. Given the conservation history of the northern spotted owl and the high level of scrutiny, TWS is surprised and dismayed that the Service, given the feedback on previous drafts, would prematurely release a revised recovery plan that has many of the same problems that were identified in previous drafts. Moreover, TWS was asked to review a recovery plan that is incomplete, which precluded comprehensive review.

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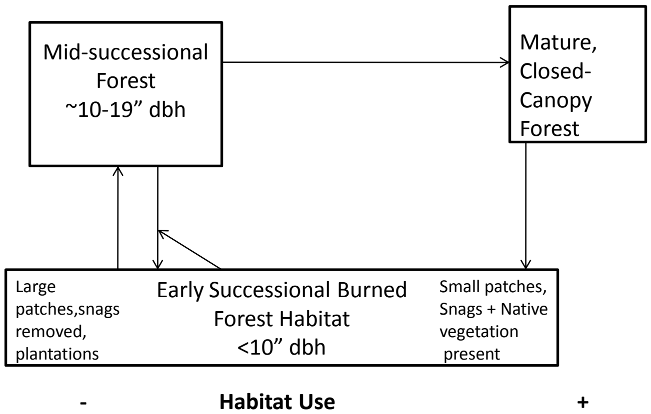
APPENDIX A

Introduction

The purpose of this appendix is to provide a quantitative framework that analyzes the risk to closed canopy forests from different scenarios for both fire and forest treatments that convert closed canopy forests to open forests. The analysis is based on the use of state and transition models, which are useful for quantifying the amounts of any landscape that will be in a particular state at a particular time based on specified disturbance and succession rates. The basic model (Figure 1) contains 3 forest states: early successional forest (generally 0-10" trees), mid-successional forest (generally 10-19" trees), and mature, closed canopy forest, where mean diameter of overstory trees is > 20" dbh (smaller understory trees are often common also). We modeled the proportions of these through time from the present until 2050. The present proportions for each of these types in the forested landscape are from the recent estimates that Moeur et al. (2005) provided the USFWS in a synopsis of their unpublished report. These proportions can be changed without much effect on the proportions of each forest type in 2050.

The default rates of high severity fire we use are from the MTBS classification (MTBS.gov) of fire effects in mature, closed canopy forests in the dry provinces (Washington Eastern Cascades, Oregon Eastern Cascades, Oregon Klamath, California Klamath, and California Cascades) from 1996-2010. We lump these provinces into the Klamath and dry Cascades regions. Mature, closed canopy forests that burned over this period are those mapped by Moeur et al. (2005) as "old forest". The MTBS rates of high severity fire in these forests are 3.0 percent per decade for the Klamath and 1.2 percent per decade for the dry Cascades. For early and mid-successional forest in both regions, we doubled this rate of high severity fire over the rate in mature forests based on empirical data (Odion et al. 2010). The regrowth rates we use are for productive forests because spotted owls do not use the drier forests in these regions (e.g. dry pine). We use the estimated time it takes for forests to redevelop after fire to have overstory trees with mean dbh > 20". The average rate of forest regrowth in the Klamath is estimated to be 60 years based on regrowth data reviewed by Odion et al. (2010). The forest regrowth rate we used for the dry Cascades was 9.5 percent per decade. This regrowth rate is what Moeur et al. (2005) estimated as the net growth rate, after subtraction for losses, for relatively unproductive forest types in the Pacific Northwest. We illustrate the model outputs using these regrowth estimates, but also run the model with slower growth rates to examine these effects. Data on regrowth rates are needed to calibrate the models, but the models still illustrate the comparative risks to closed forests from fire and the proposed treatments that would open up these forests.

Figure 1. Simple state (boxes) and transition (arrows) model for Pacific Northwest forest vegetation with fire disturbances and regrowth.



Fire Risk

The future levels of mature forest that will develop under the default scenarios for the two regions are shown in Figures 2 and 3. These results show deterministic growth of mature, closed canopy forest under current fire regimes to be 64 and 57 percent of the forested landscape in the Klamath and Cascades regions, respectively, by 2050. This growth would continue after 2050 such that mature forest would come to occupy about 75 percent of the forested landscapes under the modeled conditions.

Figure 2. Amounts of the three forest types in the landscape in future years based on transition rates modeled for the Klamath region.

