

## **Responses to comments on the Northern Spotted Owl Draft Revised Recovery Plan**

**June 28, 2011**

The following black text represents comments or paraphrased comments received from public, agencies, Tribes, State and local governments, etc., and peer reviewers.

### **Listing**

Comment: 12C threat ranking is too low

Response: This recovery priority number is consistent with our regulations which include the level of threat (moderate as the owl is not in imminent danger of extinction) and the uncertain nature of our ability to control the effects of barred owls on spotted owls, since this approach is still experimental.

Comment: The statement "...which matches our guidelines 'low recovery potential' definition" needlessly casts doubt on the likelihood of both the barred owl removal experiments and spotted owl recovery in general and should be removed.

Response: As noted in the draft Revised Recovery Plan, a 'low recovery potential' applies to a species where the method to reduce the threats is "experimental" and "uncertain." This does not diminish the Service's focus on spotted owl recovery or our interest and confidence in the proposed barred owl removal experiment.

Comment: The Service should state that delisting (following the species recovery) does not require that all recovery actions be completed, or that all recovery criteria be met.

Response: This has been added.

### **Recovery Criteria and other elements of recovery**

Comment: While the barred owl is complicating northern spotted owl recovery, there is no statistical reference point to assess the impact of the barred owl or gauge the potential success of recovery actions in light of the barred owl. We suggest that the science of the revised recovery plan strategies be assessed in the context of statistical degrees of confidence and reported both in the context of barred owl presence and in the absence of barred owls. Absent this analysis, it is impossible to assess the scientific validity of the various recovery actions.

Response: The scientific information available at this time is not adequate to statistically assess the effect of barred owls on any specific conservation strategy, though these strategies include efforts to address barred owls. We can, and are, modeling some approaches with and without barred owl influences and will continue to do so as new information becomes available. Individual recovery actions are not anticipated, by themselves, to recover spotted owls. Rather, it is the combination of recovery actions that should provide for recovery. Therefore, assessing whether various recovery actions are scientifically valid should be based on the action's effect on the threat for which it is designed, rather than just overall recovery.

Comment: The 30-year recovery estimate contradicts the best available science and is not backed by any scientific analysis or data whatsoever

Response: Recovery actions are based upon the best available scientific information available to us at this time, and we believe the 30-year estimate is consistent when considering the successful implementation of all the recovery actions. We are unaware of any additional analysis that indicates this estimate may be in error.

Comment: Delisting a stable population (Recovery Criterion 1) after decades of decline conflicts with the best available science on conservation biology, metapopulation dynamics, and northern spotted owl ecology.

Response: As noted in Section II, this is not the only recovery criterion. Recovery Criterion 2 requires that spotted owl populations be well-distributed and viable at the province level, providing a greater level of certainty about the population's condition.

Comment: The Service should cooperate with and learn from the captive breeding and releasing of spotted owls being done in British Columbia.

Response: We are aware of the program in British Columbia and will continue to watch its progress with interest. However, we do not believe the U.S. population of the spotted owl is in a condition where captive breeding is necessary or needs to be considered. If it becomes a necessity later, we will look to lessons learned from British Columbia's effort.

Comment: We recommend that a recovery criterion be added that addresses ecological restoration, as this restoration contributes to long-term recovery of spotted owls

Response: We believe that active forest management and restoration are a tool for achieving habitat development and stability and thus are a component of Recovery Criterion 3. They do not require a separate criterion.

## **Recovery Criteria**

Comment: The draft Revised Recovery Plan fails to demonstrate that meeting the three recovery criteria will lead to a stable, self-sustaining population.

Response: The three recovery criteria are designed to meet the critical needs of spotted owl populations – 1) stable or increasing populations, 2) adequate population distribution and viability, and 3) maintenance and recruitment of the habitat to support that population. However, the decision on delisting would be made based on an evaluation of progress made towards achieving the Revised Recovery Plan criteria.

Comment: Recovery Criterion 1 should require that overall population trend of spotted owls throughout the range will remain stable or increasing for the next 100 years

Response: This criterion is based on an actual measurement that shows the population is stable, not an estimate of future condition. This is only one of the criteria that would have to be met, and even then, a delisting decision would have to include a full analysis of the condition of, and threats to, the species. We do not believe that we need to wait for 100 years to determine if the species is recovered, or that an analysis predicting a 100-year trend is needed.

Comment: The Service should revise Recovery Criterion 1, or add a new criterion, that establishes the levels of spotted owl abundance that must be achieved before the species will be deemed eligible for delisting.

Response: Numerical thresholds would require that we project a population level that is adequate for recovery. While some people have proposed theoretical levels below which populations are at risk, setting such numbers for real world conditions are rarely accurate. The population size will be a component of any analysis of viability in the future.

Comment: Define “viability”

Response: Viable populations have been defined in the glossary.

Comment: Recovery Criterion 2 – Define the viability of spotted owls in numerical terms. This includes the number of subpopulations in each province and numeric descriptions of what constitutes “viable” (e.g. 95% confidence that the subpopulations will persist for 100 years with a stable or increasing population).

Response: The Service has committed to using the best available scientific and quantitative measures for assessing viability, including the HexSim tool and other available techniques.

Comment: In Recovery Criterion 2, "viable" must specify that populations are sufficiently close to other so they do not become overly isolated or a genetic bottleneck

Response: If proximity of populations is determined necessary for viability, then this condition would be part of the Service’s evaluation as to whether we meet Recovery Criterion 2 in any future assessment.

Comment: In Recovery Criterion 2, there is no explanation of how many populations within a recovery province must achieve viability

Response: We have not attempted to calculate this value at this time, but such an estimate would be useful for future assessments prior to consideration of delisting. Modeling tools will very likely shed some light on this question in the near future. Viability is defined in the glossary.

Comment: It is important that the spotted owl population be well-distributed before it is delisted.

Response: Range-wide spotted owl distribution is addressed by Recovery Criterion 2.

Comment: In Recovery Criterion 2, the Service must ensure that recovery provinces are not deemed viable when in fact they are only acting as a population sink

Response: We agree, and we believe modeling tools and future analysis of population information will avoid such an outcome.

Comment: Draft Recovery Criterion 2 calls for monitoring at the province level, but it must also be required range-wide. Without a province-by-province or site-specific evaluation, it is impossible to accurately determine which areas are necessary to provide contributions to recovery. For example, there is no analysis or discussion of the importance of the Western Washington Lowlands province in Washington. In Recovery Criterion 2, need to include Western Washington Lowlands as link to Olympic Peninsula.

Response: If province-wide monitoring is conducted, it should lend itself to being compiled for a range-wide assessment/analysis. This would address the concerns that monitoring should be

completed at provincial and range-wide scales as the two can be conducted in a way that they are mutually complimentary. Future monitoring efforts are difficult to specify at this time as we assume tools and methods are likely to evolve. While we do not speak specifically to the Western Washington Lowlands, we have not excluded them from this criterion.

Comment: Several commenters questioned the value of including northwest Oregon and southwest Washington as part of draft Recovery Action 2. They noted that the area will take decades to develop old forest, only small patches of marginal habitat exist, and few spotted owls are present. Others noted that early analyses of southwest Washington showed little effect of connectivity through the area on the stability of the Olympic Peninsula spotted owl population.

Response: Owls were historically present in northwest Oregon and southwest Washington, and were present on some lands these areas during the early 2000s. While it may take decades to create conditions that can sustain a large spotted owl population, we believe this area remains important to provide distribution of spotted owl across their historical range. Data from 1994 on the effect of connectivity on the Olympic Peninsula is out of date given subsequent declines in the spotted owl population in the area.

Comment: Recovery Criterion 3 is in contrast to ESA Section 4 which describes the need to identify not all habitats but that which is critical in light of economic interests. Suggest revision to read “Maintenance and Recruitment of Critical Spotted Owl Habitat: There is no net loss in nesting/roosting or foraging habitat as identified in the critical habitat exercise (Appendix C) and as measured by effectiveness monitoring efforts or other reliable habitat monitoring programs.”

Response: Recovery Criterion 3 applies to the habitat which will allow the species to survive without the protections of the ESA, not the lands that meet the definition of critical habitat. The Act requires the FWS to consider whether the designation of critical habitat is appropriate. Designation of critical habitat serves several important express purposes and also informs other aspects of habitat protection under the Act. The FWS must designate critical habitat on the basis of the best scientific data available and after taking into consideration the economic impact, and any other relevant impact, of designating a particular area as critical habitat, may exclude an area from designation if we determine that the benefits of such exclusion outweigh the benefits unless the failure to designate the area will result in the extinction of the species. Due to the exemption clauses, there may be lands that are essential for the conservation of the species but do not meet the definition of critical habitat.

Comment: Commenters suggested that Recovery Criterion 3 should include an increase in habitat, rather than just “no net loss” because current levels of habitat are not adequate for recovery.

Response: Language has been modified to improve clarity for maintaining or increasing habitat trend. This criterion, acting in concert with the other criteria (stable or increasing populations and adequate population distribution with viability) would provide for sufficient rationale to consider delisting.

Comment: The Service should consider protection of forests in the future that develop into spotted owl habitat.

Response: Developing habitat in areas recommended for spotted owl goals would be retained under the Revised Recovery Plan's recommendations (Recovery Actions 4, 10, 32), meeting this goal.

Comment: Recovery Criterion 3 should include numerical baseline data to allow measurement of "no net loss".

Response: The criterion is not based on maintaining the exact distribution of extant habitat, but rather developing a stable or increasing level of habitat when evaluated in the future. We believe quantitative estimates such as that provided by Davis and Dugger (in press) are appropriate for this purpose.

Comment: For Recovery Criterion 3, the Service must include a spatial requirement of habitat (e.g., well-distributed, in large blocks).

Response: To meet Recovery Criteria 1 and 2 we believe the habitat configuration of Recovery Criterion 3 will be in a spatial distribution that effectively provides for the recovery of the spotted owl.

Comment: For Recovery Criterion 3, the Service must include protection of dispersal habitat.

Response: Spotted owl dispersal is supported and enhanced by the presence of nesting, roosting and foraging habitat on the landscape, as well as forest conditions that allow for safe movement. Meeting the requirements of Recovery Criterion 3 will include adequate dispersal habitat.

Comment: Several commenters had questions about the concept of "no net loss" and how, and at what scale, it would be measured.

Response: The term "no net loss" has been removed from the document.

Comment: Use of the term "no net loss of nesting, roosting and foraging habitat" precludes the types of forest management practices needed in the Klamath Province to improve fire resiliency. Recommend including a discussion on the need for certain types of active management that may have short-term negative effects to owls or their habitat in order to achieve a longer-term benefit in habitat development and forest resiliency.

Response: The term "no net loss" has been removed from the document. We have included a more detailed discussion of active management including the concept of short-term impacts.

Comment: A "no net loss" criterion for habitat is insufficient for a species where current conservation measures are failing to stem well established decline.

Response: The Revised Recovery Plan includes a broad focus, of which maintaining current habitat conditions are only one component, stressing both maintenance and recruitment of spotted owl habitat. Recovery Actions 10 and 32 focus on maintaining the habitat near spotted owl sites (including those not currently occupied) and across the landscape. However, this is only two of the many recovery actions included in this Revised Recovery Plan to conserve spotted owls. Numerous recovery actions include restoration of habitat and potential management of barred owls, both active approaches to improving the status quo. The term "no net loss" has been removed from the document.

Comment: Due to continued loss of spotted owl habitat to wildfire, it seems that it will be very difficult to meet Recovery Criterion 3.

Response: There is considerable scientific debate over the risk of fire to spotted owl habitat. Not all fire causes habitat “loss”, so an accounting of these areas will be important. Recovery Criterion 3 stresses both maintenance and recruitment of spotted owl habitat; protection or maintenance alone will not result in meeting the criterion.

Comment: The Service needs a means by which to measure and monitor “continued maintenance and recruitment of spotted owl habitat.”

Response: We anticipate the Northwest Forest Plan Effectiveness Monitoring program will produce the data to answer this question, as stated in Recovery Criterion 3. However, we intend to retain flexibility in this process by not narrowing the options for how monitoring will be conducted.

Comment: Recovery Criterion 4 is not a recovery criterion at all because it is not something that, when implemented, would justify delisting spotted owls.

Response: The effective monitoring of the status of a recently delisted species for a period of at least five years is required by section 4(g) of the ESA. To be sure that we have a plan for such effective monitoring developed and ready to implement when a species is delisted due to recovery, it has been Service practice to require the preparation of a post-delisting monitoring plan as one of the criteria.

## **Recovery Units**

Comment: Concerning establishing recovery units (page 37), it is unclear from the draft Revised Recovery Plan if the establishment of these units would allow different listing status in different units. This should be clarified.

Response: Recovery units cannot establish listable entities such that one recovery unit might be listed as threatened and another as endangered, or not listed at all. Only species, subspecies or distinct vertebrate populations may be considered listable entities.

Comment: We recommend use of modeling regions developed by Service as recovery units rather than physiographic provinces.

Response: The physiographic provinces are similar to the modeling regions and well-known. Any analysis we would need to do by modeling region can also be conducted for the physiographic provinces. We chose to stay with the familiar physiographic provinces.

Comment: The Service needs to explain how physiographic provinces will be used and their implications to land management agencies.

Response: Information in “Recovery Units” in Section III and “Population Trends and Distribution” in Appendix A provides the context in which physiographic provinces are used. We have not provided explicit management recommendations for each, as projects will often need to be evaluated on a case-by-case basis.

Comment: The Service should explain the use of provinces as recovery units. For example, Are there any currently functioning spotted owl meta-populations that straddle province boundaries? If so, what are the implications?

Response: We believe the Revised Recovery Plan adequately explains our decision to use physiographic provinces as recovery units. Meta-populations do currently straddle the recovery units, but that is likely true for any units we could rely on. We will be able to evaluate spotted owl populations at the recovery unit scale which makes them a functional choice given the needs of the Recovery Criteria.

### **NSO Recovery Implementation Team**

Comment: The Service should ensure that the science advisory teams provide guidance to recovery implementation groups.

Response: The Science Review Committee is available to review products and documents produced by the various work groups. However, most of the “recovery implementation groups” (work groups) are staffed by scientists who provide their individual opinions and do not require this level of management or guidance.

### **Defining Habitat Terms and Concepts**

Comment: Several commenters requested definitions for terms used in the Revised Recovery Plan related to spotted owl sites and habitats -- for example, terms such as “site”, “unoccupied habitat” and “know sites”.

Response: We have added a glossary to the document that includes definitions for many of the terms. This should provide important consistency to advance spotted owl conservation. However, some terms are used in a manner that purposefully allows for development of local or contextual definitions. These terms are not defined specifically in the document or glossary.

Comment: The Service should define the terms “short-term” and “long-term”.

Response: Both “short-term” and “long-term” have been defined in the glossary.

Comment: The definition of suitable habitat includes “meeting some or all of the life needs of the spotted owl,” and would include dispersal habitat, but that is not consistent with past definitions.

Response: We no longer use the term “suitable” in terms of spotted owl habitat except where it is used in a state regulatory process or specific research studies/reports.

Comment: The word “suitable” should be dropped from the document as a modifier for habitat. If an area is not suitable for a species, then it is not habitat.

Response: Suitable habitat has been used historically to define the habitat types needed to support resident spotted owls, a subset of all habitat used, which includes habitat that supports only dispersal movements. We have generally replaced this term with spotted owl or NRF habitat, which defines the same concept. It is retained where used by others in a regulatory context that we are describing (*e.g.* State regulations or specific research studies/reports).



Comment: References to age of trees in habitat definitions should be replaced by descriptions of stand structure and function to spotted owls.

Response: We have removed reference to age from most of definitions of habitat and have included description of forest stand structure.

Comment: Table 1 should include definitions of “snags” and “dead wood.”

Response: Snag has been added to the glossary. Dead wood (wood on the ground that is not alive) has not been added as we think the term is well understood.

Comment: The Revised Recovery Plan should differentiate between dry forests and moist forests throughout the document, including different definitions of high-quality and dispersal habitat.

Response: While there are differences between what constitutes spotted owl habitat in moist vs. dry forest, spotted owls use structurally diverse forest in all regions for nesting and roosting. While the range of forest conditions used for foraging and dispersal is broader and is often more heterogeneous, spotted owls still require areas that are primarily closed canopy with sufficient roost sites and small mammal populations. Descriptions of these habitats vary across the range, beyond just moist and dry forest, making a specific definition at this scale problematic.

Comment: In Recovery Action 13, current habitat definitions are adequate and built into Washington regulations. We urge the Service not to reopen these debates

Response: We acknowledge that local and provincial habitat definitions are available in some areas, but not across the entire range. In addition, we have and will continue to get new, more detailed information on habitat use over time. It is important that definitions are considered in light of new information through a collaborative process. If still appropriate, definitions may stay the same or individual states may choose not to review their definitions.

Comment: The term "very rare" (relative to thinning trees more than 120 years old) must be defined.

Response: This recommendation will be addressed cooperatively on a case by case basis in the development of specific projects or prescriptions.

Comment: Use of the term "short-term impacts" is meaningless for practical application, and potentially opens up the door to approval of actions detrimental to owl recovery.

Response: The definition of this term is dependent on the context of how it is used, which varies within the Revised Recovery Plan. The word “short-term” is defined in the glossary.

Comment: Some commenters recommended including habitat information from California, in particular the redwood zone, as habitat structure and management is unique in this area.

Response: We have added some language to Appendix A pertaining to the redwood forests of Coastal California providing context for the habitat conditions and needs of spotted owls in that region/sub-region.

Comment: California uses 0.5 mile for core area, not 0.7 mile (Appendix A, page 90)

Response: Text referring to core area sizes has been removed from Appendix A.



Comment: We received comments recommending that we separate nesting, roosting, and foraging habitat throughout the Revised Recovery Plan. Others questioned the separation of foraging habitat in some cases and wondered how this would affect Section 7 consultation reporting.

Response: There are some discussions in the Revised Recovery Plan where combining nesting, roosting, and foraging habitat is appropriate and some where splitting them out is necessary given the content of the discussion. Distinguishing between nesting and roosting habitat at the scale of the Revised Recovery Plan is extremely difficult and fraught with inaccuracies. Therefore, we combined these types of habitat. While spotted owls often forage in nesting/roosting habitat, they also use a broader range of forest types for foraging. Reporting approaches for Section 7 consultation have been worked out between the agencies and the use of terms in the Revised Recovery Plan will not change these.

Comment: The draft Revised Recovery Plan lacks a strategy to provide for dispersal of spotted owls between the yet-to-be-designated reserves. The ISC Strategy relied on the 50-11-40 rule. The Northwest Forest Plan relied on the riparian reserve network as well as mitigating standards for management of the matrix. The draft Revised Recovery Plan has neither.

Response: We are currently recommending following the Northwest Forest Plan reserve system until we are able to recommend an alternate habitat conservation network later in time, so the Northwest Forest Plan's provisions for dispersal should apply for the time being. When we recommend a future habitat conservation network it will incorporate spotted owl dispersal needs.

Comment: Three commenters requested the Service make recommendations for dispersal habitat. One noted that the definitions appear to vary from previous definitions (*e.g.* 50-11-40 of the ISC Spotted Owl Conservation Strategy versus Table 1 in the draft Revised Recovery Plan), though it appears the Service is recommending that Federal land managers continue to follow the rule, at least until the Service completes their range-wide modeling process. They questioned whether the Service intentionally left out the 50% landscape criteria for dispersal.

Response: Dispersal habitat is discussed in "Monitoring and Inventory" in Section III and Appendix A of the draft Revised Recovery Plan. We revised this section to better describe spotted owl juvenile dispersal, including recognition that successful dispersal required not only movement habitat ( $\geq 11$  dbh and  $\geq 40\%$  crown closure) but also temporary settlement habitat. The "11-40" portion of the dispersal management direction of the ISC Spotted Owl Conservation Strategy remains the best information available on conditions that dispersing spotted owls used (not avoided) (Miller *et al.* 1997), so we continue to use this in our operational evaluations. Any new information will be incorporated as it becomes available. The "50%" portion of the ISC definition is not a definition of habitat, but management direction on how habitat should be distributed across the landscape to avoid large gaps that would hinder movement. We are defining forest stands that meet the minimum to provide for dispersal movement, acknowledging that this alone is not adequate for successful dispersal.

Comment: The draft Revised Recovery Plan contains many statements that tend to perpetuate the notion that spotted owl dispersal is effectively accommodated by the presence of intensively managed second growth forest without substantiation (*e.g.* dispersal only requires minimal foraging opportunities, scenic rivers provide dispersal. However, these are localized and typically are not associated with non-federal lands, where dispersal habitat is important. Until there is better information about spotted owl use of habitat during dispersal and how this relates to dispersal success, we recommend that the Service place a greater emphasis on the survival of juveniles – including during dispersal – than is currently afforded.

**Response: We agree that successful dispersal and survival of juveniles are important to recovery. We have revised the discussion of dispersal to better describe the current state of knowledge. Consideration of spotted owl dispersal needs will be included as part of any habitat conservation network the Service recommends in the future.**

Comment: Should address the need to restore and/or enhance connectivity the half million acres of late-successional/old growth forest (LSOG) harvested from non-federal lands between 1994 and 2007. Data suggest that spotted owl habitat on private land disappeared rapidly during the period 1996-2006. Moeur (unpubl.) states “Nearly a half million acres of late-successional/old growth forest LSOG were harvested from non-federal lands between 1994 and 2007 (concentrated in the coastal provinces of Oregon and Washington).” This is likely to impede recovery goals in areas such the northern Oregon coast and southeast Washington. Some portions of this type of habitat may need to be prioritized for restoration and/or to enhance connectivity. This issue is not treated adequately in the Revised Recovery Plan.

**Response: Federal lands will still provide the majority of owl habitat. The Revised Recovery Plan recognizes that Federal lands alone are not enough in certain portions of the spotted owl’s range, and highlights the need for conservation contributions from non-federal landowners. We recognize the need for connectivity at the landscape scale and have addressed this in Section III and Appendix A.**

### **Active Forest Management**

Comment: Conflicting guidance on pages 25 and 34 ("Management actions that may have short-term impacts but are beneficial to spotted owl occupied sites and unoccupied, high quality spotted owl habitat on all lands in the long-term meet the recovery intent of habitat conservation") and 51 ("As a general rule, management activities in occupied habitat that tend to diminish that habitat’s capability to support spotted owl occupancy, survival and productivity should be discouraged, and those activities that retain or improve the quality of the habitat in the long-term should be encouraged") need to be reconciled.

**Response: Language has been revised in several sections of the Revised Recovery Plan to clarify the intent.**

Comment: The statement "...that may have short-term impacts but are beneficial to spotted owl..." (p. 31) offer contrasting and inconsistent perspectives. The rationale for the first action is the need for a short-term safeguard and the second statement calls for management actions that by definition are inconsistent – in fact, contradictory – with the first proposed action. We ask that the Service reconsider or rephrase its intent and revise, as needed, the recommendation to modify spotted owl habitat in the short-term.

Response: We believe a short-term impact is acceptable when it avoids or minimizes impacts to spotted owl occupancy, survival and reproduction and when it will maintain or improve habitat conditions in the long-term. We do not see this as contradictory and have added language in several places within the Revised Recovery Plan to clarify the intent.

Comment: The Service should present information concerning significant deficit in large snags in all forested regions of Oregon and California, and should address the option of creating snags and downed logs as part of active management by including specific provisions.

Response: Maintaining and restoring ecosystem structure and function in the dry-forest landscape, as called for in the Final Revised Recovery Plan, would include developing and restoring the legacy structures such as large snags and down wood, as well as the disturbance processes that create them. Recovery Action 12 should also help provide large snags resulting from fires.

Comment: The Service proposes "active management of fuels in overstocked stands within the dry-forest landscape" (p. 46), but does not review or propose any of the published, peer-reviewed suggestions in Hanson *et al.* (2010) of simple and scientifically proven active and passive management actions that may be equally effective or more so in restoring spotted owl habitat in dry forests.

Response: We have provided treatment principles in dry forest ecosystems that have been pulled from multiple sources, including Hanson *et al.* (2010).

Comment: Recovery Action 7 in the 2008 Recovery Plan emphasized restoration of "ecological process and function" mainly through active management outside of "high quality habitat patches." These are important recommendations that should be carried through to the Revised Recovery Plan.

Response: We agree. We have elaborated on this topic in various sections of the Revised Recovery Plan (*e.g.* Habitat Conservation and Active Forest Restoration section, Habitat Management in Dry Forest section), and have carried this concept forward through Recovery Actions 7 and 12.

Comment: Guidelines for active management to reduce natural hazards and protect habitat must be at least as cautious as the 1994 Northwest Forest Plan Final Environmental Impact Statement.

Response: In the Revised Recovery Plan we have presented our rationale for our recommendations on active management, based on the best available science. In some cases, those recommendations may differ from those proposed under the Northwest Forest Plan due to changes in our scientific understanding of the owl, the threats it faces and the ecosystem upon which it depends.

Comment: Several commenters stated that the active management proposed in the draft Revised Recovery Plan was overly aggressive, untested, and lacked support, leading to a recommendation that we scale back the active forest management recommendation. Some recommended taking the precautionary approach and conducting rigorous paired experimental treatments. Some suggested we not be too eager to trade currently suitable habitat which supports current population for speculative future habitat. One commenter notes that we took a cautious approach to removing barred owls, but inconsistently recommends large-scale active management treatments. Two commenters questioned the emphasis on active forest management in the absence of strong, adequate regulatory mechanisms and given draft Recovery Action 12 admits to a poor understanding of the effects of thinning. One noted that logging generally simplifies forest stands.

Response: Given the effects of past management in dry-forest ecosystems combined with the substantial documentation about the effects of climate change in these systems, the Service believes there is a need to restore landscapes and manage for landscapes that are resilient and adaptable to the impending effects of climate change. The Service acknowledges the risks to treating spotted owl habitat and potential effects on spotted owls. We stress that treatments need to be strategic and focus on restoring and maintaining ecosystem structure, composition and processes with an eye towards recovering spotted owls while maintaining ecosystem resiliency in the face of future climate change. Given the uncertainties, there are risks associated with both taking action and with not taking action until further information is obtained. Thus, the Service has proposed using adaptive management as part of this Revised Recovery Plan to help us learn the effects of current management decisions and inform future decisions. In addition, the Revised Recovery Plan is clear in recommending building on the Late-Successional Reserve network of the Northwest Forest Plan and increasing conservation of high quality spotted owl habitat in the Matrix land allocations throughout the range of the northern spotted owl.

Comment: We suggest that research topics are prioritized before fuel-reduction treatments are done anywhere: a) recent thinning in owl habitat; b) effects of recent wildfires in owl habitat; c) effects of beetle kill in owl habitat; d) changing use of habitat due to warming temperatures from climate change; e) effects of the creation of fuel breaks and more open areas in or near owl habitat.

Response: We describe an adaptive management approach to restoration management activities in areas managed for spotted owls that may include these questions or variation thereof. However, studies of this sort require many years to complete. Where information is available on these topics it has been included and considered. While we are collecting and including information on these projects, we believe the negative consequences of delaying these restoration activities may be greater than implementing those that may have adverse impacts on spotted owls.

Comment: The endorsement of “active management” as a contributor to recovery of the spotted owl is an important step forward. However, the vagueness of the discussion on when and where it might be appropriate creates significant policy uncertainty and confusion.

Response: Numerous edits have been made throughout the Revised Recovery Plan to provide clarity on active forest management opportunities. Land management decisions on when and where to apply these approaches are context-specific, based on local conditions, and cannot be completely described at the scale of the Revised Recovery Plan.

Comment: Because, as stated in draft Revised Recovery Plan, “more research is needed to understand if the costs of such short-term impacts are outweighed by the long-term gains,” the Service should not claim logging in spotted owl habitat constitutes a net benefit to owls

Response: The draft Revised Recovery Plan does not claim that logging in spotted owl habitat is a net benefit to owls.

Comment: The Service should provide examples of action that may have short-term negative impacts but provide long-term benefits to recovery of the spotted owl.

Response: Specific situations where short-term negative and long-term positive effects are dependent on the context, details of the stand and landscape, and therefore cannot be necessarily described in detail at the scale of the Revised Recovery Plan. However, in Recovery Action 10, we do provide examples of management tools and a list of prioritized site conditions to help managers determine whether activities will result in conservation of owl sites and habitat.

Comment: The Service needs to assess impacts by new roads from forest management

Response: Spotted owls do not appear to be greatly affected by forest roads so the information we presented in the Revised Recovery Plan should be sufficient.

Comment: We fail to see the logic for widespread active management when there are only two studies on owl response to fire; spotted owls may be resilient or they may respond negatively to only certain types of fires depending on local habitat condition. Fires may be controlled increasingly by climate rather than fuels (*e.g.*, on page 72 the Service admits that “the amount of wildfire area burned is substantially controlled by climate”), yet the 2010 draft Revised Recovery Plan continues to be a fuels-based active management plan.

Response: The purpose of active management in dry-forest ecosystems is not intended to be a blanket fuel reduction program for the purpose of favoring low-severity fires. The intent is to restore ecosystem structures and processes that will provide resiliency in the face of projected climate change. We believe developing this resiliency will require restoring natural vegetation patterns and patch sizes to reintegrate the relationship between forest vegetation and the inherent disturbance regimes. As such, while there may be places on the landscape where it will be desirable to do vegetation management to reduce stand densities around large, fire-tolerant trees to improve their resistance to drought stress, and there may be other places where managing for high-severity events may be appropriate. Disturbance regimes shaped these landscapes, and they no longer function as they once did. Restoring these regimes will require managing for the variety of severities inherent in these systems.

Comment: The Service should extend draft Recovery Action 9, Klamath Province recommendations, to the rest of the dry forest provinces to collect much needed data and provide a more complete review of the literature on fire effects, owl occupancy in burned areas, identification of high value areas, and the role of fire.

Response: Habitat and ecological conditions in the Klamath Province differ significantly from other dry forest areas. Recovery Action 7 recommends a separate work group for the remaining dry-forest provinces. Recovery Action 8 includes specific direction on data collection on spotted owl occupancy and fire. The products from the work groups are available to the other work groups to consider as applicable.

Comment: Active forest management within LSR's should be a last resort, after it has been scientifically demonstrated that the absence of preferred habitat conditions is the primary impediment to spotted owl recovery, not competition from barred owls. It makes no sense, from a recovery standpoint, to manipulate within LSR's and naturally regenerated mature stands if all the agency is providing are additional barred owl nesting areas. Address the most proximate problem first, and monitor the effect of this management action.

Response: Maintaining and improving habitat is a central tenet of this Revised Recovery Plan. While we believe that natural mature stands are likely to provide the highest value habitat for spotted owls, we also recognize that past management practices (e.g., fire suppression) may have reduced the effectiveness of those stands contributing to spotted owl demographic support. Consequently, we support treatment in LSR's when it will contribute to the recovery needs of the spotted owl. Providing more or better spotted owl habitat would not simply provide more nesting opportunities for barred owls, but is as likely to provide opportunities for some spotted owls to survive.

Comment: The Service needs to address the maintenance and restoration of habitat heterogeneity (i.e., mixture of old and young forest stands), as shown in Green Diamond lands and Hoopa lands. Should insert the sentence in the last paragraph of p. 31: "Examples of management actions that may have short-term impacts but may be beneficial in the long-term include creating openings and early seral forests in those portions of the spotted owl's range known to benefit from habitat heterogeneity (i.e., where dusky-footed woodrats are the primary prey) or thinning stands to prevent devastating wild fires in regions susceptible to such events."

Response: We agree and have added text to the Revised Recovery Plan to address this.

Comment: The draft Revised Recovery Plan notes that 3,000 acres of spotted owl habitat were harvested in Federal reserve areas and 26,000 acres on non-reserved Federal lands during the period 1994 to 2004. The Service should describe where this harvest occurred.

Response: The general location at the physiographic province level of Federal activities that resulted in the removal of spotted owl habitat can be found in Table B-1. The projects comprising these acres were likely diverse and varied. The intention in including this information is to represent past effects to spotted owl habitat so as to provide a baseline from which to manage into the future.

Comment: The draft Revised Recovery Plan is confusing and inconsistent in the roles of timber harvest and active management (i.e., recommends timber harvest and calls timber harvest "lost" habitat).

Response: Timber harvest can result in lost habitat (e.g. clearcut/regeneration harvest), but also can maintain or create habitat (e.g. thinning of young stand that may have been low quality spotted owl habitat). Therefore, we chose to retain the terms used in the draft Revised Recovery Plan.

Comment: The draft Revised Recovery Plan conveys the idea that timber harvest is a generic activity that does not vary in time, space, intensity, or quality.

Response: We disagree. The draft Revised Recovery Plan indicates that different timber harvest/management strategies can have very different outcomes.



Comment: The draft Revised Recovery Plan needs to recognize that to increase population of spotted owls it is necessary to increase the prey base, and this is done by actively managing stands, not by avoiding disturbance.

Response: We disagree that there is evidence that a lack of adequate prey is the factor causing spotted owl declines or limiting population increases. The spotted owl's primary prey varies across its range. In areas where dusky-footed woodrats (a species capable of exploiting openings) are the primary prey, some active forest management may increase prey populations. In areas where flying squirrels are a major component of the spotted owl diet, active forest management may not maintain or improve prey populations. In some areas, we do recommend active management for the benefit of spotted owls.

Comment: Restricting thinning on Federal LSRs beyond the age of 80 years (p. 42) is based on the false premise that only late successional forest will provide for spotted owl recovery.

Response: This section does not advise restricting thinning, but rather presents factors to address when considering potential management projects to enhance spotted owl habitat. Although spotted owls utilize a variety of forest habitat conditions, late successional forest provides many of the habitat components necessary for spotted owl recovery.

### **Recovery Action 10**

Comment: The preamble to draft Recovery Action 10 used the terms "sufficient suitable habitat". This should be defined to ensure everyone understands the intent.

Response: Recovery Action 10 has been revised. "Sufficient suitable habitat" is no longer included in the preamble.

Comment: Page 50 of the draft Revised Recovery Plan proposes retention of all occupied sites, especially those containing the habitat conditions that support successful reproduction. However, habitat conditions supporting successful reproduction have not been well described. We suggest that a section (or appendix) of the Revised Recovery Plan include a forthcoming and thorough review that clarifies the relative ability to predict spotted owl population performance using habitat measures.

Response: Known sites that have reproducing owl pairs meet these conditions by definition. Appendix A (Habitat Characteristics) provides descriptions of habitat conditions associated with successful reproduction. While predictive ability is limited, these studies provide the best available science for determining habitat conditions that are most likely to enhance spotted owl demographic performance. Additionally, we will rely on the local experts to outline how to best meet Recovery Action 10 in specific areas.

Comment: Several commenters request we drop the concept of "abandoned" spotted owl sites, not release these areas for logging, or better describe what constitutes "sufficiently small" contribution by an unoccupied spotted owl site so that the site can be considered abandoned.

Response: We are no longer using the term "abandoned."



Comment: A narrow focus on occupied areas is a step to maintaining the status quo, which has proven to be ineffectual.

Response: The goal of Recovery Action 10 is to conserve spotted owl sites and high value habitat. We are not focusing only on occupied areas. Recovery Action 10 which is focused on protecting sites (including those not currently occupied) is only one of the recovery actions. Other recovery actions (e.g. Recovery Actions 18, 19, and 32) are designed to develop future spotted owl habitat and protect the current higher quality habitat.

Comment: The Service should protect all spotted owl sites, not just those currently occupied, so these areas will be available for reoccupation.

Response: Recovery Action 10 recommends protection of all spotted owl sites, including occupied, historic sites not currently occupied, and areas that are potentially occupied but lack surveys.

Comment: Any activity within the provincial home range of occupied sites should only occur if the activity is scientifically supported to benefit the species.

Response: We recommend allowing activities that do not preclude occupancy and reproduction. We will work with local experts to develop direction on this issue. We believe that activities within the provincial home range of occupied sites can be appropriate when they meet this standard.

Comment: The commenter supports draft Recovery Action 10 recommendation relative to currently occupied or recently occupied sites on Federal lands. Sites where spotted owls remain or did until recently suggests that there may be something about that habitat that may give spotted owls an advantage over barred owls. We should let the spotted owls tell us what is the best available habitat in a landscape dominated by barred owls and these sites should have the highest priority for conservation.

Response: Recovery Action 10 recommends the maintenance of habitat to support spotted owl at all sites, including occupied and those recently occupied sites. It also includes areas not occupied as recently, as these may still be important to spotted owl recovery if we develop an approach to manage barred owl populations. These all represent areas where spotted owls have shown us habitat exists that they can use under the right circumstances.

Comment: Pages 49/50 – *Additional Habitat Actions for All Areas*... Subheading “*Conserving occupied spotted owl habitat*”. The 3<sup>rd</sup> paragraph in this section infers (and we think this is the overall intent) that the site is of interest here, regardless of its occupancy status.

Response: We agree, but consider both habitat and sites important. Recovery Action 10 focuses on maintaining conditions on spotted owl sites. Recovery Action 32 addresses maintenance of high-quality habitat as a potential refuge for displaced spotted owls.

Comment: The Revised Recovery Plan should explain what management is envisioned in the "habitat-capable lands within occupied spotted owl sites across all ownerships" (draft page 51).

Response: The language in Recovery Action 10 has been substantially revised and this wording no longer occurs. We provided general guidelines in the discussion of draft Revised Recovery Action 10 for how management could be implemented.

Comment: The Service should describe what would be acceptable vs. non-acceptable actions that have short-term adverse impacts but long-term beneficial impacts for draft Recovery Action 10.

Response: We have included some general examples. However, determination of the short and long-term effects of any action is dependent on the details of the project, the condition and history of forests in the area, and other site-specific information. Therefore, we cannot provide more clarification.

Comment: The Service should have a more direct description of the need for active management in achieving the goals of draft Recovery Action 10.

Response: The goal of Recovery Action 10 is to maintain existing spotted owls on the landscape. Active management is an effective tool to create spotted owl habitat in some cases that we believe would be consistent with Recovery Action 10. For example, in stands that are not currently spotted owl habitat, active management can help develop habitat more quickly.

Comment: Concerning draft Recovery Action 10, the Service cannot demonstrate beneficial qualities to timber sales that would outweigh immediate harm to spotted owls, and even explicitly contradicts its ecological restoration theory when it later acknowledges, “post-fire timber harvest activities undermine many of the ecosystem benefits of major disturbances... and frequently ignore important ecological lessons, especially the role of disturbances in diversifying and rejuvenating landscapes.”

Response: Recovery Action 10 does not suggest that timber harvest should occur directly adjacent to spotted owls, but does not preclude some forms of active management under certain circumstances. Post-disturbance logging impacts are sufficiently different from activities in live stands that we do not believe the comparison in this comment is valid.

