SCIENCE CONSISTENCY REVIEW REPORT— 13 May 2010

REVIEW OF:

DRAFT ENVIRONMENTAL IMPACT STATEMENT:
GIANT SEQUOIA NATIONAL MONUMENT

REVIEW ADMINISTRATOR:

Carl N. Skinner, Project Leader and Geographer, USDA Forest Service, Pacific Southwest Research Station, Redding, CA

REVIEW PANEL:

Malcolm North, Research Plant Ecologist, USDA Forest Service, Pacific Southwest Research Station, Davis, CA

Kevin L. O'Hara, Professor of Silviculture, Department of Environmental Science, Policy, and Management, University of California, Berkeley, CA

Keith M. Reynolds, Research Forester, USDA Forest Service, Pacific Northwest Research Station, Corvallis, OR

Nina S. Roberts, Associate Professor, Department of Parks, Recreation, and Tourism, San Francisco State University, CA

Scott L. Stephens, Associate Professor of Fire Science, Department of Environmental Science, Policy, and Management, University of California, Berkeley, CA

Jackson Wilson, Assistant Professor, Department of Parks, Recreation, and Tourism, San Francisco State University, CA

William J. Zielinski, Research Ecologist, USDA Forest Service, Pacific Southwest Research Station, Arcata, CA

Science Consistency Review

Giant Sequoia National Monument Plan DEIS

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PART I

Review Administrator's Summary

INTRODUCTION

At the request of Forest Supervisor Tina Terrell, a panel of scientists was brought together on April 1, 2010 to conduct a science consistency review (SCR) to evaluate the Draft Environmental Impact Statement (DEIS) for the Giant Sequoia National Monument (GSNM) Plan. This science consistency review report summarizes the SCR panel's findings.

A standardized process for the conduct of science consistency reviews (Guldin and others, 2003a, 2003b) provided a template under which the panel worked. SCR panel members were given copies of the DEIS at the SCR review meeting. At the meeting, discussions were held among the SCR panel, Tina Terrell, and the review administrator. Those discussions led to the development by the GSNM planning team of a list of specific topics and associated elements that warranted individual scrutiny by one or another of the SCR panel members. These elements represent a distillation of the crucial scientific topics addressed in the DEIS, as viewed by Terrell and the GSNM planning team. The context for that scrutiny was based on a standardized set of science consistency evaluation criteria (Guldin and others, 2003a, 2003b):

1) Is the relevant scientific information considered?
2) Is the scientific information reasonably interpreted and accurately presented?
3) Are the uncertainties associated with the scientific information acknowledged and documented?
4) Are the relevant management consequences identified and documented, including associated risks and uncertainties?

SCR panel members were asked to review and rate each element under five categories that was thought to be important by each of the above evaluation criteria. The review panel responded to each category generally and more specifically to the elements. The five categories the SCR panel was asked to were:

- Vegetation, including giant sequoias
- Fire and fuels
- Wildlife and plant habitat
- Human uses
- Use of multi-criterion decision support

The review of the use of Multi-criteria Decision Support does not fit the standard SCR format. MCDS is a process for arriving at decisions rather than scientifically developed information.

As such, the review of the MCDS process relied on a different set of criteria than the reviews of the other topics. These criteria were:

1) Is MCDS used appropriately?
2) Is MCDS used effectively?
3) Are the MCDS process and results adequately documented in appropriate planning documents?

A matrix (see Tables 1, 2, 3, 4, 5) was used to structure the review of the elements associated with each topic within the review criteria. SCR panel members were asked to rate any of the element x criterion cells in the matrix that they felt qualified to evaluate using a yes/no answer, with supplemental explanations about the rating. The matrix was not intended to be all inclusive and the reviewers were instructed to comment on other topics according to their expertise as appropriate. The Appendix to this report contains all of the original reviews from each SCR panel member submitted to the review administrator.

The reviews and ratings were conducted by each panel member individually over a subsequent four week period after the meeting, and were then forwarded to the review administrator.

Some cells of the matrix contain both yes and no evaluations, offered by different reviewers. The review administrator did not suggest one comment over the other, but included both for consideration by the GSNM technical experts that are responsible for any revision of the DEIS.

Not every cell in the matrix contains review comments. Each reviewer commented only on the portions of the DEIS for which they felt qualified. Therefore, some cells may not have received review ratings or have comments associated with them.

One final point deserves mention. Concerning wildlife issues, this SCR review panel focused on those issues chiefly associated with fur bearers relative to the DEIS. Our understanding was that the GSNM was primarily interested in review concerning fur bearers.

As envisioned in the process for the conduct of science consistency reviews, this report will be made available to the Regional Forester, the Forest Supervisor, and the technical experts responsible for preparation of the document. At this point the interim recommendation of the review panel is that science consistency has not been attained in the current DEIS. The science consistency review is not decisional, and the Regional Forester and Forest Supervisor have the authority to decide whether to undertake a revision of the DEIS and/or incorporate revisions into a Final EIS to better reflect consistency with available science. If revisions are made, major progress will be made in developing a document that is consistent with available scientific information by addressing the attached comments and especially the individual reviewer comments.

RESULTS OF THE REVIEW

General comments

Overall, review panel members judged the DEIS to be generally consistent with available scientific information with some important exceptions. The exceptions to consistency are primarily related to:

1) a general lack of citations (the link to scientific information) to support statements made in the DEIS,
2) concern that the cited scientific literature was at times outdated and the DEIS would be improved by using more recent literature,
3) lack of sufficient detail in the discussion of monitoring plans that might be used to check whether unacceptable outcomes associated with risk and uncertainty under various alternatives will occur or not,
4) lack of a clear connection or association of the scientific literature with the activities proposed to achieve the goals of the plan.

1) All reviewers noted a general lack of citations to support statements made in the DEIS. This was true even though many of the statements made were considered consistent with current science. The panel determined that citations to relevant scientific information had to be present to make a determination of 'consistent with scientific information.' There needs to be a clear trail from the scientific literature to the DEIS for the decision makers and the public.

2) The reviewers noted that the cited scientific information was at times outdated. It was further noted that recent research on giant sequoia ecology, sugar pine ecology, fire, fur bearers, and human uses undertaken within and in the vicinity of the GSNM was often not cited.

3) Several reviewers noted that, given the lack of citations, it was confusing and difficult to see how current scientific information would be used to develop monitoring plans that would help to determine the success of the plan.

4) The DEIS was not always clear as to how the literature was used to support the activities and standards and guidelines that were being proposed as a way to achieve the goals of the plan.

All reviewers suggested relevant recent scientific literature as well as potential ways to link the literature to written discussions that they thought would help improve the DEIS. The suggested scientific literature is listed at the end of this report.

Reviewers stated they believe the treatment of climate change and its potential effect on ecosystems, though brief, was generally adequate and consistent with current scientific information.

Review Tables

Table 1. Specific elements under the 'Vegetation, including Giant Sequoia' issue reviewed by the science consistency review panel. A 'YES' indicates that one or more of the reviewers found the element was consistent with available science. A 'NO' indicates that one or more of the reviewers found the element to be at least partially inconsistent with available science information for the given criterion.

Elements	**Criteria for Decision**			
	Is the relevant scientific information considered?	Is the scientific information reasonably interpreted and accurately presented?	Are the uncertainties associated with the relevant scientific information acknowledged and documented?	Are the relevant management consequences identified and documented, including associated risks and uncertainties?
1. Vegetation, Including Giant Sequoias				
1.a. Giant sequoia groves and mixed conifer ecosystems	YES [N,S] NO [O]	YES [N,S] NO [O]	YES [N] NO [O,S]	YES [N,O]
1.b. Conditions under which trees need to be cut and removed from the Monument	NO [N,O,Z]	YES [N] NO [O,Z]	NO [N,O,Z]	YES [O] NO [N,Z]
1.c. Methods for giant sequoia regeneration	YES [N,S] NO [O]	YES [N,S] NO [O]	YES [N] NO [O,S]	YES [N,O]
1.d. Forest resilience and ecological restoration	YES [S] NO [N]	YES [N,S]	YES [N] NO [S]	YES [N]
1.e. Climate change	YES [N,S]	YES [N,S]	YES [N,S]	YES [N]
1.f. Carbon sequestration	YES [N,O]	YES [N,O]	YES [N,O]	YES [N,O]

Key to the Tables (Names of Reviewers):
N – Malcolm North, O – Kevin O'Hara, KR – Keith Reynolds, NR – Nina Roberts, S – Scott Stephens, W – Jackson Wilson, Z – William Zielinski.

Table 2. Specific elements under the 'Fire and Fuels' issue reviewed by the science consistency review panel. A 'YES' indicates that one or more of the reviewers found the element was consistent with available science. A 'NO' indicates that one or more of the reviewers found the element to be at least partially inconsistent with available science information for the given criterion. A 'N/A' indicates no comments from any member of the review panel.

Elements	**Criteria for Decision**			
	Is the relevant scientific information considered?	Is the scientific information reasonably interpreted and accurately presented?	Are the uncertainties associated with the relevant scientific information acknowledged and documented?	Are the relevant management consequences identified and documented, including associated risks and uncertainties?
2. Fire and Fuels				
2.a. Fuels management and community protection	YES [S]	YES [S]	N/A	N/A
2.b. Current fuel loading	YES [S]	YES [S]	N/A	N/A
2.c. Current and future wildfire trends	NO [S]	NO [S]	N/A	N/A
2.d. Effectiveness of treatments for fuel reduction	NO [S]	NO [S]	N/A	N/A
2.e. Chances of fires spreading to Tribal lands	N/A	N/A	N/A	N/A
2.f. Smoke emissions and effects on human health	N/A	N/A	N/A	N/A

Key to the Tables (Names of Reviewers):
N – Malcolm North, O – Kevin O'Hara, KR – Keith Reynolds, NR – Nina Roberts, S – Scott Stephens, W – Jackson Wilson, Z – William Zielinski.

Table 3. Specific elements under the 'Wildlife and Plant Habitat' issue reviewed by the science consistency review panel. A 'YES' indicates that one or more of the reviewers found the element was consistent with available science. A 'NO' indicates that one or more of the reviewers found the element to be at least partially inconsistent with available science information for the given criterion. A 'N/A' indicates no comments from any member of the review panel.

Elements	**Criteria for Decision**			
	Is the relevant scientific information considered?	Is the scientific information reasonably interpreted and accurately presented?	Are the uncertainties associated with the relevant scientific information acknowledged and documented?	Are the relevant management consequences identified and documented, including associated risks and uncertainties?
3. Wildlife and Plant Habitat				
3.a. Diverse array of wildlife and their habitats	N/A	N/A	N/A	N/A
3.b. Retention old forest and associated species	NO [Z]	NO [Z]	NO [Z]	NO [Z]
3.c. Threatened and endangered species habitat requirements and availability	NO [Z]	NO [Z]	NO [Z]	NO [Z]
3.d. FS sensitive species habitat requirements and availability	N/A	N/A	N/A	N/A
3.e. Fisher habitat requirements and availability	NO [Z]	NO [Z]	NO [Z]	NO [Z]

Key to the Tables (Names of Reviewers):
N – Malcolm North, O – Kevin O'Hara, KR – Keith Reynolds, NR – Nina Roberts, S – Scott Stephens, W – Jackson Wilson, Z – William Zielinski.

Table 4. Specific elements under the 'Human Use' issue reviewed by the science consistency review panel. A 'YES' indicates that one or more of the reviewers found the element was consistent with available science. A 'NO' indicates that one or more of the reviewers found the element to be at least partially inconsistent with available science information for the given criterion.