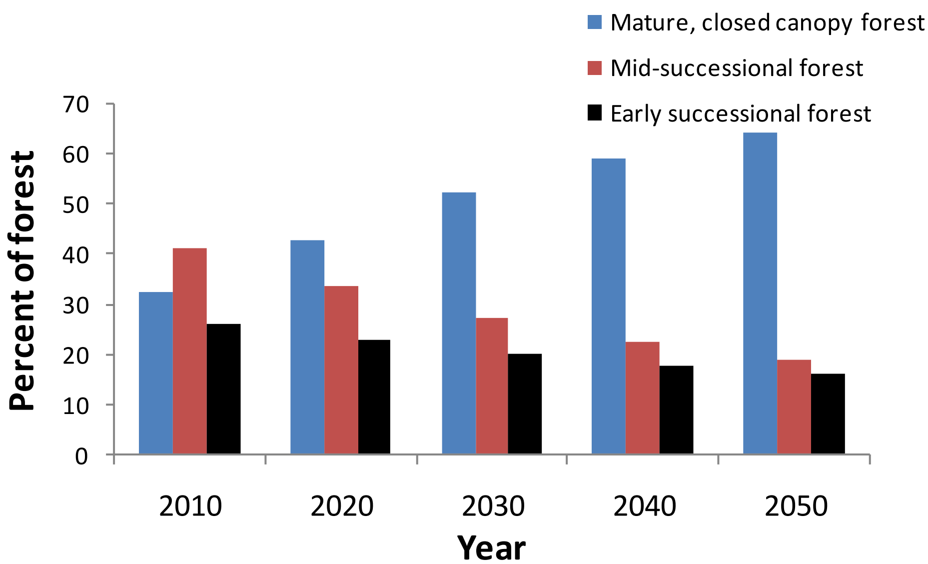
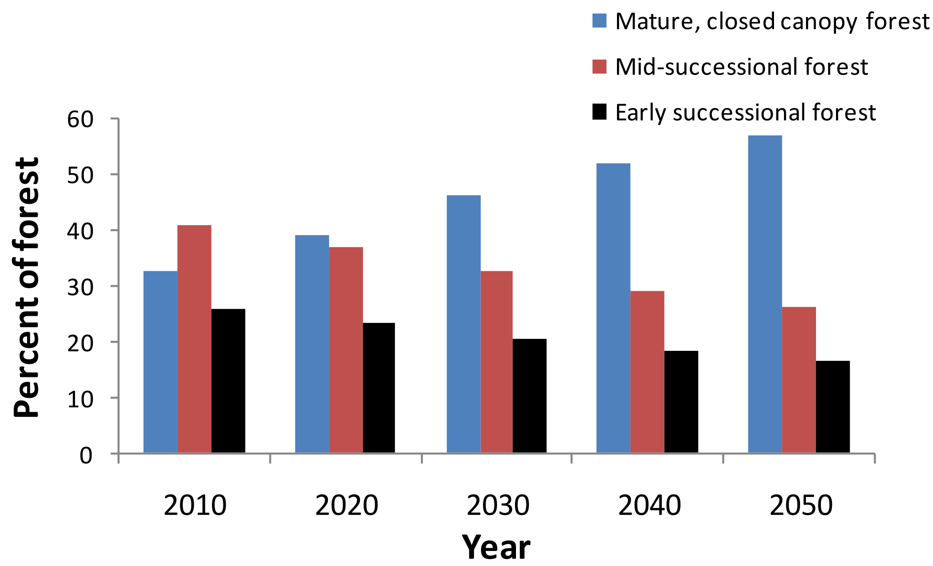


Figure 3. Amounts of the three forest types in the landscape in future years based on transition rates modeled for the Dry Cascades provinces.