Comment: What is meant by protecting sites or habitat “to the greatest possible extent”? In private lands and state lands in Oregon, as soon as sites are not occupied, they can (and often are), cut.

Response: Language in Recovery Action 10 has been modified, and no longer contains “to the greatest possible extent.”

Comment: The statement “...impacted by medium and low-severity fires often still function as spotted owl habitat and should be managed as such” (p. 53) should be modified so to indicated that burned forest areas should first be assessed as to their condition and a decision can then be made as to whether the forest patch(es) might continue to function as owl habitat.

Response: We believe the current wording of this topic is sufficient to provide the information needed to make decisions about spotted owl use of these areas.

Comment: The following revision of draft Recovery Action 10 was suggested: “Manage habitat-capable lands within occupied spotted owl sites to retain extant spotted owl pairs and resident singles as needed to promote recovery. *The Service will collaborate with other land managers to develop and test standards and approaches that address the overall intent of this recovery action. A key component of this recovery action in certain provinces is the application of active management for landscape scale forest management. In general, these goals are compatible and will need to balance short-term impacts to spotted owls with longer term gains in ecosystem function and species recovery. The Service will work closely with land managers to develop*

*landscape scale approaches to implementing active management to effectively conserve spotted owls and restore forest resiliency.”*

**Response:** This text was modified to reflect input from a number of reviewers. While we state that the Service is available to participate in these efforts, the specific language proposed in this comment assumes that land managers need our participation to implement Recovery Action 10, which may or may not be accurate.

Comment: Washington DNR is concerned with apparently narrow wording of draft Recovery Action 10 “Manage habitat-capable lands within occupied spotted owl sites across all ownerships to retain extant spotted owl pairs and resident singles.” This wording does not reflect the spotted owl conservation strategy in DNR's 70-year acronym (signed in 1997): a series of long-term, landscape-level commitments that provide demographic support, maintain species distribution, and facilitate interchange of owls among sub-populations--not site-by-site management.

...DNR's HCP has designated approximately 345,000 acres of trust lands for the creation and maintenance of quality nesting, roosting, foraging, and dispersal habitat for spotted owls over the life of the HCP. ...We urge that the wording of draft Recovery Action 10 be modified (or accompanying narrative be expanded) to acknowledge the important role that landscape-level habitat conservation approaches such as DNR's can play in spotted owl recovery.

**Response:** This language has been modified. Recovery Action 10 acts in concert with other landscape-level conservation efforts and should not result in minimizing those efforts.

Comment: Don't use “extant” in draft Recovery Action 10.

**Response:** The term “extant” has been removed.

Delete “*what constitutes a site to be retained*” or provide examples why you would not retain a site.

**Response:** We have modified the language to include known occupied and known unoccupied sites, as well as sites estimated to exist in surveyed habitat.

Comment: The Service should identify which group would implement draft Recovery Action 10 (the draft Revised Recovery Plan identified four groups) and determine what constitutes a site to be retained and what habitat “improvement” looks like.

**Response:** Implementation of Recovery Action 10 will be a cooperative effort by, as we stated, land managers, the Service and researchers. This is a collaborative process and not specifically assigned to one of the groups identified in the Revised Recovery Plan. We may approach this with teams at various scales (*e.g.* provincial team, State or Regional team, or range-wide via a new Spotted Owl Habitat work group.) Sites to be retained have been defined in the glossary (see spotted owl site). Habitat improvement will need to be evaluated on a case by case basis at a more localized scale than the recovery plan.

Comment: Draft Recovery Action 10 creates some lack of clarity and focus for the Revised Recovery Plan by standing in contrast to the critical habitat modeling effort described in Appendix C (retain everything everywhere versus a focused effort to retain, manage or create habitat in targeted areas that will achieve recovery goals but minimize impacts to land managers and owners).

**Response:** Recovery Action 10 is focused on maintaining adequate habitat conditions within spotted owl sites, to support spotted owls that are using, or may use this habitat in the future, outside a habitat conservation network.

Comment: Clarify how draft Recovery Action 10 is related to requirements to avoid incidental take.

**Response:** We have not defined Recovery Action 10 in relation to take standards. However, avoiding or minimizing the potential for take would be consistent with the intent of this recovery action. Where take avoidance approaches are being employed with Service assistance, they are likely consistent with this recovery action.

Comment: Landscape-scale analysis could recognize the relative values of spotted owl sites and utilize agency discretion in the timing, spatial location, and types of silviculture treatments to develop strategies that might be more effective than draft Recovery Action 10.

**Response:** Recovery Action 10 is specifically designed to protect existing spotted owls and their sites, given the declining population trends across the species range.

Comment: Commenter would like to work with the Service to model how draft Recovery Action 10 would affect regional spotted owl populations and by testing its effectiveness through the use of stand-level vegetation growth modeling.

**Response:** The Service has investigated the potential for using stand-level vegetation growth modeling to assist with modeling future habitat scenarios and looks forward to working the BLM on future evaluation and analysis.

## **Restoration**

Comment: Planners should consider how habitat restoration can best build on existing remnant habitat to restore subpopulation viability where necessary.

**Response:** The Revised Recovery Plan calls for retaining remnant habitat elements (diversity, trees w/ deformities in addition to large, old trees, etc.) which adequately addresses this concern.

Comment: The Service should focus more on increasing amount of habitat by letting degraded areas recover.

**Response:** The Revised Recovery Plan calls for maintaining and developing spotted owl habitat through a variety of measures.

Comment: Forest restoration discussed in the draft Revised Recovery Plan based on an unpublished report (Johnson and Franklin 2009) likely will lead to a reduction in the amount and quality of spotted owl habitat.

**Response:** We have included a wide variety of new citations and discussion in the Revised Recovery Plan. Additionally, we believe our recommendations in places managed for spotted

owl habitat (Recovery Actions 10 and 32, LSRs, etc.) seek to increase the amount and quality of spotted owl habitat over time.

Comment: Establish strategies and define measurable goals to ensure that degraded areas on Federal and non-federal lands are allowed to develop and be restored into functional spotted owl habitat.

Response: In areas where we recommend managing for spotted owl habitat (Recovery Actions 10 and 32, LSRs, etc.) we believe our recommendations will promote the development of functional spotted owl habitat. The scale of the Revised Recovery Plan, however, does not allow us to develop site-specific measurable goals for stand-level treatments.

### **Fire and forest management to reduce risk of fire**

Comment: Past impacts of defoliators and future threats from Western Spruce Budworm and other defoliators are not currently recognized in the draft Revised Recovery Plan nor by critics of the Revised Recovery Plan except for their inclusion as a category in Table 1.

Response: The draft Revised Recovery Plan addresses forest insects, pathogens, and fire in a broad context, rather than presenting specific prescriptions for specific events. Implications of climate change on future threats of forest insects and pathogens have been incorporated into the Revised Recovery Plan.

Comment: Draft Recovery Action 8 lacks focus and would benefit from a workable, tangible timeframe and plan, instead of the skeletal strategy it outlines. The Service needs to address the needs of the spotted owl *while* it attempts to collect data, and take action to address short-term goals, using the current best available science. The Revised Recovery Plan should discuss research needs as well but must contain specific timelines for completion of this research and specific mechanisms to ensure that the research will be completed on time. There is no opportunity for public input in the prioritization of these key management questions, where substantial and impactful decisions will be made for the spotted owl's future in dry-forest systems

Response: This recovery action regarding adaptive management has been removed. Specific needs of the spotted owl are addressed in other recovery actions, such as Recovery Actions 10 and 32

Comment: In draft Recovery Action 9, the Service fails to establish a framework for creating the interagency Klamath Province Work Group, management plan, and monitoring requirements that are the objectives of this new item. The draft Revised Recovery Plan only summarizes past related progress, and does not elaborate on any future intentions or plans. In addition, it appears to rely on results from a spotted owl habitat relationships report, spotted owl habitat models, and fire models that were not yet available at the time the draft Revised Recovery Plan was written. The decision about how to utilize the results from the report and models, to create a management plan for this area, should be subject to scientific review and public comment.

Response: It is likely that implementation of management actions based on this work group's work will be considered within a public and notice comments process afforded through NEPA, the ESA, or other public review processes.

Comment: The Service should use the precautionary approach by conducting studies on pre- and post-fire use of habitat by spotted owls to determine effects of fires.

Response: The Dry Cascades Work Group (renamed from the Dry Forest Work Group) is currently analyzing existing data on spotted owl habitat use in fire areas. However, it would be extremely difficult and time consuming to attempt to develop a study of the pre- and post-fire use by spotted owls. To do so would require that we predict where fires will burn and affect spotted owl sites, collect pre-fire data on spotted owls, wait for the fire to happen, and then continue to study the sites post-fire. A retrospective approach, looking at current data, is the most effective method to gather information, and as described above, we have initiated this approach.

Comment: Implementation of the draft Revised Recovery Plan could result in as much as 70 percent of the landscape being treated. Managers should take a more conservative approach to managing forests to reduce the risk of fire.

Response: We are not including Appendix D in the final Revised Recovery Plan. The 70 percent value was not intended as a precise treatment target in the draft Revised Recovery Plan. Appendix D (Managing for Sustainable Spotted Owl Habitat in Dry Eastern Cascades Forests of the Inland Northwest (from SEI 2008)) was provided in the 2008 Recovery Plan because it represented information behind the development of the dry-forest management strategy. Because components of the 2008 dry-forest management strategy were scattered throughout Appendix D, judging by the comments received it has created confusion as to the specific management being proposed for dry-forests. Thus, we have removed Appendix D from the document and either refer to specific parts of Appendix D by reference, or have incorporated applicable parts into the main body of the document.

Comment: The proposed approach to conservation of northern spotted owl habitat does not provide any scientific analysis that connects the habitat actions to spotted owl population performance. Simply announcing habitat management strategies and describing various recovery criteria without making an effort based on the best scientific and commercial data available to determine whether the former will meet the latter disconnects recovery planning from species recovery.

Response: We based our habitat actions on the best available information and understanding of spotted owl biology. The modeling framework described in Appendix C establishes a direct relationship between habitat-based recovery actions and spotted owl population response and recovery.

Comment: Several commenters objected to our use of unpublished information or documents such as Moeur *et al.* (in prep or 2010), Johnson and Franklin (2009), and SEI (2008).

Response: The majority of information supporting the Revised Recovery Plan has been published, peer-reviewed, and is available to the public. The Service considered the above referenced documents as well as many other references on fire regimes, climate change, implications of climate change on vegetation and disturbance regimes, considerations for forest management in light of projected climate change, implications of vegetation management treatments on spotted owls, efficacy of treatments to meet vegetation objectives, and adaptive management. We did not rely solely on these documents where other information was available. We no longer reference Moeur *et al.* (in prep) in the final Revised Recovery Plan because we do not need to rely on this information for the Revised Recovery Plan's recommendations. We



continue to use unpublished documents where they represent the most recent or new information, as part of our responsibility to use the best available information. As with all documents, we consider the quality of unpublished reports in determining whether and how to use the information.

Comment: Several commenters stated that the Service did not consider specific documents or use them in appropriate sections. These include Hanson *et al.* (2009), Hessburg *et al.* (2007), Odion *et al.* (2010), Meimann *et al.* (2003), Gomez *et al.* (2005), and Meyer *et al.* (2007).

Response: The Service considered the above referenced documents in its analysis, as well as many other references on fire regimes, climate change, implications of climate change on vegetation and disturbance regimes, considerations for forest management in light of projected climate change, implications of vegetation management treatments on spotted owls, efficacy of treatments to meet vegetation objectives, and adaptive management.

Comment: The draft Revised Recovery Plan proposes to treat stands “to reduce landscape and stand scale susceptibility to stand-replacing disturbance” (page 141), but Hessburg *et al.* (2007) showed that these disturbances were characteristic of historical dry forests.

Response: This comment is specific to Appendix D, which has been removed from the final Revised Recovery Plan. However, we incorporated Hessburg *et al.* (2007) into our analysis. While this work does indeed show that stand-replacing disturbances were part of the disturbance regimes in dry forest types, it does not support the idea that stand-replacing events were the dominant regime across all dry forests. In fact, Hessburg *et al.* (2007) notes that the predominant fires that occurred in dry mixed conifer forests prior to intensive forest management, while manifesting as all three severity categories (low, mixed, and high), were predominantly surface-fire dominated, coming from low and mixed severity fires, rather than crown-fire dominated. Thus, while we believe stand-replacing disturbances are an ecological process that needs to be incorporated into dry-forest restoration where it is ecologically appropriate and socially acceptable, the best available science indicates there will still be locations on the landscape where it will be ecologically appropriate to reduce the susceptibility to stand-replacing disturbance.

Comment: Treatments (*Forest Treatments on Closed Forest Habitat*) would render treated areas non-habitat for spotted owls.

Response: In areas managed for spotted owl habitat, these activities should occur where stands would benefit from the treatment and where doing so would not preclude owl occupancy, survival, and reproduction. Recovery Actions 10 and 32 describe ways to achieve this intent.

Comment: In the section “Favor retention of fire tolerant tree species” (draft Revised Recovery Plan page 141-142), it is proposed that large, old trees of ponderosa pine, western larch, Douglas-fir, sugar pine, incense-cedar, Jeffrey pine” that are fire resistant be favored, which could lead to the loss of other fir that are, along with Douglas-fir, typically favored by spotted owls.

Response: This statement is taken from Appendix D, which has been removed from the final document. Nevertheless, we did make this recommendation for managing in dry-forest ecosystems in locations where retaining this structure is important. Our treatment principles also include retention of large and old trees, which may include the less fire-tolerant species.



Comment: Eliminate the use of risk-reduction activities in high-quality spotted owl habitat. As recognized in the Northwest Forest Plan and 2008 Recovery Plan, high-quality habitat can be protected through landscape planning that focuses risk-reduction treatments in surrounding non-suitable habitat, instead of by degrading high-quality habitat.

Response: We believe there may be limited situations where management of high-quality spotted owl habitat is appropriate and, thus, we need to incorporate this option into the language of the recovery action (as we did in Recovery Action 32 in the 2008 Recovery Plan). Language in Section II. Recovery Goal, Objectives, and Strategy and Habitat Management in Dry Forests (Section III), as well as Recovery Action 10, recommends prioritizing these treatments, if necessary, in non-habitat, low-quality habitat, and outside of owl core areas.

Comment: The draft Revised Recovery Plan misinterprets Johnson and Franklin (2009). Be clear that the authors of Johnson and Franklin (2009) seem to be addressing the threat of the Western Oregon Plan Revision unraveling the Northwest Forest Plan. They were suggesting *less bad* ways of obtaining timber volume. They were NOT suggesting improved ways of recovering spotted owls. Johnson & Franklin do not offer a strategy for spotted owl recovery. They do not address barred owls. They do not address the real trade-off between logging effects and fire effects in a world where fire regimes are mixed and fire suppression continues. They also propose regeneration harvest in a pattern that is not natural and has no clear benefit for spotted owls.

Response: This is one of the many sources of information we are using in the final Revised Recovery Plan, including numerous studies that do focus on spotted owl-specific recovery approaches and other published scientific studies on ecological forestry. The use of this information is couched in the context of the overall approach of retaining and restoring habitat.

Comment: The draft Recovery Plan implies that regeneration timber harvest may be beneficial to spotted owls. The draft Revised Recovery Plan may have intended to state that regeneration logging that *retains legacy structures* is relatively *less adverse* than regeneration harvest that does *not* retain legacy structures, but there is no evidence that regeneration logging is *beneficial* to spotted owls in the short- or long-term.

Response: We do not seek to argue whether regeneration harvest is or is not beneficial to spotted owls. We revised the language to clarify our intent.

Comment: There must be a credible process for deciding what “ecological restoration” means in each stand and landscape, and whether short-term negative effects of logging are off-set by long-term benefits. To date, such definitions and methodologies are lacking. Restoration definitions need to be based on clear and specific ecological objectives related to the spotted owl. Project evaluation methodologies need to be based on probabilistic risk assessment.

Response: Decisions to apply ecological restoration require consideration of the specific conditions of the landscape and stands and cannot be described or defined at the scale of the Revised Recovery Plan. The Service is available to work with land managers to assist in these determinations.

Comment: The Revised Recovery Plan needs clear criteria for identifying projects that may be adverse in the short-term but beneficial in the long-term.

Response: We have provided general examples of the types of projects we think may provide long-term spotted owl benefits in several locations within the Revised Recovery Plan. However, it is difficult to provide specific examples at the scale of the Revised Recovery Plan as the impacts to spotted owls are largely based on site-specific details of the treated stands.

Comment: Fire-risk-reduction objectives should be designed at a landscape scale rather than a stand scale. This will allow managers to focus risk reduction treatments outside of owl habitat rather than by treating existing nesting, roosting, foraging habitat.

Response: The Service acknowledges the risks to treating owl habitat and potential effects on owls. We stress that treatments need to be strategic and focus on restoring and maintaining ecosystem structure, composition and processes with an eye towards recovering spotted owls while maintaining ecosystem resiliency in the face of future climate change. To that end, we have added treatment principles in the dry-forest management section recommending application outside of owl core areas and high quality habitat, and to follow a landscape approach to assess treatment prescriptions and locations that will meet restoration and spotted owl recovery needs.

Comment: The Service should clarify what is meant by the reference to peer review (p. 43, 1<sup>st</sup> sentence in 1<sup>st</sup> full paragraph; “Habitat Management in Dry Forests”).

Response: We have removed this reference from the section. In addition, the Service has a published peer review policy that outlines our methods, criteria, etc.

Comment: Draft Recovery Action 6 is vague in regards to management of dry forests and fire sites. A lot of information is stated in the item text resulting in vague description of how the service plans to reach an implementation plan in these areas. Draft Recovery Action 6 is but one step that the Service needs to take to determine if and what kinds of fire sites the spotted owl prefers, a good starting point, but by no means should it be the end.

Response: We have revised the section on Habitat Management in Dry Forests, addressing dry forest and fire issues. Recovery Action 7 (revised version of draft Recovery Action 6) does not describe recommended management because we are still developing this with the groups created under this action. We did provide a summary of the process to date. The Northwest Forest Plan standards and guidelines, with additional actions identified in this Revised Recovery Plan, provide site-specific measures for recovery.

Comment: The draft Revised Recovery Plan incorrectly assumed that fire severity has increased in the range of the spotted owl.

Response: We note that fire activity, including size and numbers, have increased in the range of the owl, whereas the trends in fire severity are less clear, but may increase with projected climate change.

Comment: Replace or define “catastrophic” or “uncharacteristic” when describing fire.

Response: We have modified these terms in the Revised Recovery Plan.

Comment: The draft Revised Recovery Plan never defines how much high severity fire is a risk to the spotted owl, yet states that there is a risk of such fires impacting spotted owl habitat

Response: We have updated the discussion of the effect of fire on spotted owl habitat. See Section III, Habitat Management in Dry Forests.

Comment: Since fire-risk reduction treatments have a limited period of effectiveness (due to fuel ingrowth), any fire rotation longer than about 20 years will result in many acres of fuel treatments being done “unnecessarily.” That is, the agencies will log the forest and degrade the owl habitat, but the sites will never be visited by fire during the period that fuels are reduced, so owl habitat will suffer the harm of logging without receiving the benefit of modified fire behavior.

Response: This information will be part of the decision process for planning treatments, including the strategic placement of treatments designed to modify fire behavior. Any decision process should address a comparison of anticipated treatment benefit with the resource impacts. There may be times, for example, when fuel treatments need to be done in the urban-wildland interface to address public safety concerns and such treatments may affect owl sites or owl habitat. In the Revised Recovery Plan we note our concerns about the effectiveness of a widespread fuels treatment solely for the purpose of reducing fire occurrence, size or amount of burned area. We further note that vegetation management treatments should be strategically located in a landscape context to restore structural elements, restore heterogeneity within and among stands, and increase resiliency to future fires and other disturbance events.

Comment: Fuel-reduction treatments should be restricted to forests less than 80 years old that are outside of spotted owl habitat.

Response: We provide treatment principles for dry-forest restoration treatments. These principles include an emphasis on placing them outside of spotted owl core areas or high quality habitat.

Comment: The Service should include active management of anthropogenic fire ignitions associated with roads through seasonal road closures and road obliteration

Response: We have added a treatment principle in the dry-forest management section related to managing roads to address fire risk.

Comment: The Service should provide for additional replacement habitat to allow owls to shift to nearby locations in response to fire effects.

Response: The concept of developing habitat is incorporated in our premise for managing to restore ecosystems by incorporating disturbance processes and by managing to retain unoccupied owl sites.

Comment: The Service should include more of the conflicting evidence regarding fire regimes and the response of spotted owls and their prey to fire and thinning.

Response: We believe we have presented an adequate synopsis of the debate surrounding fire effects to owls and their prey. We have added an enhanced discussion of the effects of thinning on spotted owls and their prey in the final Revised Recovery Plan.

Comment: Several commenters objected to the draft Revised Recovery Plan’s description of the risk of fire, some felt it was underestimated and some considered it overstated.

Response: There is considerable scientific uncertainty over the risk of fire to spotted owl habitat. Where data are available, the literature shows that high severity fire may be a risk to the nesting function of spotted owl habitat. Spotted owls were found to forage in high-severity burns and selected burned over unburned areas. The literature so far is unclear, not only on how much high-severity fire may be a risk to spotted owls, but also regarding what spatial arrangement and amount of burned and unburned vegetation or different burn severities may be beneficial or detrimental to spotted owl occupancy and habitat use. We address this issue in the Revised Recovery Plan, and also incorporate an adaptive management framework to test hypotheses that will help address this uncertainty.

Comment: Commenters recommended the Service explicitly and simultaneously consider the rates of fire, forest recruitment, and forest treatment over time.

Response: We have, to the best of our ability, addressed this in Appendix B by conducting an analysis specific to spotted owl habitat. We have included the most recent data on potential habitat loss. We also describe the difficulties in detecting recruitment or ingrowth of spotted owl habitat, and the concerns of substituting old-growth forest recruitment for spotted owl habitat recruitment.

Comment: Page 33, fifth issue identified (“Effects of fuel reduction on fire behavior”) seems out of place, or unnecessary. Fire behavior, per se, has been extensively studied, and is not a focus of this recovery plan. We recommend that this issue be eliminated from the list, or reworded to more clearly indicate its relationship to owl recovery.

Response: This portion of the document has been revised and this bullet no longer exists within the recovery plan.

Comment: Define “pre-fire management.”

Response: The management direction relative to the area prior to a wildland fire.

Comment: A more appropriate focus might be to maintain and restore the historical fire regime in a manner that will help maintain and restore spotted owl habitat. That would certainly include continuing some high-severity fire, since that has likely been a part of spotted owl habitat for thousands of years.

Response: The Service agrees that maintaining and restoring ecosystem functions in the dry-forest landscape would include restoring the disturbance processes inherent in those landscapes, including some high severity fires and other large-scale disturbances. Whether or not historical fire regimes will retain ecosystem resiliency with the onset of projected climate change is unknown. Our intent is to maintain and restore not only fire, but other disturbance regimes that will not only maintain and restore spotted owl habitat, but ecosystem structure and functions such that they are resilient to the effects of impending climate change.

Comment: The Service should define “restoration” and “conserving.”

Response: We have added definitions to the glossary.

Comment: The Service should consider an analytic approach like that used by Mitchell and Harmon (2008) which addressed the intertwined effect of logging and fire on carbon storage. This study showed that since the location, timing, and severity of future wildfires cannot be accurately predicted, treatments that are extensive enough to effectively modify fire behavior must degrade habitat values across a large fraction of the landscape. Since fuel treatments are only temporarily effective, the majority of fuel treatment acres will never interact with wildfire during the relatively short period they are effective. So, the widespread treatments that reduce habitat without reducing fire effects, must be counted as costs of fuel treatment that lack off-setting benefits.

Response: The comment described Mitchell and Harmon (2008), but provided the citation for Mitchell *et al.* (2009). This paper did not address the necessity of extensive treatments to increase the chance of intersecting a fire to modify behavior. Their study looked at the trade-offs in managing forests for fuel reduction vs. carbon storage in both moist and dry forests. Contrary to the commenter's description of the author's conclusion, Mitchell *et al.* (2009) concluded that fuel reduction treatments may be essential for ecosystem restoration in dry forests characteristic of the east Cascades, whereas this would not be appropriate in wetter forests of the Coast Range and west Cascades that do not show undesirable fuel accumulations. Nevertheless, we note in the recovery plan the concern with the effectiveness of a widespread treatment of fuels solely for the purpose of reducing fire occurrence, size or amount of burned area; we further note that such treatments should be implemented only where they increase the acceptability of wildfire through reducing fire behavior and severity in specific areas, such as where it is desirable to meet public safety needs or to save valuable ecosystem elements necessary for resiliency.

Comment: A compelling analogy to Mitchell and Harmon (2008) suggests that risk-reduction logging in owl habitat will be truly beneficial to owls only where (a) the modern (*de facto*) fire return interval as affected by fire suppression policies is very frequent, and (b) the level of habitat degradation resulting from logging is very slight.

Response: The Service acknowledges the risks to treating owl habitat and potential effects on owls. We stress that treatments need to be strategic and focus on restoring and maintaining ecosystem structure, composition and processes with an eye towards recovering spotted owls while maintaining ecosystem resiliency in the face of future climate change. By using a landscape approach, as noted in the treatment principles in the dry-forest management section, we believe this would lead to an efficient use of treatments while reducing the risk to individual owl sites or owl habitat.

Comment: The Service overestimates the effectiveness of risk reduction treatments. The Service has not shown that the treatments are better than the loss of habitat to the fire itself. We are likely to lose habitat to wildfire regardless of treatment so logging becomes additive to wildfire.

Response: Given the effects of past management in dry-forest ecosystems, combined with the compelling documentation on potential future effects of climate change in these systems, the Service believes we need to restore and manage for landscapes that are resilient and adaptable to the impending effects of climate change. We are concerned about the effects of potential ecosystem stressors that are projected with climate change, such as increased drought stress on key legacy structures like large, fire-tolerant trees. The Service acknowledges the risks to treating owl habitat and potential effects on owls. We stress that treatments need to be strategic and focus on restoring and maintaining ecosystem structure, composition and processes with an

eye towards recovering spotted owls while maintaining ecosystem resiliency in the face of future climate change. The Service believes that maintaining and restoring ecosystem functions in the dry-forest landscape would include restoring the disturbance processes inherent in those landscapes, including some high severity fires and other large-scale disturbances. Our intent is to maintain and restore not only fire, but other disturbance regimes that will maintain and restore spotted owl habitat, as well as ecosystem structure and functions such that they are resilient to the effects of impending climate change. Given the uncertainties, there are risks associated with both taking action and with not taking action until further information is obtained. The Service has proposed an adaptive management approach as part of this recovery plan to help us learn the effects of current management decisions and inform future decisions.

Comment: The Service should also consider the scientific article Swanson *et al.*, *The Forgotten Stage of Forest Succession: Early-Successional Ecosystems on Forest Sites* 2010 – which discussed how natural disturbance (fire) creates early seral forest conditions that are important to proper ecological function, and differ significantly from managed stand condition.

Response: This paper has been considered in the revised post-fire harvest discussion and in the dry-forest management section.

Comment: Fire is a natural process. However, the majority of catastrophic fires are the consequence of fire suppression, which is not part of the natural fire regime. Therefore, suggest dropping the phrase “natural process” as a descriptor of fire in these circumstances.

Response: This phrase is quoted from Hanson *et al.* (2010).

Comment: The draft Revised Recovery Plan should delete information from SEI (2008) concerning fire history and should include information from Hessburg *et al.* (2007).

Response: Appendix D (SEI 2008 chapter) has been removed, although portions of it have been pulled into the body of the recovery plan. We continue to incorporate information from SEI (2008) and also incorporate Hessburg *et al.* (2007).

Comment: The draft Revised Recovery Plan should include a rotation estimate (330 years) which used in virtually every previous scientific assessment of risk to spotted owl habitat from natural disturbances. The rotation estimate of 330 years is not a high rate of loss nor does it indicate a high current risk to owl habitat, as there is ample time in 330 years for replacement forest to be recruited. In addition, the data in Hanson *et al.* (2009) show those rotations are even longer than 330 years.

Response: We only used the term “high rate of loss” in a comparison between the rates of losses in two provinces. This reference is no longer in the document. We simply report the latest information on rates of habitat loss.

Comment: Several commenters suggested we change references to habitat loss and replace them with habitat change, acknowledging that habitat has been recruited as well as lost. They also recommended we not assume high-severity fire resulted in habitat loss and felt we overestimated the effect of fires on habitat.

Response: We have acknowledged that not all habitat affected by wildfire should be considered “lost.” However, specific to Appendix B, we have continued to use the term “loss” to be consistent with the terminology used by the authors of the information we referenced. Their



analysis used change in stand condition to determine when nesting/roosting habitat lost the necessary characteristics and applied this standard in all habitat change analyses, regardless of mechanism. We have incorporated a preamble in this section noting that with respect to wildfire and other disturbance events, some habitat affected by these events may still be used by spotted owls.

Comment: Two commenters questioned our representation of the fire rotation metric, which they believe inaccurately describes the concept as an incomplete measure. Specifically, they noted that fire rotations can be applied to different land areas, vegetation types, or temporal periods, as an example, to characterize the variability in fire rates.

Response: Our description of fire rotations in the 2010 draft Revised Recovery Plan was not meant as a criticism of the metric itself, but intended to caution interpretation of the rotations that have been derived for the dry-forest provinces in both Hanson *et al.* (2009) as well as the 2008 Recovery Plan. This section of the document has been revised.

Comment: Paragraph on page 45 starting with “There is tremendous complexity...” focuses on how fire exclusion and the removal of large trees are said to have homogenized landscapes but omits the large opposing influences of roads, timber harvests, powerlines, and other landscape-altering human activities, which have broken up formerly more continuous fuels, and increased landscape heterogeneity.

Response: Our discussion of this topic was specific to the homogenization of vegetation structure and composition. While the anthropogenic features described in this comment may have fragmented fuels and vegetation patches, we don’t equate this form of heterogeneity with functioning ecosystems. In fact, many of these features, while they may break up forested landscapes, may actually cause further erosion of ecosystem functions through such means as increasing fire starts and severities, or providing avenues of invasion by exotic plant species.

Comment: The paragraph that begins “In addition to these concerns...” (page 45) suggests that fire severity is increasing, but this paragraph is an inaccurate and incomplete summary of the scientific literature; it does not use or even cite Hanson *et al.* (2009).

Response: We have revised our description of fire severity trends and incorporated additional citations, including projected fire activity trends based on projected changes in climate.

Comment: The paragraph that begins “In addition to these concerns...” (page 45) suggests that fire frequency is expected to continue to increase, but cites only Westerling *et al.* (2006), an insufficient treatment of this complex scientific topic. Perhaps 20 or more published peer reviewed studies are available, but not used on this topic.

Response: We have expanded our discussion of the impacts of climate change on vegetation and disturbance regimes, citing to multiple published papers.

Comment: What are “fire-dominated trees” (p. 45)?

Response: We no longer use this term.



Comment: The draft Revised Recovery Plan (page 44) states that “no spotted owl nests have been observed on sites burned by high-severity fires”, citing Gaines *et al.* (1997), Bond *et al.* (2002), Jenness *et al.* (2004), Clark (2007), and Bond *et al.* (2009). However, no such conclusion can be drawn from any of these studies (see page 4 of Hanson *et al.*’s comment).

Response: We have modified the statement accordingly. We note that Bond *et al.* (2009) does describe the burn severity of the forests where nest trees were located, and none were located in high severity burns.

Comment: One commenter, considering “the absence of published data on northern spotted owl occupancy in burned areas and because such data are lacking in the recovery plan”, provide data gathered concerning occupancy by California spotted owls relative to amount of burned forest and submitted these data for inclusion in the final northern spotted owl Revised Recovery Plan.

Response: We reviewed this information which indicated no difference in annual occupancy rates of California spotted owls between burned and unburned territories. We did not include it in the Revised Recovery Plan because it does not shed any new light on our understanding of owl use of post-fire habitats. Contrary to the comment, there are published studies that were cited in the draft Revised Recovery Plan and are carried forward into the Revised Recovery Plan. Also, a recently published paper on California spotted owl occupancy in post-fire environments in the Sierra Nevada was also added. In general, the studies referenced in the Revised Recovery Plan already show similarities in occupancy rates between owls in burned and unburned areas.

Comment: The draft Revised Recovery Plan implies (page *x*) that current wildfires in the Northwest Forest Plan area are “uncharacteristic”, but provides no citation to any primary scientific data to support this. The peer-reviewed, published scientific literature is clear that, prior to fire suppression and logging in dry forests of the Pacific Northwest, natural fire regimes were comprised of a mix of low-, moderate-, and high-severity effects, including ponderosa pine and other conifer forest types with frequent fire.

Response: We have defined the term “uncharacteristic fire” in the Revised Recovery Plan. While natural fire regimes did comprise a mix of fire severities, there were still areas on the landscape predominated by particular severities (*e.g.* higher fire severities in the montane forests and lower severities in the dryer forest types (see Hessburg *et al.* 2007)). We note in the final Revised Recovery Plan that restoring dry-forest ecosystems should incorporate high-severity fires where it is ecologically and socially acceptable.

Comment: The Revised Recovery Plan should present the strong and overwhelming weight of scientific opinion that unmanaged post-fire habitat from high-severity fire is highly biodiverse, rare, and ecologically important.

Response: We agree that unmanaged post-fire habitat is diverse and ecologically important in many circumstances. We also believe focusing this discussion on the management of these areas for spotted owls is appropriate for this Revised Recovery Plan and provides adequate guidance to land managers to make specific decisions to benefit spotted owls on a case-by-case basis.

Comment: The Johnson and Franklin (2009) report did not address, or cite, several key recent studies that refute their central assumptions.

Response: The “Spotted Owls and Ecological Forestry” section in Section III has been expanded to include many additional studies.

Comment: A study showed that time since fire is not an accurate predictor of fire hazard, at least in the Klamath Provinces (Odion et al (2004) Odion, D.C., E.J. Frost, J.R. Strittholt, H. Jiang, D.A. DellaSala and M.A. Maritz. 2004. Patterns of fire severity and forest conditions in the western Klamath Mountains, California. *Conservation Biology* 18(4): 927-936).

**Response: We reference this work when discussing the need to understand fire regimes when planning restoration activities.**

Comment: Hurteau's analysis is flawed to the extent that it assumes that every fuel reduction treatment has a 100% chance of interacting with wildfire, which implies that managers know where and when future wildfire will occur, and that fuel treatments can be implemented exactly where and when needed. This is clearly not the case.

**Response: We believe we provided an adequate caveat to the implications of Hurteau's assertion on reducing catastrophic carbon release.**

Comment: The sentence "...any single fire event may not be outside the range of events that have occurred historically..." (page 45) oversimplifies fire dynamics in dry forests and should be removed or revised.

**Response: This section has been revised.**

Comment: The statement "...a process with which they have evolved" oversimplifies the situation.

**Response: This section has been revised.**

Comment: The draft Revised Recovery Plan does not acknowledge that thinning may increase the magnitude of wildfires or fire hazard.

**Response: We have presented cautions about vegetation management activities and the potential for increasing the fire activity which they were meant to diminish. We also note the need for treating activity fuels after treatment.**

Comment: Apparent buyoff to allow thinning in mature forest (80-160 years old) is problematic because (1) there is often little evidence that thinning will make those stands more resilient to fire and (2) it is likely that thinning in those stands will reduce their quality as habitat for spotted owls and their prey.

**Response: We have expanded the section on effects of thinning on spotted owls and their prey (Effects of Forest Management Practices on Spotted Owls), and have highlighted potential negative impacts of these activities. We do not encourage these activities near nest/activity centers or in core areas.**

**Specific to vegetation management activities in dry forests, we have described several treatment principles that should be applied, including: 1) using a landscape approach to identify strategic and effective treatment locations; 2) prioritizing treatments outside of spotted owl core areas or valuable habitat; and 3) monitoring owl response to treatments or applying an adaptive management approach if item number 2 isn't possible. In addition, we emphasize in the Revised Recovery Plan that it is not our intent to do landscape-wide treatments for the purpose of excluding disturbance events such as fires, including high-severity fires, but rather to support the disturbance regimes inherent to these systems, which includes, according to Hessburg *et al.***

(2007:21), “. . . managing for more natural patterns and patch size distributions of forest structure, composition, fuels, and fire regime area . . .”

Comment: 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 recommendations for managing spotted owl habitat did not include these studies.

Response: Additional thinning language and reference to these specific studies has been added.

Comment: The Service should establish priorities for thinning in younger stands before older stands.

Response: In many cases this should be the priority. However, treatment priority depends on many factors in addition to stand age. Stand level context is needed to determine these priorities and therefore final decisions concerning site-specific prioritization should not be done at the recovery plan scale.

Comment: Thinning smaller trees to reduce the risk of future insect disturbances may result in greater loss of spotted owl habitat because smaller trees can survive insect epidemics at much higher rates.

Response: The Revised Recovery Plan addresses the efficacy of vegetation management to reduce a stand's susceptibility to insect attack. The preference for larger trees seems to be specific to mountain pine beetles in lodgepole pine stands, which we note in the Revised Recovery Plan and caution managers to consider these risks when evaluating treatments to reduce the risk of insect attack.

Comment: Draft Recovery Action 5 recommendations for thinning - provide more specifics in order to guide managers in making appropriate decisions. Recommendations to make decisions about treatment based on “if it will benefit spotted owl recovery” or if it will “accelerate the development of suitable owl habitat” are too vague.

Response: Recovery Action 6 (revision of draft Recovery Action 5) generally applies to stands that are younger than spotted owl habitat – dense plantations, etc. with little structural or species diversity. Thinning and other silvicultural techniques (creating small openings, etc.) can accelerate the development of forests with late-successional/old-growth characteristics relative to leaving these stands as dense plantations.

Comment: The draft Revised Recovery Plan appears to recommend landscape-level thinning without adequately addressing effects on spotted owl habitat quality. The draft Revised Recovery Plan is too vague, leaving it open to many interpretations, including that this is a recommendation for landscape-level mechanical thinning.

Response: We are specific about the types of stands that could/should be treated within areas where management is recommended to be geared towards development of spotted owl habitat (plantations, overstocked stands and modified younger stands to accelerate the development of structural complexity and biological diversity that will benefit spotted owl recovery). However, treatment priority depends on many factors in addition to stand age. Stand level context is needed to determine these priorities and therefore final decisions concerning site-specific prioritization should not be done at the recovery plan scale.

Comment: The draft Revised Recovery Plan focuses on the growth rate of the few largest live trees per acre, but fails to cite to any scientific studies indicating that the growth rate of the few largest live trees per acre is more important in determining suitable spotted owl nesting/roosting habitat than all other key habitat factors identified in the scientific literature, such as overall live tree basal area, large snag basal area, large downed log density, and a multi-layered stand structure—most or all of which would be reduced by stand density reduction from thinning.