Elements	**Criteria for Decision**			
	Is the relevant scientific information considered?	Is the scientific information reasonably interpreted and accurately presented?	Are the uncertainties associated with the relevant scientific information acknowledged and documented?	Are the relevant management consequences identified and documented, including associated risks and uncertainties?
4. Human Use				
4.a. Recreation demand analysis	NO [NR,W]	NO [NR,W]	NO [NR,W]	NO [NR,W]
4.b.Recreation opportunities	NO [NR,W]	NO [NR,W]	NO [NR,W]	NO [NR,W]
4.c. Rural community economic and population trends	NO [NR,W]	NO [NR,W]	YES [NR,W]	NO [NR,W]

Key to the Tables (Names of Reviewers):
N – Malcolm North, O – Kevin O'Hara, KR – Keith Reynolds, NR – Nina Roberts, S – Scott Stephens, W – Jackson Wilson, Z – William Zielinski.

Table 5. Specific elements under the 'Multi-criteria Decision Support' issue reviewed by the science consistency review panel. A 'YES' indicates that one or more of the reviewers found the element was consistent with available science. A 'NO' indicates that one or more of the reviewers found the element to be at least partially inconsistent with available science information for the given criterion.

Elements	**Criteria for Decision**		
	Is MCDS used appropriately?	Is MCDS used effectively?	Are the MCDS process and results adequately documented in appropriate planning documents?
5. Multi-Criteria Decision Support			
5.a. Use of MCDS	YES [KR]	YES [KR]	YES [KR]

Key to the Tables (Names of Reviewers):
N – Malcolm North, O – Kevin O'Hara, KR – Keith Reynolds, NR – Nina Roberts, S – Scott Stephens, W – Jackson Wilson, Z – William Zielinski.

SUMMARY

The science consistency review of the GSNM DEIS has not resolved all questions of whether the document is consistent with available scientific information. Upon revision of the DEIS, efforts should concentrate on several key findings.

Reviewers found many statements made in the document that, though consistent with current science, have no citations to tie them to the relevant scientific documents. Citations should be more complete and the DEIS bibliography should include all citations used to develop the text, figures, and tables of the DEIS.

Specific concerns that were raised by reviewers regarding the consistency of the DEIS with available scientific information are shown in Tables 1-5 and in each reviewer's report. A reading of each reviewer's report will provide the detail for the ratings present in the tables. Some of these problems can be quickly dispensed with by relatively straightforward editing, additions (especially citations), or revisions. However, a few of the comments are more substantive in scope and will require a more arduous response.

Finally, the science consistency review process is designed to be iterative, but decisions about editing the DEIS and subsequent review are at the discretion of the responsible official. The responsible official may discuss with the SCR panel the need for further review and comment about whether a revised DEIS is consistent with available scientific information.

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SUGGESTED LITERATURE

Each reviewer has suggested scientific literature/reports that did not appear in the DEIS bibliography. They suggest that the use of information in these documents would help to make the DEIS more consistent with currently available science. The suggested literature is summarized below and listed according to that suggested by each reviewer. The list is long largely due to the need to update the literature that the DEIS is based on.

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Science Consistency Review

Giant Sequoia National Monument Plan DEIS

PART II

Individual Reports from the Science Consistency Review Panel

Malcolm North – Vegetation, Including Giant Sequoias II-2

Kevin L. O'Hara – Vegetation, Including Giant Sequoias (Silviculture) II-8

Keith M. Reynolds – Multi-criteria Decision Support II-14

Nina S. Roberts & Jackson Wilson – Human Use II-19

Scott L. Stephens – Fire and Fuels II-39

William J. Zielinski – Wildlife Habitat II-45

Science Consistency Review Comments, Giant Sequoia National Monument DEIS

Written Statement Prepared By

Malcolm North

My focus in reviewing the DEIS was on the vegetation section and whether the information it presents helps establish the impacts of the different alternatives and is accurate and up to date.

Elements	Criteria for Decision			
	Is the relevant scientific information considered?	Is the scientific information reasonably interpreted and accurately presented?	Are the uncertainties associated with the relevant scientific information acknowledged and documented?	Are the relevant management consequences identified and documented, including associated risks and uncertainties?
1. Vegetation, Including Giant Sequoias				
1.a. Giant sequoia groves and mixed conifer ecosystems	Yes	Yes	Yes	Yes
1.b. Conditions under which trees need to be cut and removed from the Monument	No	Yes	No	Some, not all
1.c. Methods for giant sequoia regeneration	Yes	Yes	Yes	Yes
1.d. Forest resilience and ecological restoration	Some, not all	Yes	Yes	Yes
1.e. Climate change	Yes	Yes	Yes	Yes
1.f. Carbon sequestration	Yes	Yes	Yes	Yes

In general the summary of scientific information in the vegetation section is accurate. There are few citations, and 3 pages (396-398) without any. However the presented information is consistent with the state of the current science. My main concerns have to do with omissions, primarily because the preferred alternative gives forest managers discretion in applying treatments without clarifying what science they will use to make decisions on thinning intensity. If the Monument had a single mission this would not be problematic because decisions would be based on the science of fuels management, or accelerating old-growth development, or whatever that

priority mission was. However the Monument needs to at least balance the needs for fuels reduction, ecosystem restoration, and provision of wildlife habitat, among other objectives. While fuels reduction and ecosystem restoration may generally have compatible goals, with the exception of the defense zone, habitat provision for sensitive species can be at odds with these other objectives. Because of this conflict, the plan needs to clarify the science it will use to make decisions about thinning intensity, particularly since the preferred alternative has no diameter limits in most zones. I agree there is no scientific rationale for a set diameter limit. For larger trees, however, there are conflicting perspectives about the ecosystem services they may or may not be providing (i.e., high canopy cover for wildlife habitat or high canopy bulk density supporting crown fire; dense stand of large trees providing multi-layered shaded microhabitat or overstocked, moisture stressed trees with stagnant growth). What are the criteria that will be used to make large tree thinning decisions? On what science will those criteria be based?

The main section addressing this issue is on P. 407 in the paragraph that begins ""Limiting diameter of trees that can be removed from a canopy layer can reduce the chances of survival for a forest stand." The paragraph states that "Increasing inter-tree competition will result in increasing tree stress" and "…diameter growth may drop dramatically." The paragraph goes on to state that as climate changes this is likely to increase tree mortality, including mortality of large trees. This section makes the assumption that groups of large trees will respond to increased density with reduced growth and increased stress, a response that has been clearly demonstrated in scores of silvicultural studies. Most of these studies, however, are on smaller size trees and often in controlled settings (i.e., plantations where density can be directly manipulated). Will large trees in the Sierra respond the same way?

Although there are few studies on large tree competitive dynamics, there are lines of evidence to support inferences. Any increase in density will increase competition for resources and should reduce growth. However it's clear in all reconstruction studies in the Sierra Nevada that large trees have historically been clumped and this pattern existed even during past periods of extended drought. This suggests that while localized high density of large trees may decrease growth it did not necessarily increase stress. Shade-intolerant large trees are more plastic in their growth response than they are in the seedling, sapling and pole stages, and often survive for decades, if not centuries, with small radial growth increments.

Why than have large trees been dying at higher than expected rates (Smith et al. 2005)? Pest and pathogens have replaced fire as the main mortality agent in the Sierra Nevada. The vegetation section mentions the importance of pest and pathogens and correctly summarizes what we know, but it would benefit from a few paragraphs directly discussing the issue. The main element left out, particularly in the top paragraph on p.396 is the synergy between drought stress and increased bark beetle mortality. Beetle mortality is fundamentally different than fire mortality in that crowded, large trees are killed more than expected. Resilience to bark beetles may necessitate keeping stand densities low, particularly in warming, and possibly lower precipitation, conditions. There's a nice summary of this literature by Fettig et al. (2007), and supporting information on

stand density and thinning effects on tree moisture stress in Walker et al. (2006), Maloney et al. (2008) and Breshears et al. (2009).

It seems clear that increased density can increase stress. The question is what type of density? Perhaps current large tree densities in large tree groups are higher than historic levels and are stressing trees. Another possibility is that historically low-density areas or gaps surrounded clumps increasing resource availability, but that these areas are now filled with shade-tolerant trees from fire suppression. To my knowledge we don't know the answer to this question. The science would support reduced growth rates in groups of large trees but it's unclear the degree to which these groups are stressed and if stressed whether its caused by large tree density or small tree infilling from fire suppression. The distinction is potentially important because thinning large trees when they occur in groups may or may not increase forest resiliency.

Thinning larger trees often reduces canopy cover. The report accurately summarizes what we know about the importance of high light environments for regeneration of some tree species, fostering shrub patches, and increasing microclimate and habitat heterogeneity.

Thinning larger trees also affects habitat, particularly for species associated with large forest structures and high canopy cover. In the Environmental Consequences chapter of the Wildlife section the same language is repeated in the Indirect Effects analysis of the preferred alternative for many species including the northern goshawk, spotted owl, and pacific fisher: Alternative F "continue(s) existing management direction to make fuel reduction activities in the current WUIs the highest priority…short-term loss of habitat features …would likely be higher in this alternative than in the other alternatives due to the lack of diameter limits on tree cutting."

In summary, the ecological consequences of thinning large trees will likely be (among other effects) 1) increased growth rates in the large leave trees that are left; 2) reduced canopy cover providing high-light environments and great microclimate and microhabitat heterogeneity; 3) in most cases will have little impact on fire severity; and 4) reduce habitat for species associated with large trees and high canopy cover. It's clear all objectives cannot be simultaneously meet on the same patch of ground. Across a landscape, however, the right mixes of forest conditions might sustain or improve ecosystem conditions. What's lacking in the report is a clarification of the science that will be used to decide where and why large trees are thinned, and how these different treatments will help restore the forest ecosystem at the landscape level.

Other topics in the matrix:

Giant sequoia grove and mixed-conifer ecology is briefly but accurately presented.

Giant sequoia regeneration is accurately summarized and well grounded in field trials and personal observation. The summary is appropriately careful to suggest that shady, mesic conditions are needed for establishment but than as sequoias move to the sapling and pole size height growth will become more dependent on the amount of direct light. There are two nice studies suggesting

optimal light environments and gap size for giant sequoia (York et al. 2003, 2008) that might be useful to discuss and cite. The summary also suggests what may be the only viable regeneration strategy for sequoia in warming, drying climate conditions—strategic planting in wet, cool years. A concern with planting versus using natural regeneration, which is not addressed, is spacing. Most studies (Bonnicksen and Stone 1982, Stephenson 1999) suggest large sequoias grow in groups with openings between which may be important for regenerating sequoias as well as providing habitat and microclimate variability. If planting is to be used in the groves, grouping planted seedlings may be more analogous to historic/natural regeneration patterns.

Carbon sequestration is currently the subject of many scientific papers that do not all agree about carbon dynamics in fire-prone ecosystems. The reports section on C sequestration accurately summarizes the literature most relevant to the Sierra Nevada. I think acknowledging that some researchers, particularly from the Pacific Northwest, have suggested fuels reduction treatments are a net carbon loss could strengthen the section (Meigs et al. 2009, Mitchell et al. 2009). Their work is often based on studies in more mesic PNW forests with infrequent fire regimes, but it has supported reservations from some stakeholders about the efficacy of fuels treatments. The C section could note that even in the latest PNW paper (Mitchell et al. 2009), a careful reading indicates the authors believe fuels treatments may benefit carbon dynamics in the one frequent fire forest type they studied, eastern Oregon ponderosa pine. In short, the report accurately summarizes the most relevant literature but it should note there is controversy and uncertainty over the best means of carbon sequestration in fire prone systems. I would also suggest citing the concept of carbon carrying capacity (Keith et al. 2009), the potential carbon mass stored under prevailing environmental conditions and natural disturbance regimes. This approach more directly gets to the concept of how much C a particular forest ecosystem can sustainably support, since some literature (Hudiburg et al. 2009) has suggesting packing the forest with the most trees is the best means of sinking C in forests. Note that Hurteau and Vitousek 2008 should be Hurteau, Koch and Hungate 2008. I think Stephens et al. (2009) and Finkrel and Evans (2008) are worth citing as both discuss in more detail than the Hurteau and North publications about the implications of where the C goes that is removed in the fuels treatments.