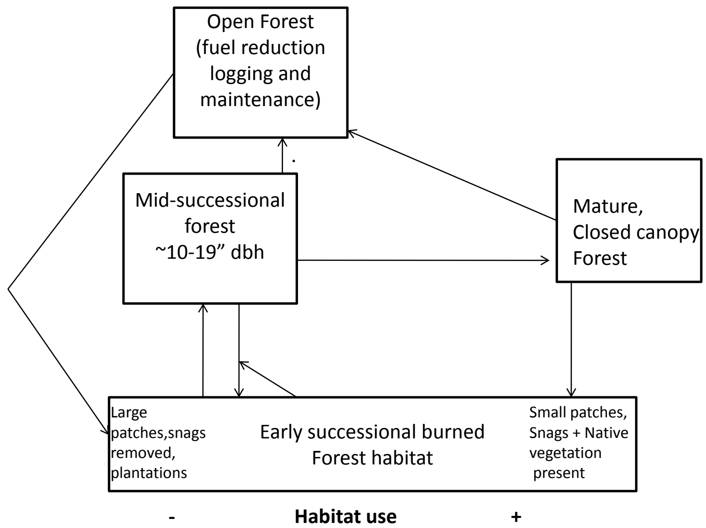


These results are relatively robust to scenarios that reduce forest regrowth rates. Even in forests that take twice as long to redevelop in the Klamath (120 years) and dry Cascades (210 years), 49 and 44 percent of the landscape would become occupied by mature, closed forest in the two regions, respectively, by 2050, which is considerably more than today's 32.5 percent. Additionally, if we double the rate of severe fire by 2050, mature, closed canopy forest would still occupy 45 and 43 percent of the landscape by 2050 and continue increasing beyond that.

Risk of Treatments

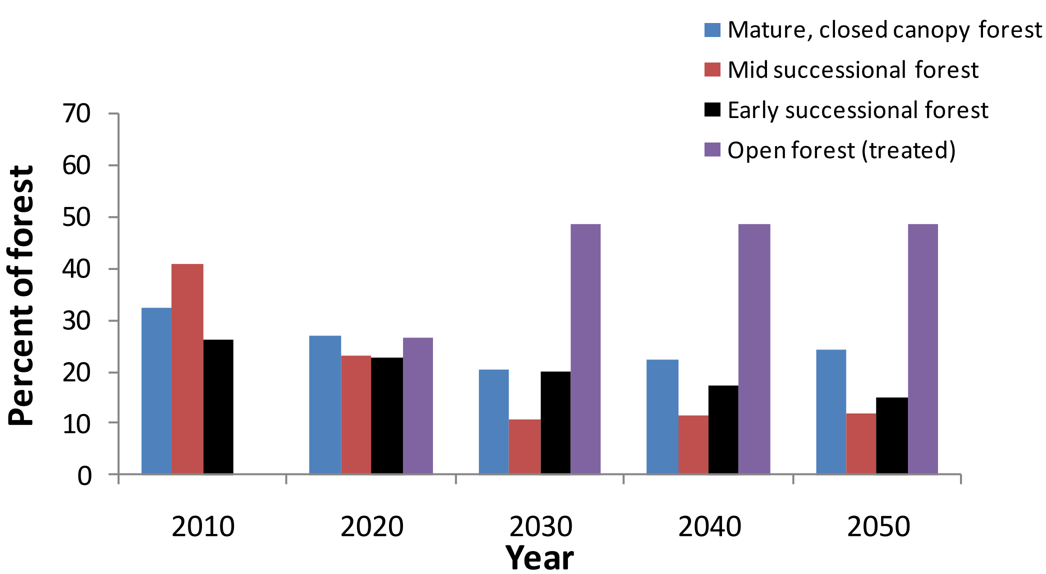
To illustrate the effects of using landscape scale treatments, which have been proposed to reduce the risk of fire, we used the state and transition model described above with an additional state added, open forest (Figure 4). Consistent with the thinning and patch cutting treatments proposed by Johnson and Franklin (unpublished report) referenced in the 2010 DRRP, we modeled treatments that open 2/3rds of the mid- and late successional forests over a 20 year period through thinning and patch cutting. It is assumed in their report that these treatments would be maintained in perpetuity. There is not enough older forest to accommodate all the thinning, so we also included mid-successional forests (2/3rds treated). Even so, the total area thinned is less than 2/3rds of the landscape. We assumed that all open forest created by thinning and patch cutting would have no stand-replacing fire. This is not realistic for fires that are weather-driven.

Figure 4. State (boxes) and transition (arrows) model for Pacific Northwest Forest vegetation with fire disturbances and thinning.