Response: We do not focus on the growth rate of these trees. Rather we focus on maintaining them when there are silvicultural activities in Late Successional Reserves. In addition, we suggest retaining any trees with characteristics that create stand diversity (*e.g.*, bole and limb deformities), and efforts should focus on structural diversity in the mid-to upper story layers but not at the expense of large snags or existing species diversity. We recommend the use of fungal inoculation, mechanical methods, or other tools as needed to create snags.

Comment: The draft Revised Recovery Plan does not adequately discuss the potential degradation of spotted owl habitat quality that could result from large-scale thinning reducing forest canopy cover, reducing basal area of trees, reducing stand density (thereby reducing competition and the potential for future recruitment of large snags and downed logs), and preventing natural heterogeneity within spotted owl territories. Any recommendation to thin to improve spotted owl habitat should include an assessment of risk to spotted owls, prey species, and barred owls. The Service seems to assume logging is more benign than fire.

Response: Habitat restoration activities should be conducted in the context of an adaptive management framework that will likely consider these factors. In addition, reducing the amount of post-fire logging at the landscape scale will greatly improve snag and down wood development (*e.g.* Recovery Action 12). The Service does not assume logging is more benign than fire and acknowledges risks associated with doing vegetation treatments in light of uncertainties.

Comment: Aggressive thinning in drier and mixed-conifer forests can cause long-lasting and irreparable harm to existing spotted owl habitat. Fire and insect risk reduction treatments may be appropriate in non-owl habitat or wildland urban interface areas, but extensive forest management to reduce the fire/insect risk in owl habitat will result in significant, long-term reduction of owl habitat quality. Benefits to owls through risk reduction are speculative at best.

Response: We have described several treatment principles that should be applied to restoration actions in dry-forest ecosystems, including: 1) using a landscape approach to identify strategic and effective treatment locations; 2) prioritizing treatments outside of spotted owl core areas or valuable habitat; and 3) monitoring owl response to treatments or applying an adaptive management approach if item number 2 isn't possible. In addition, we emphasize in the Revised Recovery Plan that it is not our intent to do landscape-wide treatments for the purpose of excluding disturbance events such as fires, including high-severity fires, but rather to support the disturbance regimes inherent to these systems, which includes, according to Hessburg *et al.* (2007:21), “. . . managing for more natural patterns and patch size distributions of forest structure, composition, fuels, and fire regime area . . .”

Comment: The draft Revised Recovery Plan should state that due to vegetative regrowth, thinning is only effective in reducing potential fire severity for at most 10-20 years, at which point they will have returned to the pre-thinned state and would need to be thinned again in order to maintain a reduced potential for higher-severity fire. Thus, when the draft Plan suggests landscape-level thinning, either this only includes areas thinned for the first time, in which case it fails to divulge the far greater acreage of re-thinning per decade, or it includes both first-time thinning as well as re-thinning, in which case the great majority of the thinned areas, at any given time, would be ineffective in reducing potential severity of fire should a fire occur.

Response: We note in the Revised Recovery Plan that fuel reduction treatments have a short lifespan and require continued maintenance to be effective. We also note the low probability of fires intersecting fuel treatments given the stochastic nature of disturbance events. We do not advocate “landscape-level thinning” for the purpose of fuel reduction. Where vegetation management treatments are done for the sole purpose of reducing fuels, we encourage these be developed in strategic areas where it is desirable to reduce the risk to fire-tolerant ecosystem components, or in urban-wildland interface areas to reduce public safety risk.

Comment: The Revised Recovery Plan does not address how the “effectiveness” of thinning would be evaluated in the Northwest Forest Plan with regard to wildland fire and spotted owl habitat. This is important, given that recent studies have promoted the effectiveness of thinning in reducing tree mortality from wildland fire without divulging that the combined mortality from the thinning itself and the subsequent fire was substantially greater than the mortality from fire alone in the unthinned areas (Prichard *et al.* 2010).

Response: Addressing how the effectiveness of thinning would be evaluated in the Northwest Forest Plan is beyond the scope of the Revised Recovery Plan. With respect to the commenters’ conclusion that Prichard *et al.* (2010) shows that “combined mortality from the thinning itself and the subsequent fire was substantially greater than the mortality from fire alone in the unthinned areas,” the commenters do not elaborate on how they reached that conclusion. Furthermore, Prichard *et al.* (2010) did not design their study to compare mortality rates that include loss of trees to the treatment itself.

Comment: Recommendations for extensive thinning treatments are without empirical studies on the effects of these treatments on spotted owls or their prey.

Response: We have included a discussion of the available information on the effects of thinning on spotted owls (*Effects of Forest Management Practices on Spotted Owls*). We have also recommended that questions regarding effects of stand treatments designed to improve structural components for owl habitat be tested through an adaptive management program. A suggested adaptive management framework has been added to the recovery plan.

Comment: Thinning should be limited to stands at or under 80 years old. Thinning in older stands could open them up and allow more predation from spotted owls. Thinning stands above 80 years old does not necessarily improve survival or structural diversity of stands and only serves as an enticement for the timber industry.

Response: We believe there are stand structural conditions, regardless of their age, where site-specific vegetation management can enhance their ability to develop the structural complexity that is beneficial to northern spotted owls.

Comment: The draft Revised Recovery Plan encourages logging in stands older than 80 years in the LSRs. However, there is no evidence that logging moist stands >80 years old will be beneficial to spotted owls.

Response: Our recommendation to actively manage forest stands in Recovery Action 5 is designed for stands that are not spotted owl habitat and where more nesting/roosting is needed to bolster spotted owl populations. Further, we recommend retaining the characteristics of the stand that are most valuable to spotted owls and take the longest time to develop, including large snags. We believe the implementation of this recovery action is described well enough that it will significantly benefit spotted owls.

### **Salvage logging and post-disturbance logging**

Comment: Stand-replacing disturbance such as fire, wind, or regeneration logging bring the process of snag recruitment to a virtual standstill for many decades. This results in a “snag gap” that has serious adverse consequences for habitat and many other ecological processes. Salvage logging will exacerbate the snag gap.

Response: This is a statement of fact, not a recommendation. However, we believe our recommendation on post-fire logging adequately provides for spotted owl habitat components, such as snags, where management direction is to retain and produce spotted owl habitat.

Comment: Draft Recovery Action 7 should be expanded to include monitoring of logged and unlogged post-fire settings. It is important to know to what extent salvage logging removes the structural elements necessary to development complex habitat over the long-term.

Response: The Service believes this request is beyond the scope of Recovery Action 8 (revision of draft Recovery Action 7). However, the question posed is an appropriate adaptive management question that can be considered as part of the adaptive management approach described in the recovery plan.

Comment: A review and meta-analysis of spotted owl responses to wildfires and post-fire conditions would help provide defensible standards and guides for post-fire management.

Response: Recovery Action 8 recommends review and analysis of information specific to this request.

Comment: Lindenmayer *et al.* (2008) did not claim that post-disturbance logging reduces erosion.

Response: We did not intend to imply that each author cited each of those impacts of post-fire logging, but that, collectively, those impacts were included by that group of authors.

Comment: The draft Revised Recovery Plan does not include guidelines for salvage and management of burned forests as were included in the 1992 draft Recovery Plan and the Northwest Forest Plan.

Response: We have provided a discussion of post-fire logging including Recovery Action 11.



Comment: Draft Recovery Action 11's focus on "restoration and conservation of spotted owl habitat" is unlikely to achieve the desired results in the absence of additional direction from the Service regarding what type of post-fire management is appropriate.

Response: We believe this section provides the background and direction necessary to provide for spotted owl habitat legacy elements resulting from wildland fire.

Comment: The Service should discuss if there is any level of salvage that is acceptable in areas where large patches of burned area are no longer capable of supporting nesting due to decreases in canopy for draft Recovery Action 11.

Response: Whether a burned area could support nesting spotted owls is not relevant to our recommending focusing on spotted owl habitat restoration and conservation of legacy habitat elements in areas where pre-fire management focused on developing spotted owl habitat. This recovery action is designed to provide for legacy habitat elements remaining after high-intensity fires which will contribute to future habitat development.

Comment: The draft Revised Recovery Plan fails to distinguish between the effects of mixed-severity wildland fire alone and the effects of post-fire salvage logging.

Response: The section on post-fire logging has been edited, based on publications and discussions with the authors who have published on the topic of owls in post-fires areas.

Comment: The Service should prohibit post-disturbance logging of trees > 21" dbh, as in 1992 draft Recovery Plan

Response: We believe the recommendation of focusing on spotted owl habitat restoration and conservation of legacy habitat elements in areas where pre-fire management focused on developing spotted owl habitat is a strong measure to provide for legacy components across the range of the owl such as would be achieved by this recommendation.

Comment: The Revised Recovery Plan should include clear guidelines prohibiting salvage logging and retaining all large woody structures.

Response: We believe our recommendation on post-fire logging adequately provides for spotted owl habitat components where management direction is to retain and produce spotted owl habitat. We don't believe prohibiting post-fire logging in all areas is necessary for spotted owl recovery.

Comment: The Revised Recovery Plan should clearly and unequivocally recommend that no post-fire logging be allowed to occur in spotted owl habitat, territories, or LSRs.

Response: We believe Recovery Action 12 as stated provides sufficient direction to provide substantial post-fire legacy spotted owl habitat elements in future spotted owl nesting habitat.

Comment: Post-fire logging is ecologically destructive and should be avoided.

Response: In areas where management is focused on the development of spotted owl habitat we are recommending that post-fire logging should concentrate on spotted owl habitat restoration and habitat elements that take the most time to develop. We believe following this recommendation would sufficiently reduce ecological disruption in areas managed for spotted owl habitat development.



Comment: The technical discussion of post-fire timber harvest is supported by an undisclosed and odd mixture of refereed articles, student papers, popular textbooks, and opinion pieces.

**Response:** These references are pertinent to the topic and reflect the science on the topic. We use the best available information which is not limited to refereed articles.

Comment: Several commenters recommended the Service include or consider additional references or materials within cited references, including Lindenmayer *et al.* (2008), Swanson *et al.* (2010), and Bond *et al.* (2010).

**Response:** This section has been edited and we have considered these papers. We believe we have substantiated the effects of post-fire harvest.

Comment: In suggesting that Level 1 teams should evaluate post-fire harvest, the draft Revised Recovery Plan seems to assume that post-fire timber sales pass through the Endangered Species Act's Section 7 consultation process. However, land managers have generally assumed that post-fire landscapes are no longer spotted owl habitat and therefore not conducted Section 7 consultation. The Revised Recovery Plan should include language to refute the assumption so that ESA consultation is more likely to occur.

**Response:** We have provided the background and direction necessary to help the Federal action agencies assess whether their projects "may affect" spotted owls, the standard to determine whether consultation is required. The Revised Recovery Plan includes a summary of the state of our knowledge about spotted owl use of burned landscapes which should assist the Federal agencies in determining when a project may affect spotted owls.

### **Non-federal lands**

Comment: The Service should provide more detail on how management of historical spotted owl sites can be done, especially on non-federal land, and how non-federal landowners can maintain spotted owl habitat and historic sites, such as offering incentives.

**Response:** We have edited Recovery Action 10 to provide more specific direction that could apply to both Federal and non-federal land management of spotted owl sites. In addition, we recommend (Recovery Action 15) soliciting ideas from individual stakeholders to develop incentives for non-federal landowners to participate in recovery activities.

Comment: Identify the areas where the Service thinks non-federal landowners may play a more critical role.

**Response:** When available, subsequent modeling results will help us identify these areas.

Comment: The amount and distribution of Federal lands are inadequate to achieve recovery, so non-federal lands must contribute to this effort. The appropriately recognizes the 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

and private lands do not notify the Service if there are possible conflicts between proposed harvest areas and sites occupied by spotted owls.

**Response:** Additional, potential contributions from non-federal lands in the future will be informed by the modeling framework and other evaluations, and through cooperative efforts with interested stakeholders.

**Comment:** The draft Revised Recovery Plan overreaches Federal authority by expanding recovery responsibility onto non-federal lands without any scientific justification.

**Response:** We are within our authority and responsibility to make the recommendations necessary for spotted owl recovery. Revised Recovery Plan recommendations, including recovery actions, are not regulatory. Recommendations to extend habitat and site protections to non-federal lands are based in the need to respond to recent demography data indicating a continued decline in the spotted owl population under current management approaches. It is reasonable to expect that managing for the retention of spotted owls on non-federal lands would contribute positively to spotted owl population trends.

**Comment:** The draft Revised Recovery Plan uses the peer review comments (*e.g.*, TWS, SCB/AOU) to inappropriately expand the primary role of recovery from Federal lands, onto non-federal lands

**Response:** The Service bases its decisions on the best scientific information available. All changes to the 2008 Recovery Plan considered the public comments as well as existing scientific information. The recovery plan still emphasizes the primary role of Federal lands in spotted owl recovery, but also recognizes that there are areas where non-federal lands may be important contributors to recovery.

**Comment:** The Endangered Species Act does not allow the Service to compel private landowners to help recover the spotted owl.

**Response:** This Revised Recovery Plan does not compel any landowner to undertake any of the actions described therein or state that it compels any action. It does, however, encourage and provide a number of different actions non-Federal landowners could pursue to help contribute to spotted owl recovery.

**Comment:** We suggest that the Service issue a moratorium on logging of suitable habitat on state and private lands until the outcomes of draft Recovery Actions 18 and 19 are known.

**Response:** The Service does not have the authority to issue any moratorium on logging on any lands, regardless of landowner. The Revised Recovery Plan provides a description of recovery actions that, if implemented, should bring about the recovery of the spotted owls, but does not create the authority to compel landowners to implement any actions.

**Comment:** The recommendation to retain all occupied spotted owl sites and unoccupied, high-quality spotted owl habitat on all lands to the maximum extent possible appears to limit a private landowner's ability to harvest private timber where spotted owls are not present. Should a state agency attempt to impose such a regulatory requirement, it would no doubt be successfully challenged for its taking of private property rights

**Response:** This is a recommendation for actions that can contribute to the recovery of the spotted owl. These are not regulations.

Comment: The Revised Recovery Plan should not imply that state forests in Oregon have a different standard under the Federal ESA than do other non-federal landowners.

Response: The Revised Recovery Plan does not imply that State Forests have a different standard under the ESA. It simply presents information from modeling on different scenarios, including one that involves all public lands (including state lands).

Comment: The Revised Recovery Plan (as the ESA requires) should make every effort to accomplish owl recovery on the millions of acres of Federal lands throughout the owl's range before extending any recovery obligations to private lands.

Response: Since the listing of the spotted owl, the changing nature of threats, including the barred owl, is leading us to re-evaluate the role non-federal lands play in spotted owl recovery. Federal lands comprise the majority of land ownership within the range of the spotted owl and thus play a primary role in recovering the spotted owl. However, in those areas where Federal lands are lacking or inadequate, non-Federal lands may make valuable contributions to spotted owl recovery efforts.

Comment: The draft Revised Recovery Plan includes the Oregon Coast modeling region, which include a significant acreage of Weyerhaeuser ownership in the southern end of the Willamette Valley. ...empirical evidence strongly suggests that active and intensive forest management will support development of dispersal habitat readily utilized by spotted owls.

Response: We acknowledge that forest management can be compatible with the maintenance and development of dispersal, but also acknowledge that some forest management practices are detrimental to supporting spotted owls and dispersal habitat. Recovery Action 11 calls for the forest management experimentation to further refine potential impacts of harvest prescriptions to forest structure and the subsequent impacts to spotted owls, their prey, and spotted owl demographic responses which could take dispersal habitat into account.

Comment: The Service should clarify that studies which demonstrate dispersal be encouraged and make it clear that dispersal habitat is the primary conservation objective for private landowners in Oregon. This point should be explicitly stated by the Service. Failing to do so might produce unintended, unnecessary reactions to the proposal.

Response: The Revised Recovery Plan does acknowledge the importance of dispersal habitat on the landscape, but this is not the primary conservation objective for all non-federal lands in all places. Non-federal lands may be able to provide nesting quality for spotted owls in areas that do not contain Federal lands but which may be important for spotted owl recovery. The habitat network modeling currently underway should assist in determining which lands can provide the most needed aspects of spotted owl habitat on the landscape.

Comment: Is recovery part of HCPs and SHAs, or is that a new direction?

Response: The Revised Recovery Plan does not instigate any changes or new directions to our HCP and SHA policies. HCPs cannot require actions that promote recovery, but the Service does encourage applicants to engage in measures that would support recovery of covered species. One standard HCPs must meet is to minimize and mitigate to the maximum extent practicable. Practicable is defined by the Service as: 1) commensurate with the impacts; and 2) providing for (*i.e.*, not precluding) recovery, which means that is every similarly situated landowner were to

manage in that way, recovery would be provided for. While there may be other threats limiting the species, the threats addressed by that HCP would be managed so as to allow recovery. Our SHA policy requires that a net conservation benefit to the covered species is achieved under a SHA, and that benefit must be sufficient to contribute, either directly or indirectly, to the recovery of the covered species. Consequently, while recovery frequently cannot be provided on a single landowner's property, consistency with recovery needs is the objective of all such agreements.

Comment: Retaining all occupied sites on non-federal lands may have the unintended consequence of discouraging habitat conservation plans (HCP) or other forms of voluntary conservation planning on private lands. Private landowners would have no incentive to develop and implement HCPs that grow more high-quality spotted owl habitat.

Response: We do not believe the Revised Recovery Plan will discourage HCP development because both the Revised Recovery Plan and the regulations governing HCPs allow for flexibility in addressing potential impacts to occupied sites. By recommending the retention of all owl sites we may encourage non-federal landowners to develop HCPs to provide more management flexibility.

Comment: The Revised Recovery Plan should encourage HCPs on private timberlands by recognizing that critical habitat should not be designated on non-federal lands.

Response: The designation of critical habitat is a subsequent process that will include its own public review process. The designation of critical habitat is based on the best scientific data available and after taking into consideration the economic impact, and any other relevant impact, of designating a particular area as critical habitat. The Secretary may exclude an area from designation if the Secretary determines that the benefits of such exclusion outweigh the benefits of specifying an area as part of critical habitat, unless he determines, based on the best scientific and commercial data available, that the failure to designate the area will result in the extinction of the species.

Comment: We suggest this additional recovery action: Incidental Take Permits: The Service supports the use of qualified, perpetual conservation easements held by accredited land trusts on managed forests as the underpinnings for Safe Harbor Agreements, Master Permit and/or Template Safe Harbor Agreements and appropriate Habitat Conservation Plans, specifically including Low Impact Habitat Conservation Plans, for non-federal, private lands with interested parties in Washington, Oregon, and California. Such agreements would be tailored to the habitat needs of spotted owls in each physiographic province.

Response: The Service currently includes all of these topics and mechanisms in development of conservation plans (HCPs and SHAs) and when funding projects that will lead to recovery. We do not believe the suggested additional recovery action is necessary since the Revised Recovery Plan already encourages these types of ESA section 10 mechanisms for non-federal lands that have been on-going, as well as their expansion to areas that may provide the greatest benefits to spotted owls.

Comment: FWS offices in California implement other types of plans and agreements with private landowners that could be mentioned in the Revised Recovery Plan.

Response: The Revised Recovery Plan contains an illustrative, not exhaustive list, of voluntary conservation tools. The Service supports the use of voluntary measures which will contribute to spotted owl recovery.

Comment: We suggest adding an appendix that provides information on the management mandates of Service and the partner agencies.

Response: We do not believe this is a necessary component of a recovery plan. This information is otherwise readily available on-line or by contacting the local Service offices.

Comment: We suggest an addition to draft Recovery Action 14 would be an outreach strategy to educate the public about Oregon's Safe Harbor Agreement Program and Healthy Forest Reserve Program.

Response: We do not believe this is necessary to add to Recovery Action 14. The primary action involves the encouragement of HCP and SHA type mechanisms across the landscape. The Oregon Department of Forestry SHA is listed to provide an example of the types of tools available. Both the Service and NRCS conduct outreach on these programs, although demand currently exceeds the amount of funding available.

Comment: We suggest inclusion of a discussion of business and economic incentives to support recovery actions.

Response: Examples of some incentives are described in the non-federal lands discussion. Recovery Action 15 addresses the solicitation of individual recommendations from stakeholders to develop a comprehensive set of tools and business and economic incentives that facilitate creative opportunities for non-federal landowners to engage in management strategies consistent with the recovery objectives.

Comment: The Revised Recovery Plan should include a clear plan for increasing conservation of spotted owls in non-federal lands.

Response: While we believe we have done this by recommending the application of Recovery Actions 10 and 32 on non-federal lands, we will also work with the states as noted in Recovery Actions 18 to 22 to be able to better develop such measures.

Comment: The Service should work with private and state landowners to identify and protect critical habitat through voluntary means.

Response: The recovery actions in this plan are voluntary and the Service is available to assist with their implementation. The designation of critical habitat is a subsequent process that will include its own public comment and review process.

Comment: The Service should cooperate in habitat-acquisition programs.

Response: The Service supports habitat acquisition where needed. Recovery Land Acquisition and HCP Land Acquisition funds are two different sources of land acquisition dollars available from the Service. The current habitat network modeling effort will help identify various options for management of spotted owls regardless of ownership.

Comment: The draft Revised Recovery Plan lacks a clear description of what the contribution might be from non-federal lands. There is thus no basis for public input and no basis to say whether the non-federal contribution will actually contribute to recovery.

Response: Within the Revised Recovery Plan we recommend application of Recovery Actions 10 and 32 on non-federal lands, with future analysis and recommendations coming from cooperative efforts with the states and from modeling results.

Comment: The statement "...the Service will continue to work with non-federal landowners...voluntary incentives...protection and development of unoccupied, high-quality habitat" can be interpreted to construe protective measures applied to unoccupied spotted owl habitat should be considered voluntary. If this is the case, a significant debate should be expected over how to determine whether habitat is unoccupied. We suggest that the Service work with the state policy working groups to revise this language.

Response: Recovery Action 32 recommends the maintenance of all high-quality habitat on all ownerships. The recovery plan recommends retaining unoccupied, high quality habitat because it believes this will help achieve recovery. This is a recommendation, not a requirement, and is, by definition, voluntary. The statement quoted in the comment above is not in conflict with the recovery action. The Service has revised the spotted owl survey protocol so that it has a high likelihood of detecting spotted owls. The recovery plan recognizes the importance of surveys for documenting the presence or absence of spotted owls and encourages surveying.

Comment: There is an inconsistency between contribution of non-fed lands between critical habitat and the draft Revised Recovery Plan. The Revised Recovery Plan should make clear that it has no regulatory effect, is purely guidance, and does not modify critical habitat.

Response: There is no inconsistency in that the Revised Recovery Plan does not modify critical habitat. Revisions to critical habitat are carried out in separate regulatory process. Following the completion of the final Revised Recovery Plan, the Service will evaluate the need to revise spotted owl critical habitat.

Comment: Spotted owl surveys in 2009 and 2010 indicate that management under the spotted owl HCP and barred owl control experiments on Green Diamond property in California have reversed the negative trend in major portions of their lands in California. The Revised Recovery Plan should support (and not prevent) the development of Green Diamond's Forest HCP.

Response: We are aware that barred owl control on Green Diamond's California ownership has led to reestablishment of spotted owls on some abandoned territories. However the spotted owl populations in California are still declining. We do not believe this Revised Recovery Plan would prevent the development of the Green Diamond Forest HCP.

Comment: One of the greatest problems is that the Service has chosen to cease providing technical assistance to private landowners for the protection of spotted owls.

Response: The technical assistance we provide to private landowners and state regulatory agencies varies from Washington to Oregon to California. In some instances, budget and time constraints of other state regulatory processes and landowners requests may not allow for us to respond in a manner that fully meets everyone's needs. In Oregon and Washington we have been able to meet all requests to date. In California, the Service worked closely with private landowners and CAL FIRE on review of timber harvest plans and non-industrial timber



management plans (plans) affecting spotted owls until 2008. In February 2008, due to budget and staffing constraints, the Service provided CAL FIRE the documents and the training to conduct "no take" evaluations. It is now CAL FIRE's responsibility to ensure that approved plans do not take federally-listed species and they are the lead regulatory agency working directly with the applicant. We continue to coordinate with CAL FIRE frequently and provide technical assistance to them when they do not have the in-house biological expertise.

Comment: We suggest this additional recovery action: Funding for Acquisition of Conservation Easements: The USFWS and the Department of Interior will work with the Department of Agriculture and other stakeholder agencies, including the Departments of Transportation, Defense and Energy as well as the Environmental Protection Agency, to make available a dedicated source of funding for the planning, development and acquisition of working forest conservation easements that can be held and stewarded by qualified land trusts for the purposes of restoration and maintenance of spotted owl habitat on private lands to support recovery goals.

Response: We agree that some type of dedicated funding is valuable. However, we do not believe that we need to add an additional recovery action to address this issue in addition to Recovery Action 15. Currently the Service allocates funds under ESA Section 6 proposals with our local partners for conservation plan development, land acquisitions, and easements for the benefit of improving spotted owl habitat. Additional increases in the existing Section 6 budget allocations could improve implementation of recovery actions on non-federal lands.

Comment: Concerning draft Recovery Action 15, we suggest the Service either delete "As appropriate and within the boundaries of our authority, the Service encourages" or include this in all other recovery actions.

Response: The wording is important to Recovery Action 15 because it recommends the creation and establishment of business and economic incentives that could potentially involve new laws or appropriations. We believe this caveat needs to be clearly stated for this recovery action.

Comment: We recommend the following language (pp. 61-62): "In light of the continued decline of the species, the apparent increase in severity of the threat from barred owls, and information indicating a recent loss of genetic diversity for the species, the revised plan identifies a potentially more important role for State, private and Tribal lands. As a result, the Service suggests States evaluate existing spotted owl conservation efforts and consider changes where appropriate to contribute to recovery goals. Upon completion of the range-wide modeling and the final recovery plan, the Service will be available to assist States in evaluating the importance of spotted owl conservation efforts on non-federal land."

Response: Rather than recommending all-encompassing recovery actions for all three states, we have developed state-specific recommendations based on the laws and regulations, and cooperative working groups, of each state. We believe these recovery actions address this point.

## **Adaptive management**

Comment: The Service first should experiment with treatment in the dry forests and research the impacts on spotted owls and their prey before conducting widespread treatments. Particularly in current spotted owl habitat.

Response: Given the effects of past management in dry-forest ecosystems combined with the substantial documentation about the effects of climate change in these systems, the Service believes there is a need now to restore landscapes and manage for landscapes that are resilient and adaptable to the impending effects of climate change. The Service acknowledges the risks to treating owl habitat and potential effects on owls. We stress that treatments need to be strategic and focus on restoring and maintaining ecosystem structure, composition and processes with an eye towards recovering spotted owls while maintaining ecosystem resiliency in the face of future climate change. Given the uncertainties, there are risks associated with both taking action and with not taking action until further information is obtained. Thus, the Service has proposed an adaptive management approach as part of this recovery plan to help us learn the effects of current management decisions and inform future decisions.

Comment: Landscape-scale adaptive restoration treatments are proposed but the number and spatial extent of these is not specified and nonscientific methods are proposed to monitor the results of these treatments. While the draft Revised Recovery Plan suggests active adaptive management, the examples are passive.

Response: Developing an adaptive management approach that is driven by key knowledge gaps and management questions will aid the implementation of the recovery plan. The Service does provide a number of specific suggested topics and questions to pursue. We believe much knowledge can be gained from a variety of monitoring methods.

Comment: We recommend experimenting with regeneration harvests in moist forest matrix lands to answer "Can a combination of structural retention elements and even-aged rotation ages be identified as an effective management practice...?"

Response: We recommend conducting these types of experiments away from currently occupied spotted owl habitat. Any timber harvest that occurs in or near owl habitat should be conducted in an adaptive management framework to determine what types of silvicultural practices are effective for creating/enhancing the development of spotted owl habitat. If this practice is effective, long-term monitoring of spotted owl use in these areas will be necessary.

Comment: We recommend deference to adaptive management rather than the precautionary principle.

Response: Adaptive management and the precautionary principle both have a role to play in spotted owl recovery depending on the site-specific condition or situation. Land managers and the Service can work together to implement the appropriate approach.

Comment: The draft Revised Recovery Plan recommends conducting management experiments only in "matrix", adaptive management areas, or non-federal lands in areas not having important conservation functions for spotted owls. This recommendation for implementing draft Recovery Action 12 experiments in such areas with few owls represents a "risk-averse" position that virtually guarantees failure to identify how thinning might be used to improve habitat conditions

for spotted owls. NCASI's letter (item 9) includes examples of where such experimentation could be conducted, including a reference to their 2010 progress report.

**Response:** While we recommend prioritizing these projects in non-reserved Federal lands (*i.e.* “matrix” in Northwest Forest Plan), Adaptive Management Areas, and non-federal lands in areas not having important conservation functions for spotted owls, we do not limit management experiments to these areas. We do recommend that when such activities occur within owl core areas or high quality habitat, that an adaptive management approach be used so we can learn from these activities.

**Comment:** The term “adaptive management” should be reserved for active changes resulting from the acquisition of information designed and collected to answer specific research or management questions that are identified in the Revised Recovery Plan.

**Response:** We have added a section on adaptive management to the recovery plan and outlined a suggest approach within the plan.

**Comment:** Specific guidance needs to be given about what the Service will consider an adequate adaptive management framework.

**Response:** We have added a section that more clearly articulates adaptive management.

### **Northwest Forest Plan**

**Comment:** We recommend that the Service explicitly state that although the Revised Recovery Plan provides the best possible guidance for implementation of actions that are designed to recover the spotted owl, the Revised Recovery Plan itself would not replace the Northwest Forest Plan (NWFP) in terms of management of Federal lands for a broad range of ecological values within the range of the spotted owl.

**Response:** The goal of the draft Revised Recovery Plan is to build on the Northwest Forest Plan framework and to utilize its site-specific recommendations. In addition, the Revised Recovery Plan allows for future amendments to land management plans under the NWFP consistent with this Plan and the principles of adaptive management. Text has been modified throughout the document to clarify this intent.

**Comment:** Any new reserve network must be at least as effective as LSR network for all model outputs.

**Response:** The Revised Recovery Plan does not contain any specific reserve or conservation network recommendations beyond what those already in place under the NWFP. The Service will recommend a habitat conservation network at a later date, informed by the modeling information and as we revise critical habitat. Our recovery criteria define a well-distributed, spotted owl population as a fundamental goal of species recovery.

**Comment:** Several commenters suggested that the Service adopt the Northwest Forest Plan and its reserve system as the spotted owl recovery plan or the backbone of the recovery plan. Some suggested that the Revised Recovery Plan should include the LSR network and additional reserves.

**Response:** The Northwest Forest Plan addresses other species and concerns beyond spotted owls, while the Revised Recovery Plan specifically addresses the needs of this species. At this time,

the Revised Recovery Plan does not contain any specific reserve or conservation network recommendations. The Service will recommend a habitat conservation network at a later date, informed by the modeling information which includes analyses of the Northwest Forest Plan reserves. Text has been modified or added throughout the document to clarify this. The Revised Recovery Plan also includes recommendations for managing spotted owl habitat on non-federal lands.

Comment: The Northwest Forest Plan urges that fuel reduction in older stands be limited to situations where fuel modification will “clearly result in greater assurance” of late successional habitat. This standard should be included in the Revised Recovery Plan.

Response: As described in the Revised Recovery Plan, fuel reduction treatments need to be part of a landscape scale restoration strategy. They should be strategically located with clear objectives, and not be used for the purpose of “fireproofing” the forest. Instead, they should be designed to increase the acceptability of wildfire by reducing fire behavior and severity in local areas (e.g. to reduce risk of loss to ecologically important elements, or to protect human safety), rather than simply to reduce fire occurrence, size, or amount of burned area. Land managers will need to make their judgments on the efficacy and impacts of proposed treatments on older stands.

Comment: The draft Revised Recovery Plan effectively makes a fundamental shift in the region’s owl conservation strategy by abandoning, and not improving upon the 2008 reserve strategy. By not affirming the Northwest Forest Plan reserve system as the foundation for owl conservation and principle recovery strategy, protecting well connected clusters of owl pairs across the range, this region economy, communities and non-federal conservation strategies that were built upon the Northwest Forest Plan are threatened.

Response: While reserves are not identified in the draft Revised Recovery Plan, they will be identified in the critical habitat process. We have not abandoned the Northwest Forest Plan, but instead have recommended continued application of the Northwest Forest Plan on Federal lands as well as full consideration of other recommendations in this Plan, until or unless we have recommended an alternative habitat conservation network in the future. While a habitat conservation network is not identified in the draft Revised Recovery Plan, it may be identified in the critical habitat process.

Comment: The draft Revised Recovery Plan says “On Federal lands, the Service continues to support the implementation of the Northwest Forest Plan and its associated Standards and Guidelines, as well as the implementation of the recovery actions in the draft Revised Recovery Plan.” But the draft Revised Recovery Plan also fails to embrace a reserve system and encourages logging in westside forests >80 years old. These incongruities must be reconciled in the final Revised Recovery Plan.

Response: With this statement we are supportive of the Northwest Forest Plan, including its reserve system. Future considerations of a habitat conservation network and critical habitat may inform this recommendation. Silvicultural activities in LSRs in stands over 80 years old that may benefit development of spotted owl habitat are consistent with the goals of the Northwest Forest Plan. Such activities are already occurring in some LSR stands over 80 years old where structural or compositional complexity can be improved.

Comment: Draft Recovery Action 4 says "Use the results from this [modeling] effort to inform decisions concerning both the possible development of a habitat conservation network and potential revisions to spotted owl critical habitat." The draft Revised Recovery Plan seems to be taking a step away from the reserve strategy that has been integral to the Northwest Forest Plan and all previous spotted owl conservation strategies. This is inappropriate. These previous plan with reserves emphasize: (a) the value of large blocks of habitat, (b) the need to restore cut-over areas within the blocks, (c) primary reliance on natural processes to maintain currently suitable habitat, and (d) a spatial relationship between the habitat blocks to facilitate owl dispersal. There is no evidentiary basis for abandoning these core principles.

**Response:** As noted above, we are not abandoning the core principles of the Northwest Forest Plan reserve system. On the contrary, we note in the Revised Recovery Plan that our recommendations affirm and build upon the scientific principles of the Northwest Forest Plan.

Comment: The Service should address the risk to the owl on Federal lands and implementation of the Northwest Forest Plan before it makes land management recommendations and further expands protections onto non-federal lands. There are broader implications of abandoning the Northwest Forest Plan as the primary conservation strategy that have not been evaluated.

**Response:** The Revised Recovery Plan does not suggest or recommend abandoning the Northwest Forest Plan as a conservation strategy. However, Federal management alone is not adequate, particularly in areas where Federal lands are limited or lacking. Non-federal lands can play an important recovery role across the range of the spotted owls. The relative importance of this role to spotted owl recovery will continue to be assessed as we encounter new information.

Comment: Due to plummeting spotted owl numbers on Federal and other lands over the past decade and a half, it serves no point (except to confuse people) to say on page 54 of the draft Revised Recovery Plan that, "In 1994, in its biological opinion on the Northwest Forest Plan, the Service concluded that the Northwest Forest Plan met or exceeded the standards expected for the Federal contribution to recovery of the spotted owl."

**Response:** This sentence refers specifically to the Service's analysis in 1994 and is a statement of fact. It reflects the Service's position and understanding of the science at the time.

Comment: The Revised Recovery Plan should show basis for lifting the age cap of westside LSRs from 80 to 120 years (p. 32).

**Response:** Our recommendation to consider treatments in stands over 80 years old within LSRs are limited to those stands where improving structural complexity would benefit northern spotted owls. Such activities are already occurring in LSR stands over 80 years old that have limited structural or compositional complexity. This recommendation builds upon the recognized conservation value high quality habitat provides.

### **Owl habitat loss/recruitment analysis**

Comment: Several commenters questioned the data on spotted owl habitat loss and provided figures or references they believe are more accurate.

**Response:** We have substantially updated this section with the most recent data from the Northwest Forest Plan Effectiveness Monitoring Program (Davis and Dugger, *in press*). The information provided by commenters is not as complete and reflects older information than we

used. The monitoring analysis used change in stand condition to determine when nesting/roosting habitat lost the necessary characteristics and applied this standard in all habitat change analyses regardless of mechanism, and it provided information on all lands, not just Federal lands.

Comment: The subtitle of the section “Loss of Habitat” is misleading, since the section covers both growth and loss of suitable habitat due to timber harvest, fire and other natural events. Furthermore, the “range-wide total” on Table B2, reports an 8.34% habitat change; the factor should be 3.4%.

Response: We have changed the text to correct numbers in now Table B-1. While growth has occurred, there was an overall net loss of habitat according to the Northwest Forest Plan Effectiveness Monitoring Data (Davis in press), hence the title “Loss of Habitat” is appropriate.

Comment: “Estimates of late-successional habitat development were calculated at the regional scale using a modeled projection approach (USDA *et al.* 1993, USFWS 2004a). This approach estimated 600,000 acres of in-growth per decade on Federal lands...” (p. 104), it appears that the data from Fig. IV-2 (FEMAT) was the basis for the above statement. If so, this estimate needs to be qualified better. Based on discussions with Dr. Tom Spies, who was involved in the FEMAT analysis, estimates of future expected recruitment of LSOG shown in Figure IV-2 in FEMAT were based only on reserve allocations in Oregon and Washington, and very simple expectations of transitions between size classes and overall losses to stand replacement fire. This analysis should be taken only as rough approximations of relative differences among FEMAT options and not used to set precise benchmarks against which to evaluate trends in LSOG under the Northwest Forest Plan.

Response: The estimate of recruitment of spotted owl habitat was based on information from the SEIS to Remove or Modify the Survey and Manage Mitigation Measure Standards and Guidelines, January 2004 (USDA and USDI 2004), not FEMAT, as described in USFWS (2004a). As described there, the approach has limitations: “However, spotted owl habitat development (from unsuitable to suitable) is not a threshold change. Forest stands develop the structures that define spotted owl habitat through a period of time probably measured in decades, moving from being unsuitable, then marginal, and eventually developing into habitat capable of supporting reproductive spotted owls. Estimating when the change from unsuitable to suitable occurs is difficult, particularly in relatively short time periods of a decade or less.” Given these limitations, we are no longer attempting to quantitatively estimate habitat development at this time.

Comment: A key assertion in the draft Revised Recovery Plan is that wildfire-related “loss” of late-successional and old-growth forest outpaced recruitment during the last decade assumes forests burned are lost to spotted owls, and the 10-year monitoring interval is too short.

Response: We do not equate all acres affected by wildfire as “lost” habitat. Nor do we consider all burned areas to necessarily be beneficial to owls. The contribution of these burned areas to spotted owl habitat varies by fire severity and distance from nest or core area, as stated in the Revised Recovery Plan.