The climate change section is brief in the vegetation section but does touch on what is generally agreed on and what is uncertain. The section in the Appendix provides more detail, and is accurate and up to date.

The material on forest resilience and restoration is accurate but rather than defining them seems to equate the two. This, however, is not so much a fault of the report, but due at least in part to a lack of consensus in the scientific literature on how these concepts should be defined. The report does cite the Millar et al. (2007) paper that attempts to define resilience. What would strengthen the section is some discussion that restoration does not mean a return to past conditions but an effort to make forest ecosystems more resistant to dramatic change and resilient to disturbance and climate change.

In summary the DEIS accurately presents the scientific information in all the critical areas except the conditions for thinning large trees.

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Science Consistency Review Comments, Giant Sequoia National Monument DEIS

Written Statement Prepared By

Kevin L. O'Hara, Department of Environmental Science, Policy and Management, University of California, Berkeley, CA

Silviculture/Vegetation Management

This review addresses silviculture and related vegetation management issues in the Giant Sequoia National Monument (GSNM) DEIS. My review comments directly focus on element 1. "Vegetation, Including Giant Sequoias" and more generally on the 6 underlying "sub-elements" (1a. giant sequoia groves and mixed conifer ecosystems; 1b. conditions under which trees need to be cut and removed from the Monument; 1c. methods for giant sequoia regeneration; 1d. forest resilience and ecological restoration; 1e. climate change; and 1f. carbon sequestration).

1) Has applicable and available scientific information been considered?

Giant sequoia regeneration:

A key issue for the GSNM is the regeneration of the namesake species. Size of openings or gaps is a critical element to success of shade intolerant conifers such as giant sequoia as well as sugar pine and ponderosa pine. In poorer light environments, shade tolerant conifers become more competitive. Highly applicable work on opening size and effect of opening size on growth rates has not been cited (see York et al. 2003, 2004, 2008, 2010). This work presented data on growth of Sierra Nevada conifers – including giant sequoia – in different size gaps, with increasing distance from gap edge, and of uncut mature trees on the edge of gaps. Openings greater than one acre are discussed in the DEIS but target opening sizes are not stated. Although determining appropriate gap size can be based on rules-of-thumb related to tree height, these published studies provide more empirical, scientific basis for establishing gap sizes and should be cited.

Sugar pine regeneration and management: Sugar pine is another critical species in the GSNM because it is threatened by the invasive pathogen white pine blister rust (*Cronartium ribicola*). Management of affected ecosystems should address the plight of sugar pine and the need to maintain this species and a broad genetic base for future adaptation. The DEIS notes plans to establish 5-10 percent sugar pine and places emphasis on collection of blister rust-resistant seed. The supporting science for this should include the symposium proceedings edited by Kinloch et al. (1996). This volume contains many papers related to sugar pine and blister rust in California including information on spread, management, and future outlook for sugar pine. Additionally, the more recent Samman et al. (2003) discussed issues with management of five-needle pine species susceptible to blister rust. Finally, existing stand growth models are poor predictors of

potential effects of sugar pine mortality on subsequent stand development in affected ecosystems. This is discussed for Sierra Nevada mixed-conifer ecosystems by Waring and O'Hara (2009). The DEIS discusses the importance of opening size in regenerating conifers in the Sierra Nevada. As noted above, no information is given on target gap sizes. The references cited above (York et al. 2003, 2004, 2008, 2010) also apply to sugar pine and other Sierra Nevada mixed-conifer species. Larger gaps provide conditions that allow more shade intolerant trees such as sugar pine to be more competitive. These publications also primarily focus on planted seedlings so have relevance to the use of artificial regeneration in the GSNM.

Stand density management – even-aged and multiaged stands:

A central component of silviculture is the management of stand density to affect growth rates of individual trees, avoid mortality, direct development trajectories of stands, and control stand structure. This is true for both even-aged stands, where the science of density management is more advanced, and multiaged stands. For the mixed-conifer zone, the DEIS describes a heterogeneous forest with low density and frequent canopy openings. Higher density stands would be found on north and east aspects. However, I found no quantification of prescribed density levels for any of these applications. Although I agree that the general direction of density management on the GSNM is appropriate, there should be both more specificity in describing density regimes and use of the literature to justify proposed density regimes.

Important science literature on this topic related to even-aged stands includes work by Oliver (1995, 1997) and others in the USFS Pacific Southwest Research Station. Heald and Barrett (1999) presented data from an extensive even-aged giant sequoia spacing study. Peracca and O'Hara (2008) showed development trends for young, even-aged ponderosa pine and giant sequoia in a spacing experiment. Many other spacing studies with other species also have relevance to general conifer development at different spacings. Many of these studies are cited in the papers cited in this paragraph.

For multiaged stands, or complex stands with more than one age class, there is less information available in the scientific literature that is specific to the Sierra Nevada. O'Hara and Gersonde (2004) described general approaches to multiaged stocking control. These approaches include the BDq approach which was described in more detail for the Sierra Nevada by Guldin (1991). This approach has limitations, particularly where flexibility in design of stand structures is needed (O'Hara 1998). Stand density index derived from even-aged stands can also be allocated to different age classes or canopy strata. The approach described in North et al. (2009) (which is cited, although not in the context of multiaged stand management) is based on earlier work by O'Hara et al. (2003) and generally applies to Sierra Nevada mixed-conifer forests. Although this leaf area allocation approach has yet to be developed, it can provide guidance in stocking allocations to age classes, species, or canopy strata. Additionally, it is sufficiently flexible to accommodate a variety of stand structures across the GSNM.

Oak regeneration: an important publication related to oak regeneration is McCreary's monograph published by U of California ANR (2001). This publication focuses primarily on oaks in woodlands, but also has relevance to regeneration of California black oak in mixed conifer forests. McCreary (1989) and McCreary and George (2005) may also be useful.

Carbon sequestration: Carbon sequestration in forest ecosystems is often assumed to parallel biomass accumulation. There is also a general assumption that greater densities in the post-fire suppression period have resulted in greater carbon accumulation in these ecosystems. The DEIS cites Fellows and Goulden (2008) which suggested loss of large trees in these Sierra Nevada systems has reduced overall sequestration. There is some debate in the literature about this paper (see Fellows and Goulden 2009) and it is possible the stands examined were affected by undocumented harvesting of large trees. This is a rapidly emerging field and it is difficult to get a complete handle on. Two useful references are Fahey et al. (2009) and Keith et al. (2009).

2) Is the scientific information interpreted reasonably and accurately?

With reviews of this sort, and with the general questions posed in the Science Consistency Review documents (Guldin et al. 2003), the tendency is to emphasize short-comings in the analysis rather than positive aspects of the document. The silviculture/vegetation management plans in the DEIS are basically sound, but difficult to evaluate because of the lack of specifics and few citations from which to gain a better understanding of the intent.

3) Are the uncertainties associated with the scientific information acknowledged and documented?

Giant sequoia regeneration: The paucity of giant sequoia regeneration in the GSNM and throughout the sequoia range is identified as a critical issue and the "continued existence of this species" is central to the Clinton proclamation creating the GSNM. However, I did not see discussion of the urgency of this need given the longevity of the species. How important is a 100-year age class gap in a species that lives for several thousand years? The uncertainty and urgency of sequoia regeneration may therefore be over-stated. The regeneration of replacement trees is critical to the sustainability of any ecosystem. Given the longevity of giant sequoia, however, sequoia regeneration is probably less of an urgent need compared to sugar pine decline, fuel loadings, or encroachment of shade tolerant into existing groves.

Sugar pine regeneration and management: The maintenance of sugar pine in these Sierra Nevada ecosystems may be a more critical problem than maintenance of giant sequoia. Although the DEIS does touch on the sugar pine crisis, there is a lack of synthesized "call-to-action" for the GSNM.

4) Have the relevant management consequences, including risks and uncertainties, been identified and documented?

The silviculture/vegetation management sections of the DEIS do a reasonably good job of discussing and anticipating risks and uncertainties. For example, artificial regeneration is noted as an alternative for sites with difficult natural regeneration options. Variable gaps are proposed for different environments as are tree stocking levels that maintain stand resiliency. What is lacking, however, is the scientific basis for these plans. In most cases, there is a sufficient scientific basis for these plans. It needs to be cited to demonstrate the scientific foundation for these plans.

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My Background/Expertise: I'm Professor of Silviculture at the University of California - Berkeley. I'm also a Registered Professional Forester in California (RPF license # 2694) and a Certified Forester by the Society of American Foresters. My education includes a B.S. in Forest Management from Humboldt State University, an MS in Silviculture from Duke University and a Ph.D. in Silviculture and Forest Management from the University of Washington. My research work focuses on forest stand dynamics and applications to stand and forest management. I'm particularly active in the research of multiaged forest stands. My total publication list includes over 100 scientific publications.

Science Consistency Review Comments, Giant Sequoia National Monument DEIS

Written Statement Prepared By

Keith M Reynolds, USDA Forest Service, PNW Research Station

Analysis of use of multi-criteria decision support to support the planning process for the Giant Sequoia National Monument

INTRODUCTION

The science consistency review (SCR) being applied to the GSNM planning process is following a process that is now fairly well standardized as documented in Guldin et al. (2003). In particular, and as illustrated in Table 5 of Guldin et al. (2003, p. 16), the SCR panel is asked to evaluate four scientific criteria concerning each element being addressed in the planning process. As a member of the GSNM SCR panel, I was asked to review the Draft Environmental Impact Statement (DEIS), Monument Plan, and associated supporting documents specifically with respect to how multi-criteria decision support (MCDS) was employed to support the Monument planning process. Assessment of the application of MCDS to the planning process does not fit neatly into the standard SCR format by which reviewers assess scientific criteria with respect to elements addressed in the plan, because the relevant questions about application of MCDS are more about a scientific process than meeting scientific criteria.

With the latter mismatch in mind, this report is provided as an addendum to the standard SCR report being prepared by the Review Administrator. Paralleling the standard questions addressing scientific criteria for assessing how the Monument Plan addresses plan elements, relevant questions about the application of MCDS to the planning process include:

- Is MCDS used appropriately?
- Is MCDS used effectively?
- Are the MCDS process and results adequately documented in appropriate planning documents?

The last three sections of this report address these three questions. But first, in the following section, I give a brief nontechnical overview of multi-criteria decision support by way of background.

OVERVIEW OF MCDS

A very typical type of decision problem involves choosing one among several alternatives. For example, which of five universities that my daughter is considering attending would best meet her educational objectives? The basic objective of multi-criteria decision support is to organize and present the relevant information about a decision problem in a way that facilitates the decision process. A variety of MCDS methods have been developed over the past 30 years. The method used in the Monument Plan, based on Criterium DecisionPlus (CDP) by InfoHarvest (1996), is an adaptation of the Analytical Hierarchy Process (AHP; Saaty 1992). The AHP methodology was first introduced by Saaty in 1980, and it remains one of the most popular and widely used MCDS methods in the world today. Although the mathematics underlying the AHP are rather esoteric, the popularity of the AHP is largely a consequence of the fact that the concepts and principles behind it are relatively easy to understand and apply, even in the context of large, complex planning processes such as the Monument Planning process. Ease of understanding is especially important in the very public context of the Monument Plan, because, if well implemented, MCDS can be a valuable tool for communicating effectively between the interested public and the planning team.

A classic application of CDP is to help decision makers select one among a number of possible alternatives, based upon how well the attributes of each alternative perform relative to a set of criteria and subcriteria. CDP facilitates design of a rational and transparent MCDS model by:

1. Structuring the elements of the problem into a hierarchy of criteria and subcriteria.
2. Providing methods to rate the criteria.
3. Providing rating scales to rate the attribute values of alternatives.