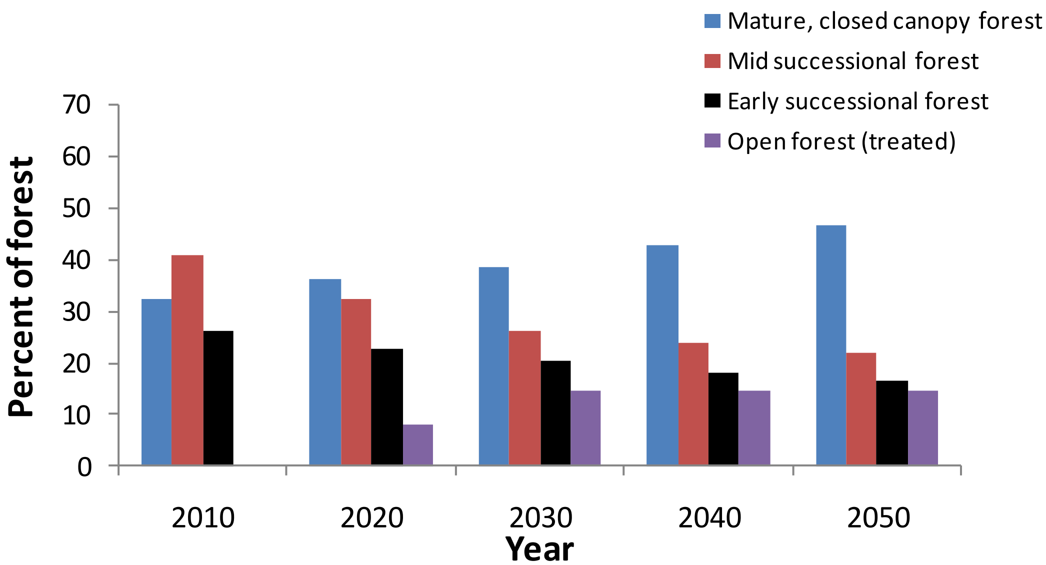
The effects of the thinning scenario on the future amount of mature, closed canopy forest in the dry Cascades is shown in Figure 5. Under this scenario, mature, closed canopy forests decrease from current amounts (32.5 percent) to 24 percent of the forested landscape by 2050, from less than half the amount with no treatment (57 percent), or from 43 to 17 percent under the scenario of slow growth and doubling the amount (2X) of fire. Not surprisingly, open forest becomes the predominant type with extensive treatments and occupies 50 percent of the landscape in all scenarios involving this treatment level. The results are similar for the Klamath except that mature, closed canopy forests are reduced to 29 percent of the forested landscape. In both regions the effect of treatment is less mature, closed canopy forest than in 2010.

Figure 5. Amounts of the three forest types in the landscape with treatment of 2/3rds of the forested area in the dry Cascades to create open forests, and maintaining the treatments.



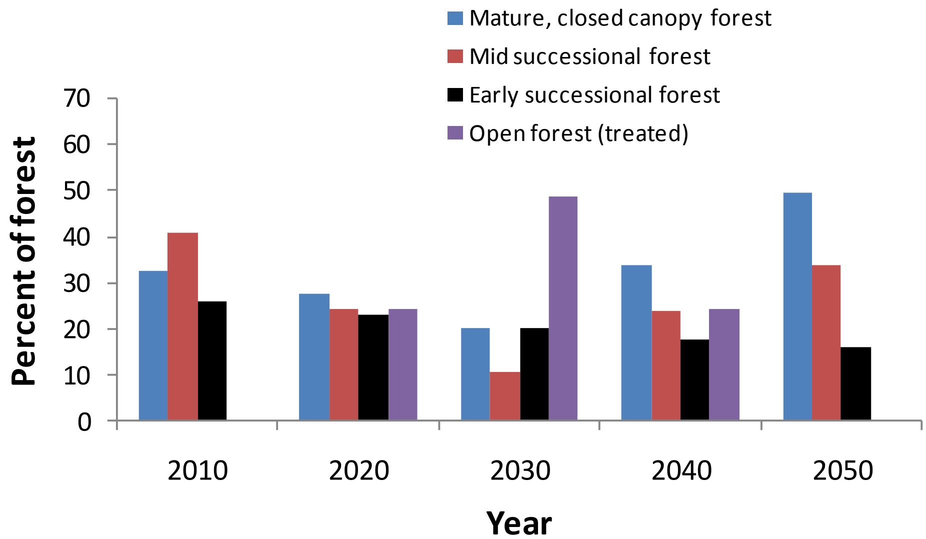
We modeled another thinning scenario by treating 20 percent of the landscape, as suggested by Ager (2007). Again, we split this evenly between mid-successional and mature, closed canopy forest. In this scenario thinning reduced the amount of mature, closed canopy forest from 57 to 46 percent (43 to 35 percent under the slow growth and twice the amount of fire scenario), while open forest occupied only 15 percent of the forested landscape (Figure 6) under all scenarios involving this treatment level.

Figure 6. Amounts of the three forest types in the landscape with treatment and maintenance of 20 percent of the forested area in the dry Cascades to create open forests.