Comment: Two commenters noted that late-successional and old-growth forest status or trend is not the same as spotted owl habitat since some late-successional and old-growth forest occurs in forest types that are not spotted owl habitat (e.g. subalpine and ponderosa pine forests).

Response: We have addressed the issue of late-successional and old-growth forest and spotted owl habitat and have substantially revised this section. We have generally reduced reliance on late-successional and old-growth forest information and, due to the degree of uncertainty, potential inaccuracy, and disagreements between results, have not provided any conclusions on habitat recruitment. While not all late-successional and old-growth forest is spotted owl habitat, trends in late-successional and old-growth forest in the range of the northern spotted owl do provide an index of change in this type of habitat. We have used spotted owl habitat estimates to the extent they are available.

## Modeling

Comment: The Service should add a recovery action that involves the creation of accurate maps of Spotted Owl habitat.

Response: The Service, along with other agencies and groups, continues to seek and develop accurate and complete maps of spotted owl habitat. We do not require a specific recovery action to address this. Such maps will be part of the Northwest Forest Plan Effectiveness Monitoring program's 15-year review (Davis and Dugger, in press) and have been incorporated into our modeling process (Appendix C.)

Comment: The Service should define roles for state wildlife departments concerning mapping high-quality forests.

Response: The Northwest Forest Plan Effectiveness Monitoring program is mapping habitat and we will work with the states to assess the recovery value of non-federal lands. We cannot, at this time, outline specific roles for the States in this process.

Comment: In modeling, the barred owl factor, as parameterized, predicts eventual extinction of many populations; therefore, equilibrium scenarios containing a barred owl effect are uninformative. Barred owl simulations thus offer a different type of decision support than habitat-based equilibrium scenarios. Simulations analyzing the effect of barred owl should instead focus on comparing the transient dynamics (population trajectory) with and without barred owl, but with an awareness of the limitations of the model.

Response: The Barred Owl Encounter Probability parameter is informative because it allows sensitivity testing to evaluate levels of barred owl influence that may be compatible with spotted owl population stability. However, it is true that above a specific Barred Owl Encounter Probability, spotted owl survival is inadequate to maintain populations regardless of habitat amount. As we continue to develop and compare scenarios to test in HexSim, we will evaluate the influence of a gradient of barred owl on the rate and magnitude of modeled spotted owl population trajectories.

Comment: The Service should model forest management as habitat loss in HexSim models

Response: We disagree with this comment for two reasons. First, we are unaware of any range-wide vegetation database of sufficient resolution and accuracy to support such an analysis; if indeed we could estimate or predict the extent and location of forest management over time.

Second, we disagree with a broad conclusion that any forest management action is equal to habitat lost. The term ‘Forest Management’ encompasses a broad range of activities, and while forest management activities have the potential to remove or degrade spotted owl habitat, there is little evidence that management inevitably results in “loss” of habitat. Some areas that are currently of very low habitat quality could be managed such that they attain habitat status much faster than they would have without management actions, and some management actions might also reduce risk to adjacent habitats (especially risk of catastrophic fire).

Comment: The Service should review Maxent model for California forests.

Response: We have conducted some, and will conduct more, evaluations of the Maxent models; modeling region by modeling region. In our evaluations of the model’s predictive abilities within six Demographic Study Areas in OR and CA, the model has performed well; at least as well as in k-fold validation tests. It is important to recognize that the Maxent models do not represent a description of a particular stand or pixel’s suitability for spotted owl; they instead provide a prediction of habitat suitability based on a range of vegetation and terrain features within a 200 ha area.

Comment: Environmental stochasticity should be incorporated into Hexsim modeling.

Response: We agree. We hope to incorporate environmental stochasticity into the models when developing and evaluating habitat networks.

Comment: The Service should use alternate scenarios (*e.g.*, difference in changes in reserves vs. non-reserves; different strategies to manage fire and fuels) in Hexsim modeling.

Response: To some degree we are already doing this; we have developed many alternate strategies to evaluate habitat changes in reserves versus non-reserved areas through time. However, modeling different fire/fuels strategies is beyond the scope of this modeling effort, and we are unaware of a vegetation database of sufficient resolution and accuracy to support this.

Comment: The Service’s model was based on data before invasion by barred owls and does not represent the current condition of spotted owls.

Response: Because we wanted to accurately model habitat selection by spotted owls, we intentionally developed our habitat model using 1996 vegetation data to reduce (as much as possible) the influence barred owls might have on spotted owls habitat selection. Barred owls existed in the Pacific Northwest prior to 1996 (though not in the numbers we now see). Barred owl impacts are being evaluated in HexSim.

Comment: Modeling shows no matter how much habitat is set aside, the spotted owl would not recover without addressing the overcrowded and unmanaged Federal forests, which are subject to predictable catastrophic wildfire impacts.

Response: We disagree with this broad generalization. Our initial HexSim simulations suggest that in some modeling regions, spotted owl populations remain relatively intact. The modeling team did not have a threshold of “recovery” with which to evaluate various scenarios; we are simply comparing predicted population outcomes across management scenarios. We also did not evaluate scenarios with or without management in “overcrowded and unmanaged Federal forests,” nor make any inference to such areas.

Comment: The process to model habitat (pages 111-116) creates further confusion about whether the Service still regards large contiguous habitat blocks as valid for spotted owls.

Response: The modeling team did not start with “rule sets” similar to those used by the ISC and others. Instead, we will let the models identify the high-value areas for spotted owls, and then model the efficacy of habitat conservation networks. Since the Zonation model creates solutions based both on the estimated distribution of habitat suitability and the ability of spotted owls to move around on the landscape it is, to some degree, predisposed to identify relatively large blocks of habitat.

Comment: Forest condition data is gathered from a limited area around nest sites. Yet nesting is only one element of the owl’s life requirement; should include food supply as well.

Response: We are unaware of any spotted owl range-wide data on prey that could be used. We’ve attempted to include proxies for prey by including foraging habitat. Although the modeling of RHS was conducted at the scale of core areas (200 ha), it is well understood that such areas provide nesting, roosting, foraging, and dispersal habitat. Furthermore, it is important to understand that our models do not suggest the entire 200-ha area surrounding nests must be comprised of a single habitat type. Recognizing regional variation in habitat use is one of the reasons we conducted the modeling in 11 discrete modeling regions.

Comment: The Revised Recovery Plan should address error propagation within the series of steps. If the Delphi process, used to identify the appropriate forest types, fails to include the forest types needed for recovery, the error will resonate through the habitat suitability selection, reserve designs and circulate around the owl population response analysis.

Response: We did not address “error propagation” per-se. The Delphi process was not the only method used to identify vegetation characteristics important to spotted owls. We evaluated histograms comparing presence/absence data for hundreds of owl territories, and conducted a rigorous review of all available literature and data sets, including academic research, agency data, and industry reports. While we have evaluated the predictive accuracy of the Maxent models we recognize that our models are not perfect, but we believe they are the best approximations given the data. We can and plan to conduct sensitivity analyses in HexSim as well.

Comment: Explain how the modeling accounts for younger stands, future habitat, and forest growth.

Response: The modeling process will evaluate different scenarios of habitat gain/loss through time by using different scenarios in HexSim. We chose this approach because we are unaware of any forest growth models that are available which represent forest growth, harvesting, and disturbance, all at a spatial grain that is similar to the grain we used for the Maxent models, and that are available throughout the entire range of the spotted owl. Furthermore, forest growth models would have to have the same attributes that exist in the Maxent models to be useful for our purposes. We will include a range of scenarios (rounds) in HexSim in which we change the relative habitat suitability values in order to get an indication of how spotted owl populations would be estimated to respond to increases and decreases in RHS.

Comment: We suggest that the Service quantify the extent to which the sensitivity/model validations were performed in each of the modeling regions, and also evaluate the influence of barred owls on sites that were used to inform Maxent models.

Response: When the modeling is completed, sensitivity evaluations, model validation results, and results model testing with independent data sets will be available for all modeling regions. It is not possible to describe the influence of barred owls on the spotted owl sites used in the modeling, because such data are unavailable. We used sites with verified occupancy by spotted owl pairs that were coincident in time with the 1996 and 2006 vegetation databases. The influence of barred owls is evaluated in HexSim, not the habitat models.

Comment: Modeling efforts should evaluate the function and value of the Washington Forest Practices Rules Spotted Owl Special Emphasis Areas, and recommendations be made relative to habitat quantity and quality that should be considered by the state during its deliberations on where and how to provide strategic non-federal habitat contributions.

Response: The Revised Recovery Plan modeling results will provide valuable information and map products to facilitate the analyses suggested here.

Comment: The Revised Recovery Plan should expressly provide Service personnel with the flexibility to favor landscape-specific data and models (*e.g.*, model developed for Green Diamond's HCP) in the future development of HCPs, permit decisions, and other conservation and recovery actions for the spotted owl.

Response: This flexibility currently exists. Our modeling effort is intended to inform broad-scale habitat conservation decisions. Locally-developed models can always be evaluated by the Service in the context of management planning and permitting.

Comment: The science of the Revised Recovery Plan strategies should be assessed in the context of statistical degrees of confidence and reported both in the context of barred owl presence and in the absence of barred owls.

Response: Where these statistics are available for presentation we will include them, although not all analyses of these strategies may lend themselves to these sorts of statistical evaluations.

Comment: In modeling scenario 2, page 127, the Revised Recovery Plan should not include State lands. All modeling of non-federal lands should include all non-federal landowners and should be cast as recommendations to consider in their overall management planning.

Response: We believe State lands differ from other non-federally owned or managed lands, primarily because of both the overall amount and configuration of land managed by the States. State-initiated actions are likely to provide a greater contribution to spotted owl recovery than other non-federally managed lands because of the number of acres affected and the distribution of those acres.

Comment: Hexsim should not be used to predict population status or size at any specific point in time.

Response: Our modeling is not designed to predict or estimate actual population size at any point in time. It is, however, designed to compare relative spotted owl population trends over time under varying habitat conservation networks.

Comment: A comparison of Hexsim scenarios with a range of parameter sets (*e.g.*, 1) equilibrium vs. declining populations, and 2) habitat effects on survival only, fecundity only, and on both parameters), could provide general insights that can better inform planning that can a single parameter structure.

Response: 1) The population trends (equilibrium vs. declining populations) simulated in HexSim resulted from the parameters (and maps, etc) that are used in the model; they are not inputs to the model. Therefore we cannot run the model with a range of these parameters. 2) This question suggests a misconception regarding how we link habitat to survival. We stratify survival by stage class, resource class, and barred owl presence/absence. Resource class is a function of habitat quality and quantity, but it's also a function of intra-specific competition. We therefore don't link habitat directly to survival. Nonetheless, we do not have the data to stratify survival by resource acquisition. Working directly with the primary authors of the demographic meta-analysis, we were unable to reliably parameterize reproductive rates for different resource acquisition classes.

Comment: We suggest using 10, rather than using three, resource classes when scaling of demography to habitat in Hexsim.

Response: We can justify three resource classes, but not 10. We found the mean of the collection of minimum region-specific survival rates, and assigned that to low resource owls. We took the mean of the collection of maximum region-specific survival rates, and assigned that to the high resource owls. We took the global mean and assigned that to medium resource owls. One could divide the range from low to high up into 10 categories, but this would be less defensible.

### General Modeling Comments

Comment: Figure C-1 (diagram) is without labels – the boxes need to be labeled to correspond to the text – otherwise the diagram is not very useful.

Response: All of the boxes shown in Figure C-1 are labeled, and the labels correspond with terminology in the text.

Comment: Specifically, which of the habitat conservation networks in Zonation contribute the most benefit to owls in accomplishing Recovery Actions 10 and 32?

Response: Recovery Actions 10 and 32 are intended to conserve habitat within the nonreserved portions of the landscape (*i.e.* areas not within LSR or critical habitat). As such, the implementation of and need for of these recovery actions would be inversely related to the extent of any revised recovery network. Zonation-derived habitat conservation networks are not developed specifically to accomplish or enhance Recovery Actions 10 and 32.

Comment: In the second paragraph from the bottom of page C-2 it would be useful to strongly emphasize that the results of this process are just to provide examples of how the process can be used to evaluate conservation scenarios and their relative contribution to recovery. In the last sentence in the last full paragraph of C-3 suggest inserting the word *relative* "...evaluate modeled *relative* population size and trend..."

Response: These clarifications will be made in the final Appendix C.

Comment: Appendix C does not reflect current reality... The modeling does not recognize the habitat quality of higher elevations, where the spotted owl is moving to in the Park [OLY], and overestimates the value of habitat in lowlands, where spotted owls are not present and barred owls are dominating. Even early results of the modeling in Appendix C show that if habitat reserves were doubled ... spotted owl population would decline nearly 50% over the next 250 years given the impact of the barred owl.

Response: The modeling framework incorporates barred owls as a stressor that can render highly-suitable habitat unavailable to spotted owls; this effect occurs in the HexSim population simulations. We believe this is the appropriate approach for predicting spotted owl distribution, rather than developing a habitat model that assumes a barred owl effect on habitat selection. The results of our comparisons of RHS models based on 1996 and 2006 spotted owl location data suggest spotted owls continue to select the same habitat conditions in the presence of barred owls; however, those habitat conditions may be less available in areas with high barred owl encounter rates.

Comment: What efforts were made to determine an error budget or otherwise assess error propagation through the modeling processes? Please provide an indication of the most important driving variables/data sources/component models in contributing to higher error rates. Were model-specific evaluation criteria or "pass/fail" thresholds considered as investigators moved from model to model through the recovery modeling processes? Some criteria or thresholds could be primarily quantitative (*e.g.*, GNN classifications) while others may be more subjective and based on professional expertise and opinion (*e.g.*, HexSim).

Response: Because the primary objectives of this modeling effort was to develop models that reliably predict habitat suitability for subsequent use in population simulations, the modeling team was not focused on evaluating the relative importance or accuracy of individual variables. Instead, we focused on each model's predictive performance (discrimination ability); whether models were well calibrated, robust, and had good generality. For these reasons, we did not use a formal process to identify the source of error rates or to evaluate whether error rates were unduly influencing the reliability of our model outputs. We thoroughly evaluated MaxEnt models (cross-validation, calibration, and independent test data) and found them to have acceptable discrimination ability, be well calibrated, robust, and have good generality. We did not have a set of pass/fail requirements. Evaluation and calibration of the HexSim output included comparison with owl numbers in DSAs and dispersal histograms, and additional calibration is possible in the future. For HexSim we used some of the outputs (owl numbers in DSAs) to fine-tune some of the parameters.

Comment: Is there any need to consider inbreeding or hybridization in recovery modeling?

Response: The influence of genetic issues such as inbreeding and hybridization become relatively more severe as populations become smaller and more isolated. These population characteristics are quantified in the HexSim modeling process; and genetic effects can be incorporated into HexSim if population simulations suggest that genetic issues are likely in the future. However, the data necessary to parameterize HexSim to simulate genetic issues are currently unavailable. At this point, the modeling team did not explicitly include genetic issues into the modeling framework, because this would add substantially to complexity.



Comment: Describe the process by which variables were identified and subsequently included in the model.

Response: This information is provided on pages C-5 through C-22 of Appendix C.

Comment: The links to the layered pdfs are helpful. A zoomed-in example map or two would strengthen the text presentation.

Response: From the comment we cannot determine what example map output is being suggested. Appendix C currently contains examples of the three primary model outputs.

Comment: Develop 95% confidence limits taking into effect all model uncertainties from all models used in the analysis on reserve scenario outcomes for the range and for individual modeling regions.

Response: This is not possible to do. Many of the model outputs do not have a statistical distribution to enable this information to be provided, and many “model uncertainties” cannot be quantified.

Comment: “Habitat Value” is a surrogate used in the model and is not an actual measurement or identification for the northern spotted owl. .... For all practical purposes the habitat model of spotted owl habitat on the Olympic Peninsula is very simple: Habitat – Not Habitat, there is not a gradient of habitat quality. The various models employed to clump and smooth the habitat levels simply hide the distinctness of the habitat-nonhabitat on the Olympic Peninsula confusing those not familiar with the landscape as to the true nature of spotted owl habitat on the Peninsula.

Response: The claim that there are no gradients of habitat suitability in the Olympic peninsula is not supported by published information or the model outputs. The habitat suitability gradient predicted in our RHS model is based on the sample of nearly all known spotted owl locations on the peninsula; it demonstrates there are habitat conditions that are used disproportionately more and less than availability. To develop the habitat suitability models, we relied on data and independent opinion from scientists and land managers working with spotted owls on the Olympic Peninsula.

Comment: Measurement units are inconsistent throughout the document (*e.g.*, use of ha on pp. C-48 vs. acres on pp. C-52).

Response: Measurement units will be standardized in the final Appendix C.

Comment: Since this model will not predict the relative ecological benefits of the added protections embodied in the Recovery Actions nor show how habitat will change over time, its utility is severely limited.

None of these stated purposes get to the heart of AFRC’s concerns about the models or lack thereof. We believe that the models should provide the scientific support for the proposed Recovery Actions and should be precise and accurate enough to show whether, if the Recovery Actions are implemented as intended, these Recovery Actions will lead to the recovery of the spotted owl. The modeling framework provided in the Revised Appendix C does not fulfill this need and because of the way it is structured, will not do so in the future.

Response: The modeling framework can potentially be used to assess the efficacy of some Recovery Actions (RA 10 and barred owl removal, for example), but it was not designed to be able to assess all Recovery Actions. For example, the stand-level conditions evaluated in support

of RA32 determinations occur at very fine scales that are inappropriate for remotely-sensed vegetation data such as those in the GNN vegetation layer. We don't believe there is any single model that could assess the efficacy of all Recovery Actions.

Comment: Redwood Coast (RDC) needs further discussion.

Response: While the Dugger *et al.* (2011) paper examines spotted owl – barred owl interference competition in the southern Oregon Cascades and results may be broadly applicable across the southern portion of the range of the NSO, this study did not specifically address owls on the redwood coast. Our understanding of resource partitioning between spotted owls and barred owls in the Redwood zone remains unclear. In addition, large areas of industrial forestland in the redwood coast have yet to experience substantial invasion by barred owls. Anthony *et al.* (2006) and Forsman *et al.* (in press) have reported declines in NSO populations across the species' range; however, these declines were smallest in northern California (Redwood Coast).

### MaxEnt comments

Comment: The modeling process for evaluating habitat suitability under MaxEnt assumes that some moderate amount of edge and degree of forest fragmentation is good for demography and fitness of northern spotted owls throughout their geographic range based on Franklin *et al.* (2000), yet this relationship has been shown mainly for northern California, not the remainder of the subspecies' range in Oregon and Washington. In contrast, Dugger *et al.* (2005) found no relationship between the amount of edge and demographic performance of spotted owls in southern Oregon, so the validity of this assumption for the entire range of the subspecies is questionable at best.

The model includes edge in habitat simulations but its value to owls is range-specific with some studies reporting owls benefiting from edge (Olson *et al.* 2004) and others showing no apparent response (Dugger *et al.* 2005). In addition, not all edges are equivalent in habitat value as clearcuts lack the structural complexity necessary to support owl fecundity (Franklin *et al.* 2000). This important distinction needs to be accounted for in model application.

Response: NR edge and NR core were allowed to enter models, but weren't forced to enter. The modeling team did not assume that "edge and degree of forest fragmentation is good for demography and fitness". Furthermore, their effects (*e.g.*, positive, negative, threshold) were driven by the data within each modeling region, not forced or pre-decided by the modeling team. The modeling team purposefully did not focus on interpreting model covariates, but on model predictions. There are many published studies that deal with covariates and their interpretation within particular study areas (*e.g.*, the studies the reviewer noted in their comment). We are not suggesting that our MaxEnt models represent the full suite of specific factors influencing spotted owl habitat use and selection; we are suggesting that the models have very good predictive performance, are well calibrated, robust, and have good generality.

Comment: Acceptance of the modeling results among scientists would be more readily facilitated if at least one other accepted niche modeling tool was run in parallel with MaxEnt, using the same data. Examples of alternative techniques would include generalized boosted methods like boosted regression or classification tree analysis, randomForest, or geographically weighted regression modeling, but there are many others.

The MaxEnt modeling, lacks adequate side-by-side comparison with other mainstream niche modeling tools, possibly preventing ready acceptance of modeling results by non-MaxEnt users. The questions are, "how do maximum information entropy assumptions influence model development and the relations of the predictors to the response? How does this vary by modeling approach? Which approach is \*best\* given the modeling goals and the nature of the particular problem? And WHY is it the best? There are indeed several good approaches that could be applied to this problem.

**Response:** The modeling team agrees that comparison of our modeling approach to other niche modeling tools would be of interest, and would be a straightforward task in the future. However, given the objectives of our modeling effort (accurate, reliable prediction) we elected to use one model and thoroughly evaluate the reliability of the resulting predictions. Peer reviewed papers by Elith *et al.* (2006), Wisz *et al.* (2008), Graham *et al.* (2008), Phillips *et al.* (2009), and Willems and Hill (2009) all compared MaxEnt to other modeling tools on identical data sets (sometimes hundreds of species), sample sizes, and geographic areas. MaxEnt always performed very well and was consistently a top performing model.

**Comment:** If barred owls really do influence spotted owl presence, this changes the interpretation of further analyses based on the MaxEnt output, in particular the analysis in step 2, which does not include the impact of barred owls in any way.

**Response:** The modeling framework incorporates barred owls as a stressor that can render highly-suitable habitat unavailable to spotted owls; this effect occurs in step 3 (HexSim population simulations). In step 1 we attempted to estimate RHS for spotted owls with lower barred owl impacts. The RHS maps represent only relative habitat suitability for spotted owls. We believe that this the appropriate approach for predicting spotted owl distribution, rather than developing a habitat model that assumes a barred owl effect on habitat selection. The results of our comparisons of RHS models based on 1996 and 2006 spotted owl location data suggest spotted owls continue to select the same habitat conditions in the presence of barred owls; however, those habitat conditions may be less available in areas with high barred owl encounter rates.

**Comment:** Spotted Owl location data: Within each modeling region, the Service "thinned" the spotted owl nest locations such that the minimum distance between nest locations would be 3.0 km (thinning with a 3 km distance resulted in removing ~25% of the locations available to us). The context of this comment suggests that thinning of data is an attempt to deal with the issue of nonrandom sampling noted above. However, it misses the mark, as any adjustment of data should be based on information about sampling effort, not information about owl presence or density. Under most models of strong habitat selection, animals are expected to be found at higher or lower densities, depending on habitat characteristics. However, this ad hoc approach assumes that high densities of owls represent greater-than-elsewhere sampling intensity. Occupancy modeling explicitly deals with variable detection probabilities and is recommended for future work of this type.

**Response:** To some degree this comment is correct – that the Service thinned the spotted owl locations in an attempt to deal with nonrandom sampling. It was more explicitly an attempt to deal with relatively small areas with intensive sampling versus more extensive areas with less sampling (though a pure random sample would obviously have been ideal). Because the spatial scale of our modeling was very large (modeling regions are millions of acres), spatial

autocorrelation due to sampling intensities could introduce a bias. We agree that animals are more likely to be found at higher or lower densities depending on habitat characteristics. As TWS noted later in their comments, “..the model calibration showed good agreement between the predicted and observed proportions of activity centers (nest sites) that were occupied. In addition, the model validation showed that the relative habitat suitability models were robust and had good generality.” These were two of the primary goals of step 1 of the modeling process (MaxEnt) – namely to develop models that accurately depicted relative habitat suitability.

Comment: The modeling regions are different from the physiographic regions that were used in the Northwest Forest Plan (NWFP) and 1992 Draft Recovery Plan, and this departure from previous works is not sufficiently described or justified.

Some of the modeling regions do not make sense from an ecological standpoint. For example, the coastal regions of western Oregon and Washington are combined with the Olympic Peninsula, which is very different in climate and prey abundance from the coastal regions farther south. In addition, it is not clear why the Service divided the Klamath region into east and west when it makes more sense to divide the region into north and south.

Response: As described in detail on page C-6, the modeling team used published literature, input from habitat experts, and numerous GIS queries to establish the modeling region boundaries. The resulting boundaries were reviewed by several forest ecologists familiar with various portions of the range and found to capture the important ecological transitions the modeling team felt likely influenced spotted owl distribution and habitat relationships. As with any effort to subdivide ecologically complex regions and retain adequate sample sizes, there is never a perfect solution. The dominant climatic and forest communities in the NCO (high annual and summer precipitation, western hemlock/Douglas-fir/western redcedar/Sitka spruce) comprise a relatively uniform ecological unit. The modeling team recognized that other factors such as prey species distributions (red tree voles) and elevational gradients could easily result in three separate subregions; however, only one would contain an adequate sample of spotted owl locations for modeling. We chose instead to use the ability of the NCO model to predict subsets of spotted owl sites within the spotted owl’s range to evaluate our decision. Modeling region descriptions on pages C-10 and C-11 describe the rationale used to divide the Klamath region into three (north-south and east-west) modeling regions. The commenters provide no information to support dividing the Klamath region into north and south, so we cannot assess this aspect.

Comment: Table C-17 is hard to interpret without knowledge of the relative frequencies of pixels in different bins and more information on the “independent test data sets” is necessary before we would accept them as an adequate test.

Response: In the final appendix C, the modeling team included a histogram depicting the distribution of RHS among several classes by modeling region.

Comment: Appendix C states, “Model calibration refers to the agreement between predicted probabilities of occurrence (habitat suitability for our study) and observed proportions of sites occupied (Pearce and Ferrier 2000, Phillips and Elith 2010). Phillips and Elith (2010) note that model discrimination and model calibration are independent measures.” This is not correct, as MaxEnt (unlike occupancy modeling) does not permit estimation of probabilities of occurrence.

Response: As stated on page C-35; “*Elith et al. (2011) state that the MaxEnt logistic output is an attempt to estimate the probability that a species is present, given the environment (i.e., the*

*environmental conditions). For our purposes, we have taken a more conservative interpretation of the MaxEnt logistic output and interpret it to represent the relative habitat suitability (RHS) for nesting spotted owls within each modeling region”, the modeling team purposefully and repeatedly used the term “relative habitat suitability” or “RHS” throughout Appendix C in an attempt to explicitly articulate what we interpret the MaxEnt output to represent. We do not believe the MaxEnt maps/values (by modeling region) represent probabilities of occurrence. Instead the RHS maps represent a gradient of habitat suitability of NSOs that goes from less to more suitable, and the SOS curve in Figure C-5 of Appendix C represents an estimate of the degree to which RHS values are more or less suitable to NSOs – thus “relative habitat suitability”. We will revise the final Appendix C to ensure clarity on this point.*

Comment: Neither the logistic, cumulative, or raw outputs allow comparison between regions as would be possible with occupancy approaches.

Response: We didn't make direct comparisons between/among regions because there was no need to do so. Zonation was run modeling region by modeling region (in order to insure well-distributed populations).

Comment: We would also like to see more justification for the authors' choice of features. For example, the threshold feature is used, but the product feature is excluded.

Response: We tried to keep things somewhat simplistic. If models would have performed poorly relative to our goals, we might have considered including product features. The Service's focus on the MaxEnt models was on their predictive capabilities.

Comment: The authors mention ranking of models and improved models (Pages C-21 - C-22), but do not explain the criteria (AUC, gain, AIC) by which they judge a model to have improved. They report AUC and gain, but do not clarify if they are based on test or training data.

Response: We did not use AIC. AUC and gain were based on training data. Only after a “best” model was found was cross-validation done and test data tested. If a “best” model would have performed poorly with cross-validation or on the test data we would have circled back to find a more robust and good predictive model.

Comment: Discuss contrasts evident between Maxent models for different modeling regions, especially Redwood Coast Modeling Region. The conclusion that variables related to vegetation structure are of secondary importance in Maxent models in the certain modeling regions (*e.g.*, RDC)[p.27] should receive more discussion as to context. It is plausible that NSO in the southern portion of the range would have a broader vegetation niche but narrower thermal niche, but the model structure could also be evidence of unmeasured vegetative attributes that only become important in certain forest types (*e.g.*, redwood region). Does the estimated relative habitat value from the RDC agree with data from the Marin DSA as well as the Green Diamond DSA?

Response: In the RDC region (and all modeling regions) expert input and data from studies conducted in redwood forests (including Green Diamond DSA) were incorporated into our *a priori* nesting and foraging models. Our model results echo findings of Stralberg *et al.* (2009) who found that vegetation variables were less influential than topographic conditions at predicting nest-site occurrence. This is not to suggest that vegetation conditions are unimportant to spotted owls. Model evaluation results for the RDC indicate that our relative habitat suitability models were well-calibrated, robust and had good generality.

Comment: Should be consistent (200 ha core vs 500 ac core) or explain why use different measures.

**Response:** The final Appendix C will be edited to reflect only metric units (200 ha)

Comment: “The demographic study areas (DSAs) take up just a fraction of the landscape.” “Just a fraction” is vague and potentially misleading; meta-analysis reports indicate the value of the study areas covering a relatively large portion of the range (~9%). Recommend stating the proportion of the landscape within DSAs.

**Response:** We carefully evaluated the potential role of the demographic study areas in our modeling. In the final Appendix C, we will include a table representing the proportion of each modeling region within DSAs, as well as the proportion of available spotted owl pair site locations.

Comment: The models are presented as linear models with additive effects (no interactions). However, in my limited understanding of MaxEnt, I don’t think the models are as simple as what was presented. Is there a specific form for the models and are there explicit parameter estimates? If so, these should be reported. At the least, the direction of the effects (*i.e.*, positive or negative) should be reported. In addition, are there any measures of precision associated with parameters estimated for the variables? This additional information would help readers judge the adequacy of these models both statistically and biologically.

**Response:** The models do (as we used them) only have additive effects (no interactions), but they were allowed to have more than just linear forms (on page C-21 of Appendix C we wrote: “We only used the linear, quadratic, and threshold features within MaxEnt.”) We purposefully did not focus on the parameter estimates, but on the MaxEnt models’ predictions. This modeling approach was not an attempt to estimate or depict the NSO’s niche. Presenting the forms of the relationships would likely suggest to readers that the Service is trying to infer something more than we are (prediction).

Comment: The role of the MaxEnt modeling process was variously described as “...predict the relative suitability of habitat within some geographic area.” (page C-5), “...we defined relative habitat suitability (RHS) as the relative similarity of environmental conditions, including both biotic (forest composition and structure) and abiotic (terrain, climate) components at spotted owl sites to the distribution of those conditions across the landscape.” (page C-6), “... identify the forest structural models that best predicted the relative likelihood of a spotted owl territory being present” (Page C-13). However, these fairly limited inferences from the MaxEnt modeling process were used to denote habitat quality in the HexSim modeling process (*e.g.*, “... two static spatial layers, one representing the distribution and quality of habitats...” on page C-48; and “The habitat map (MaxEnt 2006 NSO Habitat) capture spotted owl resource quality and was derived from RHS values developed using MaxEnt in Step 1.” on page C-59). Presence modeling does not represent habitat quality as is usually defined in ecology; habitat quality is explicitly linked with demographic processes (see Franklin *et al.* 2000, Olson *et al.* 2004, Dugger *et al.* 2005). Thus, there seems a disconnect between Step 1 and Step 3 of the modeling process in terms of what inferences can be drawn from the habitat maps used.

**Response:** In the modeling framework, the MaxEnt outputs (RHS values) form the basis for hexagon scores, which influence spotted owl territory acquisition and, secondarily, resource



acquisition and 'resource class' categories that affect survival rates. Hexagon scores were assumed to be proxies for amount of resources for spotted owls. We will make changes in the final Appendix C to better describe our assumptions.

Comment: I did not immediately understand the relevance of climate variables in a temporally (1-3 years) static dataset. If the intent was to define habitat based on tolerance levels, I think the vegetation structure would have reflected this better (*i.e.*, owls can behaviorally ameliorate the effects of external temperatures by seeking better thermal environments) given the short time scale and this also seemed beyond the intent of this exercise (relevance would have been more in line with changes in geographic distribution limits as with Carroll (2010)).

Response: At large spatial scales (the entire range of the spotted owl or a modeling region) it is reasonable to assume climate variables could limit a species' use of areas. We did not force climate variables into the final models, but allowed them to enter (if the inclusion of climate variables made for worse models they would not have been allowed to stay in a final model). The Service believed that a strict reliance on vegetation structural variables would have resulted in many unsuitable (*e.g.*, high-elevation forests) areas for owls being identified as being suitable.

Comment: If climate variables were to be included into the modeling process, I would have thought that the variables found to affect spotted owl populations in Franklin *et al.* 2000, Olson *et al.* 2004, Dugger *et al.* 2005, especially Glenn *et al.* 2010 would have been considered. Rather, the climate data from Carroll 2010 were used. This struck me as odd because the former publications dealt explicitly with effects on owl population dynamics while the Carroll 2010 publication dealt primarily with geographic range limitation at a much coarser scale.

Response: Carroll (2010) was the only paper that dealt with the majority of the (though not the entire) spotted owl's geographic range. The other papers cited were of much smaller spatial extent. Furthermore, our intention with the MaxEnt modeling was to find models that had good discrimination ability, were well calibrated, robust, and with good generality.

Comment: The demographic study areas provide a rich data set that might have been used to better develop the RHS models and validate the resulting predictions from the HEXSIM models. It appeared that the data from these demographic studies was lumped with lower quality data and then thinned because of potential biases due to clumping. I would argue that the data sets from the demographic areas are probably the most appropriate for building the RHS models and then using the other ancillary data to test these models to make inferences at a broader geographic extent. I would also argue against trimming data in the demographic areas because any clumping probably represents real spatial distribution of the population on the landscape rather than biases in survey effort. In short, I thought the data from the demographic study areas was diluted with data of lower quality and could have been used to greater advantage. Alternatively, the mathematical algorithms for describing habitat quality in Franklin *et al.* 2000, Olson *et al.* 2004, and Dugger *et al.* 2005 could also be used to develop habitat maps for at least some of the provinces and compared to the MaxEnt results for those areas as at least a check on reality. In addition, analysis of the mark-recapture data from select demography study areas using open Jolly-Seber estimators could have been used to evaluate the HexSim results (*e.g.*, in Figure C14); these would be from the same data used in the lambda analysis during the last meta-analysis.

Response: For pair site data used by the Service, we had relatively strict criteria for including data in the analyses. We agree that the DSAs represent very high quality data and we relied on

those data heavily throughout our modeling processes. Nonetheless, the spotted owl site location data from the DSAs represent a much smaller portion of the owl's range than the full data set we used, and we would argue the larger data set represents more fully the spectrum or gradient of biotic and abiotic features that spotted owls select for nesting and roosting. For example, the total number of NSO site locations inside DSAs was 1,199, and when thinned by 3 km was 755. In contrast, the total number of site locations outside of DSAs was 2,591, and when thinned was 2,110. With our 200-ha analysis area, if we would have sampled from only the DSAs we would have sampled ~151,000 ha around thinned DSA sites versus the 573,000 ha sampled around all thinned sites. Given the DSAs represent nearly the only areas within the spotted owl's range that have consistently been surveyed over long periods of time and that they represent a smaller portion of the species' geographic range, the data from them (at the scale of a modeling region) is generally spatially aggregated. There are certainly many other ways the data could have been analyzed, and the modeling team considered other approaches. However, with the goal of the MaxEnt modeling being to develop well calibrated, robust models with good generality and discrimination, we succeeded in producing such models.

Comment: What procedures were used to validate the GNN/MaxEnt procedures on different ownerships, in particular, on managed industrial forestlands.

Were data from industry lands adequately represented in GNN modeling and used to validate GNN and MaxEnt outputs?

Can you provide a description of the source and nature of habitat data used to develop models, assign parameters, or inform scenario development, BY landowner classification? Is there any disparity between the amount of data on public land and private land? Given differing management, what is the probability of a bias being introduced? Is there a possibility of unfavorable bias towards a fair characterization of owl behavior and/or habitat availability on private land?

Response: The modeling team did not conduct a separate evaluation by land ownership. Both the GNN database and the sample of spotted owl locations used in our habitat models are representative of conditions on private lands. We obtained spotted owl locations directly from several large industrial forestland owners, as well as sites reported (and verified) in state and various research project data sets. The GNN vegetation modeling is based on the FIA vegetation inventory grid, which encompasses both private and Federal lands.

Comment: Are there plans to compare MaxEnt output with site demography data (vs just presence/absence)?

Response: There are no formal plans to do this. The comparisons we have made are between HexSim-simulated population sizes and numbers reported within DSAs.

Comment: Would the Service consider testing outcomes of MaxEnt models against actual data or NSO resource selection models based upon habitat use vs. availability by telemetered owls?

Response: The MaxEnt models were compared to actual data (in both cross validation and with test data (2006 spotted owl locations)). Specific comparisons would have to be for specific purposes, so it is difficult to answer the question in terms of "against ... NSO resource selection models... by telemetered owls?" Some such comparisons could be insightful, but it depends on the rationale/purpose of the comparison. We would expect that well-constructed locally-developed models of spotted owl-habitat selection/use would generally be more accurate than the

large-scale models we developed due to the spatial scale at which the MaxEnt, Zonation, and HexSim models were developed and at which they are designed to be used. Similarly, we believe it would be inappropriate to apply small-scale (local) models at very large spatial scales.

Comment: Where did the 1996 nest site data come from? Were inactive sites culled? If state databases of NSO sites were used, were accuracy issues dealt with?

Response: The sources of the 1996 spotted owl locations used in our modeling are clearly described on page C-16 of Appendix C.

Comment: Were NSO habitat characteristics identified by expert panels and from the literature appropriate for industry lands with owls?

Response: We obtained information regarding spotted owl habitat associations from published sources and habitat experts representative of all land ownerships, including private industrial forest lands.

Comment: Would it be possible to see the actual MaxEnt models (with parameters) that were developed, by region?

Response: Because the goal of the MaxEnt modeling was to develop models that were well calibrated, robust, and had good discrimination ability and generality. The modeling team has purposefully not focused on covariates and their associated parameter estimates. We relied heavily on the published literature to develop our models, and would recommend reviewers and other interested parties evaluate those studies that were designed to understand/evaluate the NSO's niche.

Comment: We suggest that perhaps two spatial scales would be more appropriate [than the 1 currently used in MAXENT]: a small area for nesting/roosting habitat and a larger area for foraging habitat.

Response: The MaxEnt models the modeling team developed were used to create the RHS layer; these models incorporate different amounts of nesting/roosting and (separately) foraging habitat within a uniform 200-ha analysis area. In HexSim the RHS values are used, but simulated owls utilize two spatial scales; a small territory (3 86.6-ha hexagons regardless of modeling region) and home range, the size of which varies depending on the modeling region (see Table C-22 in the Draft of Appendix C).