Given a MCDS model as defined in steps 1-3, CDP reports a variety of results, some of the more important being:

1. A chart of overall priority scores for the set of alternatives under consideration.
2. Charts that illustrate how criteria and subcriteria contribute to the overall priority score or to specific criteria.
3. A sensitivity analysis that helps reveal ways in which the model is or is not robust to changes in criteria weights.
4. A tradeoff analysis that provides insights into how changes in attribute ratings trade for one another in determining the overall priority score of the alternatives, given the attributes values of the alternatives, how they are scored, and how criteria have been weighted.

IS MCDS USED APPROPRIATELY?

Yes.

The document, 713_ECR_MCDS_Final.pdf, provides a good overview of how MCDS has been implemented over the planning process, up to the time of this review. Based on this and other supporting documents provided to me for the review, I believe that it is fair to conclude that the planning team has used the MCDS methods quite appropriately thus far in the overall planning process.

Part of the question of appropriate use relates to how well the public was informed about the concepts and principles behind application of MCDS in the Monument Planning process, especially because use of this type of technology is still very novel in public planning, and therefore probably quite unfamiliar to most interested publics initially. The document, DaylightDecisions_GSNM_Tools Descriptions.docx, is a positive indicator of the effort made by the planning team to be sure that interested publics were well informed about MCDS. Other documents produced by the Sequoia Monument Recreation Council (an independent citizen group) and provided to the planning team as recommendations on recreation elements to be considered, provide further evidence that interested publics had been given sufficient training in MCDS to have a practical grasp on its use in the planning process.

Two documents, 2009_GSNM_Rating_and_DEIS_Plan_Alternatives_v6_4.pdf and 2009_GSNM_Rating_and_DEIS_Plan_Alternatives_v6.3_2009_6_19_ALL.doc, do a good job of clearly defining the rating scales to be applied to the attributes of the alternatives. It is my understanding that the final MCDS model developed by the planning team (GSNM_DF_VIBE_v12.3.CDP) will be put up on the Monument planning website to be run interactively by interested publics upon release of the DEIS. Because this model includes the ratings assigned by the planning team for the attributes of all alternatives, it will be important to develop a companion document that provides a clear rationale for each rating. Statements of rationale are, in fact, already scattered through the text of the DEIS, but it is virtually impossible for interested readers to effectively track the reasoning of the planning team when the information is scattered through the body of a rather massive document text. Compiling the rationale statements in a document associated to the model would be a tremendous help to readers.

IS MCDS USED EFFECTIVELY?

Yes, up to the time of this review.

Thus far, application of the overall MCDS process seems to have been effective at engaging the public, and guiding evolution of the model structure in terms of identifying and organizing the criteria and subcriteria that the model addresses, and in terms of clearly defining the rating scales of attributes of the alternatives.

I have added the qualification, “up to the time of this review,” because there are important considerations related to effective application of the MCDS process that extend into the DEIS review process, and ultimately to the successful conclusion of the planning process. A typical plan, and the Monument Plan is typical, is so large and detailed that few if any readers can effectively trace the reasoning for selection of the preferred alternative. I suspect that this accounts for much of the suspicion and frustration that planning teams frequently encounter from the public. The Monument planning team, however, has taken the novel and rather bold step of applying a formal MCDS process to support their planning effort.

As I mentioned earlier, it is my understanding that the planning team intends to put up the interactive MCDS model on the Plan website upon release of the DEIS. I would strongly encourage doing so, although there may well be some understandable nervousness at that prospect. After all, this will clearly reveal the reasoning of the planning team. Not all interested publics are likely to agree with some of the attribute ratings provided by the planning team, for example, so some may see the model transparency as a liability. I would argue the converse though: full disclosure of all model details will allow interested parties to quickly zero in on specific points of disagreement, at least promoting the opportunity for a much more focused and constructive discussion.

ARE THE MCDS PROCESS AND RESULTS ADEQUATELY DOCUMENTED IN APPROPRIATE PLANNING DOCUMENTS?

Yes, up to the time of this review.

The role of MCDS in public participation and the Monument planning process in general is explained in numerous places throughout Chapters 1, 3, and 4 of the DEIS (Volume 1). I was provided with an additional 15-20 supporting documents, which I presume are part of the public record, and these documents shed additional light on how MCDS was used to support the process.

The primary outstanding issue is whether or not the MCDS process is adequately documented in the final plan documents. For the purposes of the DEIS, the MCDS documentation, in terms of its quantity and quality, is definitely sufficient. However, for the purposes of the final documents, I would strongly recommend that the planning team consider the following. To the best of my knowledge, a formal MCDS process has never been an integral part of a Forest-level planning process, and there is certainly no NEPA requirement, of which I am aware, to document this aspect of a planning process. It is also quite true that it remains to be seen how well MCDS performs in terms of facilitating the planning process for the Monument, and ultimately enhancing public acceptance of the Monument plan. If, however, the application of an MCDS process is perceived by the planning team as having a positive impact on the planning process, then it would be of great value to future planning activities of the USDA Forest Service to carefully document the MCDS process. I leave it to the planning team to make that determination. But, if they find that MCDS has

significantly enhanced the overall process, then I think it is incumbent on the planning team to include an additional appendix to the DEIS that fully documents the MCDS process so that other administrative units of the agency may benefit from this experiment.

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SOCIAL SCIENCE CONSISTENCY REVIEW COMMENTS

Core Report

April 2010

TITLE: "Designing and facilitating a public participation strategy for Sequoia National Forest and Giant Sequoia National Monument for a Science Review Panel that is involved in developing a final Environmental Impact Statement and subsequent Management Plan for the Monument"

REVIEW TEAM:

San Francisco State University, Department of Recreation, Parks, & Tourism

Nina S. Roberts, Ph.D., Associate Professor and Lead Social Scientist

Jackson Wilson, Ph.D., Assistant Professor and Co-Investigator

INTRODUCTION

Thank you for the opportunity to participate with the Science Consistency Review Team. On April 1, 2010**,** a Science Consistency Review (SCR) team was convened by the Pacific Southwest Research Station in Davis, CA to evaluate the Draft Environmental Impact Statement (DEIS) for the Great Sequoia National Monument (GSNM). We met several people in Davis and others participated via webcam. This review report is based on Issue 1 and, to a lesser extent Issue 2 as discussed in Chapter 1. We read Chapter 1 in depth, briefly inspected Ch. 2, carefully read and reviewed Ch. 3 and 4, and thoroughly examined the Recreation Demand Analysis Appendix (Vol. 2, p. 391). Human Use sections reviewed pertain to the following affected environments: *Recreation, Scenery Resources, and Socioeconomic*. Although beyond the scope of our contract and general expertise, we took a cursory look at Cultural Resources and Transportation Systems.

After the elements were provided by the PSW research station, the review administrator confirmed the elements were relevant and correct. The following three elements were provided for social sciences under the "Human Use" domain:

4. Human Use
a. Recreation demand analysis
b. Recreation opportunities
c. Rural community economic and population trends

As independent and credible experts in this field, we were asked to respond to the following standardized set of science consistency evaluation criteria:

1) Has applicable and available scientific information been considered?
2) Is the scientific information interpreted reasonably and accurately?
3) Are the uncertainties associated with the scientific information acknowledged and documented?
4) Have the relevant management consequences, including risks and uncertainties, been identified and documented?

Note: An Addendum has been written and submitted separately offering additional comments in support of supplementing this Core Review.

Our task was to rate each element that were thought to be important by each of the above four evaluation criteria. A matrix was used to structure the review of the elements within the review criteria. We were then asked to rate any of the element x criterion cells in the matrix that we felt qualified to respond using a dichotomous "yes / no" answer, with supplemental explanations about each rating. That rating was conducted by both reviewers on this team, individually first, then Dr. Roberts summarized. The comments provided in this review are fair and impartial. We have not imposed our values or preferences into the judgments made herein. Our collective review occurred over a four week period subsequent to the initial meeting; this document with our comments was then forwarded to the Review Administrator.

It is important to note that the Human Use section in the DEIS is not well organized regarding structure of content. Our assessment was therefore challenging to complete. This section needs more uniformity (e.g., lacks structure), better connections needed between sub-sections, and there is a lack of consistency and in some cases-absence of any referenced citations within the text throughout this section (especially "recreation opportunities"). Broadly, the Human Use section is fragmented in its format and approach, rarely focused on management consequences and lacked convergence on the purpose of the report of the DEIS: To inform management in the decision-making process for the GSNM.

Regarding the table below, a "NO" indicates the element to be inconsistent with available science information for the given criterion. A "YES" indicates the element was consistent with science available. Where "N/A" is noted, this indicates no comments are applicable hence not provided.

Elements	**Criteria for Decision**			
	1. Is the relevant scientific information considered?	**2.** Is the scientific information reasonably interpreted and accurately presented?	**3.** Are uncertainties associated with the relevant scientific information acknowledged and documented?	**4.** Are the relevant management consequences identified and documented, including associated risks and uncertainties?
4. Human Use				
4a. Recreation demand analysis	NO	NO	NO	NO
4b. Recreation opportunities	NO	NO	NO	NO
4c. Rural community economic and population trends	NO	NO	YES	NO

For purposes of this review the *elements* were defined using specifications provided in the reports and documentation provided as follows:

4a. **Recreation demand analysis**: Appendix D and the summary in Chapter 3

4b. **Recreation opportunities**: Recreation information in Chapter 3 and other associated recreation information in Chapter 4 and other places in the report.

4c. **Rural community economic and population trends**: The socioeconomic data in Chapter 3 and the associated information in Chapter 4 and elsewhere in the report.

I. RECREATION DEMAND ANALYSIS

Criterion 1: Is the relevant scientific information considered?

NO: The most relevant information was not always considered in the *Recreation Demand Analysis*. Our interpretation of this question hinges on the question of, "Considered for what?" The answer to this implicit question was assumed to be, "considered for the purposes of the alternative plans". If this is an implicit consideration, then, although the *Recreation Demand Analysis* does provide good information about recreation demand, it fails to link this information specifically to the proposed alternatives.

In order to definitively state "yes" to this criterion, this section would need to be explicitly organized based on the implicit questions of interest. From our review, these appear to be:

1. What are the different recreational and tourist activities currently occurring in the Monument and how is that changing over time?
2. Who is participating in these activities and how is that changing over time?
3. What structural variables facilitate or constrain participation across user groups and how is that changing over time?
4. Where are these activities currently occurring and how is that changing over time?
5. When do these activities occur?
6. Why do individuals engage in these activities?
7. How do motivations differ between user groups?
8. What is the potential and actual impact of different types of visitor activities on the objects of interest?
9. What aspects affect the impact of the recreational activities on the objects of interest (e.g., weather, concentration of users, facilities, etc.)?
10. What is the relationship between participation in these activities and conservation behaviors/attitudes?
11. Some sections (i.e., p. 257) start to highlight this issue, but a much more thorough analysis is essential.

12. What is the availability (location, economic cost, and access) of similar alternative activities (based on the variables of interest to participants) for current and future participants?

Many potential sources of information that could help inform these implicit questions are not included. Additional sources of scientific information are listed at the end of this document.

Note: Another survey with applicable results would be the 1962 landmark ORRRC report (Outdoor Recreation Resources Review Commission).

Criterion 2: Is the scientific information reasonably interpreted and accurately presented?

NO: The scientific information was not always logically interpreted or accurately presented.

1. There is a near complete absence of in-text citations, footnotes, or endnotes. This makes it impossible, as a reviewer, to definitively state if the scientific information was reasonably interpreted and/or accurately presented.

2. The use of unnecessary jargon (e.g., traditional users, forest zone of influence) makes it difficult for the average member of the public to interpret this information. Whenever a technical term is first introduced in each section it should be defined and linked to a full definition.

3. Ambiguous statements, such as "various sources of information" limit the credibility of the author's statements.

4. Additional information is necessary at times to support bold claims.

   a) For example, "Family and friends and computers/the internet were most frequently reported as the most trusted information sources across all ethnic groups..." (p. 274). In our experience (review team) the Internet/computers is not a universal source of information among all ethnic groups. This conflict with previous research makes it essential for the authors to provide multiple sources to support this claim.