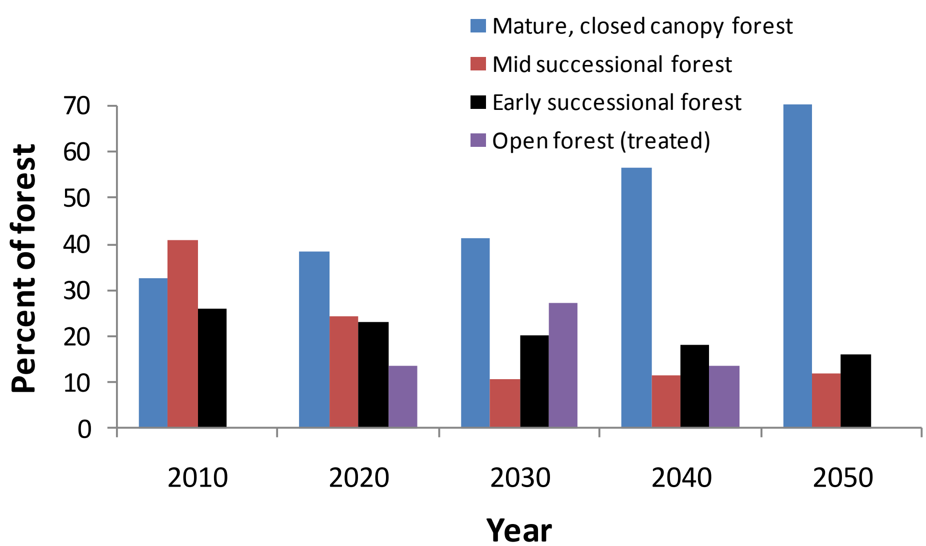
The 2008 Plan and Appendix D of the 2010 DRRP both suggest that thinning and patch cutting much of the landscape can be consistent with protecting more closed forest habitat because open canopy forests could be allowed to recover to closed canopy forest at any time. This scenario is modeled in Figure 7 assuming recovery takes 20 years (data are needed to calibrate this assumption). The scenario in which treatments are not maintained may be more realistic than the scenario where treatments are maintained in perpetuity because maintenance would be very costly and generate little revenue after the first entry. It would also be necessary to increase prescribed burning by enormous amounts, but this will be constrained by air quality regulations and lack of fire-fighting resources to conduct burns. The assumption that treatments could be maintained or even that slash could be treated has not been analyzed in terms of economic and social feasibility. In any event, allowing the treatments to recover diminishes the amounts of mature, closed forests less, but closed forests would still be diminished substantially for a period of time compared to the no treatment scenario (compare Figures 2 and 7). After treatments recover there would be no increase in the amounts of mature, closed forest than prior to treatments. In fact, there would be a slight reduction from 57 percent to 50 percent because less mid-successional forest would develop into mature, closed canopy forest (Figure 7).

Figure 7. Amounts of the three forest types in the landscape with thinning 2/3rds of the forested area in 20 years and then assuming treatments revert back to the pre-treatment forest type.



Figures 6-7 illustrate the futility of maintaining closed canopy forests if they are subjected to treatments that open them up, even if they recover quickly back to closed forests. However, if only mid-successional forests are treated, and they all recover to mature, closed canopy forests within 20 years, there would be an increase in these mature forests (Figure 8), for example from 57 percent to 72 percent in the Cascades. There would be a similar magnitude effect with the slow growth and doubling the rate of fire scenario but this effect is not a robust finding. If only half the mid-successional forests that were treated recovered to mature, closed canopy forests in 20 years (i.e., slow growth scenario), there would be almost no effect of these treatments on long-term amounts of mature, closed forest, especially if treated forests experienced any severe fire, for example, during extreme weather.

Figure 8. Amounts of the three forest types in the landscape with thinning 2/3rds of the mid-successional forests in 20 years and then assuming all treated forests become mature closed canopy forests after 20 years of recovering from treatments.



Conclusions

Using a quantitative framework to analyze active management treatments that have been proposed in the name of restoration and climate adaptation suggests that they are not complementary to spotted owl recovery as presumed by the 2010 DRRP because they will come at the expense of closed canopy forests. These treatments may be negatively affecting spotted owls currently because of the large net area of reduced forest canopy. Conversely, treating mid-successional forest might increase closed canopy forest after many decades if the treated forests transition relatively quickly to mature, closed canopy forests, and if they experience minimal high severity fire.