Comment: Using expert-opinion definitions of foraging (or nesting) habitat in models for MaxEnt does not appear justified. ... foraging habitat is poorly described for most of the modeling regions, and the ad-hoc definitions appear to be simple step-down definitions of nesting habitat (*e.g.*, smaller trees, lower canopy cover, etc.). As a result, the above-described benefits of GNN- or kNN-derived continuous measures of individual habitat covariates were defeated when the individual continuous habitat measures were recombined into categorical definitions of nesting and roosting (NR) and foraging (F) habitat. ... Therefore, since the MaxEnt modeling effort included individual non-habitat variables such as precipitation, we recommend a data-exploratory step that similarly evaluates the relative importance of each habitat variable.

Response: The goal of the MaxEnt modeling was to develop models that had good discrimination ability, were well calibrated, robust, and with good generality. The modeling team has purposefully not focused on covariates and their associated parameter estimates, nor on

the relative importance of each habitat variable. We presented some of that information because we presumed many readers find it informative. However, the primary focus of the modeling team was on how well the models work to predict relative habitat suitability.

Comment: Given that prediction was a stated goal, the Service might consider using Landsat spectral values directly in MaxEnt modeling.

Response: The modeling team elected to use the GNN database for our modeling.

Comment: What are the effects on MaxEnt outputs of (a) not using multiple imputation of FIA plot data to pixels, (b) presence-only data,

Response: We can't answer (a) that unless we were to have such data with which to develop another set of MaxEnt models. (b) MaxEnt is specifically designed to evaluate presence-only data, and many peer-reviewed studies (on a variety of species, using variable numbers of presence locations, and many geographic regions) have reported it to be one of the best (if not the best) best presence-only modeling programs.

Comment: In the description of the East Cascades North (page C-10) identify the DSA that occurs in this region. Also the map (Fig. C2) seems to indicate a break south of Wenatchee which is different than described in the text.

Response: We will correct this in the final Appendix C.

Comment: It is unclear how the modeling accounted for areas with high structural complexity but are hardly ever used by owls. Some of our mid-upper elevation forests with heavy snowpack are an example. Were these masked out somehow?

It is important that the most recent version of Ray Davis's maps were used to identify "exclusion areas" as previous versions overestimated habitat capable areas on the east-side in both the ponderosa pine and the subalpine fir zones.

Response: We used the same mask as Davis *et al.* (in press) within which we conducted our modeling. In addition to masking out some areas (*e.g.*, high elevation areas, valleys, Pacific Ocean, lakes), we also allowed (but did not force) covariates in our models that represented climate, species composition, and elevation, all of which could further refine the discrimination between forests with high structural complexity but that are also not used, or used infrequently, by NSOs and lower elevation high structural complexity forests.

Comment: Bottom of the page under Model Evaluation. This does not seem like model evaluation. We suggest a different heading.

Response: We have made this revision in the final Appendix C.

Comment: There is a need to describe how the "available" dataset was generated. It is not clear if points were randomly distributed in each modeling region and how many were used. It is also not clear if they constrained to a subset of the forest types, and if they were somehow spatially separated from any "used" datapoint.

Response: The available dataset was randomly generated, consisted of approximately 10,000 points per modeling region, and was constrained to the unmasked layer within each modeling region. Used points could be part of the available – it was a random sample of all locations in the region.

Comment: The habitat models are developed for the wrong areas. ...should have focused on specific areas most likely to support owls in the future.

Response: We disagree, largely because we know of no reliable way to determine where owls are likely to exist in the future, without first modeling their contemporary habitat associations.

Comment: Computer modeling for spotted owl recovery should pay particular attention to the value of edge effect, a traditional predictor of carrying capacity for either a specific species or for overall species diversity in a given habitat.

Response: Nesting/Roosting habitat edge was allowed, but not forced, to enter MaxEnt models. The goal of the MaxEnt modeling was to develop models that had good discrimination ability, were well calibrated, robust, and that had good generality.

Comment: The GNN variable “MNDBHBA\_CON\_GE\_50” is defined here as “mean stand diameter is  $\leq 50$ cm”. This variable is actually a basal-area weighted mean, as defined by the GNN data dictionary provided on the LEMMA website.

Response: This will be clarified in the final Appendix C.

Comment: Where are the direct or indirect predictors for disturbance (natural and anthro) history? Is this adequately addressed in the appendix? Under historical conditions, these global vars would poorly predict structural attributes. With longer periods of fire exclusion, structure is more clearly influenced by productivity gradients, but still more variance is explained by anthro and fire disturbance history. I suspect this concern merits some attention in the text.

Response: In the GNN models, disturbance history is assessed only indirectly based on forest structure and stand age, which is correlated primarily with the landsat variables. Current research is incorporating direct measures of disturbance history derived from the Landsat time-series, which should improve model accuracy for many of the forest structure attributes.

Comment: We think a better [than GNN] mapping product may result if the kNN method is used. This would also facilitate uncertainty estimation of the final map product since multiple-imputation methods could be applied... We suggest that Appendix C analysts consider acquiring maps constructed via kNN, or at least present an error-matrix comparing GNN-map variables with data from geo-referenced, ground-truthed plots.

Response: The modeling team needed to develop habitat models based on the vegetation databases currently available to them. GNN actually is a variation on kNN, so they are essentially the same approach. By using  $k > 1$ , it's true that additional model diagnostics (uncertainty estimates) could be calculated, but it wouldn't necessarily result in a 'better mapping product.' There are error matrices and other model diagnostics in the accuracy assessment reports that are based on geo-referenced ground plots.

### Accuracy of GNN

Comment: Accuracy of the GNN habitat map is a critical issue, and the reader is referred to a website to find this information. Appendix C should include this information so that the reader is more aware of the accuracy assessments for the satellite imagery and does not have to go looking for it.

“we were also interested in the accuracy of GNN at the core area (500 acre) spatial scale”

Was the accuracy of GNN data validated for use in NSO modeling?

Was any testing of error propagation within GNN conducted?

... there does not appear to be any plans to check the GNN output.

letter identifies 7 major points, I've noted these but also included additional points. Potential errors in model-based vegetation maps (GNN) could be injected into the analysis and carried forward to all other modeling steps, with unknown effects on MaxEnt predictions of relative habitat suitability, as well as on subsequent applications of model output in conservation and land management. We suggest that predicted vegetation mapping needs to include a validation process.

As far as we could determine no formal data were prepared that quantified accuracy [ of GNN generated variables]. As a result, Appendix C does not provide convincing evidence of accuracy of the covariates used in MaxEnt modeling... GNN apparently cannot identify tree species composition very well.... We presume that other errors exist as well, so it should be useful to take a fresh look at which GNN variables can be considered accurate for modeling.

RHS modeling in MaxEnt relies on the spatial accuracy of the GNN data used in modeling. At the scale of modeling, GNN spatial accuracy is probably poorest. Is this adequately addressed? Like any satellite-based map, however, the GNN is imperfect and highly scale-dependent. The limitations of the GNN method need to be considered carefully with respect to the simulation results and future applications of the spotted owl model.

The reliability and accuracy of the GNN map is discussed on pp. C-16, but certain aspects of this discussion are vague and lacking detail. For example, the LEMMA website does not provide Kappa coefficients for every single GNN variable, so how were the variables that did not have an associated measure of accuracy evaluated? Also, in the less formal independent accuracy assessment discussed on pp. C-16, what published estimates were used to compare with GNN values estimated within spotted owl core areas? Was an error matrix produced from this effort?

**Response:** Several commenters expressed concerns about the accuracy of the GNN vegetation maps used in the RHS modeling, our portrayal of accuracy assessments, and the potential effects of GNN's accuracy on the reliability of our RHS models. The modeling team selected the GNN vegetation database for a number of reasons; most importantly that it is the layer developed for use in the Northwest Forest Plan monitoring program. It is the only vegetation layer available that covers all land ownerships across the entire range of the spotted owl.

In our attempt to keep Appendix C relatively concise, and to retain its focus on the primary objective of the RHS models (prediction), we did not include the actual GNN accuracy assessments in the appendix. Instead, we provided a link to the GNN website where interested parties can view the accuracy assessments. Many GNN diagnostics are available from the accuracy assessment report for each modeling region. Accuracy assessments apply to the GNN model(s), rather than the satellite imagery. Commenters correctly pointed out that accuracy assessments for all variables used in the modeling are not easily available on the GNN website. In the final Appendix C, we will include accuracy assessments for the GNN variables used in our RHS models.

Although we recognize the importance of the accuracy of the GNN data, the primary goal of the MaxEnt modeling was to develop models that had good discrimination ability, were well calibrated, were robust, and had good generality. At the scale MaxEnt models were developed and evaluated, the Service believes we have developed such models. Thus, we believe that the GNN habitat map was accurate enough for our purposes.



### MaxEnt model overfitting, parsimony

Comment: What are the effects on MaxEnt outputs of (c) possibly over-fitting the data?

The author's analyses on page C-34, do not directly address the issue of over-fitting.

Most of the 'top' models for each region had 4-6 variables that explained less than 1% of the data. The description of the modeling process stated a penalty term for additional variables was included when ranking models, but as there was no supporting information, I was not able to assess the validity of including these terms in the model. The inclusion of additional parameters will always increase a model's fit, but this must be weighed against increasing the standard errors of the terms in the model and the model's increasing lack of precision.

Given the goal of not over-fitting, seems like many of the full models have covariates that contribute minimally to the model; *e.g.* in Western Klamath the full model includes 4 covariates contributing <1% each with a total of 1.7%. While these factors may contribute to owls using an area this appears to be overfitting in general. While the cross-validation does appear to address the possibility of overfitting, seems like expert opinion and the contributing value of covariates could be used to reduce the number of parameters.

The models presented did not seem very parsimonious in that they appeared to be overparameterized. For example, there are 15-17 variables included for the full models in table C7, 4 to 6 of which contribute <1% to the full model. This suggests models are overfit with a subsequent loss of precision.

What safeguards were in place to prevent problems of overparameterization? Was there any assessment of model over-fitting or sensitivity to data (by bootstrap or other)?

What are the effects of a..., b... and (c) possibly over-fitting the data?

In general, the number of habitat covariates included in models is far greater than in published studies, leading to concern that

MaxEnt models are over parameterized/over fit. If the authors reported coefficients, we would be able to determine the number of parameters and to compare between coefficients between different regions. If these coefficients were reported alongside the a priori hypotheses, it would also allow us to see the degree to which their model agreed with published results (including the impact of edge habitat).

**Response:** Several commenters expressed concern about the number of covariates in the RHS models, and the potential for over-fitting. MaxEnt is designed to reduce the effects of the model over-fitting through its use of regularization. The main consequence of over-fitting that the modeling team wished to guard against was that of having models so tightly fit to the training data that they were not generalizable (*i.e.*, that they did not work well at classifying test data or data that did not contribute to the model's development). Our extensive cross-validation (randomly removing 25% of the data, each of 10 times within each modeling region) and evaluation of each model's full and cross-validated performance revealed that the models were not over-fit (see Table C-16). Furthermore, where we had adequate independent data, the models performed almost identically on them as on the training data (see Table C-17). Thus, we share the reviewers concerns with over-fitting models, and we directly evaluated whether the consequences of over-fitting were realized and found that they were not. Thus, the conclusions on page C-35 under "Model evaluation summary" remain valid.

Comment: Central place foraging depends on the prey type and availability which ranges widely. This does not seem to be a valid assumption, and further work should be done to verify core area size in different regions.

“Furthermore, even if core areas are not identically-sized throughout the spotted owl’s geographic range, it is likely that modeling at the 200-ha scale effectively identifies patterns that would be found with slightly smaller or larger scales. “

A reference should be provided to validate this assumption.

The modeling team might consider using statistical procedures to identify the potential for multiple scales of analysis for MaxEnt modeling instead of a single scale. ...we suggest the Service consider a nest-site and “ring” modeling process similar to that used for Northern Goshawks by McGrath *et al.* (2003) and for Northern Spotted Owls by Ripple *et al.* (1997) to identify both the scales and conditions (with equal weights of individual covariates as described above) that best predict locations of nest sites and are integrated with other conditions that support acquisition of prey.

I thought the justification for using single core area of 200 ha throughout the range of the owl was weak. ... Under central foraging theory, one would expect that core areas would expand with changing prey densities, such as in the northern latitudes where flying squirrels are less dense than woodrats in the south. I think at least two different sized core areas (one below and one above the dusky-footed woodrat distributional limit) would have been more appropriate or at least tested to see if just a single core was appropriate.

An analysis window of 200 ha was rejected in the 1990 listing: what justifies this scale now if it was rejected before?

Most models make some important assumptions, but the assumptions for this modeling process are not completely spelled out nor is their validity addressed. For example, the modeling of habitat suitability assumes that core use areas for spotted owls are relatively constant in size throughout their geographic range, but this assumption is not well supported by the Appendix or the published literature.

**Response:** We agree that the justification for using 200-ha analysis areas across the spotted owl’s range should not have been linked solely with a discussion of core area sizes. For simplicity, the modeling team elected to use a uniformly-sized analysis area across the spotted owls range. To determine a reliable analysis area size, we evaluated a range of information, including core areas, nearest-neighbor distances, and the results of nested-ring analyses conducted at spotted owl sites across the range. Based on this review, we felt a 200 ha analysis area would be broadly representative of an important, disproportionately used area surrounding the nest site. If this is not the case we would expect models developed for owls in the central and northern portions of their range to perform more poorly than those developed in the southern portion of their range because of the documented gradient in home-range size variation from south (smaller) to north (larger). In the final Appendix C, we will clarify and expand on the rationale behind our use of 200-ha analysis areas.

Comment: All of the ‘top’ models included many variables that appear to be highly correlated. For example, the Klamath West top model included variables for NR01, NR01 edge, and NR01 core. Highly correlated variables should not be included in the same model because this will adversely affect the parameter estimates of the terms in the model, as well as increasing their lack of precision. Other variables in the models also appear to be correlated, such as elevation and max. and min. temperatures.

We suggest that Appendix C include the correlation matrix for the numerous variables [used in MAXENT] that were tested and specify the threshold value used for screening... Davis *et al.* (in press) used a Pearson correlation coefficient of 0.7 to screen correlated explanatory variables in their application of MaxEnt. Appendix C indicated only that variables were retained if they had “low” correlations. If Appendix C analysts used the same correlation coefficient threshold (*i.e.*, 0.7), they may not have ensured that spurious variables were excluded in the definitions of F and NR habitat or that the relative importance of explanatory variables was accurately assessed. Were there any auto-correlation problems associated with using similar variables in both GNN and MaxEnt modeling? Were included variables [MAXENT] ...tested for correlation? ...entered in a stepwise approach?

**Response:** We agree with the general comments of the reviewer (*i.e.*, that it is not helpful to have correlated variables in a model). Given the stepwise model building process we used, one would expect that the addition of a covariate that is highly correlated with one already in the model would not add to the model’s performance. If that were the case, the highly correlated covariate would likely not enter the model. Furthermore, Elith *et al.* (2010) note that MaxEnt is more stable “in the face of correlated variables...so there is less need to remove correlated variables..”

We were not focused on evaluating the relative importance of individual variables, but on each model’s predictive performance (discrimination ability); whether models were well calibrated, robust, and had good generality.

**Comment:** Discuss possible sample selection bias and propagation of uncertainty across models. One of the key assumptions of the Maxent modeling is that the presence locations were based on a random sample of the focal population. In the case of the NSO demographic studies we know this not to be the case. We would like to see some additional discussion or analyses that address this possible source of bias in the Maxent model. For example, Elith *et al.* (2010, 2011) discuss potential approaches to account for survey bias that may be relevant here. Additionally, the degree of robustness of conclusions to propagation of model uncertainty across the three stages of the modeling process (Maxent-Zonation-Hexsim) should be discussed.

In order to use all available (Site) data the authors instead choose a presence-only method, MaxEnt. However, in order to provide useful results, MaxEnt requires random spatial sampling (Elith *et al.* 2011), which Appendix C clearly states is not the case over much of the spotted owl’s range. While random sampling is desirable for many kinds of inference problems, it is essential to inferences from MaxEnt. This should produce serious skepticism about any habitat suitability.

This leaves the authors with two options: (1) use occupancy methods to gain unbiased estimates from a portion of the owl’s range and extrapolate to other areas, or (2) use a program like MaxEnt on biased data that covers a larger portion of the owl’s range. The second option, the one chosen by the Service, is biased and requires various contortions to provide inputs for the second and third steps in the overall modeling approach (e. g. MaxEnt does not provide true estimates of probability of occupancy and cannot be compared between different modeling regions, see comments below). The first option, on the other hand, depends on the degree to which environmental conditions in the demographic study areas (and other areas with detection/non-detection data) are representative of the whole range (allowing extrapolation); however, it provides unbiased estimates of occupancy and will not lead to overfitting (see

comments below). The Service should consider the relative merits of these two approaches in future efforts. For example, MaxEnt models without demographic study area data could be tested against the demographic study area data to determine the degree of bias introduced by nonrandom sampling.

**Response:** The Service will evaluate the potential impacts of apparent sample selection bias on the final MaxEnt model outputs using approaches similar to those recommended by Phillips *et al.* (2009) – for modeling regions in which it appears that such bias could be consequential. The potential effect of sample selection bias is that the resulting model would represent a model of the survey effort rather than the NSO’s RHS throughout the modeling region. Phillips *et al.* (2009) noted “If a spatially biased sample proportionately covered the full range of environments in the region, then it would cause no problem in a model based on environmental data. However, this is usually not the case.” For NSO’s, such extensive sampling has happened in some modeling regions (perhaps most) that sample selection bias is unlikely to be an issue. Furthermore, the performance of the MaxEnt models suggests that this issue is not a problem.

**Comment:** As they were presented, I found the results of the MaxEnt modeling somewhat confusing and difficult to interpret. I was confused by some of the terminology used when presenting the model results. For example, in the North Coast and Olympics models in Table C7, there are separate models for Nesting, Foraging, and the full model. The full model contains variables NR06, NR06EDGE, and FORAGING HAB04. I assumed these were Nesting and Foraging models but I was never sure if this assumption was correct.

The “full models,” covariates, and their contributions are shown on pp C-27 to C-31, but the **codes** used to represent the variables for each modeling region are not described in Appendix C. *E.g.*, what do “NR07 + F03” and “NR02 Edge” mean?

**Response:** (C103 – C104) The codes for the ‘best’ NR and F models in each modeling region are provided within Table Series C-7; but in the final Appendix C we will add the codes alongside each best NR and F model description.

**Comment:** Many adjustments and corrections are needed to make the model in Appendix C reflect reality for northern spotted owls on the Olympic Peninsula.

The recovery plan assumption that spotted owls are limited to lower elevations <900m on the Olympic Peninsula underestimates available and occupied habitat on federal lands of the Olympic Peninsula.

The model because of its averaging effect assumes a lower resource value for habitats at higher elevations. ... Actual detection of single birds at up to 5,200 feet (1585m) and nests at up to 1097 m indicates that territories and resource gathering occurs at higher elevations.... Seeking the Park Service local knowledge would greatly enhance the model.

[USFWS should] reassess habitat at high elevations of the Olympic Peninsula and check habitat for reasonableness against known nest sites and habitat use.

Reassess habitat on private lands within the NCO area using a simpler habitat model that reflects the habitat-nonhabitat quality on the Olympic.

**Response:** The modeling team found no compelling reason the use a separate modeling procedure or make different assumptions regarding model development for the Olympic Peninsula. The model is based on nearly all spotted owl locations within the region, at all elevations where pair sites have been detected. Because our NCO model performs well at

**predicting spotted owl locations within both the Olympic NP and adjacent lowlands, we feel that it appropriately incorporates the elevation and habitat gradients that exist there.**

Comment: ...we cannot determine how managers could apply MaxEnt models or output to determine relative benefits and consequences of implementing RA-10 or RA-32 as outlined in the Draft Revised Recovery Plan for the northern spotted owl... we do not believe the modeling process described in Appendix C necessarily allows federal land managers to translate recovery actions directly into standards and guides for their planning. Perhaps a table demonstrating a cross-walk between Appendix C's MaxEnt output and that used in Davis *et al.* (in press) would be helpful.

In our view, continuous variables that are carried forward to MaxEnt from the initial mapping carry strong information for communicating with land managers.

There is also concern about how the definitions used in the Revised Appendix C framework correlate with those used in the latest demography analysis conducted by Davis et.al. which is cited extensively in the 2010 Draft Recovery Plan. Dr. Irwin writes in his comments on the Revised Appendix C: "Appendix C is unclear how MaxEnt outputs (relative habitat suitability) for each modeling region translate to "suitable habitat" as mapped by Davis *et al.* (in press) for the Northwest Monitoring Plan. Similarly, despite stated goals of Appendix C, we cannot determine how managers could apply MaxEnt models or output to determine relative benefits and consequences of implementing RA-10 or RA-32 as outlined in the Draft Revised Recovery Plan for the northern spotted owl, which involves specific vegetative conditions that may or may not resemble relative habitat suitability in MaxEnt or HexSim output. Further, because Davis *et al.* (in press) used different variables in mapping suitable habitat than Appendix C, we do not believe the modeling process described in Appendix C necessarily allows federal land managers to translate recovery actions directly into standards and guides for their planning. Perhaps a table demonstrating a cross-walk between Appendix C's MaxEnt output and that used in Davis *et al.* (in press) would be helpful. Or it might help to provide a table that describes marginal changes in relative habitat suitability with 10% increments of NR habitat at multiple scales."

Some site-specific activities may be proposed at a scale that clearly has adverse effects on suitable habitat but might not manifest with an effect on owl populations. Use of this model during consultation must be done with caution.

The model must account for both the site-specific and cumulative effects of habitat modification activities. It is also important for the model to account for the fact that some habitat modifications have long term effects that can influence habitat availability over many generations of owls.

It is important for the model to capture the qualitative differences between high-quality and marginal-quality NRF habitat, as well as between high-quality and marginal-quality dispersal habitat. One of the big differences in both cases is the relative abundance (or shortage) of snags and dead wood which structurally enriches habitat for owls and their prey.

Not only is the vegetation data unlikely to adequately describe dead wood components of owl habitat, even more problematic is that fact that the habitat definitions developed for the models (pp C-18 to C-20) do not appear to accurately reflect the importance of snags or dead wood for spotted owls and their prey. This could strongly bias the model in favor of logging, because one of the most significant effects of logging is to reduce the recruitment of dead wood.



The habitat definitions should make clear that foraging opportunities can (and should ideally) occur in both nesting and roosting habitat and dispersal habitat, and that foraging habitat is promoted by both vegetation diversity and dead wood abundance and complexity.

While there is some evidence that spotted owls in California may benefit from a mosaic of suitable habitat and “other” habitat, it is not clear that logging can create the kind of edges or mosaics that the owl appear to be responding to. Draft Appendix C did not explain enough about how it handled this issue to provide meaningful comment.

**Response:** The habitat models are intended to portray the distribution of *relative habitat suitability* (RHS) at the landscape scale; they are composed of the variables that best correlate with the large sample of spotted owl sites available to us. The fact that MaxEnt models were well calibrated (see Figure C-5 on page 33 of the Draft Appendix C) suggests that they do capture differences among various RHS classes. We did not attempt to formally model dispersal habitat. Our modeling is not an attempt to suggest or describe all of the habitat features important to NSOs overall, or within modeling regions. The resolution and accuracy of the RHS models and the vegetation databases that they are based on do not permit their use in evaluation of site-specific effects of habitat modification activities. For these reasons, the models are not intended to portray the entire range of stand-level structure (such as snags) or changes resulting from management activities such as thinning.

The models are not intended for use in site-specific consultations, or for predicting specific locations where foraging opportunities are likely to occur. Locally developed models based on ground-truthed or plot-based vegetation data are more appropriate for evaluating stand-level changes in habitat suitability, as is conducted in consultation. The model results should, however, prove to be useful for project planning at appropriate scales such as watersheds, and prediction of spotted owl territories based on environmental conditions at the core area scale.

**Comment:** MaxEnt was run without barred owl effects (1996 data). If barred owls alter habitat choice (and demography) shouldn't this be reflected in a version of MaxEnt to avoid protection of habitat less likely to be used by NSO?

site-center locations of owls are from an extremely old dataset (1993-1999, Table C-1) that may no longer be valid particularly with barred owls now more prevalent.

It is important to evaluate realistic representations of reality. Did the habitat use model really exclude the influence of the barred owl. Even with the possibility of future experimental population control, the barred owl is likely to continue to exist in large numbers throughout the range of the spotted owl. We need to know how to recover the spotted owl in the real world, not in some pretend world without barred owls.

The appendix (p C-35) says “the models had good ability to predict spotted owl locations” but it should really read “the models had good ability to predict old spotted owl locations when there were far fewer barred owls on the landscape occupying and defending suitable habitat.” Model calibration must account for the recent invasion of the barred owl and the fact that barred owls are likely to persist as a problem for spotted owl recovery. If the 3,000 night locations of spotted owl used to calibrate the model were collected mostly before the barred owl had greatly expanded its range and abundance, then the strength-of-selection curve may be skewed in favor of certain habitats that spotted owls are now excluded from, while certain other habitat are now used relatively more frequently by spotted owls but that is not reflected in the SOS curve.

**Response:** The Modeling Team's objective for the habitat models was to portray the environmental conditions selected or preferred by spotted owls. It has been suggested, but not



demonstrated, that barred owls may displace spotted owls into lower-suitability habitats. Because the RHS models predict a range of habitat suitability from low to high, the models are useful for evaluating whether there have been changes in RHS at spotted owl sites between 1996 and 2006. We tested this during model evaluation (see page C-35) in the Western Klamath, Eastern Klamath, and Redwood Coast modeling regions (the Redwood modeling region contains large populations of barred owls) and found that the RHS models based on 1996 spotted owl data performed well at predicting 2006 spotted owl sites (Table C17). These results do not support the commenter's suggested addition to Appendix C.

Comment: "Dispersal habitat is thought to have large value for dispersal, to lack nest/roost sites and to provide few foraging opportunities", and that "...nesting-roosting habitat is generally considered to provide all or most habitat requirements, whereas foraging and dispersal habitats are considered to provide only a subset of the spotted owl's habitat requirements." (pp C-13). There may be good reasons to focus on breeding habitat conditions in this stage of the modeling process, but these statements inappropriately dismiss the importance of habitat conditions used during dispersal and outside of the breeding season. Do these statements really justify the exclusion of dispersal habitat from the model? A suggestion here is to include further detail as to why dispersal habitat is not considered in the model, and how excluding conditions used during this critical life stage might influence future applications of the model.

Response: The modeling team recognized the importance of dispersal and habitats used by dispersing spotted owls in developing habitat conservation planning models. However, relatively little is known about the characteristics of areas used by dispersing spotted owls. In the spotted owl modeling effort, the modeling team therefore elected not to define or attempt to model dispersal habitat, but instead to rely on reasonable assumptions about the influence of relative habitat suitability (for nesting) on successful dispersal. Success (survival) of spotted owls dispersing through variable landscapes may be influenced by factors similar to those affecting territorial owls (*e.g.* availability of prey, cover from predation, thermal stress) albeit at a different scale. Because the RHS values generated by MaxEnt retain the full gradient of habitat suitability (*i.e.* not 'thresholded' or categorized), it is reasonable to assume that relative habitat suitability is correlated with relative success of dispersal occurring in those areas (pixels). In HexSim, dispersing owls are allowed to disperse through the full range of RHS values, with some degree of repulsion to the lowest RHS values.

### **Zonation Comments**

Comment: The conservation planning model "Zonation" was used to develop a spotted owl conservation planning model that can be used to design an array of habitat conservation network scenarios. However, it seems odd to consider locations that are good or bad across the landscape based solely on current habitat. For example, it would seem that barred owls are very relevant to the suitability of a location to spotted owls. Recent changes in barred owl numbers and distribution emphasize another point that projections of spotted owl years into the future should likely include simultaneous projections of habitat, climate, competitors, etc.

Response: The modeling team developed the modeling framework so that barred owl effects to spotted owls occur within HexSim; with barred owls representing a probabilistic stressor rather than a spatially-explicit one. This is because data are not available to develop a reliable spatially explicit barred owl habitat suitability model. We are able to more explicitly account for barred

owl impacts within HexSim, and the approach we used allows us to (as the reviewers recommended) evaluate changes in barred owl impacts, and to evaluate the relative influences of habitat and barred owls on NSOs. The framework we have developed allows for projections of habitat change, climate change, and potential impacts of competitors.

Comment: Selection of the 30, 50, and 70% of total habitat value (Zonation) for spotted owls seemed very much arbitrary, and it appears that other habitat conservation networks might be more effective and efficient. Can the Service tell the reader why these different levels of habitat suitability were chosen?

Response: These Zonation percentages were somewhat of an arbitrary starting point, capturing a wide range of total habitat values. If the results were to be “all simulated owl populations seem to do great in the 30, 50, and 70% scenarios”, it might have been reasonable to then look at Zonation 15, 20, and 25% of habitat value. If, in contrast, the 30, 50, and 70% of value scenarios resulted in simulated owl populations that all went extinct, it would be reasonable to look at Zonation 75, 80, 90 and maybe 100%. They were only meant to be starting points (points of entry for our inquiry), not recommended reserve areas. There are likely more efficient or effective reserve networks that are possible.

Comment: Zonation 50 for all lands under step 2 is more efficient and much better than the NWFP, MOCAs, critical habitat and Zonation 30. Why wasn't this option for conservation planning given more attention and support by the Service?

Response: All Zonation scenarios, NWFP, MOCAs, and the critical habitat scenarios evaluated were meant for initial comparison and to exemplify how the modeling framework can/could be used, not to choose a final conservation reserve network. The Service has not yet begun develop a specific conservation reserve network.

Comment: Any plans to test whether models over-estimate habitat suitability on private lands (affects Zonation)?

Response: This comment really pertains to the MaxEnt models. If RHS values do not accurately reflect habitat suitability on private lands, this would be incorporated into Zonation. Because the model evaluation results indicate that the RHS models are robust and have good generality, the modeling team did not specifically assess any bias associated with land ownership classes.

Comment: Is there a relative habitat suitability value (*i.e.*, a threshold) below which it is considered not habitat when doing Zonation?

Response: No. Zonation uses all available pixel values – except areas that are masked out as unsuitable (like high elevation areas or the ocean). The areas with the lowest value are removed first, and on down until the highest value is removed last.

Comment: We do not understand what is being portrayed in Fig C8. We recommend a more clear explanation in the heading.

Figure C8: Isn't the map for all land ownerships shown on the right, not the left?

Revise legends and description of Zonation result. In some places in the document, legends referring to the Zonation results are inaccurate or unclear. For example, on p.42, the legend has it backwards on which solution the left and right panels refer to, and which color refers to the 40% and 50% Zonation. More importantly, in the 'locked-in' solution, Zonation was constrained to

prioritize Congressional Reserves and LSRs, not all public lands, which changes the interpretation of results (in that much NSO habitat falls on non-reserve federal or state lands that could potentially form part of a reserve network).

**Response:** We will revise the caption on Fig. C-8, and also revise the document to more thoroughly articulate exactly what we did in terms of the “locked-in” solutions.

**Comment:** Provide more complete comparison of Zonation priority classes and Maxent RHS results. The appendix provides tables describing the proportion of total RHS habitat value captured within different Zonation priority levels. However, Maxent results are not necessarily calibrated to owl density, *i.e.*, one hectare with RHS of 0.9 is not necessarily equal in conservation value to two hectares with RHS value 0.45. Therefore, tables should be prepared cross-tabulating Zonation levels to RHS classes, *e.g.*, the Zonation ‘top 70%’ level captures x% of RHS > 0.9,.., x% of RHS < 0.15.

What was the relative composition of Zonation blobs by habitat suitability class (*e.g.*, best, suitable, marginal, non-habitat), and by region or conservation reserve area? How might this influence HexSim outcomes?

**Response:** We have added a table into the final Appendix C in which we portray the distribution of RHS values within 10 equal-sized bins among the 6 Zonation scenarios, NWFP, MOCAs, and the two critical habitat scenarios.

### HexSim Comments

**Comment:** The simulation assume that if a spotted owl pair has encountered a barred owl that the spotted owls will not reproduce. This assumption is incorrect; we have multiple examples of spotted owls successfully fledging 1 or 2 young in the presence of barred owls. I agree that barred owls probably negatively influence spotted owl productivity, but think the effect should not be set to zero.

Similar to comment #2, it is unclear how the Barred Owl Nesting Effect uses the barred owl encounter probability to set the value of a barred owl nesting effect trait (pp. C-57). In some parts of the Appendix (Table C19, pp. C-52, 54, 57) the barred owl nesting effect is described as being “halted” or “normal”, but it’s difficult to tell exactly how this effect is derived.

HexSim - It is also unrealistic to assume that barred owls have no effect on spotted owl nesting.

**Response:** These comments point to a lack of clarity in our discussion of the effect of barred owls on spotted owl fecundity in the HexSim Spotted Owl Scenario. The modeling team made no assumptions about the effects of barred owls on spotted owl fecundity. The HexSim Spotted Owl Scenario includes the machinery necessary to impose a barred owl effect on reproduction, but because the data required to create this parameter were not available for the majority of the spotted owl’s range, it has not been used. Therefore, HexSim was programmed to have a “no effect on reproduction” of barred owls if they were present in a territory. However, we used fecundity data from Forsman *et al.* (in press) and those estimates include the impacts of barred owls (the mean effect over the course of the studies evaluated by Forsman *et al.* (in press), but not “with” and “without” barred owls).

This will be clarified in the final Appendix C.

**Comment:** HexSim modeling seems to assume that conditions around nest sites (based upon Maxent) limit owl survival and reproduction. To what extent has that assumption been validated? Were other assumptions validated or tested, and if so how?

Appendix C provides little confidence that the modeling framework enables reliable evaluation of the influence of habitat suitability and barred owls on spotted owl demographics.... Appendix C under-reported the lack of predictive strength of correlations between owl population performance measures and habitat covariates. ...

... the simulations of population persistence within modeling regions are not supported by reliable models that link habitat conditions and other resources to fitness measures. In our opinion, that remains an unfortunate “missing link” that requires remedy.

**Response:** In the HexSim Spotted Owl Scenario, a primary influence of relative habitat suitability on simulated spotted owl populations occurs in territory acquisition (occupancy). To the extent that some areas aren't selected by owls (or disproportionately selected against), habitat suitability acts to limit survival and reproduction (*i.e.*, owls don't survive or reproduce in areas that they don't occupy). Subsequent to territory establishment, resource acquisition (RHS values) determines the resource class an owl is placed in. Reproduction was not influenced by resource acquisition, and thus was not influenced by habitat quality. Individual studies (*e.g.*, Franklin *et al.* 2000) and meta-analyses have reported influences of habitat on survival and in some cases fecundity (see Forsman *et al.* in press). We evaluated our results (population size) to data from the DSAs. The good agreement we found provide evidence that our model is well-parameterized. Concerns such as this explain why we kept the model as simple as possible, and why we are using it to rank order reserve strategies, etc. instead of predicting absolute population sizes. I don't believe our outputs suggest there is a particularly high correlation between owl population performance and habitat quality.

**Comment:** I did have several concerns regarding sensitivities of the final HexSim model to various input parameters (see below), and fully agree that a sensitivity analysis is needed. In fact, it was unclear to me why the sensitivity analysis described on pp. C-66 was not included in this DRAFT; this analysis is needed to fully understand how the model results are affected by uncertainties associated with parameterization of the model. Some information on how sensitive HexSim is to changes in basic input parameters (*e.g.*, hexagon size) would be helpful as well. Please provide a description of sensitivity analyses of the models relative to input variables. It is a prudent and necessary step to evaluate input variables as to their sensitivity in affecting output. Would such analyses inform us about where additional effort should be spent in evaluation and further research activities?

Expand sensitivity analyses. The Appendix states [p.65] that the potential effect of habitat on reproduction was not analyzed in sensitivity analyses because the recent meta-analysis (Forsman *et al.* (2011)) found only ambiguous relationships between habitat and reproduction. However, the Forsman *et al.* (2011) monograph also found ambiguous relationships in some regions between survival and habitat. The appropriate approach, which this document adopts, is to use data from both the monograph and previous publications. Given this uncertainty, it is appropriate to explore fecundity/habitat relationships as part of the sensitivity analysis. In general, evaluation of results from a complex PVA scenario such as that for the NSO requires more extensive sensitivity analyses than are described in the document.

What sensitivity analyses were conducted? Results?

**Response:** As described on page C-66 of the draft Appendix C, the modeling team recommends that sensitivity analyses, particularly of habitat influences on survival and fecundity, be conducted before the HexSim model results are used to inform management decisions.

Comment: Under Environmental Stochasticity – This is one of the most significant concerns of the process and its interpretation. The influence of environmental stochasticity on recovery options vary by modeling region. This should be explicitly recognized and described in the document. In fire-prone provinces with large-scale disturbances that interact with habitat suitability this is an important limitation of the current modeling framework. Keeping habitat static over time was appropriate for what the modeling process was intended to accomplish and accounting for changes to habitat over time adds tremendous complexity to the modeling framework. However, this has implications in dynamic systems relative to how effective habitat conservation networks fill function over time to achieve recovery.

Response: The modeling team agrees that the addition of environmental stochasticity will be necessary when making estimates of population size or extinction probability in HexSim. Because the probability of occurrence and effects of wildfires can be modeled, we feel it is more appropriate to simulate the effects of wildfires as habitat change scenarios. This is accomplished by creating a time series of habitat maps that capture the influence of fire and other disturbance regimes, specific to patterns observed in different modeling regions.

Comment: We hope that future iterations of the HexSim model will account for stochastic events like weather.

Response: As described on page C-64, addition of environmental stochasticity will be necessary when making estimates of population size or extinction probability in HexSim. Because the addition of environmental stochasticity greatly increases the complexity of HexSim scenarios, and the necessary computer time for the model runs, the modeling team elected not to introduce stochasticity until after the initial rank-ordering of basic scenarios. In the future, the more variable models incorporating stochasticity could be used to test a subset of the rank-ordering results obtained without environmental stochasticity. Recent research into the effects of variability in climate on spotted owl demographic rates (Glenn *et al.* 2010) suggested adding realistic variation in annual temperature and precipitation would provide an important element of environmental stochasticity into HexSim simulations.

Comment: The encounter rates for barred owls are static and set for the rates observed on the demographic study areas in 2008 for each modeling region. These encounter rates should be incremented over time as the data in Forman *et al.* (2011) show.

Response: The long-term dynamics of NSO populations (*e.g.*, from time-step 100 on) are unlikely to be influenced by an abrupt insertion of barred owls (at time-step 40, as we did) versus a gradual insertion. For this reason (and to keep the simulations simple) we did not increment the barred owl influence prior to year 40. However, doing what the reviewer recommended could add more realism to the HexSim simulations.

Comment: There are some scenarios/demographic study areas where encounter rates with barred owls have increased then leveled off or even declined some. Some modeling of these encounter rates with barred owls should be modeled as well.