5. The composition of individuals involved in the public input process was not clearly articulated.

6. Additional figures are needed to help explain the information:

   a) Map 22: "Recreation Opportunity Areas for Alternative C' (p. 570) effectively presents geographic information for the reader. Similar maps for the following sections (i.e., roads, trails, signage) would be helpful for readers.

b) Table 195: "Potential Improvement of Existing Scenic Integrity" (p. 586) is a wonderful matrix; however, it lacks information about how the Alternatives were classified as Low, Moderate, or High.

c) There is a lot of text and few bullet points included. There are lengthy narratives discussing trends; yet without the use of graphs/charts providing a visual depiction of the data, makes it difficult to navigate the intent. Charts, tables, graphs, etc. would be helpful to explain all of the data.

YES: At times the analysis is reasonably interpreted and accurately presented.

1. Analysis about race, age (e.g., youth and baby boomers) is reasonably interpreted and accurately presented.
   a) Constraints and barriers are also very accurate and interpreted with solid statements.
   b) Management consequences are addressed and clearly spelled out. Visitor needs and desires are highlighted and corroborates with studies conducted across the country (e.g., facilities, expectations, desired services).
   2. Societal issues affecting attitudes and use patterns are reasonably interpreted and accurate from a broad standpoint (e.g., recession, unemployment = reduced personal disposable income).
   3. Statements made about **travel and tourism** are accurate and reasonably interpreted.
   4. The changing demographics and population trends information is relevant and reasonably interpreted.
   5. How and where the public involvement information was gathered is clear and comprehensible.
   6. "Site specific environmental analysis" is mentioned in a variety of sections as something needed prior to any new development (e.g., facilities, trailheads, parking areas, restrooms, trails, etc.). This is vital for decision-making.

Criterion 3: Are uncertainties associated with the relevant scientific information acknowledged and documented?

NO: The uncertainties associated with the relevant scientific information are neither acknowledged nor documented.

1. With the exception of an explanation about the incommensurability of the survey data, there is no attempt to articulate what the uncertainties are with the literature and what the current limitations are in relation to that body of knowledge.

Criterion 4: Are the relevant management consequences identified and documented, including associated risks and uncertainties?

1. Relevant consequences are provided in several cases (e.g., promote diversity of users) yet in other sections (such as "promotes diversity of uses") the associated risks are not identified.

2. Table 43 (p. 110): “Comparison of Alternatives by issues and their Unit of Measure” is a good comparison of the Alternatives
3. These Alternatives impact different user groups inequitably. For example, Alternative D emphasizes primitive recreation which may support traditional users (middle class, able-bodied, recreationists with primitive recreational skills), but would negatively impact disabled users or users that prefer to recreate in large groups (Hispanic/Latino users, larger families, etc.) that the Monument is attempting to attract. The problem is these disparate impacts are not clearly stated in the document.

II. RECREATION OPPORTUNITIES

Criterion 1: Is the relevant scientific information considered?

NO: The most relevant recreation opportunities were not always considered, since this information does not specifically inform the potential impact of the alternative plans.

Criterion 2: Is the scientific information reasonably interpreted and accurately presented?

NO: The **Recreation Opportunities section** (Ch. 3) does not always reasonably interpret and accurately present the scientific information.

1. There is a lack of in-text citations, footnotes, and/or endnotes. This makes it difficult to understand what parts of the report are based on existing research and what parts are the authors' opinions.

a) **"Connection to Place"** (sub-section, p. 260): The last paragraph is a great statement; yet, it appears to be a vast assumption with no empirical evidence noted in-text. A lot of research with large samples would have to substantiate descriptors such as "highly valued" and "evoking deep emotional response even from people who have never experienced their grandeur firsthand." *(Note: Additional information would help authenticate these claims).*

b) **"Recreation Niche Settings"** - Table 103 (p. 264 and top p. 265): This information and detail is impressive. It corroborates other scientific literature on *niche conformance*. The author discusses the evaluation criteria in relation to what makes this forest a "special place". However, it is not clear who evaluated this or where the "criteria" came from.

2. Sometimes it is difficult to understand the intention for why data is presented. For example, it is difficult to understand the relevance of the segment about land exchanges on p. 256 in relation to the topic of recreation.

3. All jargon and technical terms need to be defined when introduced in each chapter and need to be linked to definitions in the appendix (e.g., the term "toys" on p. 265 should be replaced with the less value-laden term "equipment").

4. This section did not present the theoretical context necessary to support the analyses.

a) While most of the information reported was accurate (with few exceptions as noted in this review), the data and results described is not validated by any theory as written in this DEIS.

b) No theoretical framework is presented connecting data to management concerns and outcomes of interest.

c) Author(s) referred the reader to the bibliography. It can be speculated that literature used by the author has theory included so something should have been integrated in the DEIS under review for science consistency. Relevant recreation theories include: motivation, satisfaction, benefits-based management, crowding, demand theory and time allocation, etc.

5. Additional graphic figures (e.g., tables, charts) are necessary to make it easier for readers to understand all of the information. All location information needs to be accompanied by

maps. All quantitative information requires tables and charts to help readers better understand the material. For example, the **User Groups** sub-section (p. 265) would be enhanced if a table was provided comparing the different demographic and participation information for the diverse user groups.

6. There was a tendency to find identical sections of text in multiple parts of the document.

a) Page 276 (prior to the **Scenery Resources Affected** section) says the following: "The analysis in the effects on recreation section of chapter 4 is based on how well the Alternatives would meet future recreation demand and protect the objects of interest. The discussion addresses both a portion of the MCDC Framework and these considerations which the public identified as important to them." This same wording appears on the bottom of p. 562, the text is exactly the same as the "Recreation Demand Analysis Summary" as noted from page 271-274.

a) When both chapters were compared with hopes they would provide separate information, we discovered the text in chapter 4 (from pages 562/bottom to the top of p. 565) is the exact same/verbatim as chapter 3. The duplicate text is not paraphrased or even summarized but rather an obvious copy and paste function occurred for 3 pages of text from Ch. 3 to Ch. 4. Turns out the beginning of most of the various categories or sub-sections were all duplicates from Ch. 3 and then discussion of Alternatives followed. This was distracting.

c) This duplication of precise text does not allow us, as reviewers, to fully comprehend what is supposed to be going on for the first part of the "Effects to Human Use" of Recreation section. It is clear this is not a simple case of cross-referencing statements from the previous chapter but rather duplicating exact text, verbatim from one chapter to the next

YES: The information in the **Scenery Resources Affected Environment** is accurately presented and reasonable interpreted. *Note*: Much better use of in-text citations and proper representation of scientific literature.

1. Interpretation of the data is accurate and well done.
   a) Statements made about "scenery" broadly are confirmed by national studies (p. 277).
   b) Viewing natural features has, in fact, been noted as the most popular activity. This does not, however, take into consideration some people might visit a forest/park purely for activity sake (e.g., climbing, hunting, skiing, etc).
2. Visitor expectations for natural landscapes and sheer beauty of the environment are evident in the analysis and accurate based on the typical outdoor recreation enthusiast even across various demographic characteristics.
3. Inclusion of Acts and legislation as set forth by both the Dept of Agriculture and USFS is appropriate and accurate.
4. This section breaks down the "Scenery Management System" into nine (9) components (p. 278-279). Each component is then explained sufficiently in connection to the GSNM.

5. This entire section is accurately represented, the science is interpreted appropriately, and management consequences are identified and adequately documented.
6. For the most part, sufficient variation of diverse sources is used. Other suggestions are included in the recommended references list at the end of this report.
7. Proper indicators are used for attributes and recreational opportunities, GIS is employed for scenic integrity measures, and proposed objectives to manage scenery resources are well organized and adequately reported.

Criterion 3: Are uncertainties associated with the relevant scientific information acknowledged and documented?

NO: The uncertainties associated with the information presented in relation to the recreation opportunities are not acknowledged and documented.

Note: At times the language is ambiguous enough that it raises questions about the accuracy and certainty of the data (e.g., how much is a "small portion" p. 268 or what percentage is "A very large percentage of visitors to the Tule River are Hispanic and Southeast Asian"); however, the author does not specifically address this limitation.

Criterion 4: Are the relevant management consequences identified and documented, including associated risks and uncertainties?

NO:

1. There is a disconnect between the presentation of the Recreation Opportunity information and the management consequences.
2. Tule River (p. 286): This is the only sub-section in **Scenery Affected Resources** that directly mentions any controversy and management challenges for the forest (e.g., crowd / traffic control, Tribal relations, litter/graffiti, gang-related activity).

YES:

1. Excellent descriptions and use of the R.O.S. (Recreation Opportunity Spectrum) as a very traditional, yet widely used model for determining and measuring use and ultimately experiences obtained.
2. The section **Effects of Recreation**, including Dispersed and Developed Recreation on Cultural Resources (p. 601) does a good job of qualitatively describing the impacts of recreation on cultural resources. The socioeconomic and environmental impacts of recreation and tourism should be similarly detailed.

III. RURAL COMMUNITY ECONOMIC AND POPULATION TRENDS

Criterion 1: Is the relevant scientific information considered?

NO: The most relevant rural community economic and population trend information necessary for the management Alternatives were mostly, but not always considered.

1. In order to definitively state "yes" to this criterion, this section would need to be explicitly organized based on the implicit questions of interest. These appear to be:
   a) What are the variables in the management Alternatives (e.g., recreation demand, timber production, etc.) that may have potential economic consequences?
   b) How are the estimated present values of economic benefit to different stakeholders
   (e.g., USFS, local businesses, local government, etc.) in the domains of interest (monument, local rural communities, and region) expected to change based on the different management Alternatives?
   c) How are the estimated present values of economic costs to different stakeholders in the domains of interest (monument, local rural communities, and region) expected to change based on the different management Alternatives?
   d) What is the cost and efficacy of methods to ameliorate the impact of different recreational and other human uses on the objects of interest?
2. Additional sources of information is needed by us, as reviewers, intermittently throughout to make better judgments.
   a) Some of the data in the **Travel & Tourism** section was obtained through single-sources. For example, the USFS contribution to the local economy (p. 319) could be potentially enhanced by including additional studies. This could serve to substantiate the economic value of the GSNM in diversifying socioeconomic patterns of household income across demographic groups in these counties as well as in smaller gateway communities.

Criterion 2: Is the scientific information reasonably interpreted and accurately presented?

Overall, this information is logical and acceptable. Although the organizational structure is difficult, it does provide a wealth of information and correctly provides a variety of appropriate and respectable in-text citations.

In addition, key research questions are clearly stated intermittently throughout this section and include sub-sets of additional questions investigated.

NO:

1. The information is not always presented in such a manner as to allow the reader to determine if the scientific information was reasonably interpreted and accurately presented.
    a) There is a lack of clarity about how information from different parts of the **Human Use** section fit together.
        i. Additional linking in Ch. 3 Affected Environment between the **Recreation** and **Socioeconomics** sections would enable readers to understand how each section (e.g., **Recreation** and **Socioeconomics**) fit together. For example, there is a respectable level of socioeconomic information under the **Socioeconomic Affected Environment** in Ch. 3 that answers questions that readers may develop reading earlier sections.
        ii. This report could facilitate such questions by either using hyperlinks in an electronic format or through the use of captions. For example, after reading information about the demographic of a specific user group, they may be interested in how this demographic information compares to the area of residence for these participants. A caption or text box could anticipate this question and state, for instance, *"See page 344 for more information about the overall demographics of these local counties."*
2. There needs to be a link between the notions of future changes in the state's population to how this may relate to the research questions being explored. To a policy-maker, it may not be clear what the context is or should be (i.e., demographics trends are referenced but better connections need to be made to the purposes of the DEIS).
3. The legend for Tulare is inadvertently flipped, meaning it is listed in the wrong position (p. 314, Figure 22). That is, the top two graphs (Fresno & Kern) both note "secondary" data as large/vast regarding secondary timber related employment. The written statement notes "largest number in all 3 counties is in secondary…" thereby indicating the reference to "secondary" in the graph's legend as being in reverse order and therefore could potentially be deceiving regarding what the graph is trying to represent.