What about testing the effect of an extreme barred owl control scenario?

It is unrealistic to assume that barred owl numbers remain static during the HexSim model runs that tested different reserve designs. It is more realistic to assume that barred owl numbers will continue to increase, which should provide compelling evidence that that adverse competitive interactions between barred owls and spotted owls can best be mitigated by maximizing the

amount of suitable owl habitat that the two owls can hopefully co-exist within. Protecting just the high quality subset of suitable habitat (as contemplated in RA 32) is likely not enough. Since this model will not predict the relative ecological benefits of the added protections embodied in the Recovery Actions nor show how habitat will change over time, its utility is severely limited.

The modeling framework described in the Revised Appendix C does not take into account the growth of future habitat and therefore does not address the concerns of the peer reviewers. What about landscape dynamics or other temporal effects (*e.g.*, forest growth, natural disturbances, continued human land use, barred owl occurrence/abundance, climate change)? The assumption of the entire modeling framework appears to be that the forest landscape will be static...we suggest this issue must be addressed.... more federal land will grow into foraging and eventually nesting/roosting.... Also, habitat availability may change on private lands... The model did not account for the dynamic nature of forest ecosystems. Is there some way to “run the clock forward” and show what the habitat could be in the future so that consultation can be informed by both current and potential future habitat values?

**Response:** Many comments pertained to the perception that the modeling framework was based on static conditions, particularly for barred owl encounter rates and habitat conditions. As mentioned on page C-68, evaluation of scenarios that represent future environmental conditions is among the objectives of the modeling framework. The preliminary scenarios described in the draft Appendix C compared simulated spotted owl populations among a range of scenarios that included contemporary barred owl encounter rates and habitat conditions, but also simulated habitat change (Rounds 2 and 3, Page C-71). The scenarios/rounds in Appendix C were not meant to be exhaustive, but indicators of what can be done with the modeling framework we developed. The modeling framework is designed to allow the evaluation of a wide variety of habitat change scenarios and barred owl effects among various reserve strategies. No changes are necessary to the simulation parameters in the HexSim model to implement such an evolving landscape. Instead, changes are made to the underlying RHS layers to reflect simulated changes in habitat conditions at different time-steps. Similarly, modified barred owl encounter rates, simulating population increases through time or effects of control actions, can be inserted at different time steps in the future. The modeling team recognized that evaluation of potential future habitat and barred owl scenarios is an important step in the design of habitat conservation networks.

**Comment:** We suggest the Service consider adding realism by modeling habitat changes over time under various conservation scenarios using more-sophisticated (and tested) forest-growth models.

Recommends incorporation of BLM habitat development data into the FWS modeling.

**Response:** The modeling team carefully considered the potential role of forest growth simulation models in our scenarios of future habitat conditions. While it seems intuitive that using forest growth projection models would add realism to scenarios of future habitat conditions, there are many reasons not to do so. Compiling information from every land owner/manager within the NSO’s range in an attempt to estimate how they will manage their land in the future is beyond the scope of the work the modeling team was asked to do. In order for habitat development data to be integrated into the modeling framework in a spatially explicit manner we would need at least: 1) estimates of habitat variables that are identical to those used in the MaxEnt models; 2) relatively accurate decadal (or longer) estimates of how those habitat variables will change over



the next 200+ years; and 3) how the landscape will be managed over the next 200+ years. Given that this information is not available throughout the spotted owls range in the near future, and that such estimates would ultimately need to incorporate unmeasured influences such as wildfire, insect outbreaks, climate change effects, and changing forest management regimes, we did not incorporate this into our process.

For development of rangewide and modeling region-wide scenarios of future habitat conditions, the Service believes it is more appropriate to introduce change in the underlying RHS layers, using RHS changes observed between the 1996 and 2006 GNN vegetation layers as a baseline. This method has the advantage of not requiring ‘crosswalking’ variables from dissimilar vegetation data sets, and allows creation of a wide range of future habitat scenarios based on a single data layer (RHS map). Using this method, events such as wildfires and forest growth can be simulated on the landscape. In addition, ‘proposals’ of future habitat conditions that *are* based on forest growth models for specific areas can be evaluated in HexSim

Comment: Reproduction [Stage Class]: it says here that unperturbed (by barred owls) reproductive rates were obtained from Table 3 of Forsman *et al.* (in press). However, Table 3 of Forsman *et al.* does not show reproductive rates with or without barred owls, and these estimates include time periods in which the barred owl encounter probability was high for many study areas.

Response: We will revise Appendix C to state; “Reproductive rates were obtained from Table 3 of Forsman *et al.* (in press). Those estimates were for time periods as long as 1985 to 2008 and as short as 1992 to 2008. It is generally agreed that barred owl populations have increased in most areas of the spotted owl’s range over that time. Thus, to the degree that barred owls have an influence on fecundity, that influence is incorporated into these estimates.”

Comment: Third paragraph from the bottom discusses that changes to the RHS were introduced (if at all) at year 40 then held constant until year 250. We understand why at year 40 but don’t understand how or why these changes were made. This needs some further description.

Response: The RHS changes being referred to are made by modifying (in a GIS) the RHS values in a variety of ways to reflect possible future conditions. For the sample scenarios in Appendix C, they were held constant from time-step 40 through 250; however they can be incremented during successive time-steps (*e.g.*, annual, decadal) to simulate changing conditions. We will clarify this in the final Appendix C.

Comment: It is unclear to us why the Fish & Wildlife Service limited the Hexsim model to site centers with nesting pairs and if the inclusion of individual males would improve model reliability

Response: The comment is difficult to interpret, because 1) the HexSim Spotted Owl Scenario is based on territories, not site centers, and 2) the HexSim model is a females-only model, and does not focus on nesting pairs. Our response is based on the assumption that the comment pertains to the females-only aspect of HexSim. Adding males would allow HexSim to do a better job of simulating very low population sizes. We don't believe we are at the point where this is necessary. Based on current demographic data, we assumed that enough spotted owls exist so that males and females are still able to find each other. Adding males would make the model much more complicated and potentially less accurate. Any mate-finding issues that are introduced by barred owls could be captured in a females-only model too.

Comment: The HexSim modeling used estimates of apparent survival from the forthcoming Forsman *et al.* (in press) meta-analysis, which is appropriate. However, the estimates reported in Forsman *et al.* implicitly include a barred owl effect because barred owls were present during the course of those studies. Therefore, including an additional barred owl effect doubles the effect that barred owls have on spotted owl survival. I strongly encourage the HexSim modeling be rerun with more appropriate survival estimates and barred owl effects. One way of dealing with this would be to use estimates of apparent survival from previous meta-analyses or published reports before barred owls were as prevalent (*e.g.* pp 66-75 in the 1992 draft recovery plan, written by Anderson and Burnham). This is a fairly large discrepancy that needs to be resolved.

**Response:** We disagree that the HexSim Spotted owl Scenario ‘double-counts’ the effect of barred owls on spotted owl survival. The modeling team (specifically Drs. Robert Anthony and Katie Dugger, coauthors of the Forsman *et al.* (in press) meta-analysis) used the most recent estimates of apparent survival to parameterize the HexSim Spotted Owl Scenario, but used an estimate of barred owl effect on adult spotted owl survival to calculate apparent adult survival with and without barred owls. We will describe the data and methods used in this analysis in the final Appendix C.

Comment: This use of apparent survival probabilities in the HexSim model may be critically important to consider in terms of interpreting the effects of barred owls. For example, if barred owls are influencing territory occupancy of spotted owls more heavily than true survival (*i.e.*, the presence of barred owls causes spotted owls to disperse/emigrate from their territories and become floaters), then the apparent survival probabilities of spotted owls when barred owls are present (as shown in Table C23) can be expected to be biased low relative to true survival. Apparently the HexSim model does not account for adult movement/dispersal, so simulated spotted owls in the presence of barred owls are more likely to die instead of just moving to another area. If simulated population sizes are sensitive to changes in adult survival probabilities (which I suspect they are), then this issue could lead to overly exaggerated differences between simulations run with and without barred owls. Consequently, I believe the use of apparent survival probabilities in the HexSim model warrants further investigation before the model can be used to inform future management decisions regarding barred owls. A sensitivity analysis of apparent survival in the model would help alleviate this concern. I emphasize that this comment is specific to the effect of barred owls in the model, and that it may not have a major influence on reserve design scenarios run without barred owls.

**Response:** Because true adult survival is unknown, the modeling team used estimated ‘apparent’ adult survival to parameterize the HexSim Spotted Owl Scenario. The final Appendix C will clarify the assumption that apparent adult survival is equal to, or a reliable surrogate for, true adult survival. As described in general terms on page C-66, we agree that sensitivity analyses of parameters, particularly survival and reproductive rates used in HexSim, should be conducted prior to using model results to inform management decisions.

The limitations of the HexSim Spotted Owl Scenario described resulted from our efforts to keep the model parsimonious, rather than limitations imposed by HexSim itself. This means that it is possible to add features to the simulation of barred owl impacts. HexSim could account for adult dispersal away from territories, as a result of barred owl presence. But this could not be done correctly without explicitly modeling the location of each barred owl. However, it does not

appear that data are sufficient range-wide to develop models to assign barred owls to specific locations in the landscape.

Comment: #1 Given the focus on barred owls in the modeling framework and simulation results, it would be helpful to have a “Barred Owl Influence” section where the effects of barred owls are described in a single location. This section might include a description of exactly how the Barred Owl Presence Trait used region-specific encounter probabilities to set survival and reproduction parameters of the HexSim model. This description could be included under “Overview of the Spotted Owl Scenario” (pp C-48).

The description of how the effect of barred owls was modeled (pages C-49 – C-51) is not clear and this section needs to be revised. Assumptions need to be included.

For parameterizing a spatially explicit spotted owl model, we would prefer to have estimates of spotted owl survival as a function of whether a barred owl also inhabits the territory.

Response: This aspect of the model is described on Page C-49 to C-51, with estimated survival with and without barred owls shown in Table C-22. The modeling team will review the text on pages C-49 to C-51 for clarity, provide additional rationale for choices made, and specify any assumptions that are not described.

Comment: For model calibration, the Service compared the results from HexSim simulations at year 50 to observed numbers of owls in the eight demographic study areas, and the results compared reasonably well for all modeling regions, except the Oregon Coast Range and Klamath regions. Can the Service tell the reader why the results for the Oregon Coast Range and Klamath regions did not compare well?

Response: The HexSim model is not intended for use at scales smaller than modeling regions – and it wasn’t specifically designed for small-scale evaluations. That said, the calibration that was done was an attempt to evaluate how similar simulated results were to empirical estimates to several relatively small areas (*i.e.*, relative to modeling regions) where estimates of abundance were available. Overall, the comparisons we conducted suggest that the HexSim model simulations provided reasonable approximations of NSO numbers on relatively small areas. Two important parameters, barred owl encounter rates and resource targets, are resolved at the modeling region scale; this may partially explain why the Oregon Coast and Klamath DSA numbers didn’t correspond more closely with the HexSim results for those modeling regions. It may be that at relatively small spatial scales the generality (or input parameters) doesn’t always account for what is really happening at a particular locale. When we modified the resource units needed (up or down) to improve correspondence with DSA data, we got more exaggerated (*i.e.*, contrasting) differences. It is important to recognize that the intended use of the modeling framework is for ranking scenarios, not for estimating specific numbers. Given that the model can be used to rank various reserve scenarios, while varying barred owl and habitat changes, we are fairly confident in the model’s ability to identify scenarios that are of higher and lower risk to NSOs.

Comment: The modeling of population response and viability under HexSim assumes that recruits into the population become co-owners of their mother’s territories, yet most owls are recruited into the population in different areas after extensive dispersal over several months and sometimes years. To what extent are these assumptions valid, and how would lack of validity potentially affect the results of the modeling process?

**Response:** The reviewers are correct in their statement regarding co-ownership of the mother's territory by recruits. However, the recruits only co-own the mother's territory for a short period of time until they are forced to become floaters. This portion of the simulation is an attempt to mimic how real owls behave. Fledged owls stay on their natal territory until late summer/early fall and then begin dispersal. In the simulation this also happens in the same year the recruit was born (as it does for real owls). Floaters then search for appropriate places to settle (within 250 km). It appears that the reviewers assumed that recruits shared their mother's territory for a longer period of time than exists in our simulations. We will clarify the timing of dispersal in the final Appendix C.

**Comment:** An "exclusion layer" was used to prevent owls from migrating beyond their range. Was this implemented in a way that would avoid bias? Owls do not normally check their official range maps before dispersing. The model needs to account for the population "sink" that likely exists at the forested edges of the species range.

**Response:** The spatial extent of our models encompasses the contemporary range of the subspecies, including the forested edges of the range and extensive areas no longer occupied by spotted owls due to timber harvest. We used an 'exclusion layer' to prevent simulated spotted owls from moving into areas of entirely unsuitable habitat where surveys and research results indicate they are not found. Because the range of the spotted owl is largely defined by habitat and climate conditions unsuitable for occupancy, it is unlikely that the use of an exclusion layer introduces 'bias' into the model results.

**Comment:** It seems unrealistic to start with 10,000 female birds equally distributed among age classes.

**Response:** The initial population is not intended to be realistic; it simply provides a broad population base to equilibrate with the simulated environment that is provided to HexSim. Were we to start with a smaller initial population size, we would run the risk that spotted owls would be absent from some portions of the landscape simply because they never had a chance to get there. That was the reason for starting with a large initial population size. As described on page C-65, this process takes 25-50 time steps (years); after which the simulated owl populations may be considered to be more 'realistic'.

**Comment:** When data about barred owl habitat suitability, resource use, and demographics become available, we hope the HexSim should be adapted for use as a two-species model that could more accurately represent the competitive interactions of both spotted owls and barred owls.

**Response:** Making the barred owl a spatially explicit stressor in the HexSim model would constitute a substantial improvement. However, as noted in the comment, this would require barred owl habitat models for the entire range of the spotted owl, as well as data on movements and demographic rates. These data do not exist, and for the majority of the spotted owl's range are unlikely to become available in the foreseeable future.

**Comment:** We are unclear what the effects of the assumption that area outside reserves are reduced to RHS <35. The sensitivity of this assumption should be tested and explored.

**Response:** Reduction of RHS outside of conservation networks to <35 did not represent an assumption; it was simply a scenario developed to show the response of simulated spotted owl

populations to a situation where high-quality habitat existed only within conservation networks (*i.e.* a high degree of reliance on reserves). This is intended to be a simulation, not a representation of future reality.

Comment: It is unclear if spotted owl population decline in rounds 2 and 3 (Figure C19) are mostly caused by the “burn in” period, or something else.

Response: As described in detail on page C-65, the “burn in” period simply denotes the period of transitory dynamics that occurs while the initial population equilibrates with the simulated environment. This period is not included in the estimation of population change.

Comment: The model may be sensitive to assumptions about the effects of fire, logging, edge effects, weather, barred owls, etc. on spotted owls and their prey, as well as assumptions about the likelihood of events like stand replacing wildfire, logging, and barred owl population expansion or control. The model’s sensitivity to these assumptions should be tested and documented. The model should be designed so that these assumptions and their use within the model are clearly disclosed and can be corrected and refined over time.

We are concerned that the effects of logging are far more adverse than assumed in the model.

Response: Development of the HexSim Spotted Owl Scenario was not based on assumptions about the likelihood of events like stand replacing wildfire, logging, and barred owl population expansion or control. Its purpose is to simulate spotted owl population response to a variety of simulated environmental conditions such as barred owl abundance, habitat, and climate. The probability and magnitude of changes in habitat suitability caused by stand-replacing fire, logging, etc. and the degree to which the RHS models reflect these changes, is incorporated into the process of developing future habitat scenarios for evaluation in HexSim. The sensitivity testing described in this comment would more appropriately be conducted at the habitat suitability modeling stage, to determine the degree to which these changes are reflected in relative habitat suitability.

Comment: Incorporate barred owl/habitat interaction and barred owl effect on reproduction in a subset of Hexsim simulations. Recent research (Dugger *et al.* in press) documents interaction between habitat and barred owl effects, at least in portions of the NSO range. The Appendix alludes to this research [p.66], but such interactions are not incorporated in the simulations. Parameters based on Dugger *et al.* (in press) should be incorporated in the scenarios as part of sensitivity analyses. Qualitative changes in results may be expected due to such an interaction effect, which would accentuate the role of high-quality habitat in areas with high barred owl encounter rates. Recent research (*e.g.*, Crozier *et al.* 2006) also suggests that presence of barred owls may affect NSO reproduction as well as survival. Simulations should incorporate this effect.

Response: The HexSim Spotted Owl Scenario is designed to include a simulated barred owl impact on spotted owl reproduction, but that function is not used in our initial scenario. The modeling team was concerned that we did not have the data necessary to do so range-wide. Also, there was some concern that the impact of barred owls on NSO survival was already effectively lowering reproduction (dead owls cannot reproduce), so we did not want to double-count. Assuming reliable data on reproductive impacts was available, it would be easy to add this feature to our simulations. Dr. Dugger was among those who argued that sufficient range-

wide data were not available for adding a barred owl impact on NSO reproduction. Also, to make the barred owl impacts more realistic, some impact on NSO site fidelity would also have to be included. However, doing so would necessitate that barred owls were located at specific places in the landscape. A barred owl impact on site fidelity cannot be correctly simulated if NSO / BO encounters are purely probabilistic. Again, range-wide data necessary to locate barred owls on the landscape were not available.

Comment: In NSOs, temporal process variance in fecundity is much higher than in survival. Was there any attempt in the Hexsim simulations to incorporate this pronounced difference in process variance? Since population growth rate in NSOs is much more sensitive to adult survival than fecundity, demographic theory would also suggest that fecundity have a much higher process variance.

Response: Earlier versions of the HexSim Spotted Owl Scenario contained temporal process variance in fecundity (“even-odd year effect”) but it was removed because we found that that, while the additional variance in fecundity lowered the range-wide owl populations by a small amount (perhaps 100-200 owls), it did not change the shape of the trajectory at all, either range-wide or within individual modeling regions, or within DSAs. Also, because the degree of the even-odd year effect varies among DSAs and through time, it was more supportable to use mean fecundities. The deterministic nature of the process variation we added was unrealistic, and it made the results hard to understand.

Comment: As noted in the previous SCB/AOU review, currently the barred owl effect in the model is different in kind from the habitat parameterization, and is effectively non-spatial. Barred owl effects should thus be described and interpreted separately from comparison of the habitat scenarios. It is not valid to state, for example, that a scenario that reduces barred owl effect by x% performs equivalently to a reserve scenario that protects x% of habitat.

Response: We agree that the barred owl effect and RHS parameterization in HexSim are different, with the barred owl effect being incorporated in a probabilistic manner by modeling region, and thus being effectively non-spatial whereas the RHS values are spatial. The relative and comparative impacts of barred owls and habitat on simulated spotted owl populations should be carefully considered before using the scenario rankings to inform management decisions in the future. To a degree, the HexSim spotted owl scenario incorporates the barred owl effect-habitat interaction described by Dugger et al, because it allows for higher survival rates for spotted owls in high-quality territories, even in the presence of barred owls.

Comment: It is unclear how the barred owl encounter probability (Table C21) was used to set the survival value (Table C23) in the HexSim model. Pp. C-56 describes that the encounter probability is used to place each territorial spotted owl into one of two classes (barred owl present or not), but there is not enough information here for the reader to understand how the encounter probability was translated to a binary variable of barred owl presence at each time step.

Response: We will revise the barred owl effects section in Appendix C to clarify.



## Editorial comments on Appendix C

Comment: Modeling/Appendix : suggest adding a column showing the actual home range size estimate used for each modeling region (ha) instead of just the number of hexagons included (especially since it's unclear what the size of a hexagon actually is).

Response: This revision will be made in the final Appendix C.

Comment: I thought the HexSim model was not an appropriate choice for this step in the modeling process because I felt it was overly complex, too individually-based, and included variables where there was no, little, or very incomplete data, such as territory searching behavior, floater dynamics, etc. not just for spotted owls but most wildlife species. In areas where information was available, estimates were inappropriately used. For example, the estimates used for survival rates were based on temporal estimates not spatial estimates, even though they came from different study areas.

Response: Mechanistic simulation models are widely used in conservation biology and other disciplines. Unlike statistical models, mechanistic models allow researchers to evaluate how systems will respond to novel conditions. In this case, the response variables are spotted owl population size, and population distribution. The novel conditions include changing relative habitat suitability and spatial arrangement, changing reserve structures, and variable disturbance regimes such as the influence of barred owls. We selected the HexSim model for several reasons. First, it is both individual-based and spatially-explicit. These attributes are useful for simulating the dynamics of a population with limited numbers that has very specific habitat needs, and that occupies a highly heterogeneous landscape. Second, HexSim is a general modeling framework that allowed us to add as little or as much biological detail as is deemed appropriate. We have the option to simplify, or to add complexity to our spotted owl simulations based on the types of questions that emerge as the planning process evolves. Finally, the HexSim model is freely available, which means that stakeholders will have an opportunity to obtain the model on their own (at no cost) and run the simulations developed by the Service. We will employ sensitivity analysis to examine the importance of individual parameters. If less well-quantified parameters end up being influential, then those parameters can be removed from the simulation, or effort can be made to better identify their actual values. If we must retain a poorly quantified but highly influential parameter, then we can test the sensitivity of our evaluations of reserve strategy effectiveness to plausible values of the parameter in question.

This process would then be used to qualify the conclusions drawn from the simulation modeling work.

Comment: How were model outputs tested? What were results? If not yet tested, will they be tested in the future?

Response: The results of initial evaluations of HexSim model outputs are described on page C-60 to C-63. The modeling team anticipates that as additional data sets become available in the future, more evaluations of simulated population sizes may be made by the Service.

Comment: Are there plans to compare HexSim output with site demography data?

Response: The modeling team compared population sizes from HexSim to population density estimates from demographic study areas (DSAs) – and included those in Appendix C (page C-62).

Comment: How are/will barred owls be included in the analysis?

Response: The influence of barred owls on spotted owls in the HexSim Spotted Owl Scenario is described in various places on pages C-48 to C-57 and on page C-65.

Comment: What data support dispersal habitat characterization? CalFor, p7. (Pg C-zonation)  
What data support dispersal habitat characterization? Is low quality habitat being identified for protection in the name of dispersal habitat?

Response: None of the models incorporated into the modeling framework describe or rely on definitions of dispersal habitat. In HexSim, dispersing owls are not limited to specific habitat types or RHS. In simulations, dispersing owls exhibit some avoidance of low-valued hexagons (low RHS), but are allowed to use the full range of RHS across the landscape during dispersal. The modeling framework does not identify low-value habitat, or any other habitat, for protection. It provides the Service information on relative performance of spotted owl populations across a range of ecological conditions, which may be used in the development of habitat protection strategies.

Comment: Why do barred owls have little impact on NSO for first 10 years of simulation (Draft Results, page 2, slides 1, 2 “Round 1”)?

Response: This comment appears to refer to a presentation given prior to release of the draft Appendix C. The Round 1 figures in Appendix C show barred owl effects having an immediate effect after they are introduced at time step 40.

Comment: Has the Service evaluated the hypothesized “boost” to NSO performance where reserves are “appropriately” planned, per SCB/AOU June 2008 comment letter (p. 6-7)?

Response: The objective of the modeling framework is to evaluate the response of simulated spotted owl populations to a variety of habitat conservation networks and other environmental conditions. By ranking habitat conservation networks based on spotted owl population performance, both of the concepts in this comment (“appropriately planned reserves” and “spotted owl performance”) will be incorporated and assessed.

Comment: When modeling “all occupied” lands, what about lands no longer occupied?

Response: This comment appears to represent a misinterpretation of the application of the HexSim model. Use of the HexSim model is not constrained to any particular area based on occupancy status. The commenter may be referring to the “All Lands” Zonation scenarios, which similarly are not restricted to occupied or unoccupied areas.

Comment: Will scenarios be applied to entire Zonation blobs, thereby treating blobs as if of equal habitat quality?

Response: This comment represents a misunderstanding of how Zonation works, and/or how it was used in this modeling process. For this process, Zonation was used only to identify the boundaries of areas (*e.g.*, what areas of the landscape represented the top 30% of habitat value if all lands were available?). Once those boundaries were identified, Zonation did not “homogenize” them in any way. The underlying RHS values were used in HexSim for all simulations.

Comment: Barred owl encounter probabilities estimated in Forsman *et al.* (in press) for the spotted owl appear to be too low.

Disclose strong cautions of Forsman et al and Wiens *et al.* in using barred owl contact numbers.

**Response:** The modeling team used the best available information to estimate current barred owl encounter rates. While we recognize that actual encounter probabilities at the modeling region scale are uncertain, the modeling framework can be used to evaluate the effects of higher (and lower) barred owl encounter probabilities.

Comment: Adjust the Forsman et al barred owl encounter probabilities using Wiens *et al.*

**Response:** Wiens *et al.* (2011) do not provide encounter probabilities.

Comment: Most reserve scenarios appear to have the same relative risk to a 75% decline. No amount of habitat can overcome the barred owl effect in any Reserve Scenario.

Risk of extinction related almost exclusively to presence of barred owls.....It is quite clear from the results presented that the barred owl is the only significant risk identified by the model.

**Response:** We disagree with these comments and suggest that they result from misinterpretation of the results shown in Appendix C. While the barred owl certainly exerts an effect in modeling regions where encounter rates are high, comparison of the “without barred owl” scenarios illustrates large differences in spotted owl populations that are habitat related. In the North Coast Olympics, the model indicates high barred owl encounter rates act to reduce spotted owl populations in all habitat conservation reserve scenarios; this does not represent a failure of the modeling framework

Comment: It is confusing that the bold text states: “..not meant to be estimates of what will occur in the future...”. Yet the questions 1 and 2 that the modeling process was intended to address both include the term “...in the foreseeable future....” More explanation is needed here about what the modeling process can be used for relative to future predictions.

**Response:** We will improve this explanation in the final Appendix C. The statement was intended to portray the model’s primary utility in evaluating relative population response to various scenarios, rather than predicting precise population measures resulting from those scenarios.

Comment: Under the Overview of Spotted Owl Scenarios, it is not clear why was an 89 hectare polygon selected?

Modeling/Appendix C 175 –: that authors state that, “All spatial data layers are converted to grids consisting of 89-ha hexagons.” However, on pp. C-59 (Spatial Data) the authors state that, “Individual hexagons are 100 m in diameter and 86.6 ha in area.” What was the correct size of hexagonal cells, and how/why was this size selected?

**Response:** The hexagons used in the HexSim Spotted owl Scenario are 100 m in diameter and 86.6 ha in area. All references to 89 ha hexagons will be corrected in the final Appendix C. This size represented a compromise between smaller hexagons which provide better spatial resolution and allow owls to conform territories and home ranges to the shape and distribution of habitat patches (but require increased processing time) and larger hexagons which would be computationally simpler but result in more averaging of habitat conditions We felt that one kilometer wide hexagons struck a nice operational and biological compromise. There are

roughly 500,000 hexagons total. Territories are represented by 3 hexagons, and home ranges by anywhere between 14-128 hexagons, depending on modeling region.

Comment: “Lastly, for effective a durable owl protection policy the current draft plan including modeled habitat maps need both a robust independent peer review and thorough public vetting.”

Response: We provided a 30-day public comment period on Appendix C which describes the modeling framework development. As part of this comment period we solicited and received three independent scientific peer reviews and received reviews from numerous science-based organizations, all in addition to public comments received.

### **Overall recovery approach**

Comment: The draft Revised Recovery Plan states barred owls are the most important range-wide threat and that barred owls have been detected wherever spotted owl surveys have been conducted (and outside of these areas), but uses additional habitat protection to address this threat without scientific support for this approach.

Response: For spotted owls to persist, maintaining habitat remains crucial to the recovery of the spotted owl regardless whether barred owls are present or not. Given that barred owls and spotted owls are now occupying similar habitats, maintaining sufficient habitat that meets the needs of spotted owls is essential for them to persist. In addition, we are preparing to implement a barred owl removal experiment to test, in part, our ability to reduce barred owl impacts.

Comment: We request that the Service partner with Umpqua National Forest to implement the program described on p. 33 (“...a program of landscape-scale, science based adaptive restoration treatments in disturbance-prone forests that will reconcile the complementary goals of conserving and developing spotted owl habitat while better enabling forests to (a) recover from past management measures and (b) respond positively to climate change concerns.”)

Response: This is something that could be done at the local scale between the Service and the Umpqua National Forest, although the Revised Recovery Plan itself will remain broad in its description of management/science strategies.

Comment: The draft Revised Recovery Plan ignores the scientific consensus that the spotted owl’s viability is threatened by “a sharp [habitat] threshold below which populations cannot persist.” Lamberson, *et al.* (1992); see also Lande (1987, 1988), Doak (1989). (none of which were cited in the Revised Recovery Plan).

Response: We are not sure whether this reviewer is referring to a threshold of habitat or a threshold of population size, nor are we sure such a consensus exists today. The focus of the Revised Recovery Plan on retaining owl territories on the landscape and develop additional spotted owl habitat in the future shows our concern about habitat loss. These actions were designed to help slow the rate of population decline and maintain populations above such a threshold, should it exist.

Comment: Naturally regenerated mature stands that are currently approaching old growth status need to be accorded full protection.

Response: To the extent these types of stands are structurally complex as discussed in Recovery Action 32 we recommend they be maintained. To the extent these types of stands are within

occupied spotted owl sites we are recommending they should be maintained. We believe it is likely the majority of stands approaching old-growth status fit into one of these two categories and will be maintained on the landscape, and that this approach will support spotted owl recovery.

### **Reserves, protecting habitat**

**Comment:** The reserve system needs to be significantly expanded to account for barred owls which renders large areas of suitable habitat unoccupied by spotted owls. There is an urgent need for a much larger reserve system that can act as an insurance policy.

**Response:** As described earlier, the Revised Recovery Plan recommends implementing the site-specific measure of the NWFP (as amended) in addition to the other Recovery Actions in this Plan. The Service may recommend an updated habitat conservation network at a later date, informed by the modeling framework and the critical habitat process.

**Comment:** Conservation Support Areas should be mapped and added back into the Revised Recovery Plan.

**Response:** The modeling framework, subsequent critical habitat decisions, and the recommendations for non-federal lands are anticipated to provide for the needs addressed by the Conservation Support Areas, so we do not believe this is necessary in the Revised Recovery Plan.

**Comment:** Any reserve system should benefit multiple species and the Revised Recovery Plan should compare alternate spotted owl-based reserve scenarios with data on priority areas for other old-growth associated species to determine which alternatives best capture habitat for multiple species.

**Response:** The focus of the recovery plan is on northern spotted owls and will base any recommendation on what is best for the owl. However, the modeling framework provides an opportunity to the value of any recommended network on a host of late-successional or old-growth forest species.

**Comment:** Commenters recommended a reserve system for the east-side provinces, or at least a strategy to analyze the effectiveness of a no-reserve approach in these areas.

**Response:** The Revised Recovery Plan does not contain any new reserve or conservation network recommendations and continues to rely upon the NWFP, including implementation of its reserve network which includes the eastern dry provinces. However, specific dry-forest work groups (see Recovery Actions 7 and 9) are being tasked with assisting the Service in developing strategies to better address the complexities of managing northern spotted owls in these dynamic ecosystems. Also, the land management agencies continue to update and amend their land management plans to address spotted owl recovery and forest health (*e.g.*, USDA 2010).

**Comment:** Spotted owls have declined at a faster rate than expected, so as much high-quality habitat should be protected as possible.

**Response:** That is the intention of Recovery Actions 10 and 32.

Comment: The Revised Recovery Plan needs a more-inclusive definition of high-quality habitat.

Response: High quality habitat (see Glossary) includes those habitat types which have been identified as the best quality spotted owl habitat by scientific peer-reviewed science.

Comment: The Service should develop specific criteria for habitat reserves that include at least: (a) large blocks of nesting, roosting, foraging, and dispersal habitat, rather than just high quality habitat as currently modeled; (b) restoration priority areas within and among habitat blocks; (c) primary reliance on natural processes to maintain currently suitable habitat particularly in the southern range where the owl appears to be fire-adapted; (d) a spatial relationship between the habitat blocks to facilitate owl dispersal; and (e) specific owl occupancy targets for each of the reserve areas.

Response: The Revised Recovery Plan does not contain any specific reserve or conservation network recommendations. The Service will recommend a habitat conservation network at a later date, informed by the modeling information. We recommend land managers continue to implement the standards and guidelines of the Northwest Forest Plan as well as other recommendations in this Revised Recovery Plan.

Comment: Recovery Action 5 of 2008 Recovery Plan should be retained (producing the “highest amount and highest quality” owl habitat within reserves).

Response: With the addition of Recovery Action 10 and Recovery Action 32, these factors are addressed in different parts of the Revised Recovery Plan.

Comment: We recommend the use of the term “conservation network” instead of “reserve strategy.”

Response: This edit has been made.

Comment: Protecting more acres that are populated by barred owls does not increase the likelihood of successful spotted owl reproduction or address the threat from barred owls. The draft Revised Recovery Plan has nothing but vague statements and unsubstantiated hypotheses to support the recovery actions calling for protection of additional forests for spotted owls.

Response: We disagree. The extent to which spotted owls remain (sometimes undetected) on areas with high barred owl densities is unclear. While peer-reviewed publications remain few, there is evidence from ongoing research in Northern California that spotted owl will rapidly recolonize areas when barred owls are no longer present. Habitat is essential for spotted owls to persist, with or without barred owls. With a second species competing for similar habitat, providing more of that habitat may increase the ability for spotted owls to persist in the presence of barred owls.

Comment: The Service should provide credible scientific analysis to show the population trajectory for the spotted owl with and without these new proposals (protecting more forest) and with and without the influence of barred owls.

Response: The habitat modeling effort is currently conducting these analyses. While not available at this time, these will be a component of the analysis in developing critical habitat and future implementation of the recovery actions where appropriate.



Comment: With billions of dollars of resources and their associated job creation potential at stake, it is imperative that the Service ensure the proposed recovery actions would actually improve the spotted owl's ability to reproduce and survive.

Response: We have used the best scientific knowledge to develop such actions and ongoing monitoring will be used to assess the effectiveness of recovery actions.

Comment: Most contemporary science points to the principle reasons for declining spotted owl as factors other than lack of older forests.

Response: We disagree. While other factors (barred owls) have had a negative impact, the initial reason listing of the northern spotted owls was habitat loss. We continue to identify the past and current loss of habitat as two of the three primary threats to the northern spotted owl.

Comment: Most geographic provinces incorporate both moist and dry forest conditions and, hence, more than one management approach may be appropriate and needed within a single province.

Response: The draft Revised Recovery Plan acknowledges this as well as the need to address projects on a case-by-case basis.

Comment: There were several suggestions for reserve landscapes in the dry forest (*e.g.*, 30% of a landscape could be in denser forest patches that would still be fully isolated within that matrix, and 300 acres to the minimum patch size for formalized (designated) spotted owl NRF reserve blocks in dry forests).

Response: The future design of landscape management projects in the range of the spotted owl is being conducted to varying degrees by land management teams (*e.g.*, USDA 2010). These processes are being informed by several work groups and the modeling framework. They will also be informed by the forthcoming critical habitat revision process. Comments such as this one can best be addressed as a part of these landscape planning processes.

Comment: We propose using the new habitat quality maps that are being generated as part of the recovery analysis as a major basis for creating the reserved polygons, and further propose that incorporating areas that rate as a quality >49 as spotted owl NRF habitat would be an appropriate starting point for defining the core reserves in addition to current spotted owl occupancy and use data.

Response: The Revised Recovery Plan does not contain any specific reserve or conservation network recommendations. The Service may recommend a habitat conservation network at a later date, informed by the modeling information. We will consider this information during that process.

Comment: We suggest use of a zoned approach to management of spotted owl habitat in provinces such as the Klamath, with (1) nesting and roosting, (2) foraging, and (3) dispersal as the zones. The first would be most restrictive and the third most permissive of active restoration treatments.

Response: The Klamath Province Work Group has been tasked with providing management recommendations for this area. While we don't know precisely when this group will provide this direction, this comment will be forwarded to that group.

Comment: Special considerations are needed for the complex biodiverse forests of southwest Oregon and northwest California.

Response: The Klamath Province Work Group has been tasked with providing management recommendations for this area. This comment will be forwarded to that group.

Comment: The Service needs to address dispersal habitat, especially since the draft Revised Recovery Plan states it is a “stand-alone” plan that does not require support from other management plans.

Response: Dispersal habitat, as defined in USFWS (1992), identifies the minimum level of habitat conditions through which an owl could move or disperse. The Revised Recovery Plan suggests a range of habitat conditions on the landscape that can facilitate dispersal (e.g. high quality habitat under Recovery Action 32 and known sites under Recovery Action 10).

Comment: Expand habitat protection to include all spotted owl habitat, not just high-quality habitat, whether or not they are currently occupied.

Response: We need to focus protection on the habitat that is most important to spotted owls and direct efforts towards development of more of this habitat.

Comment: Sweeping recommendations such as conserving all areas of occupied, unoccupied, and potential owl habitat appear to be lacking scientific justification, especially since the Revised Recovery Plan does not present any reserve system and the modeling has not been completed. Suggest that these sweeping references be removed from the Revised Recovery Plan.

Response: Revisions have been made to clarify language. Justification for protection of known owl sites and habitat is provided in the discussions for Recovery Actions 10 and 32.

Comment: The Service should hedge its bets and do more to maximize habitat protection to address the new and significant threat from barred owls.

Response: Recovery Action 32 is specifically designed to do this.

Comment: The draft Revised Recovery Plan mentions that the four main building blocks of the revised recovery plan include assessments of the following: a) adequacy of reserves; b) adequacy of non-federal lands' contributions to recovery; c) protection of high-quality habitat and occupied habitat; and d) relations of management of fire/forest diseases in dynamic landscapes. Although various processes were described to assist with synthesizing scientific information on these topics, so far as we could determine not one of these cornerstones was completed. We recommend that these cornerstones be completed in full detail and provided for public review prior to dissemination of the final recovery plan.

Response: The Revised Recovery Plan includes recommendations to undertake all four of these assessments, some of which are already underway. However, we believe spotted owl recovery will be enhanced if many of the recovery actions are implemented immediately, and that we not wait until all recommended assessments are completed prior to issuing the Plan or initiating actions.

Comment: The draft Revised Recovery Plan presents numerous hypotheses, but falls short on describing theoretical or empirical scientific support for the hypotheses. Examples: (1) “retaining all high quality habitat (whether occupied by spotted owls or not) could ameliorate impacts of

barred owls as barred owl management options are considered and tested”; (2) accelerating structural complexity and biological diversity will benefit recovery of spotted owls; and (3) “spotted owls may have evolved with large-scale disturbance events such as wildfires”. The final Revised Recovery Plan should provide data, analyses, literature review, or other justification for such dangling hypothetical statements.