4. *Method of Commute* charts: The reason these charts are included in this report is not clear. The purpose for why this detail is incorporated lacks support.
a) A direct connection to how this focuses on the implicit questions of interest are in direct relation to policy is ambiguous.
b) The data is interesting yet the rationale for including these data for each community is ill-defined. If, in fact, this is essential, it's important to create a better connection to why it matters by establishing a better link to questions/content of greatest interest.
5. Given the recent high levels of unemployment in the nation and in California in particular, it would be prudent to update the unemployment data with more recent data (p. 306).

YES:

1. Differences among the counties are acknowledged, and discussed; and, a breakdown is provided for the various unique gateway communities.
   a) Excellent job comparing this tri-county area with both statewide and national demographics.
2. **Travel and Tourism** data analysis reflects a terse, yet adequate investigation of the relationship of jobs in the tri-county area to impacts on the local economy (p. 316). Sources used are viable and offer a worthwhile vantage point of growth in these communities.
3. Theoretical models and frameworks (p. 340): Good use of the Multi-Criteria Decision Making theory (MCDM) and the Values and Interest-Based Explorer (VIBE) model. These relate to the public values, beliefs, and attitudes section.
   a) Decision Theory: This framework is accurately depicted and explained very well. This substantial analysis will allow for efficient management actions to be executed and evaluated with conscientious intention of "balancing enjoyment with protection of the objects" within the GSNM.

4. The analyses and subsequent proposed Alternatives are well organized, scientific information is acknowledged and documented, risks and uncertainties are identified, and potential consequences (e.g., Environmental Justice) are documented.
5. The Socioeconomic profile completed is adequate for decision-making. References to demographic trends could be enhanced as follows:
a) As shown in Census.gov data and/or projections provided by the Pew Research Center's Social and Demographic Trends would offer much needed substantiation: http://pewsocialtrends.org
b) A solid variation of resources is used. However another key source for such data that would be good to also explore is: American Community Survey (a sub-division of the U.S. Census that collects data across the country annually) www.census.gov/acs/www/

Criterion 3: Are uncertainties associated with the relevant scientific information acknowledged and documented?

YES: The uncertainties are acknowledged and documented.

Example: Environmental Justice (EJ) (p. 344-357).
a) Starting this section off with the Executive Order 12898 was very smart (Federal actions to address EJ in minority and low income populations).
b) The sources and studies used in the analysis for this section are applicable, credible, and interpreted accurately.
c) A potential key resource for review and application of ideas is "Diversifying access to and support for the Forests" (Garcia, et. al., Center for Law in the Public Interest Policy Brief).

Criterion 4: Are the relevant management consequences identified and documented, including associated risks and uncertainties?

NO: This section fails to link the presented material with the management consequences of interest.

1. Economic data is often heavily quantitative and the data in this report is no exception. Unfortunately, the author fails to connect this quantitative data to the management consequences of interest. "At this time, it is not possible to quantify changes to the number and type of recreation visits to the monument caused by any particular alternative" (p. 587). All economic quantitative data holds a degree of uncertainty; however, the apparent refusal to connect the quantitative data to management concerns highlights the potential that some of this data may have no direct connection with the management concerns and therefore should probably not be included in this report.
2. As detailed under Criterion 1, this section could do a much better job of explicitly structuring the text to address management questions and decisions needed.
a) The detailed analysis provided in the **Secure Rural Schools and Community Self-Determination Act of 2000** section of the report reviewed reflects the magnitude of management impacts of the GSNM in relation to this tri-county area of influence.
b) The current ability and future potential of projects under Title II, for example, shows many realistic management actions that can occur over the next 3-5 years and beyond (p. 311).
c) According to this section of the report, "all three counties have elected to use a Resource Advisory Committee (RAC) to recommend special projects on federal land" (p. 312). This offers a level of strength added to the scientific inquiry that has led to enactment of this Public Law (PL 106-393) to begin with providing essential support for the Forest Service with the potential for improving community relationships.

YES:
Public opinion/values process - The Multi-Criteria Decision Support (MCDS) Framework effectively informs management consequences. This adequately addresses 7 primary categories and 12 interrelated sub-themes all of which are extremely relevant to the GSNM.

✧ ✧ ✧ ✧ ✧ ✧ ✧ ✧✧

ADDITIONAL RESOURCES (SAMPLE)

The following items are offered as recommended domains in relation to the three sections under review for Human Uses: Recreation, Scenery, and Socioeconomic Affected Environment sections. The sample citations noted are provided in the reference section for recommended additions to the literature that follows:

A. Outdoor recreational activity participation

1. Activities (Bowker, et al., 2006; Cordell, Betz, & Green, 2008; Harshaw, 2008; Siikamäki, 2009)
2. Demographics
   a) *Age* (R. Burns, et al., 2007; McNeil, Wilson, Siever, BEd, & Mah, 2009; Ricciardo, 2006; Robinson, 2007; Zinn & Graefe, 2007)
   b) *Race/Ethnicity/Nationality* (R. C. Burns, Covelli, & Graefe, 2008; Byrne & Wolch, 2009; Chavez & Olson, 2008; Covelli, Burns, & Graefe, 2006; Crano, Quist, & Winter, 2008; Johnson, Bowker, Green, & Cordell, 2007; Kahn, Velasquez, & Surguine, 2005; C. Li, Absher, Graefe, & Hsu, 2008; C Li, et al., 2007; Stanfield, Manning, Budruk, & Floyd, 2005; Stodolska, Acevedo, & Shinew, 2009)
   c) *Gender* (Anderson & Loomis, 2006; Heintzman, 2006; Jones, 2007; Lee, Graefe, & Li, 2007; Moore, Scott, & Moore, 2008; Sali & Kuehn, 2006)
   d) *Abilities* (Den Hoed & Parks, 2008; R. Williams, Vogelsong, Green, & Cordell, 2004)
   e) *Family Structure* (Du Lee, Graefe, & Burns, 2006)
3. Facilitators/Constraints/Motivations for participation (Ajzen & Fishbein, 1980; Nyaupane & Andereck, 2007; Pigram & Jenkins, 2006; Shores, Scott, & Floyd, 2007; White, 2008)

B. Environmental impact of outdoor recreation activities (Barton & Holmes, 2007; Bricker, Chavez, & Hendricks, 2008; Ewert, 1996; Makhdoum & Khorasani, 2009; Peterson, Hull, Mertig, & Liu, 2008; Taylor & Knight, 2008; Törn, Tolvanen, Norokorpi, Tervo, & Siikamäki, 2009; D. R. Williams, 2007)

1. Impact minimization strategies (Kaiser, 2008)
2. Association between participation and environmental attitudes/ behavior (Jacobs & Manfredo, 2008; Jacobson, McDuff, & Monroe, 2006; Kaplan & Kaplan, 1989; Pergams & Zaradic, 2008; Thapa, 2010; Theodori, Luloff, & Willits, 2010; Zaradic, Pergams, & Kareiva, 2009)

C. Activity substitution (Hyun & Ditton, 2006)

D. Economic impact (Bristow, 2006; Flores, Haileyesus, & Greenspan, 2008; Godbey, 2009; Humphreys & Ruseski, 2007; Keske & Loomis, 2008; Kruger, et al., 2009; Oh & Ditton, 2006; Rosenberger, Bergerson, & Kline, 2009)

E. Environmental Justice (Garcia, Flores, & Hicks, 2004)

[END]

RECOMMENDED REFERENCES FOR CONSIDERATION

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Bricker, K., Chavez, D., & Hendricks, W. (2008). Recreation and fire management in urban national forests: A study of manager perspectives. *Fire Social Science Research From the Pacific Southwest Research Station: Studies Supported by National Fire Plan Funds*, 69.

Bristow, R. S. (2006). *Tourism in New England towns: A threat to rural fabric.* Paper presented at the Northeastern Recreation Research Symposium, Bolton Landing, NY.

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Science Consistency Review Comments, Giant Sequoia National Monument DEIS

Written Statement Prepared By

Scott L. Stephens

May 4, 2010

Subject: Review of Giant Sequoia National Monument Draft Environmental Impact Statement from a wildland fire perspective

After reviewing the document I have decided to focus my attention to the following sections: 1) Giant sequoia regeneration and structure (Vol, 1, pages 143-144), 2) Fire and fuels affected environment (Vol. 1, pages 144-150), 3) Trends in climate change (Vol. 2, pages 374-379), 4) Regional trends over last century linked to climate change (Vol. 2, pages 380-382), and 5) Future predictions (Vol 2, pages 383-390).

I did not comment on the extensive standard and guidelines because they are very specific and I do not have a sufficient background in NEPA to be able to provide significant comments. My comments follow. In many cases I will address comments to specific paragraphs in the text.

1) Giant sequoia regeneration and structure

This section is fairly well written but does rely on somewhat dated references. Certainly older papers and studies are relevant today but new information is also available that should be incorporated into this section.

P143 3rd paragraph. In the pre-historic period human caused fires were started by Native Americans and their frequency allowed regeneration of giant sequoia. Small groups of similarly sized/aged giant sequoia have been detected in the field but I have seen little evidence of 'large even-aged cohorts'. Nate Stephenson's work point to average group sizes well below an acre, with most groups much smaller than an acre.

Last paragraph. I agree that you can kill small white fir and incense-cedar with prescribed fire. However the statement 'Smaller white fir and incense-cedar tree up to 6 inches or more in diameter are easily killed in light to …' The term 6 inches or more is problematic. How much larger? When white fir gets even moderate diameters it can become resistant to mortality from prescribed fire. One paper that presents data on this is for the Sierra is

Stephens, S.L., and M.A. Finney, 2002. Prescribed fire mortality of Sierra Nevada mixed conifer tree species: Effects of crown damage and forest floor combustion. Forest Ecology and Management 162: 261-271.

Additional line on the last paragraph on this page. 'Fire return intervals in giant sequoia ecosystems may have ranged from a few years to several hundred depending on the location and size.' I have not seen information on return intervals of several hundred years in giant sequoia

groves expect possibly the last 100 years before of fire exclusion. Tom Swetnam's work is the best in this area. He has one recent paper, it is

Swetnam, T.W., C. Baisan, A. Caprio, P. Brown, R. Touchan, R.S. Anderson, and D. Hallett. 2009. Multi-millennial fire history of the Giant Forest, Sequoia National park, California, USA. Fire Ecology 5: 120-150.

P144 2nd paragraph. 'Exposure to sunlight in extremely hot weather, where the canopy openings is greater than 70%, may reduce the growth and survival of first year giant sequoia seedlings (Hannt unpublished).' I cannot fully understand this sentence. One recent paper on giant sequoia regeneration and restoration that may be useful in this section is

York, R. A., J. J. Battles, A. E. Eschtruth and F. G. Schurr In Press. Giant sequoia (*Sequoiadendron giganteum*) regeneration in experimental canopy gaps. Restoration Ecology doi: 10.1111/j.1526-100X.2009.00537.

One more paper that was recently published has important information on old-growth giant sequoia trees, it is

York, R.A., D. Fuchs, J.B. Battles, and S.L. Stephens 2010. Radial growth responses to gap creation in large, old *Sequoiadendron giganteum.* Applied Vegetation Science (in press).