**Response:** These recommendations (e.g., retaining high quality habitat, actions to accelerate habitat development) were made based on the best available science, and with our best understanding of forest ecology, interspecific competition (e.g. barred owls), and natural disturbance regimes.

Comment: Concerning “retaining all occupied sites and unoccupied, high quality Spotted Owl habitat on all lands to the maximum extent possible”, without language that better frames the recommendation and allows for consistency among recovery actions, the Service’s recommendation becomes equivocal and may unnecessarily invite criticism regarding this issue. We suggest that the Service not make the distinction between “high quality habitat” and “Spotted Owl habitat” relative to unoccupied sites.

**Response:** Language on this issue has been modified to improve clarity regarding intent.

Comment: Concerning the statement “...within the provincial core use area...” (page 50, item 1(b)), protection should always be embedded within protections provided at the scale of the owl home range, typically expressed as the area of the provincial owl management circle. Descriptions of the core area are potentially subjective and the determination of core areas in some regions would require substantial new information. Washington Department of Fish and Wildlife comments (item 13) contain many specifics concerning this.

**Response:** Recovery Action 10 states that protection should retain habitat both within the provincial core area and within the provincial home range because numerous studies have shown that the proportion of habitat needed to support owls is greater in the core area than in the larger home range.

Comment: The second sentence in the 1<sup>st</sup> full paragraph on p. 52 should be modified to indicate that such “unoccupied” sites may continue to be used by spotted owls in the landscape.

**Response:** This section was modified to reflect this.

Comment: There is no biological reason to retain all unoccupied sites; it's a political move to reduce logging on private and non-federal lands.

**Response:** The draft Revised Recovery Plan does not recommend retaining all unoccupied sites. Instead, on an interim basis until a longer-term process is developed, the Revised Recovery Plan recommends prioritizing which occupied spotted owl sites should be retained to meet Recovery Action 10.

Comment: 50-11-40 rule (p. 41) would prohibit harvest in areas that can never meet this criterion (due to brush fields, prairies, rocky or serpentine soils, etc.).

**Response:** This is a description of what a previous conservation strategy recommended, and is not specifically included in the Revised Recovery Plan as a recommendation.

Comment: The draft Revised Recovery Plan continues to claim that spotted owls need old-growth or late-successional forest, yet spotted owls are very abundant in 2nd- and 3rd-growth coastal California forest; the Revised Recovery Plan should explain this.

Response: We agree and made this edit.

### **Inadequate regulatory mechanisms**

Comment: The draft Revised Recovery Plan suggests that actions to implement land use plans will be accompanied with plan or project-level consultation to ensure actions align with recovery plan goals. However, implementing the recovery plan on a project-by-project basis is inefficient; leads to individual team level and geographic inconsistencies in interpretation of recovery actions; and creates a higher standard at the project level.

Response: Implementation of wide-ranging recovery plans occurs on a variety of scales, including project by project. In many cases, incorporating the site-specific expertise of local experts is the most effective approach to implementing recovery actions, and differences between teams is due to real geographical differences in the species biology. At the same time, many provincial, state-wide and regional efforts are currently underway that will assist implementation of species recovery at a variety of scales.

Comment: The Revised Recovery Plan should clarify how ESA section 7 consultations should take into account short- vs. long- term effects from projects (page 32).

Response: Any action that affects a listed species, regardless of duration, magnitude or impact (beneficial vs. adverse), requires a Section 7 consultation. This includes affects to individual owls and to the population as a whole. The action agencies and the Service have been conducting consultation on actions considering short- vs. long-term effects since the listing of the spotted owl, considering the details of each action.

Comment: Commenters suggested that the Service needs to increase enforcement of the prohibition on “take” of spotted owls particularly on private lands. One commenter recommended the Service halt take of spotted owls on non-federal lands given the rate of population drop has been greater on private lands.

Response: Currently it is illegal to “take” a listed species without a Federal Incidental Take Permit or Incidental Take Statement in a section 7 consultation. Where Incidental Take Permits or Incidental Take Statements have been issued, we have analyzed the effects of that taking and deemed it would not jeopardize the species. The completion of a recovery plan does not affect this requirement or our efforts in enforcing the regulation. However, we do believe that future cooperative efforts with the States, as described in the Revised Recovery Plan, will result in improved guidance to non-federal landowners, better enabling them to meet the legal standards of the ESA.

Comment: Commenters suggested we provide an explanation of the role of the Service in administering the take avoidance provision of the Federal ESA and conduct an evaluation of the adequacy of this to avoid incidental take relative to the recovery objectives of this recovery plan. This was considered more appropriate than an evaluation of State Forest practices rules.

Response: The recovery actions in the Revised Recovery Plan, working with the three States to evaluate the recovery contribution from non-federal spotted owls, will provide the foundation for

any subsequent evaluations of both future management of spotted owl sites and future regulatory approaches to working with non-federal landowners who manage these sites.

Comment: Two commenters recommend we add a recovery action stating that the Service would provide specific formal requirements for avoiding take, and one included financial support for landowners, when possible.

Response: The evaluation of whether an action “takes” as spotted owl is often dependent on the site-specific context of a particular spotted owl site. The Service often provides land managers with technical assistance on how to best minimize or avoid the potential for take of spotted owls. This information is best coupled with the site-specific and project specific information provided by the landowner.

### **Non-federal regulatory mechanisms**

Comment: The Service should provide guidance on management of non-federal lands.

Response: Recovery Actions 18 through 22 are the necessary first step in a cooperative process to provide guidance to non-federal land managers.

Comment: Pierce *et al.* (2005) should be included.

Response: Pierce *et al.* (2005) is one of many documents the WA Forest Practices Board’s Northern Spotted Owl Policy Working Group considered in making its recommendations to the Board in February 2010. We have reviewed Pierce *et al.* (2005) and have considered it in the modeling framework and Revised Recovery Plan.

Comment: Delegating the task of resolving the issue of inadequate regulatory mechanisms on State and private timberlands to a working group is extremely problematic. This approach causes the Service to not develop specific non-federal recovery actions, deprives the public of the right to comment on these actions, and prevents the Service and the public from evaluating whether best available science was used.

Response: We believe a topic-specific work group or other cooperative effort with the States is an effective and efficient method to address a wide variety of recovery needs of the spotted owl. The work groups that have operated to date have been extremely effective at cooperatively developing approaches to spotted owl recovery. In addition, we anticipate that any future management direction resulting from this sort of work group effort would go through the appropriate public comment processes.

Comment: The Service should address better the inadequacies of existing regulations at the state level.

Response: Recovery Actions 18-21 address regulatory mechanisms in each of the three states where spotted owls are found.

Comment: The draft Revised Recovery Plan discredits existing non-federal contributions by failing to connect the dots and does not address the criticism from peer review comments calling for further analysis and explanation of other Federal habitat reserve allocations and non-federal contributions.

Response: We do not believe the Revised Recovery Plan in any way discredits existing non-federal land contributions. The Revised Recovery Plan emphasizes the potential role that these lands might play in recovery, especially in areas lacking Federal ownership. The habitat network modeling effort evaluating all ownerships should assist in determining where non-federal lands could provide important contributions to recovery.

Comment: The draft Revised Recovery Plan cannot qualify as a recovery plan because it lacks measures for addressing inadequate regulatory mechanisms on non-federal lands.

Response: Recovery Actions 18-21 provide measures for addressing potentially inadequate regulatory measures, as defined in the ESA.

Comment: We recommend the following language (p. 62) "Draft Recovery Action 17: The Service recommends the Washington State Forest Practices Board use the modeling information, when complete, and the final recovery plan to inform the process it currently has underway to identify areas on non-federal lands in Washington that can make strategic contributions to spotted owl conservation over time. The Service encourages timely completion of the Washington State Forest Practices Board's effort and will be available to assist as necessary."

Response: Recovery Action 18 (revision of draft Recovery Action 17) has been revised to be better tailored to the State of Washington forest practices rules and spotted owl management infrastructure. The current version of this Recovery Action includes much of this language.

Comment: Draft Recovery Action 17 recommends that the Washington State Forest Practices Board should evaluate the recovery contribution from spotted owl sites on all private lands and design specific protections for those site centers, including sites where protocol surveys have not indicated occupancy by spotted owls for more than 3 years. The presumed need for this action has not been supported by any formal analysis. For example, surveys by NCASI and an ongoing telemetry study have discovered that barred owls now occupy nearly all spotted owl sites on non-federal lands in the southern parts of Washington. Retaining extant habitat and increasing protections on non-federal lands therefore seem unlikely to have any measurable benefit to spotted owl conservation and recovery, unless barred owls are first removed across extensive areas.

Response: The available information on spotted owls suggests that known spotted owl sites may now be vacant due to barred owls or sites are occupied but appear vacant due to behavioral effects of barred owls on spotted owls. If sites are occupied, habitat protection is still warranted. If sites are vacant, and the habitat is removed, control of barred owls will do little to benefit spotted owls as the habitat will be gone for decades to come. Therefore, protection of key habitat and even apparently unoccupied sites may be warranted in the interim while potential barred owl control is considered.

Comment: Draft Recovery Action 17 gives far too little credit to Washington State and the landowners who have been severely impacted by restrictions on their management activities due to the spotted owl. We suggest the Revised Recovery Plan allows the ongoing process to



proceed rather than suggesting new directions or regulatory restrictions to the Washington State Forest Practices Board.

**Response:** We recognize and appreciate the efforts of many landowners in Washington State, as well as the cooperative Timber, Fish, and Wildlife forum that allow issues such as this to be discussed cooperatively and brought to the Forest Practice Board in a collaborative way. We agree that this collaboration should be utilized in the conduct of a statewide analysis to determine what efforts may be appropriate and how to best apply those efforts to achieve conservation of the spotted owl without undue hardships to non-federal landowners. We believe where additional efforts are needed incentives should be considered, as regulatory restrictions alone may not meet the needs of landowners or of the spotted owl.

**Comment:** We believe draft Recovery Action 17 should be reworded to "encourage the Washington State Forest Practices Board to complete the process it currently has underway to identify areas on non-federal lands in Washington that can make strategic contributions to spotted owl conservation over time. Following this evaluation and completion of the Service's modeling efforts; the Service will work with the Board and other interested stakeholders to provide specific recommendations of how to best address spotted owl conservations needs on Washington's non-federal lands."

**Response:** Recovery Action 18, a revision of draft Recovery Action 17, includes some of this language and concept.

**Comment:** The Service should improve protections on non-federal lands in Washington and Oregon. In Washington, more than 40% of the owl's historical range receives no protection for owls. HCPs in key habitat linkages, like Washington's central Cascades authorize take for two-thirds of owls in the first 20 years and the remaining owls after 20 years, and HCPs have facilitated owl habitat logging around nest sites that are critical to owl recovery.

**Response:** The commenter is correct that significant portions of the species range receive little protection under the forest practice rules. These areas have generally received little emphasis for owl conservation in the past due to low densities of known sites and significant distance from owl clusters. Yet, these areas are still protected by section 9 take practices of the ESA, if owls are present. We agree that these areas should be included in a statewide analysis to determine which areas are most important. With declining populations, all remaining sites and high quality habitat areas are becoming more important than they were in the past. An analysis should address this changing baseline and priorities. Therefore, the Service has been recommending a cooperative effort with both the states of Washington and Oregon to conduct evaluations of the contribution to recovery from spotted owls on non-federal lands. These evaluations are expected to inform future approaches to managing these lands, particularly where non-federal spotted owl sites are necessary for spotted owl recovery. Until these evaluations have been completed, however, it is pre-mature to make specific recommendations about spotted owl site protections in specific areas beyond our recommendations captured in Recovery Actions 10 and 32.

In Washington State, two HCPs were completed that involved significant numbers of spotted owl sites: the Plum Creek Cascades HCP and the State Lands HCP. Together, these addressed a significant portion of the sites which overlapped onto non-federal lands. In both HCPs, the spotted owl sites were prioritized and conservation was applied where it was most needed. For instance, in the Plum Creek HCP (which occurred almost exclusively within Spotted Owl Special Emphasis Areas), we analyzed sites and prioritized them based on whether they were territorial

singles, had been vacant for a long time, were reproductive and active, amount of Federal land, and so forth. For high priority sites where Plum Creek owned key pieces of habitat, we established deferrals to further aid these owls in the first 20 years. Under that HCP, a majority of the harvest that would occur in owl habitat was expected to occur in the first 20 years. In other words, during the first 20 years we anticipated a slight decrease in the amount of owl habitat, followed by increasing amounts in subsequent years. The HCP is based upon dynamic amounts of nesting habitat as well as foraging and dispersal habitat over time. We did not authorize take for “two-thirds of the owls” in the first 20 years. We anticipated and continue to anticipate that habitat amounts inside owl circles would fluctuate, but that the HCP would result in very few cases where the sites would become vacant due to Plum Creek’s activities. The effect of the HCP on owls has actually been even less than anticipated, due to reduced harvest levels, voluntary conservation by the permittee, land exchanges, and other factors. The actual implementation and effects to spotted owls are documented in the annual reports which are approved by the Service. That HCP is now only about half of its original size due to a combination of land exchanges and conservation sales, and harvest levels now and in the near future are expected to remain at very low levels.

Regarding the Washington DNR State Lands HCP, a list of sites was prepared and a commitment made to protect those sites for the first 10 years to aid in transition to the landscape based approach, similar to the situation with Plum Creek. The State Lands HCP owl strategy was developed by a science team that analyzed the needs of owls in the context of the Northwest Forest Plan. The science team did not develop its recommendations based upon the location of SOSEAs, but later analysis showed a considerable overlap between DNR HCP owl management areas and SOSEAs, even though they were developed independently. The Service continues to work with our permittees to monitor spotted owl sites and evaluate when changes in conservation strategies may be needed.

**Comment:** Commenters recommended that the Service consider the WDFW report on non-federal land habitat loss in the Revised Recovery Plan.

**Response:** When the statewide assessment is conducted, we expect all of the best available science to be considered, including this document. The Service will work with each of the three states to assess the contribution of non-federal lands. The above suggestion will likely be part of that effort subsequent to the Revised Recovery Plan.

**Comment:** We recommend including in the Revised Recovery Plan that the Service is conducting scoping on an additional HCP involving an additional incidental take permit with the Washington State Department of Fish and Wildlife (draft Revised Recovery Plan page 98).

**Response:** While we recognize the desire of the State of Washington to enter into this HCP, it is not appropriate to include it in the Revised Recovery Plan. The Plan is written to address management issues and needs at both a wide-ranging scale (such as the development of landowner incentives), as well as at the more site specific areas, such as RA 10, RA 32 and many of the active management recovery actions. HCPs or SHAs cited in the plan are as examples only. If the HCP were to be completed, it could be used as an example but is not yet ripe to do so while it is in its scoping phase.

**Comment:** The Washington Forest Practices Act has demonstrated with the latest set of consensus recommendations from the NSO Policy Working Group that we continue to work

towards innovative ways non-federal landowners can participate in owl conservation in addition to protecting owls through our robust State regulatory system. We would like the Service to encourage non-federal landowners to continue down this path, rather than be driven back in time through overreaching and unsupported recommendations that are out of step with the science.

**Response:** We, too, encourage collaborative ways to participate in spotted owl conservation. We intend to avoid unsupported recommendations and do not believe our current recommendations in the Revised Recovery Plan are overreaching, unsupported, or out of step with science.

**Comment:** The complementary contributions from non-federal lands are not properly analyzed (e.g., Washington State contributes an additional 3 million acres of non-federal forestlands in the form of Habitat Conservation Plans, Safe Harbors, land exchanges and its state Forest Practices Rule, with special landscape set-asides known as Spotted Owl Special Emphasis Areas; more than 730,000 acres of non-federal habitat in streamside buffers resulting from the 1999 Forests & Fish Law.).

**Response:** This analysis may be incorporated as part of Recovery Action 18, which recommends describing working with Washington State to evaluate the recovery contribution from spotted owl sites on all private lands and design specific protections for those site centers, if the State and the Service believe it to be the most beneficial method of implementing this recovery action.

**Comment:** Commenters stated that the failure to make the connection between federally-approved HCPs, State Forest Practice rules, and other agreements discredits these actions and undermines any interest by landowners to develop these voluntary measures in the future.

**Response:** We are unsure about the commenter's remarks on making connections, as each of these efforts was developed somewhat independently of the others. We recognize that together, these efforts make significant contributions toward recovery of the spotted owl in Washington State. We believe we do provide the deserved credit regarding the levels of owl conservation these plans are providing. HCPs and similar agreements with landowners provide those landowners with assurances. Those assurances and the way the Service works with the landowners in implementing these agreements provide incentives to remain in such agreements.

**Comment:** Extend draft Recovery Action 17 to all non-federal lands, not just Washington because draft Recovery Action 18 is completely inadequate for Oregon.

**Response:** Recovery Action 18, as with all recovery actions, is a recommendation and does not require or mandate actions. Each State has their own regulations and we intend to work with each state to achieve spotted owl recovery goals utilizing their regulations, and the processes needed to amend them where appropriate. We believe that the Recovery Action 19, specific to Oregon, does allow us to address the protection of spotted owl sites.

**Comment:** The agency lead for draft Recovery Actions 18 and 19 should be the Service, not Oregon Department of Forestry. The Oregon Department of Forestry is not the lead agency for spotted owl recovery efforts on non-federal lands.

**Response:** The Service considers Recovery Action 19 (a combination of draft Recovery Actions 18 and 19) to be cooperative efforts between the Oregon Department of Forestry and the Service, and other interested parties. As the State Agency is the leading authority on their lands, we believe it is appropriate that they are the lead agency.

Comment: No Federal spotted owl regulation should include private property. Private property is regulated under the Oregon Forest Practices Act.

Response: A recovery plan is not a regulation. The Revised Recovery Plan describes the actions needed to recover the spotted owl. Certain aspects of the ESA apply to private lands (*e.g.*, Section 9). However, the Service works hard to identify nonregulatory and voluntary measures to address recovery needs, and the Revised Recovery Plan has many such recommendations. If necessary, any future regulatory changes that affect non-federal landowners should occur as a result of a State-led collaborative process that involves affected stakeholders.

Comment: The draft Revised Recovery Plan and critical habitat should include the Elliott State Forest, Oregon.

Response: All potentially-suitable habitat areas are being considered in the Revised Recovery Plan. Decisions regarding critical habitat will be made through a critical habitat designation process, not the Revised Recovery Plan.

Comment: Identify a clear role for non-federal lands in the recovery of the northern spotted owl, including the Elliott, Tillamook, Clatsop and Santiam State Forests managed by the State of Oregon, and large industrial timberland holdings spread across the owl's range.

Response: As described in Recovery Action 19, we will further clarify the roles of non-federal lands after additional scientific evaluation of the potential of these lands to support spotted owl recovery, and as part of discussions with the Oregon Department of Forestry, the Oregon Division of State Lands, and other knowledgeable partners.

Comment: We encourage strong action by the Service in Oregon, or else this present situation is a prescription for elimination of spotted owl nesting on non-federal lands in Oregon.

Response: We recommend a cooperative approach with the State of Oregon to address spotted owl habitat needs on non-federal lands. As a result of these cooperative efforts, we anticipate developing specific recommendations of how best to address spotted owl conservation needs on Oregon's non-federal lands.

Comment: The draft Revised Recovery Plan assumes that the Oregon Department of Forestry's action of protecting 70-acre cores around occupied owl-pair sites is insufficient. Under that assumption, one probably could also include the 100-acre LSRs identified within the Northwest Forest Plan, which were intended to provide owl core areas over time. In neither situation have surveys or formal analyses actually determined the short- or long-term contributions to spotted owl conservation. Plan should recommend adaptive management research on this topic.

Response: The language in the Revised Recovery Plan does not assume that the 70-acre cores are insufficient. The Revised Recovery Plan does recommend that the Oregon Department of Forestry review their interim spotted owl resource site protection rules and update them as needed, as well as for them to identify any research needed to further evaluate the protection levels, as called for under existing Oregon Administrative Rules. The Northwest Forest Plan 100-acre owl cores were not created to support current owl populations and were not considered sufficient by themselves to maintain spotted owl sites.

Comment: The draft seems to imply that the Oregon Forest Practices Act is the primary mechanism by which the ESA is administered in Oregon. However, the protection goal of the Oregon Forest Practices Act for northern spotted owl sites is to ensure that forest practices do not lead to resource site destruction, abandonment or reduced productivity (OAR 629-665-0010(1)). The Oregon Forest Practices Act defines an active spotted owl resource site as the nesting site (or activity center) of a pair of adult spotted owls (OAR 629-6650210(2)). Compliance with Oregon Forest Practices Act rules is not intended to be equivalent to protection under the Endangered Species Act. This distinction is specified in rule and communicated to landowners, operators and timber owners with harvest operations in the vicinity of spotted owl resource sites (OAR 629665-0210(4)). Coordination with the Service is encouraged where harvest operations coincide with known specified resource sites also protected under the ESA. Adequacy of the FPA must be judged in terms of the goals for which it was designed not for implementation and effectiveness of the ESA.

**Response:** Recovery Action 20 in the Revised Recovery Plan specifically addresses the need for an evaluation of the Oregon Forest Practices Act and subsequently working with the state of Oregon to address the outcome of this evaluation. We believe this recommended process will adequately address the concerns raised in this comment.

Comment: Revise draft Recovery Action 18 to read "The Service will lead a process in cooperation with ODF in reviewing the habitat modeling rules, processes and results and overlay these results with existing Federal and non-federal ownership patterns. This exercise will be the basis for draft Recovery Action 19."

**Response:** Because the suggested wording eliminates desired details including addressing the potential recovery role of non-federal lands in Oregon and working with the State to potentially make changes to the forest practices regulations, we have not adopted this change.

Comment: Revise draft Recovery Action 19 to provide specific recommendations of how best to address spotted owl conservation needs in Oregon.

**Response:** We have revised the text in Recovery Action 19 to have one, combined Recovery Action on this issue for the State of Oregon.

Comment: On the bottom of page 62, delete the sentence "Furthermore, due to issues related to confidentiality the Department of Forestry has been reluctant to share harvest locations..." and replace it with language indicating that the Service will work with the Oregon Department of Forestry to receive monthly summaries of forest operations.

**Response:** We have edited the recovery plan to reflect this recommendation.

### **Habitat Conservation Plans, Safe Harbor Agreements**

Comment: Commenters stated that non-federal land contributions to spotted owls was not properly analyzed, in particular related to federally-endorsed plans (HCPs, Safe Harbors, etc.), State Forest Practices Rules, and other contributions. One suggested that the draft Revised Recovery Plan was overly directive and prescriptive.

**Response:** The analyses and cooperative processes recommended in the Revised Recovery Plan, which will be able to incorporate the latest modeling information, should reflect the recovery

contributions gained from HCPs, Safe Harbors, etc. because of the spotted owl habitat contributions contained within them.

Comment: Concerning draft Recovery Action 14, a critical and independent look at HCPs would be helpful to identify the extent to which the Service should seek opportunities to incentivize higher standards for future or existing plans.

Response: The analyses and cooperative processes recommended in the Revised Recovery Plan, which will incorporate the latest modeling information, should reflect the recovery contributions gained from HCPs because of the spotted owl habitat contributions contained within them. This analysis will provide the best information into how those contributions have manifested themselves on the ground.

Comment: There is no indication that the recovery team investigated how HCPs are contributing—or failing to contribute—to recovery.

Response: Each individual HCP undergoes significant environmental review prior to permitting, as well as regular monitoring subsequent to permitting.

### **Barred owls**

Comment: The threat of barred owls would be better understood by the reader if it were described in more detail in Chapter II. Much has been learned about the barred owl threat since the publication of the May 2008 version of the recovery plan. However, this is not reflected in this draft revised recovery plan. We encourage the authors to substantially bolster this section.

Response: We have updated the discussion of the barred owl threat in Appendix B as reflected in the draft Revised Recovery Plan. Appendix B is the more appropriate place for detailed information on this threat.

Comment: The draft plan is silent on this basic ecological principle that inter-species competition for resources (not to be confused with predation or disease, which are often extinction threats) is rarely the cause of extinction. The draft plan provides no theoretical justification for its conclusion that competition with barred owls threatens the spotted owl's survival. Nor does the Revised Recovery Plan provide any empirical data that demonstrates barred owl are the cause of the spotted owl's negative population rate-of-change. Inter-species competition for resources is rarely the cause of extinction.

Response: The commenter cited to a conclusion from Davis (2003) that “theory and data suggest that, compared to the effects of intertrophic interactions and habitat loss, competition from introduced species is not likely to be a common cause of extinctions of long-term resident species at global, metacommunity, and even most community levels” [Emphasis added]. His work, as cited by the commenter, is a summary of past history, not a basic ecological principle. While this may be true as a general statement summarizing past extinctions, and perhaps in terms of likely “common cause” of extinction, it provides no specific information relative to this situation. The Revised Recovery Plan, and the documents on which it relies, describe the basis for the conclusion that barred owls are a significant threat to spotted owl populations through competition and (potentially) predation. The Revised Recovery Plan does not present “empirical data that demonstrates barred owls are the cause of the spotted owl's negative population rate of change” because no one has collected and published any empirical information to date. The



Revised Recovery Plan includes Recovery Action 29 in an attempt to test the effect of barred owls on spotted owl population dynamics. Gutierrez *et al.* (2004, 2007) provided a more specific evaluation of the information on barred and spotted owl competition and likely outcomes. The most plausible outcomes all lead to significant declines in spotted owl populations which would exacerbate numerous other threat mechanisms (*e.g.*, habitat loss, increased sensitivity to stochastic events).

Comment: The document repeatedly states that barred owls continue to increase, but never offers data to support this statement. Most of the information provided is specific to Washington and Oregon, with little mention of California.

Response: We have added a statement to Appendix B under the barred owl section that provides a citation that barred owls are increasing across the range, including in California.

Comment: Data on recent spotted owl and barred owl trends were provided for the Hoopa Reservation and Green Diamond Resources lands in northern California.

Response: We appreciate the information provided by the commenters and will include this information in our record as well as use this in implementation of some of the barred owl related recovery actions.

Comment: The draft Revised Recovery Plan does not fully capture the urgency of the threat from barred owls. While barred owl numbers were low in southern Oregon and northern California in the 1990's, in just the last two breeding seasons barred owl numbers appear to have increased in these areas.

Response: We believe that we have captured the urgency of the barred owl threat to spotted owls. In the draft Revised Recovery Plan we clearly stated "It is the Service's position that the threat from barred owls is extremely pressing and complex, requiring immediate consideration." (page 24) and was one of the three most pressing threats identified. We agree that there has been a sharp increase in barred owls in southern Oregon and northern California in recent years.

Comment: Early modeling shows that no matter how much habitat is set aside, the spotted owl will not recover in 10 of the 11 modeling areas without addressing the barred owl invasion. The draft plan simply underestimates the impact of the barred owl.

Response: We do not agree that the draft Revised Recovery Plan underestimates the impact of the barred owl. We identified the barred owl as one of the three primary threats to spotted owls and clearly state, "It is the Service's position that the threat from barred owls is extremely pressing and complex, requiring immediate consideration" (page 24). Recovery Action 29 will allow us to more accurately identify the effects of barred owls on spotted owl populations, including the strength of this effect.

Comment: It is important the Revised Recovery Plan expressly recognizes that the barred owl is an imminent threat to the northern spotted owl throughout its range, warranting immediate action in support of barred owl control. It is also essential the Service promptly remove any barriers to barred owl control within its authority.

Response: We agree that barred owls appear to be an imminent threat to spotted owl populations; Recovery Actions 29 and 30 represent a response to this threat. Given that no studies have yet been conducted providing specific evidence that the removing barred owls

would improve spotted owl populations, and the sensitivity and controversy over removal of a large number of a protected species (barred owls), we believe we need to conduct experiments first to establish a stronger cause and effect relationship and determine the efficacy, feasibility, cost, and scale of removal efforts prior to management of barred owls.

Comment: Page 60 Listing Factor C, Predation. The introductory sentence understates the barred owl problem while other parts of the draft Revised Recovery Plan expound on how detrimental barred owls are to spotted owl.

Response: In general, barred owls are considered a threat because of their competition with spotted owls, not specifically predation. We have only a few examples of documented spotted owl predation by barred owls. While aggressive encounters are likely part of the mechanism for barred owl effects on spotted owl populations, competition has been the most likely mechanism. Therefore, we provide the more detailed discussion under Listing Factor E, "Other natural and manmade factors."

Comment: We support the draft plan's acknowledgement of the barred owl threat as a primary threat. The draft recovery plan characterizes the barred owl threat as "extremely pressing and complex requiring immediate consideration." Yet, the Revised Recovery Plan recommends a rather academic approach to addressing the barred owl threat. The Service proposes control only after experimental studies on barred owl effects on spotted owl population dynamics and there is demonstrated feasibility for control implementation. ...This does little to address a serious problem.

Response: While we appreciate the commenter's support of our characterization that the barred owl threat is extremely pressing and complex, we disagree that the draft Revised Recovery Plan, including the barred owl removal experiments, does little to address the problem or that including an experiment is an academic approach. Control or removal programs are time and resource intensive, are not always successful, and can be extremely controversial. Before considering implementation of large scale barred owl management, we need to determine if barred owl removal would improve spotted owl population dynamics, as well as measure cost, efficacy, and efficiency of a control program. This is a focused, management-based experiment. This information will allow us to make informed decisions on future barred owl management.

Comment: The draft Revised Recovery Plan notes that data indicating negative effects of barred owls on northern spotted owls are correlational and incidental to studies on northern spotted owls. While true, it could also be stated more strongly, in that the effects of barred owls very likely are much stronger than indicated by correlational and incidental studies. New research that directly features the biology and ecology of barred owls simultaneous with data acquisition from sympatric spotted owls may illuminate the true relations between the two species.

Response: We do not have the experimental data to support or refute the statement that the effects of barred owls are likely much stronger than indicated by current studies and data. While the number of barred owls is likely underestimated on many studies, their effect may not be. Recovery Action 29 will allow us to more accurately identify the effects of barred owls on spotted owl populations, including the strength of this effect. The research described here, simultaneous studies of both species, could provide additional information on the aspects of interactions.

## **Barred Owl management or control**

Comment: The Service should address how the motivation to protect old-growth forest indirectly motivates the consideration to kill barred owls.

Response: The decision to consider removal or management of barred owl populations as a component of the Revised Recovery Plan is based on the identified threat barred owls represent to spotted owl populations, not a forest protection-based motivation.

Comment: We conclude that efforts to manage barred owls need to be done in an experimentally sound way so that the effectiveness can be properly evaluated and that barred owl control should not substitute for appropriate habitat restoration and protection.

Response: We agree. We have retained the focus on experimental removal of barred owls and continue to address habitat issues in the Revised Recovery Plan.

Comment: The Service needs to shift its primary focus from habitat to control of the barred owl. Address the barred owl by identifying control of the barred owl as the single most significant issue in recovery of the spotted owl. This means budgeting sufficient funds to control the barred owl during the period of the Revised Recovery Plan or identifying where efforts to protect the owl will be conducted and withdrawing management restrictions on private lands in other areas.

Response: We are not limited to a single focus in the recovery of the northern spotted owl. Habitat loss and barred owls are both considered serious threats to spotted owl conservation, and are, in fact, interconnected. Smaller amounts of habitat would leave spotted owls with fewer options in responding to increasing barred owl pressure and could exacerbate the effect of competition from barred owl. Long-term conservation is dependent on addressing both issues.

The Service is proceeding with a staged approach to barred owl removal, starting with experiments to confirm the effects of barred owls on spotted owls and determine the efficacy, efficiency, and cost of such removal. This information will allow us to make informed decisions on future barred owl management.

Comment: We don't think it will be possible to permanently control barred owls, so the Service should hedge its bets and do more to maximize habitat protection to address this new and significant threat.

Response: We've recommended significant increases in habitat conservation (Recovery Actions 10 and 32 across all land ownerships) in this Revised Recovery Plan while we test our ability to control the impacts of barred owls on spotted owls.

Comment: It is also essential that the Service promptly remove any barriers to barred owl control within its authority.

Response: Implementation of Recovery Action 27 should, in part, address the issue of barriers to barred owl control. However, we do still retain responsibility for regulating any removal of barred owls under the Migratory Bird Treaty Act and must ensure we follow regulations in issuing any permit. We can work on processes that meet the required regulations in a timely manner.

Comment: Provide Safe Harbor Provisions for landowners who allow control of barred owls on their lands.

Response: Safe Harbor Agreements may be one of the tools to encourage non-federal landowners to participate in barred owl removal efforts in the future, including removal experiments, if such removals are implemented. We will consider this as we move forward on barred owl recovery action implementation. These provisions would have to be completed outside the Revised Recovery Plan and could be part of implementation of Recovery Actions 28, 29, and 30.

Comment: Although California Fish and Game Code Sections 3505 and 3513 generally prohibit killing of barred owls or destruction of their nests and eggs, these prohibitions would not apply to barred owl management through Federal actions to promote spotted owl conservation under the ESA.

Response: One of the issuance criteria for SHAs, HCPs, etc., is that the Service does not authorize anything that is illegal under state and local laws. So the Service is careful when knowingly approving a SHA, HCP, or barred owl management plan that violates California state law. We are working with the State of California to come up with a solution for barred owl control per Recovery Action 22.

Comment: Cooperative agreements under California Fish and Game Code Sections 3802 and 3803 should be identified in the Revised Recovery Plan as appropriate means to achieve barred owl management in California in support of the goals of the Revised Recovery Plan.

Response: For California Fish and Game to use CAFGC sections 3802 and 3803 to allow barred owl control, they would need to make a determination that barred owls are "predatory." At this time California Fish and Game has not made that determination.

Comment: Spotted owls need generations of time to adapt to the barred owl threat. There is a very, very pressing need for areas of safe harbor for northern spotted owls, where they can live and reproduce well, from which young can disperse into the challenging landscapes beyond their natal areas. The eradication of barred owls from Late-Successional Reserves will help support this process of adaptation, by buying time for spotted owls. Further research can and should be done on barred owl/spotted owl habitat differences, but also, an aggressive program of barred owl elimination should immediately proceed (in Late-successional Reserves and other study areas).

Response: While the preponderance of evidence suggests that the barred owl range expansion represents an extremely pressing threat to the northern spotted owl, the evidence that barred owls have caused the current observed decline in spotted owl is not completely conclusive. Data indicating negative effects of barred owls on spotted owls are largely correlational and are almost exclusively gathered incidentally to data collected on spotted owls (Gutiérrez *et al.* 2004, Livezey and Fleming 2007, Forsman *et al.* in press).

However, the Service does not take the lethal removal of wildlife species lightly, and feels compelled to apply due diligence to such a management decision. Control or removal programs are very time and resource intensive, not always successful and can be very controversial. Before considering implementation of large scale barred owl management, we have proposed control experiments to scientifically assess the effects of barred owl removal on spotted owl site occupancy, reproduction, and survival as well as measure cost, efficacy, and efficiency of a

control program. This information will allow us to make informed decisions on future barred owl management.

Comment: I think more important, preliminary questions the Revised Recovery Plan should answer include: (a) whether control of barred owls is necessary (not just helpful); (b) whether barred owls should or would be killed at a geographic scale and timeframe that would ensure recovery of the spotted owl; and (c) whether the area in which spotted owls are protected and maintained for the foreseeable future should be decreased to a more manageable size.

Response: The Revised Recovery Plan describes why we have concluded that the control of barred owls may be necessary, though we have focused on starting with an experimental removal to determine the efficacy of this approach and the effects on spotted owls. Until those experiments are completed, we lack some important information to evaluate the potential geographic scale and timeframe of control should we decide to apply this at a larger scale (geographic or time). Since we have made no decision to control barred owls at any scale other than the experiment, we cannot evaluate whether any area should be increased or decreased. This will be part of the management decision process for implementation of Recovery Action 30.

### **Barred Owl Removal experiment**

Comment: Nowhere in the Revised Recovery Plan does the Service ask whether such removal studies, which are based on killing of native (non-introduced) wildlife, are justifiable ethically, or how they fit into a *long-term* strategy for the recovery of the spotted owl. The Service should address how removal studies fit into a long-term strategy for the recovery of the spotted owl and whether the Service would be willing to consider control of the 19,000 barred owls that would need to be killed in first 10 years if control were done throughout all designated spotted owl critical habitat, as estimated by Livezey.

Response: We have provided information we believe justifies the need to conduct an experiment to allow us to determine whether removal of barred owls will have the desired effect on spotted owl populations and the cost of doing so. The costs are weighed not only in monetary terms, but also in terms of societal desires and obligations, and the welfare of the animals involved. Ethics are not a mathematical formula. What is considered ethical or justified is based, in part, on the individual's value judgments and social systems. Therefore, different people will have different views of whether a proposal is ethical. This level of analysis would be beyond the scope of a recovery plan and is more appropriately addressed in the implementation of specific recovery actions; in this case, the development of the experimental removal NEPA documentation. We have already done significant work on questions of societal values and ethics, including working closely with a broad-based stakeholder group and retaining a professional ethicist to help us evaluate any and all ethical considerations for conducting such experiments. This issue will be covered in detail in the NEPA documents needed to implement the experiment and any future management application. That is the appropriate place for this discussion.

Removal studies are designed to answer specific questions on the efficacy, efficiency, and cost of removing barred owls for the benefit of spotted owl populations. Answers to these questions are essential to a thoughtful management decision on barred owl removal as a potential management tool. While we are considering this as a potential management approach, we have not concluded yet that we can or will apply this range wide, or developed any long-term strategies yet. The results of these studies will be part of the information used to determine appropriate long-term

strategies, including whether these strategies will include any barred owl removal and, if so, to what degree or scope. The potential number of barred owls that would be removed in any management strategy, and the effect of that removal on the barred owl as well as the spotted owl, will be fully addressed in the decision documents (*e.g.* NEPA) associated with any future management decision.

Comment: The “unambiguous result” quotation should be deleted. Barred owl: The oft-quoted “unambiguous result” phrase by Gutiérrez *et al.* (2007) in draft Recovery Action 28 is a misleadingly optimistic expectation of results obtainable from a barred owl removal study.

Response: While some may interpret “unambiguous” as overly optimistic description of the results of any experiment, this is the description from the quoted document. Our intent with the studies described in Recovery Action 29 (revision of draft Recovery Action 28) is to develop scientifically-credible information supporting inferences on cause and effect based on data collected specifically to address this question.

Comment: The Service should address whether control of barred owls, even for an Approach 1 removal study (Johnson *et al.* 2008), is justified when compared to other conservation-motivated control of native birds worldwide. The Service should address the globally precedent-setting nature of an Approach 1 removal study given the large number of species of wildlife that are expanding their ranges due to human alterations of habitat and climate.

Response: We are recommending this approach, starting with appropriate experimental efforts, as an appropriate response to this specific situation and conditions and have provided justification for our recommendation. We are not proposing this approach as the answer to all global issues related to the expansion of wildlife species ranges due to human activity or climate change. We are only recommending this approach as an appropriate response to this specific situation.

Comment: We think it is unnecessary to introduce an unexplained numerical value associated with a number of barred owls that might be removed (page 28).

Response: We agree and have edited this information.

### **RA 32 (Habitat protection)**

Comment: The "high-quality, unoccupied habitat" statements should be limited to Federal lands or the Revised Recovery Plan must explain that short-term and lesser impacts to occupied sites and unoccupied, high-quality, habitat on non-federal lands may be supported or approved by the Service where there are related commitments to protect and/or create a greater amount of high-quality spotted owl habitat, such as through an HCP or other agreement.

Response: The recommendations to retain occupied and high-quality habitat will provide benefits to spotted owls throughout their range, whether on Federal or non-federal land.

Comment: Draft Recovery Action 32 provides little assurance that these activities will take place. For example, many of the provisions of this activity have yet to be developed; are based on uncertain policy outcomes (*e.g.*, carbon credits) and untested Safe-Harbor Agreements that are on short time horizons relative to owl habitat needs (*e.g.*, 60 year Safe-Harbor Agreements



vs. mature forests >80 years; or depend on landowner participation in evaluating the merits of regulatory, voluntary, and financial incentives).

Response: Since the signing of the 2008 Recovery Plan the implementation of Recovery Action 32 has been approached cooperatively and has been successfully implemented across much of the range of the species. Recovery Action 32 does not include carbon credits or safe-harbor agreements.

Comment: 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.

Response: The Revised Recovery Plan recommends protection of known spotted owl sites in addition to high quality habitat. We believe the combination of these two management approaches will effectively provide for spotted owl demographic and population needs until we are able to ascertain the likelihood of reducing the impact of barred owls on spotted owls. We believe thinning or commercial harvest outside of the stands and areas identified in the Revised Recovery Plan is consistent with spotted owl recovery.

Comment: Commenters asked that we define several terms, including site, unoccupied habitat, occupied site, occupied habitat, known sites, protect, manage, and retain.

Response: Some of this language has been modified and a glossary has been added. We used definitions from a variety of sources.

Comment: Commenters recommended we define terms such as “maximum extent practicable,” “older and more structurally complex” forests, and “maintain all.”

Response: The terms “maximum extent possible” and “maintain all” has been removed from the document. We realize land managers have competing mandates that may not permit managing every structurally complex stand as we’ve recommended. Recovery Action 32 stands vary in their structure and composition across the range of the spotted owl so specific definitions of “older and more structurally complex” forest is not appropriate beyond what is already in the Revised Recovery Plan.

Comment: The Service should delete vague phrase “to the maximum extent possible” (concerning retention of high-quality habitat).

Response: We have removed this phrase.

Comment: Delete “substantially all.”

Response: We no longer include this term in the Revised Recovery Plan.

Comment: Several commenters recommended expanding draft Recovery Action 32 to include all suitable spotted owl habitat.

Response: We recommended increases in habitat protection (Recovery Actions 10 and 32 across all lands) in this Revised Recovery Plan while we evaluate our ability to manage the impacts of barred owls on spotted owls. However, Recovery Action 32 remains focused on higher quality habitat patches of structurally complex forest for the purpose of providing spotted owl refugia when displaced by barred owls. We believe it is sufficient as written as it will, in concert with the other recommendations of the Revised Recovery Plan, contribute to spotted owl recovery.

Comment: Two commenters stated that barred owls represent the primary recovery issue, and that protecting more habitat on private lands will not advance recovery of the spotted owl.

**Response:** We are proposing a barred owl removal experiment to better understand the interaction between barred owls and spotted owls and to test the efficacy of barred owl removal on the spotted owl. Until we better understand the relationship between these two species and assess our ability to reduce the impacts of the barred owl on the spotted owl, retaining as many spotted owls as possible through habitat retention is a prudent course of action, including on non-federal lands.

Comment: One commenter suggested the following revision of draft Recovery Action 32 (and includes text in support of this revision): “The Service will work collaboratively with land managers to conduct additional analysis and modeling that would test various strategies in managing high-quality habitat to promote recovery range wide or in specific recovery units. A collaborative approach will be developed to delineate high-value habitats that fall outside spotted owl reserves, but support regionally-significant, extant owl populations, and develop recovery unit-specific prescriptions for the management of these habitats. The Service will collaborate with other land managers to map high value stands and develop recovery actions for each recovery unit. The Service will develop and test other standards and approaches that address the overall intent of this recovery action.”

**Response:** Recovery action 32 was modified to reflect input from a number of commenters.

Comment: Commenters stated that the Revised Recovery Plan included no analyses or scientific basis to support draft Recovery Action 32’s recommendation to retain all high quality habitat could ameliorate effects from barred owls.

**Response:** This recommendation can be justified at several scales and is supported by the best available research. At the scale of a spotted owl territory, Dugger *et al.* (in press) found an inverse relationship between the amount of old forest within the core area and spotted owl extinction rates from territories. At the population scale, Forsman *et al.* (in press) found a positive relationship between recruitment of spotted owls into the overall population and the percent cover of spotted owl NRF habitat within study areas. Both of these studies provide scientific support for the value to spotted owls of retaining structurally complex stands on the landscape.

Comment: Concerning refugia from barred owls (Page 50, last sentence in first full paragraph; to item 4 on page 17; draft Recovery Action 32 at the bottom of page 69), this is not a logical explanation and needs to be presented more comprehensively. As written, the statement seems to imply no competition will occur in these additional protected areas, or refugia (*i.e.*, displaced Spotted Owls will go to these special places to avoid Barred Owls). The best possible realization of the strategy is that retention of more habitat will result in a greater likelihood that, for one reason or another, Spotted Owls may be able to persist with or without the presence of Barred Owls. The issue is really one of risk management, and this should be stated more clearly.

**Response:** We believe these high-quality habitat patches may provide areas where spotted owls which encounter barred owls can survive in the near-term, or where competitive pressures are reduced without necessarily establishing a territory, until pressure from the barred owl is lessened through management actions. The Revised Recovery Plan includes the retention of

occupied habitat in Recovery Action 10, which represents areas where spotted owls can reliably establish and defend territories.

Comment: Draft Recovery Action 32 assumes that spotted owls are entirely dependent upon west-side nesting habitat conditions and such nesting habitat is the key to minimizing competition with barred owls. Neither appears to be supported by data or statistical analyses. A formal, quantitative analysis would seem required to conclude there is a necessity for habitat contributions beyond those provided by Federal lands and that the Northwest Forest Plan is not working as intended.

Response: Recovery Action 32 identifies areas to increase the likelihood of survival of displaced spotted owls in the near-term. While we have extended this recommendation to the eastside of the Cascades, we realize a description of these stands varies widely. We are not able, however, to describe all the possible stand conditions at the scale of this Revised Recovery Plan. We instead rely on localized expertise and our discussion of adaptive restoration activities in the Revised Recovery Plan for guidance. It is expected to provide for refugia for those individuals who have already experienced competition with barred owls.

Comment: The Revised Recovery Plan calls for habitat protection expansion due to threat from barred owls, but barred owls have been found throughout range of spotted owl and outside range of spotted owl.

Response: The expanded habitat protection provisions of the Revised Recovery Plan are intended to retain spotted owls on the landscape and maintain their contribution to the species' demographic rates. While we believe barred owls occur throughout the spotted owl range and its range of habitats, we believe spotted owls will benefit from the retention of structurally complex forest stands when they have been displaced from their territorial areas.

Comment: In spite of draft Recovery Action 32, the Revised Recovery Plan still seems to view the barred owl and habitat as two separate elements of recovery, without explicit recognition that more habitat can help mitigate for the barred owl.

Response: We disagree. Barred owl management and habitat maintenance and retention are two needs to address the dual threats to spotted owls from interspecific competitive interactions and habitat loss. We believe Recovery Action 32 helps address the threat of barred owl competition specifically through retention of high-quality habitat stands, and Recovery Action 10 helps address this threat through retention of occupied sites.

Comment: The draft Revised Recovery Plan says that draft Recovery Action 32 may be needed only temporarily. This is risky because the barred owl threat is unlikely to ever be completely eliminated.

Response: Prior to withdrawing this recommendation in the future the Service will assess whether it is still necessary for spotted owl recovery. This assessment will likely be based on the level of impact the barred owl is exhibiting on spotted owls at that time.

Comment: Draft Recovery Action 32 should address the tradeoffs required of National Park Service in fire planning.

Response: Recovery Action 32 allows for the need to address threats to the targeted stands due to fire (and insects and disease). At the scale of this Revised Recovery Plan we believe we

included the appropriate level of specificity. Addressing National Park Service fire planning trade-offs is most effectively done at a more localized scale when National Park Service has specific project needs.

Comment: Text after draft Recovery Action 32 states "...all of the older and more structurally complex multi-layered conifer forests on Federal and non-federal lands across the range of the spotted owl" should be protected, "allowing for other threats, such as fire and insects, to be addressed by restoration management actions." The wording of this recovery action is vague enough that it has multiple interpretations. One commenter described two such interpretations.

Response: The application of specific management actions in Recovery Action 32 stands has been and will continue to be addressed by more localized teams at a variety of scales with specific stand conditions available. This interagency approach has worked well and we anticipate that it will continue to in the future, including resolving issues of interpretation.

Comment: Adaptive management regarding the barred owl should contemplate additional protection of suitable habitat as a "tool in the toolbox." Draft Recovery Action 29 calls for developing tools to better address the barred owl but it does not seem to contemplate additional habitat protection as one of those tools, even though draft Recovery Action 32 already seems to conclude that this could be an effective strategy and it does not go nearly as far as it could.

Response: We believe we have recommended sufficient "additional" habitat protection through Recovery Action 10 and the recommendation of extending Recovery Action 32 to both non-federal lands and the eastside provinces, both of which are improvements from the 2008 Recovery Plan.

Comment: Draft Recovery Actions 21, 29, and 32 regarding the barred owl should be better integrated with habitat protection.

Response: Recovery Action 21 is no longer part of the plan. Recovery Action 30 (revision of draft Recovery Action 29) and Recovery Action 32 are integrated with habitat protection.

Comment: The Service should address how it will ensure protection of all occupied and all high-quality spotted owl habitat.

Response: The Revised Recovery Plan is not a regulation, and cannot ensure habitat protection. Recovery plans are designed to provide recommendations for actions that will recover the species.

Comment: Page 25, first sentence in second complete paragraph. "Because spotted owls and barred owls compete for similar resources..." We recommend that you reword the sentence to be more explicit about the nature of the similarity. In particular, resources are similar only where barred owls occur in spotted owl habitat. Where barred owls use other forest types or conditions not used by spotted owls the resources are very different.

Response: We have edited this section.

Comment: More needs to be done to implement draft Recovery Action 26 than use of the Barred Owl Stakeholders' Group.

Response: The Barred Owl Stakeholder Group is only a portion of the outreach effort to educate the public on the threat barred owl represent for spotted owls. The description of what has been

done does not limit our efforts on this issue in the future. We have reworded to indicate that the stakeholder group is only a portion of the effort.

Comment: The last five words of the statement "...addressing a large-scale threat of one raptor on another, closely related raptor has many unknowns and has never been attempted" should be removed.

Response: We agree and have made this change.

Comment: We recommend deletion of "spotted owls can persist in portions of their range due to the partitioning of habitat use by the two species, but this may be overly optimistic."

Response: We agree and have made this change.

Comment: The draft Revised Recovery Plan states that barred owls "use, and in some cases prefer old-growth forests and older forests" and given that the northern spotted owl is utilizing more edge habitat and younger stands, the emphasis on old growth and older forests for reserves, critical habitat and recovery may in fact be enhancing barred owl dominance.

Response: We disagree. The data available to the Service suggests that barred owls have a competitive advantage over spotted owl through a wide range of habitats, including late-successional forests. While barred owls may use or prefer old-growth habitat, they are also capable of using all types of habitat used by spotted owls, plus some younger seral stages not preferred by spotted owls. Whether spotted owls are currently utilizing edge or younger habitat, in most areas they also still generally prefer, and do better demographically, where they have older forest available. We have no evidence that the presence of old-growth forest attracts barred owls or increases barred owls' competitive advantage over spotted owls. Therefore, focusing on old-growth or older forest landscapes for reserves, critical habitat, or recovery needs is still the best strategy for spotted owl recovery, and would not enhance barred owl dominance when considered under a long-term strategy.

## **Climate change**

Comment: The draft Revised Recovery Plan fails to consider potential impacts from global warming

Response: We have a section and Recovery Action 5 specific to analyzing the effects of global warming (climate change) including conducting an in-depth vulnerability assessment. We also discuss climate change in detail in the dry-forest management section and have added a new discussion of managing for spotted owl recovery in the context of the effects of climate change.

Comment: The Service should recognize that logging reduces stored-carbon pools more than fire does. Except in forests with very frequent fire regimes, efforts to store more carbon by reducing the effects of fire are likely to be counterproductive (Mitchell *et al.* 2009).

Response: Specific prescriptions or recommendations for how best to manage forests to address carbon retention are beyond the scope of this Revised Recovery Plan.

Comment: The draft Revised Recovery Plan cites Hurteau *et al.* (2008) for the proposition that thinning may reduce the risk of catastrophic carbon release through fire. However, Hurteau's

analysis is deeply flawed as it makes an unreasonable assumption that every fuel reduction treatment has a 100% chance of interacting with wildfire.

**Response:** We believe we provided an adequate caveat to the implications of Hurteau's assertion on reducing catastrophic carbon release. We noted that while the validity of the concept is not in dispute among mainstream scientists, there is significant disagreement regarding where, when, and how to implement such management measures to optimize the potential for positive outcomes.

**Comment:** The Service's interest in simultaneously considering spotted owl habitat protection and carbon sequestration for climate change amelioration is a positive step, but it will be positive only if that component addressing carbon sequestration is additive to current habitat protection (*i.e.* Northwest Forest Plan).

**Response:** The Revised Recovery Plan does recommend habitat protection in addition to that in the Northwest Forest Plan (Recovery Actions 10 and 32).

**Comment:** There is no evidence that spotted owls have moved uphill due to climate change or that spotted owls are now observed at higher elevations than expected.

**Response:** That section has been edited and this statement removed.

**Comment:** The Service should calculate projected habitat value under future climates using the Maxent models.

**Response:** Changes in climate parameters (annual and seasonal temperatures, precipitation) can easily be incorporated into scenarios for comparison. Current predictions of climate-related changes in vegetation are highly variable and likely cannot be adequately modeled at this time. The Service will incorporate, as appropriate, potential climate change impacts in long-range planning or when making major decisions affecting the spotted owl.

**Comment:** The Revised Recovery Plan should provide additional information concerning the nature and probable intensity of impacts in Pacific Northwest forests and the probability that climate change will be most profoundly experienced as major and diverse disturbances (see pp. 11-12 of comments from Jerry Franklin and Norman Johnson for specifics).

**Response:** A more detailed discussion of the nature of climate change impacts in Pacific Northwest forests and disturbance are included in Climate Change and Forest Ecosystems section.

**Comment:** Protecting and increasing habitat is an overlooked way to increase the spotted owl's resilience to climate change. Increased habitat provides options for spotted owl populations to increase, and it is axiomatic that larger populations are more resilient than smaller populations to stochastic variations such as those that may be caused by climate change.

**Response:** The Revised Recovery Plan proposes to retain more occupied sites and high-quality habitat as well as institute restorative actions inside and outside reserves where silvicultural actions can improve habitat conditions. We believe these are significant recommendations towards increasing the species' resilience to climate change.



Comment: In draft Recovery Action 33, while it may be important to identify suitable owl habitat in locations that may be less susceptible to climate change, existing suitable habitat is far more valuable than any speculative prediction of where future habitat might be “safe.”

**Response:** Nothing in draft Recovery Action 33, or the new Recovery Action 5 which replaces it, precludes the maintenance of existing spotted owl habitat.

Comment: We recommend that the Revised Recovery Plan urges the Climate Action Reserve and the California Air Resources Board (when it take official action to adopt a forest project protocol) to recognize and provide credit for carbon sequestration under any HCP regardless of when it was approved.

**Response:** The Revised Recovery Plan recognizes the compatibility of some spotted owl focused forest management and carbon sequestration. Subsequent recommendations for site-specific HCPs can be considered at a later time consistent with current Department of Interior policy on carbon sequestration.

### **Tribal Issues**

Comment: The Confederated Tribes of the Grand Ronde Community of Oregon requests a more detailed description that explicitly covers how the Service plans to address spotted owl recovery on Tribal lands.

**Response:** In coordination with numerous Tribes within the range of the spotted owl, we have added a discussion of the role Tribal lands play in spotted owl recovery and how we will enter into Government to Government consultation with the Tribes regarding spotted owl recovery activities on Tribal lands. The Grande Ronde Tribe was part of the discussions leading up to this new language.

Comment: The 2008 designations of spotted owl critical habitat did not include any tribal lands. The Revised Recovery Plan should explicitly acknowledge that neither the draft nor final spotted owl recovery plan can in any way modify spotted owl critical habitat, and any such modifications must be made through a formal rulemaking process.

**Response:** Edits were added regarding this comment.

Comment: In its current form, draft Recovery Action 10 is unacceptable. In addition, draft Recovery Action 10 requires clarification as to intent, a description of habitat capable lands, and a description of occupied sites. In addition, please substantiate this recovery action with additional scientific literature or modeling information.

**Response:** All recovery actions are recommendations. We have edited Recovery Action 10 to make it clearer and easier to implement. In addition, the Service and the Tribes will cooperatively consult on spotted owl recovery actions on a Government to Government basis consistent with applicable executive and secretarial orders, memoranda, and policies, including Executive Order 13175, “Consultation and Coordination with Indian Tribal Governments” (11/6/2000); Secretarial Order 3206, “American Indian Tribal Rights, Federal-Tribal Responsibilities, and the Endangered Species Act” (6/5/97); Presidential Memorandum (11/5/09); the U.S. Fish and Wildlife Service’s Native American Policy (6/28/94), and the Endangered Species Act.

Comment: In its current form, draft Recovery Action 32 is unacceptable. In addition, draft Recovery Action 10 requires clarification as to the definition of forests that fit this definition in both wet and dry sites, a procedural approach for describing this habitat. This approach should rely on site-specific information provided by agency biologists.

Response: All recovery actions are recommendations. The Service and the Tribes will cooperatively consult on spotted owl recovery actions on a Government to Government basis consistent with applicable executive and secretarial orders, memoranda, and policies, including Executive Order 13175, "Consultation and Coordination with Indian Tribal Governments" (11/6/2000); Secretarial Order 3206, "American Indian Tribal Rights, Federal-Tribal Responsibilities, and the Endangered Species Act" (6/5/97); Presidential Memorandum (11/5/09); the U.S. Fish and Wildlife Service's Native American Policy (6/28/94), and the Endangered Species Act.

Comment: The Revised Recovery Plan should reference the Secretarial Order ("American Indian Tribal Rights, Federal-Tribal Trust Responsibilities, and the ESA").

Response: In coordination with numerous Tribes within the range of the spotted owl, we have added a discussion of the role tribal lands play in spotted owl recovery which specifically includes this Secretarial Order.

Comment: The Revised Recovery Plan should clearly indicate that all "Indian lands" are non-federal lands.

Response: This edit was made.

Comment: The Coquille Indian Tribe demands that the Service amend the draft Revised Recovery Plan to make it applicable to Federal lands only and to expressly exclude all non-federal lands.

Response: The Service worked closely with representatives of various Tribes to address concerns raised during the public comment period.

Comment: The Revised Recovery Plan should explicitly exempt Tribes from blanket recovery actions, and exclude Tribal lands from critical habitat designations

Response: All recovery actions are recommendations. In coordination with numerous Tribes within the range of the spotted owl, we have added a discussion of the role tribal lands play in spotted owl recovery and how we will enter into Government to Government consultation with the Tribes regarding spotted owl recovery activities on Tribal lands.

Comment: Process -12: The Service knowingly excluded Tribes from all consultation and involvement in the draft Revised Recovery Plan.

Response: The Service did not purposefully exclude anyone from the details of the draft Revised Recovery Plan. In fact, we distributed a weekly update to a wide audience, including some of the Northwest Tribes, detailing our progress on the development of the draft Revised Recovery Plan and our modeling process. We also improved our outreach and coordination with interested Tribes.

Comment: “Recommendations” in recovery plans are treated by the Service as legal mandates (e.g., RA 32), which is in violation of the Administrative Procedures Act.

Response: Recovery plan recovery actions are recommendations (see p. XII of draft Revised Recovery Plan) that we believe will result in spotted owl recovery. We do not have the authority to treat recovery actions as legal mandates.

Comment: Tribes, as sovereign nations, should not be grouped together with Federal, state or private lands within public documents addressing recovery efforts of T&E species (e.g., RAs 10, 32).

Response: In coordination with numerous Tribes within the range of the spotted owl, we have added a discussion of the role Tribal lands play in spotted owl recovery and how we will enter into Government to Government consultation with the Tribes regarding spotted owl recovery activities on Tribal lands.

Comment: Tribes with significant land bases within the range of the spotted owl, will be consulted with to determine whether or not deference can be given to the Tribal management plans or if additional conservation measures might be requested. If Tribal plans are determined to be inadequate, then negotiate with the Tribes directly one-on-one.

Response: In coordination with numerous Tribes within the range of the spotted owl, we have added a discussion of the role tribal lands play in spotted owl recovery and how we will enter into Government to Government consultation with the Tribes regarding spotted owl recovery activities on Tribal lands.

## **Cost and time**

Comment: The Revised Recovery Plan should include estimates of cost and time for all recovery actions. The draft Revised Recovery Plan only included time estimates for 17 of the 34 recovery actions.

Response: We estimate 30 years for recovery if all recovery actions are completed. Time estimates for recovery action implementation vary depending on whether the activity lends itself to a process with a start and finish, as opposed to an activity that is considered to be continuous. Those where the start or end time may not be determinable we have stated that in table IV-1.

Comment: Need to include cost and time to change California Fish and Game Code concerning take of raptors (removal of barred owls).

Response: We did include the estimated cost and time to implement Recovery Action 22 in Table 2. The Service (Region 8) will pursue this with the California Department of Fish and Game.

Comment: One commenter stated that the Revised Recovery Plan should include a cost-benefit analysis while another requested an analysis of the economic effect of draft Recovery Action 32 removing stands from active management. A third commenter suggested the Revised Recovery Plan include an analysis of the costs and benefits of post-fire timber harvest.

Response: The statute does not give us the discretion to weigh whether the cost of recovery is warranted and whether such recovery actions are worth pursuing. We can only define what the actions will cost, to the best of our ability.

Comment: Funding for draft Recovery Action 29 (\$35.4 million) should be significantly increased relative to monitoring spotted owls (\$69 million).

Response: There are many uncertainties about the scale and costs of managing barred owls. We are starting the process with Recovery Action 29, (conduct experimental removal studies of barred owls), which will help inform decisions on future decisions on barred owl management. We believe the amount in the draft Revised Recovery Plan is a fair estimate of the cost. When we have more information on costs from the experiment and make a determination as to whether and how we manage barred owls, we will update the estimate.

Comment: Page 78, four assumptions at bottom of page. It would be appropriate to clarify that the cost estimates shown include certain actions that have no new costs (e.g. certain agencies or organizations are already staffed and committed to participating in some of the actions identified). Without this caveat there may be reaction to the implication that the costs are entirely new. It may be helpful to estimate costs of ongoing programs and costs associated with new initiatives.

Response: We have clarified the first point, noting that some costs are already covered.

Comment: The Revised Recovery Plan cannot just dismiss the "opportunity costs" as stated in Assumption 4. It's not an economic analysis of costs if the authors ignore the reality of opportunity costs.

Response: Costs in a recovery plan are designed to demonstrate the financial resources needed to implement the recommended recovery actions, not an analysis of other potential uses of the affected resources.

Comment: The Revised Recovery Plan must disclose costs of maintaining high-quality habitat across all ownerships. The costs cannot be concealed from the public by claiming zero dollars.

Response: The Revised Recovery Plan does not include an economic analysis, but rather an estimate of the actual cost of implementation, to the extent possible. It is difficult to determine the costs on non-federal lands because the Revised Recovery Plan is not a regulation and we cannot anticipate which landowners may choose to adopt this recommendation.

## **Population**

Comment: Need to define what a "viable" population is.

Response: We have added a definition to the glossary.

Comment: The 2008 Recovery Plan called for some clear spotted owl population targets for reserves. No similar requirement can be found in the draft Revised Recovery Plan, but it is very important and should be reinstated.

Response: Those targets were based on the sizes of the proposed MOCAs in the 2008 strategy. The Revised Recovery Plan recommends instead continued use of the NWFP reserve network and looks ahead to use of the habitat modeling framework and the critical habitat process to update the owl conservation network. This process will include an evaluation of various potential network scenarios and population viability.

Comment: The Service should address whether the rate of population decline has moderated.

Response: Text has been added to Appendix A regarding trends in rate of population decline. While we cannot directly compare rates across different meta-analyses, the overall rate of decline does not appear to have moderated in recent years.

Comment: The Service should address how long it would take, at present rate of decline, for spotted owls in the United States to be functionally extinct in the wild (like the spotted owls in British Columbia).

Response: The rate of decline generally varies more widely when populations get small. There is no specific definition of when a species reaches “functional” extinction. Therefore, it is very difficult to predict with confidence the time it would take for spotted owls to be functionally extinct given the current rate of decline.

Comment: If spotted owls in southwest Washington are functionally extinct, the Revised Recovery Plan should so state.

Response: We don’t believe spotted owls are functionally extinct in southwest Washington, or that this area is not important to conservation of spotted owls.

Comment: The Service should identify and discuss the possible factors behind the observed decline in spotted owls in the north and relative stability in the south.

Response: We added this information to the Revised Recovery Plan.

Comment: Draft Recovery Action 2 calls for monitoring at the province level, but it must also be required at the range-wide level.

Response: Recovery Action 2 doesn’t specify the province as the level of monitoring. However, if we monitor at the province level and provide a meta-analysis applicable to the full range, this could be an efficient use of monitoring resources.

Comment: The Revised Recovery Plan should include the statistical analyses supporting the decreased probability of detection of spotted owls when barred owls are present. The Revised Recovery Plan should discuss to what degree the decline in spotted owl populations is real vs. a matter of failure to detect them when barred owls are present.

Response: This information on detection probability has been developed for the implementation of Recovery Action 25 and is available at [www.fws.gov/species/nso/library&maps/documents](http://www.fws.gov/species/nso/library&maps/documents) under Dugger et. al. (2009). This information is being used to help develop more effective spotted owl survey protocols. In conducting spotted owl demographic analyses, researchers have modeled impacts of barred owl presence on detection rates. Because these models can account for annual variation in detection, observed patterns in demographic rates reflect trends in the demographic rates rather than simply reduced detection rates given barred owl presence.

Comment: The annual probability of spotted owl territories being occupied (draft Revised Recovery Plan page 108) and the status of reproducing spotted owls (draft Revised Recovery Plan page 109) cannot be relied upon due to the decreased probability of detecting spotted owls when barred owls are present.

Response: We disagree. While detection probability for spotted owls has decreased as barred owl presence has increased, the estimates of demographic rates and site occupancy are still valid.

In fact, the occupancy models used to estimate these values were specifically developed to account for the fact that the probability of detection of the species of interest is less than 100% and change over time (MacKenzie *et al.* 2006). As detection probability decreases, the confidence intervals around estimates of occupancy, survival, population growth, and recruitment tend to get larger. However, this variation is always reported with the parameter estimates.

Comment: The Service modeling team's preliminary runs clearly show that no matter how much habitat is "protected," the spotted owl population approaches zero when the influence of the barred owl is considered. Instead of proposing additional restrictions on managing spotted owl habitat, the Service should make contingency plans on how to maintain a representative sample of spotted owls if control of the barred owl population cannot be accomplished.

Response: Recovery Action 29 should allow us to determine if barred owl populations can be managed and therefore help frame the potential responses, including maintenance of representative spotted owls. We believe it is prudent to protect more habitat in the face of the barred owl threat and also to pursue the removal of barred owls by testing our ability to influence the barred owl effect on spotted owls. Given the condition of the species' population we do not believe it is necessary to pursue the maintenance of merely "a representative sample of spotted owls" at this time.

Comment: Tests of genetic bottlenecks may be plagued by false positives, and results reported in Funk *et al.* (2010) may be examples of this. It seems unlikely that any purported bottleneck was causative to any decline in populations of spotted owls.

Response: Language in the topic in "Loss of Genetic Variation" (Appendix B) has been revised to address this comment.

Comment: The draft Revised Recovery Plan contains no substantiation of mentioned loss of genetic diversity of spotted owls

Response: The draft Revised Recovery Plan includes a discussion of the loss of genetic variation under the heading "Loss of Genetic Variation" (Appendix B). We have provided as much substantiation as is available in that section.

Comment: The Service should update information concerning bottlenecks (use Funk *et al.* 2010, not the earlier review of Funk *et al.* when unpublished).

Response: We do not cite Funk *et al.* (unpublished) in the Revised Recovery Plan.

Comment: The Service has failed to include augmentation of the spotted owl population through an active breeding program as an option of the Revised Recovery Plan. Money that could be spent to shoot barred owls should be spent to augment the population of spotted owls.

Response: We do not believe an augmentation program is warranted at this time. Managing habitat conditions and the influence of barred owls is likely more beneficial to spotted owl populations than an augmentation program. Raising and releasing captive-bred spotted owls into forests with the current habitat condition and barred owl populations would likely not be successful. Augmentation programs work when there is empty habitat to repopulated and where threats have been reduced/removed before reintroduction.



## Recovery Process

Comment: The draft Revised Recovery Plan mentions in several sections that it “contains many site-specific recommendations”, yet we could find almost no such site-specificity. The final Revised Recovery Plan should include numerous site-specific recommendations and examples for each physiographic province.

Response: Recovery actions are applicable at varying scales, such as at the scale of individual trees, forest stands, watersheds, provinces, states, and the listed range, to name a few. Within each of these scales, some recommendations include place names or specific sites, such as the “Oregon Coast Range,” or a particular National Forest (*e.g.*, USDA 2010), or a state forest. Some provide recommendations at a site specific scale (*e.g.*, Recovery Actions 10 and 32, or the recommendation to continue implementing standards and guidelines of the NWFP), while others are at a broader scale or are directed as policy direction (*e.g.*, Recovery Actions 18-22).

But almost all of these recommendations can manifest themselves – directly or indirectly – as site-specific measures being applied on the ground. For example, Recovery Action 10 includes very prescriptive recommendations that should be applied at the stand level. The Dry Forest restoration discussion includes very specific recommendations (pgs. III 34-38) that should be applied at the tree/stand/watershed/province level.

However, readers should also understand that this Revised Recovery Plan is addressing the broad recovery needs of a subspecies that occurs across three states and millions of acres. An exhaustive list of geographically narrow specific prescriptions across these millions of acres would be extremely difficult to produce and would likely not contribute much to on-the-ground recovery efforts. In fact, it is more likely that recommendations that are overly specific or prescriptive could have a negative effect on recovery if they restrict the ability of managers to exercise local judgment to address site-specific conditions. We believe this Revised Recovery Plan strikes the proper balance between applying broad principles and site-specificity.

Comment: The Service should wait until modeling is completed before publishing the final Revised Recovery Plan.

Response: Appendix C of the Revised Recovery Plan includes the modeling process, which has resulted in a habitat and population modeling framework/tool which can be used for a variety of analyses and Recovery Actions.

Comment: We request that the Service, prior to final adoption of the Revised Recovery Plan, make the results of the modeling effort and the proposed habitat reserve network available and seek further public comment.

Response: In early December the Service made available to the public the most up-to-date modeling results we had, nearly two weeks prior to the close of the public comment period on December 15<sup>th</sup>. In addition, we provided an additional 30-day comment period on a revised and technically robust version of Appendix C on the modeling framework. Therefore, the public has had an opportunity to review and comment on our modeling process and results, to date. When the Service recommends a habitat conservation network, we anticipate it will be made available to the public for review and comment.

Comment: Several commenters stated that they were unable to evaluate the draft Revised Recovery Plan without the final results of the modeling effort and the reserve options or designs for a conservation network. Because modeling results are central to the recovery plan, several commenters considered the Revised Recovery Plan incomplete without a complete discussion of the modeling process.

Response: The Service provided multiple opportunities for the public to comment on Appendix C, and we believe there was a thorough and complete review of this and all portions of the Revised Recovery Plan. Public review and comment on any potential habitat conservation scenarios will also occur through the forthcoming critical habitat revision process. We have recommended the Federal agencies continue to implement the Northwest Forest Plan reserve network, along with the other recommendations in the Revised Recovery Plan.

Comment: For scientific reasons, until it has been disclosed and subjected to public and scientific scrutiny, the habitat modeling should not be used to designate critical habitat.

Response: All data and analysis utilized as part of the forthcoming critical habitat revision process will be available for public review and comment. We also provided an additional 30-day public comment period on a complete version of Appendix C which was subject to public and scientific scrutiny.

Comment: Any meaningful public input to role of non-federal landowners is foreclosed by the late invitation (October 13, 2010) of non-federal landowners into the modeling effort. Reliance on non-federal lands represents a major problem for private landowners, yet the lack of a reserve system prohibits the ability to comment on the draft Revised Recovery Plan.

Response: The Service has gone to great lengths to include a wide-variety of stakeholders in modeling discussions, and has received a great deal of input from those attending workshops and presentations, including the sharing of data. This interaction occurred prior to and after October 13, 2010. The role of non-federal landowners is not determined by the modeling, which simply predicts habitat suitability on all lands, and the response of spotted owl populations to different configurations of habitat through time. In addition, the forthcoming critical habitat revision process includes a robust public review and comment process that provides additional opportunities for non-federal landowners to participate in how the habitat modeling framework may be applied to land management decisions and potential habitat conservation networks for the spotted owl.

Comment: It is nearly impossible to review the potential effectiveness of the recovery strategies due to the draft Revised Recovery Plan being a general, vague framework.

Response: The level of specificity of this Revised Recovery Plan is proportional to the wide geographic range and complex suite of challenges facing spotted owl recovery. The document includes many prescriptive recommendations and site-specific references, but it also includes many broad recommendations concerning management principles, policy and science.

Comment: The Service needs to provide strong oversight to the working groups both by agency personnel, other professionals, and by the Science Review Committee. In particular, the Service should lead a non-federal landowners working group.

Response: All the work groups include Service personnel. We participate in or propose non-federal landowner work groups, or a cooperative effort with each state. The recommendations are largely dependent on the laws and policies of the individual states.

Comment: Objectives should have specific measurable criteria by which one can determine success

Response: In the Service's recovery planning guidance, recovery objectives are considered more general targets. Recovery criteria are required to be measurable and obtainable.

Comment: The draft Revised Recovery Plan does not include the required description of such site-specific management actions; objective, measurable criteria which, when met, would result in a determination that the species be removed from the list; and estimates of the time required and the cost to carry out those measures. The Revised Recovery Plan fails to explain how the generalized actions will achieve the Revised Recovery Plan's goals, fails to provide objective, measurable criteria, and did not properly assess the time and cost necessary (*e.g.*, time and cost to conduct recommended management measures on private lands).

Response: As explained earlier, recovery actions are applicable at varying scales, such as at the scale of individual trees, forest stands, watersheds, provinces, states, and the listed range, to name a few. Within each of these scales, some recommendations include place names or specific sites, such as the "Oregon Coast Range," or a particular National Forest (*e.g.*, USDA 2010), or a state forest. Some provide recommendations at a site specific scale (*e.g.*, Recovery Actions 10 and 32, or the recommendation to continue implementing standards and guidelines of the NWFP), while others are at a broader scale or are directed as policy direction (*e.g.*, Recovery Actions 18-22).

But almost all of these recommendations can manifest themselves – directly or indirectly – as site-specific measures being applied on the ground. For example, Recovery Action 10 includes very prescriptive recommendations that should be applied at the stand level. The Dry Forest restoration discussion includes very specific recommendations (pgs. III 34-38) that should be applied at the tree/stand/watershed/province level.

However, readers should also understand that this Revised Recovery Plan is addressing the broad recovery needs of a subspecies that occurs across three states and millions of acres. An exhaustive list of geographically narrow specific prescriptions across these millions of acres would be extremely difficult to produce and would likely not contribute much to on-the-ground recovery efforts. In fact, it is more likely that recommendations that are overly specific or prescriptive could have a negative effect on recovery if they restrict the ability of managers to exercise local judgment to address site-specific conditions. We believe this Revised Recovery Plan strikes the proper balance between applying broad principles and site-specificity.

Comment: The draft Revised Recovery Plan is premature because it should follow the completion of the 5-year status review.

**Response:** On November 24, 2010, the Service initiated a 5-year status review on the spotted owl and opened a comment period to seek input on the status of the species. To the extent appropriate, the input received in response to the initiation of the 5-year status review has been incorporated into the Revised Recovery Plan. The Revised Recovery Plan is organized to address the 5 listing factors also addressed in a 5-year status review; the public comment received on the Revised Recovery Plan will greatly facilitate finalization of the 5-year status review once the Revised Recovery Plan is done.

**Comment:** Statements on pages 21-22 of the draft Revised Recovery Plan about the delisting process and assumptions about other plans such as the Northwest Forest Plan are inappropriate and should be removed.

**Response:** This language was intended to provide sufficient context to the reader so they were aware how the Revised Recovery Plan fits in the process of species recovery and how it relates to other existing management plans/direction.

## **Appendices**

**Comment:** Habitat-249: The Service should address geographic locations and ownerships of continued habitat loss. Is this loss geographically focused (*e.g.* in the northern or southern part of the range) or equally distributed throughout the species' range? If not geographical, is it on State-owned lands rather than Federal lands? If habitat loss is occurring on Federal lands while the species continues to decline, how can this habitat alteration be justified?

**Response:** We provided a general geographic distribution of Federal habitat loss in Table B-1, which is described by physiographic province. Table B-2 shows the losses on Federal and non-federal ownership, broken out by state. Finally, Table B-3 shows the losses on non-federal lands to natural events, again by state. As Table B-2 demonstrates, habitat loss to Federal actions is very small.

**Comment:** Habitat-49: It should be made clear whether the statement "Recent landscape-level analyses in portions of the Oregon Coast and California Provinces suggest that a mosaic of late-successional habitat interspersed with other seral condition may benefit spotted owls more than large homogeneous expanses of older forests" (p. 93) refers to areas where wood rats are a major part of the prey base for spotted owls or is intended as a more general comment.

**Response:** This does apply primarily to the areas where woodrats are a major component of spotted owl diets. Most of the mosaic is also at finer level than timber harvest or other human actions. Text was edited to reflect this.