The abstract of this paper is

Questions: Do large, old *Sequoiadondron giganteum* trees respond to the creation of adjacent canopy gaps? Can growth responses be attributed to changes in belowground water availability (as indicated by carbon isotope discrimination)? Do other co-occurring tree species and younger *S. giganteum* adjacent to gaps also respond? What are the likely factors affecting growth responses?
Results: On both a 5-year and 10-year time frame, gap-adjacent old *S. giganteum* grew more than reference trees. The magnitude of difference between gap-adjacent and reference trees increased across the 10-year post gap-creation period. *Abies concolor* trees also exhibited a growth response to gap creation. No response was detected for young *S. giganteum* or *Pinus lambertiana*, although power of detection was lower for these groups. There was no difference in carbon isotope discrimination response to gap creation between gap-adjacent and reference trees for old *S. giganteum*. *S. giganteum* radial growth was positively correlated with winter precipitation, but not growing season temperature.
Conclusion: It is unclear what caused the growth release in old *S. giganteum* trees, although liberation of belowground resources following removal of competing vegetation appears to be a significant contributor. Old trees of many species can respond to removal of competing vegetation. *S. giganteum*, the third-longest lived and the largest of all species, remains sensitive to local environmental changes even after emerging above the surrounding canopy. Management activities that reduce vegetation surrounding individual specimen old trees can be expected to result in increased vigor of even these very old and large trees.

2) Fire and fuels affected environment

P145 1st paragraph. Burning with different prescriptions (firing patterns) will also create diversity in fire effects instead of only burning at different seasons.

End of 2nd paragraph. Appendix referenced has no number.

3rd paragraph. Over what time period does your human and lightning ignitions data come from?

Table on this page. How much area has been burned with fire use? I know the Sequoia has been doing this for several years.

P146, 1st paragraph, 3rd line. Slope is another factor that influences fire behavior, it is not included here.

5th line in this paragraph. How can weather during a prescribed fire be adjusted? Is the firing pattern adjusted? Or do you select a different weather window?

3rd paragraph. A range of fuel loads is reported here (26-103). What fuel components does this include? Only surface fuels? Duff?

5th paragraph. Fireline intensity is the product of biomass consumption, rate of spread, and heat content of the fuel. The latter term is not included here.

Last paragraph, last sentence. How does the management for the historic fire regime relate to an era of changing climates? One paper that discusses this issue is

Millar, C.I., N.L. Stephenson, and S.L. Stephens. 2007. Climate change and forests of the future: managing in the face of uncertainty. Ecological Applications 17(8): 2145-2151.

Pg 147. 1st paragraph. What is the 'fire susceptibility rating'? Need to define this.

Last paragraph on this page. 'One of the contributors to intense fire behavior and fuel availability is the shift from the open, fire resistant crown structures and surface fuels that support frequent fire, toward open tree canopy structures favored by fire-resistant species that are naturally found in the Monument (giant sequoia, ponderosa pine, sugar pine) to more susceptible ones. The third factor, risk, is a measure of the likelihood that an ignition will occur based on historical fire occurrence.'

I cannot fully understand the first sentence above. Regarding the 2nd sentence, I would add that we are not only interested in historic fire occurrences but also how this will change in an era of changing climates.

P148 3rd paragraph. A good set of information for the southern Sierra Nevada comes from Malcolm North's work at the Teakettle Experimental Forest. I don't see any of Malcolm's references here, I think they would be applicable. One good place to see many of his papers is in the literature cited section of

North, M. P. Stine, K. O'Hara, W. Zielinski, and S. Stephens. 2009. An Ecosystems Management Strategy for Sierra Mixed-Conifer Forests. US Dept. Agriculture Forest Service Pacific Southwest Research Station. General Technical Report PSW-GTR-220 w/ addendum. 52 pages.

P149 2nd paragraph. Fire is in nearly all Monument ecosystems versus all ecosystems?

4th paragraph. I believe that during the active fire regime that litter fuels would not be continuous, there would be discontinuities that would inhibit fire spread.

'Lightning ignited fires alone are unlikely to provide sufficient ignitions to restore fire to the Monument.' This is an interesting statement but is there some analysis to support this? Jan van Wagtendonk in Yosemite has published a paper saying that lightning ignitions might be adequate when looking at the pre historical fire regimes.

3) Trends in climate change

In general references in this section are up to date and fairly complete. I will add a few new ones to consider.

The figures in this section are interesting but standard correlations may not be the best method to analyze these data. An auto-regressive approach may be more applicable. However the trends shown here are important and this information should be contained in the document.

4) Regional trends over last century linked to climate change

Pg 381, 1st paragraph. Miller et al. (2009) does show increased mean and maximum fire size and total burned area in the Sierra Nevada but not all forest types area similar. Mixed conifer is one that has seen some of the largest change but ponderosa pine much less. It might be a good idea to add some more text here to clarify this.

I want to add that there is a set of papers from the central and southern Sierra Nevada that have shown that in an area of upper elevation mixed conifer forest subjected to lightning ignited fires for the last 35 years that there is no evidence of increase fire severity. I think these papers present information on what managed wildfire can do in remote areas. The papers are

Collins, B.M. and S.L. Stephens. 2007. Managing natural fires in Sierra Nevada wilderness areas. Frontiers in Ecology and the Environment 5(10): 523-52.

Collins B.M., Miller J.D., Thode A.E., Kelly M, van Wagtendonk J.W., Stephens S.L. 2009. Interactions among wildland fires in a long-established Sierra Nevada natural fire area. Ecosystems 12:114-128.

Collins, B.M., and S.L. Stephens 2010. Stand-replacing patches within a mixed severity fire regime: quantitative characterization using recent fires in a long-established natural fire area. Landscape Ecology DOI 10.1007/s10980-010-9470-5.

I think some of the information from these papers could be used in this section, it is an area not covered in the present EIS but may be important to managers and the public.

5) Future predictions

P387 end of 1st paragraph. My suggestions above to include the recent work by Collins and his co-authors is appropriate here as well. As fire becomes more active in future climates one of the mitigating factors to reduce undesirable effects is getting more fire on the ground and these papers report on such a place in the central and southern Sierra. I think this perspective would add to this EIS.

Elements	Criteria for Decision			
	Is the relevant scientific information considered?	Is the scientific information reasonably interpreted and accurately presented?	Are the uncertainties associated with the relevant scientific information acknowledged and documented?	Are the relevant management consequences identified and documented, including associated risks and uncertainties?
1. Vegetation, Including Giant Sequoias				
1.a. Giant sequoia groves and mixed conifer ecosystems	Yes with additions	yes	partially	
1.b. Conditions under which trees need to be cut and removed from the Monument				
1.c. Methods for giant sequoia regeneration	Yes with additions	yes	partially	
1.d. Forest resilience and ecological restoration	Yes with additions	yes	partially	
1.e. Climate change	Yes with additions	yes	yes	
1.f. Carbon sequestration				
2. Fire and Fuels				
2.a. Fuels management and community protection	yes	yes		
2.b. Current fuel loading	yes	yes		
2.c. Current and future wildfire trends	partially	partially		
2.d. Effectiveness of treatments for fuel reduction	partially	partially		

2.e. Chances of fires spreading to Tribal lands				
2.f. Smoke emissions and effects on human health				

Science Consistency Review Comments, Giant Sequoia National Monument DEIS

Written Statement Prepared By

William J. Zielinski

April 29, 2010

I focused my attention on 2 specific elements in the list sent to us on 6 April 2010: "Fisher habitat requirements and availability" and "Retention old forest and associated species". These elements allowed me to address the science used in the EIS that was related to the conservation of fishers, martens and their habitat. I also comment on issues relevant to the general application of science in the stewardship of public trust resources, even if it was not directly related to the management of wildlife species for which I have expertise.

I reviewed the DEIS Vol. 1 and 2 and the "Specialist Report" for information relevant to the conservation and management of fishers and martens and their habitat. My comments are grouped by category and my opinion concludes with responses to the 4 questions posed to science reviewers.

Scientific Study and Adaptive Management

The presidential proclamation describes the promise of science in the monument, referring to an "investment in ….adaptive management projects that allow us to gain more knowledge and adjust future management techniques based on that knowledge". The DEIS states (pg. 13, Vol. 2): "*Scientific study of monument resources and management effects on these resources is one of the most important aspects of the monument Plan*". Conspicuously absent, or at least not emphasized, is reference to a list of new scientific needs, so that we can continue to learn from the management of the monument. There must be general areas of uncertainty that new science can help resolve. Given the emphasis in the proclamation on "Scientific Study and Adaptive Management" (pg. 3, Vol. 2), I would expect the specialists to have included a list of potential research needs.

Also absent is reference to the development of a rigorous and science-based monitoring program that will track the status and trends in objects of interest. Monitoring is a key component of adaptive management and, in fact, adaptive management cannot be practiced without monitoring. I see very little reference to the quantitative means by which the objects of interest will be monitored. The Draft Management Plan has a few sentences about wildlife, and fisher, monitoring but I'm concerned that so little attention is dedicated to the scientific aspects of

developing a monument-specific monitoring plan. There should be discussions about thresholds that will trigger changes, consideration of how monitoring data will feedback into decision making, and what statistical designs will be used. I'm surprised that monitoring programs that currently apply to the monument, such as the Southern Sierra Fisher Population Monitoring program, are not referred to and discussed as to whether they will be used, or modified, to address future fisher and/or marten monitoring on the Monument. In my experience, the best forest-specific wildlife monitoring plans in California have been developed for the Lake Tahoe Basin Mgmt Unit – they should be reviewed as examples.

Tools for Evaluating the Effects of Projects on Fisher Habitat

At several locations in the document, the anticipated future use of models to evaluate and forecast the effects of projects on fisher habitat is mentioned. Sometimes the details are not discussed and in other locations reference is made to using the CBI model (Spencer et al. 2008). It is important to understand that the CBI model was designed to evaluate general broad questions about the value of fuels treatments, and their locations, relative to their direct and indirect effects on fisher habitat and fisher populations at very large spatial scales. The CBI model is *not* designed to evaluate the effects of individual projects (W. Spencer, pers. comm.). Instead, we (Craig Thompson, Kathryn Purcell and me) are developing a tool that is more appropriate to this question. This tool can help managers determine whether proposed projects are likely to create future conditions that are more, or less, likely to maintain fisher habitat (Thompson et al. in prep.). I understand that Craig may also be working with the GSNM folks directly to develop a Sequoia-specific version of this tool. Accelerated development of this tool should be a priority for new scientific studies encouraged by the proclamation. This new work should be referenced in the current document as the most appropriate future tool for evaluating the effects of projects. Biologists on the monument are aware of it, and should also be aware that the large-scale regional models that have been published (e.g., Davis et al. 2007, Spencer et al. 2008) are not at the appropriate scale to be sensitive to forecast changes in landscapes caused by individual projects.

The authors also do not appear to be aware of, or realize the value of, models published that can be used to evaluate the effects of projects on fisher <u>resting</u> habitat. This includes models developed from data within the monument specifically for the purpose of predicting resting habitat value from plot data (Zielinski et al. 2004a, Zielinski et al. 2006). One such model developed using data from the monument (Zielinski et al. 2006) is directly linked to FIA plot data, making it very easy to estimate future resting habitat value at FIA plots and any other plot where the variables in this model can be estimated using the Forest Vegetation Simulator (FVS) (Dixon 2002). Good quality fisher resting habitat is rare, due to the association with large and old, live and dead trees. In sum, there is no mention of using existing, published and FS-funded products to conduct future analyses on the effects of projects on important microhabitat features such as resting habitat.

Along these same lines, Diane Macfarlane, from the Regional Office, has developed a tool for evaluating the effects of projects on fisher habitat, referred to as Fisher Analysis and Assessment Tool (FAST). I was surprised to see no reference to this important new tool in either the Specialist Report or either volume of the DEIS. Even if it is not relevant to programmatic documents such as the DEIS, it should be referenced in respect to future standards and guidelines for projects that will be proposed to implement the plan.

Size of Trees that Can be Removed

Alternatives vary in respect to maximum tree sizes that can be removed, with Alt. F allowing trees of all sizes to be removed in the interest of maintaining resiliency and flexibility. Two sources of scientific information suggest that removing larger trees is: (1) not necessary to reduce fire threat and, (2) that larger trees are important components of Sierran ecosystems to key species of wildlife, including the fisher. The first source is North et al. (2009) which summarizes the current state of the scientific literature on the effects of treatments on reducing fire severity. This report finds little support in the scientific literature for removing conifers greater than 20-inch dbh if the goal is to reduce fire spread rate or severity. This is because these rates are primarily affected by the volume of surface fuels and the abundance of ladder fuels. There are circumstances where the science has demonstrated that removing conifers >20-inch dbh may achieve an ecological restoration goal (e.g., aspen regeneration) but these are not common (see addendum in North et al. 2009). Moreover, it is difficult to understand the need for so much flexibility when a maximum of 4% of the monument per decade is predicted to be affected by wildfire (pg. 22, Specialist Report) and when "*fires will drastically change habitat in limited areas, [but] the effects would only affect a small portion monument wide*" (underlining added, pg. 22, Specialist Report).

The second source of scientific information relates to the conservation of fishers, in particular. Published work, on the same location now referred to as the monument, found that although fishers regularly select as rest structures cavities in conifers that exceed 40 inches dbh, they also regularly rest in cavities and platforms in conifers that are between 20 – 30-inch dbh (Zielinski et al. 2004a). Fishers use many different rest structures during their life; our estimate of reuse during a 2-year study was about 10%, meaning that many large trees are needed within a typical home range area. Given: (1) the importance of relatively large conifers and hardwoods as rest structures for fishers, (2) the fact that historical factors have led to deficits in large trees on managed lands in the Sierra Nevada (Frankin and Fites-Kaufman 1996; Bouldin 1999), and (3) that the removal of trees > 20" dbh is usually not required to reduce fire threat (North et al. 2009), there appears to be little scientific support for removing these trees in the interest of restoration or maintaining resiliency. If such support does exit, the document has not provided scientific references to justify the ecological benefits of large tree removal.

In addition to the lack of scientific justification provided for the removal of trees > 20-inch dbh, the FS also apparently suffers a lack of trust regarding the removal of larger trees (pg. 25: "*The public is concerned that the Forest Service will cut and remove more and larger-diameter tress than are absolutely necessary…..*"). Thus, it is not clear why the authors risk selecting an alternative where the risks to wildlife habitat are the "largest" and "high" (pg.116). Is this because the risks to loss of habitat from severe fire are greater? If so, this needs to be outlined in more detail, and perhaps reference to the specific analyses in the CBI report would help. On a related issue, on pg. 400 (Vol. 1; Environmental Consequences) the author(s) recommend cutting "white fir and incense cedar large enough to provide a cost offset". This suggests that there is an economic, not entirely ecological restoration, motive (or necessity). I failed to find the economic analysis that demonstrates that this is necessary. I don't doubt that it is necessary to cut a certain number of larger trees to pay for the treatments, but I don't see anywhere in the document the analysis that accounts for the fact that retreatment will probably be necessary every 10-20 years, and that for each of these cycles it will also be necessary to pay for them by cutting the larger trees. Thus, every 10-20 years, whenever sufficient in-growth has occurred, it would appear that another set of larger trees will need to pay for each successive treatment. Where is the analysis that evaluates the cumulative effects of cutting larger trees to pay for each successive thinning operation? White firs and incense cedars > 20-inch dbh are used by fishers (Zielinski et al. 2004; Purcell et al. 2009) and others species as refugia, and we are currently uncertain as to how many such resting structures are necessary to maintain sensitive wildlife species in the monument.

The sum total of the issues raised above calls for more scientific justification for the flexibility to remove trees regardless of their size.

Den Site Buffers

The document retains the legacy of direction from the Sierra Framework for limited operating periods and limited vegetation treatments in buffers around known fisher and marten reproductive dens. The logic of this action is indisputable in that reproduction is an important event and animals are presumed to be most sensitive to disturbance when their offspring may be at risk. However, this strategy only can be effective if there is a companion program, each spring, of fieldwork to locate new dens. Illustrative of the failure of this approach, is the fact that there is only 1 protected marten den tree on the entire monument (pg. 72, Specialist Report) despite that buffers have been employed as a conservation practice for almost 10 years. This is because there has been no direction to fund the fieldwork necessary to find new dens, and no incidental marten studies that would produce this collateral information. A 'den buffer' conservation strategy will not succeed – and worse yet will provide the concerned public false assurances – if a program of fieldwork necessary to find new dens isn't advocated by line officers and adequately funded. Finding new dens, for fishers and martens, and determining how often they are reused (a measure

of their relative importance) would be a good candidate for a new scientific study on the monument.

Also, regarding den sites, it is not clear to me what takes priority if a fisher or marten den is within a WUI; which will have precedence? We don't know how fishers or martens will respond to structural changes to the vegetation in immediate vicinity of a den, but if treatment in WUIs trumps fisher or marten den protection, then it will be important to fund new science to evaluate the effects of this treatment.

Missing References to Important Literature.

Much is known about the sensitivity of martens, in particular, to forest fragmentation and the thresholds when this occurs yet none of this important literature (Bissonnette et al. 1997, Bissonnette and Broekhuizen 1995, Chapin et al. 1998, Hargis et al. 1999, Potvin et al. 2000) is referenced in either the DEIS or the Specialist Report (see pg. 69 – 71). This is an omission but, more importantly, reflects on the general lack of understanding of just how sensitive martens, and most likely fishers also, are to loss of dense forest cover. Moreover, the seminal reference on the status of martens, fishers and other carnivores in the Sierra Nevada is a paper we published in the Journal of Biogeography (Zielinski et al. 2005). This updates information in previous, earlier papers, and is conspicuous by its absence in this section. Also, an important new paper has been published in a preeminent ecological journal which summarizes the mechanisms that link martens to complex structural habitat, via their prey (Andruskiew et al. 2008). This should be read and considered. Finally, the Sequoia NF and Region 5 sponsored a key study in the 1990s on fishers and martens in the area now included in the monument. Much of the fisher-related science that came from this work has been published (Zielinski et al. 2004a, 2004b, Zielinski et al. 1999, Wisely et al. 2004, Drew et al. 2003), but not all of it appears to have been referenced, or used to influence, the fisher section of this document. For example, our paper on resting site selection by fishers (Zielinski et al. 2006) includes in the predictive model the variable "basal area of small ($5 < x < 51$ cm dbh) trees" which indicates just how important dense small-diameter trees are to the selection of resting sites by fishers. This is a critical piece of information that should be addressed and discussed in terms of reconciling fisher habitat protection with the goal of reducing severe fire. Reference to the conclusions of the CBI report (Spencer et al. 2008) would help in this respect.

Although the *marten* data from our Sequoia NF study has unfortunately not been published, it is available in a set of progress reports that were sent to biologists on the Sequoia NF (e.g, Zielinski et al. 1997). Reference to this local information on marten habitat and marten population characteristics appears nowhere in the DEIS or the specialist report. This is unfortunate since the data were collected within the administrative boundaries of the monument. Instead, too much reference is made (pg. 71) to the Humboldt marten, which doesn't occur anywhere near the monument. I suggest deleting reference to the Humboldt marten entirely and emphasize the

relevant inferences from the work on martens conducted within the monument. We trapped and studied martens on the Sequoia that occurred in lower-than-expected elevations, which may have implications for the calculated effects of WUIs on marten habitat (percents estimated on pg. 481, Vol. 1). Depending on how marten habitat is considered, this information may mean that WUIs may have greater effects on marten habitat that the current calculations indicate.

Finally, there is no reference in the Specialist Report or the DEIS to the Joint Fire Science-sponsored work that examined the effects of various fuels treatments on predicted fisher resting habitat (Truex and Zielinski 2005). This work occurred on the Blodgett Research Forest (Eldorado NF) and the Sequoia Kings National Park, but is relevant throughout the central and southern Sierra. It demonstrates how mechanical thinning vs. spring or fall prescribed fire affects fisher resting habitat. Inferences from this work apply to the conflicts that arise on the monument when reconciling the need for fuels treatments with the need to protect fisher habitat.

Learning from Sequoia-Kings Canyon National Park

Alt. C appears meant to represent a set of actions that will simulate the management actions used to maintain ecological resiliency at the nearby Sequoia-Kings Canyon NF (SEKI). If that is the case, where is the science that describes the status and quality of the monument's 'objects of interest' that also occur – or are similarly valued – in SEKI? Shouldn't there be a scientific examination of the current status of the park, in terms of ecological resiliency, application of fire, protection of species at risk, and other future desired conditions that provide similar vision for the monument? If the park is found to have achieved some or all of the goals set for the monument, then this alternative would appear to be very viable indeed. It would appear that many of the issues (i.e., Issue, 3, 4, 5 and 6; pg. 22-28) apply to the park as well as the monument. Alt. C is the only alternative for which we have a model – in the form of the current condition of ecosystems in SEKI – for how the actions specified in *any* alternative have achieved their goals. Insofar as SEKI has achieved the goal of maintaining ecological resiliency, it would appear to be a good model for the monument. A great deal of ecosystem science has been conducted in SEKI (as well as Yosemite NP, for that matter) that can be used to evaluate whether the management approach in the parks has achieved the goals articulated for the monument. Yet, very little of these inferences appear to be outlined when evaluating Alt. C. A more serious consideration of Alt. C would evaluate the body of ecological work that has come out of SEKI (and Yosemite).

Lack of Citations, in General

References to the published literature are used inconsistently. In particular I draw attention to an entire section on indirect effects (pages 395-411, Vol. 1) which is dominated by unsubstantiated comments or 'pers. obs.' (which should at least be attributed to a person by name). This is

unscientific and reads like a long collection of personal opinion garnered over a lifetime of experience. This material can have its place in management, but it detracts from the credibility of a document that is supposed to be based on the best available science. For example:

• pg. 395: No reference for the assumption that fires would be "*larger and more severe*" (even though in the Specialist Report (pg. 22) the author(s) state that "only 4% of the Monument per decade will be affected by fire".

• pg. 396: No reference to support treatment on "*more productive sites….north facing and riparian..*". In fact, this is contrary to the body of literature summarized in North et al. (2009).

•pg. 396: No reference to literature, or analyses, to support the conclusion that "*Alternative F will accomplish most protection of forests from drought, insects, disease and unwanted fire*".

•pg. 398: No ref to literature, or analyses, to support the statement: "*Larger black oaks in mixed stands will decline…. not provided by mechanical methods*".

The entire section from 396-411 would benefit from fewer photographs and more figures and tables of the results of analyses. The authors appear to be attempting to make an argument using selected images of conditions or outcomes of management, rather than with more robust summaries of analyses in tables and figures. This section of text is unique, within Volume 1, in this respect.

Habitat Calculations Consider only Amount, not Configuration

It appears that every assessment of the amount of affected habitat for martens and fishers is based on the absolute amount of habitat affected (e.g., pg 381, Vol. 1); there is no recognition that management can also affect the configuration and connectivity of habitat. It is has long been recognized that many species are affected as much by landscape *habitat configuration* as by *absolute amount* of habitat (Noss and Cooperrider 1994, Harris et al. 1996, Wiens et al. 2002, Li and Wu 2004), particularly for habitat specialists like martens and fishers (Bissonette et al. 1997). Habitat that has been fragmented into small patches, or patches that are distant from similar habitat, can be useless to a species and including patches that do not meet the minimal size will inflate calculations of the amount of habitat. Bissonette's chapter on the effects of fragmentation on martens is particularly helpful at explaining this phenomenon. Understanding the basis of the phenomenon is one thing, but conducting an analysis to account for it is altogether different since it is not straightforward. One must first decide on a metric for fragmentation, for which the software FRAGSTATS is helpful. We have found a number of fragmentation indices in FRAGSTATS helpful in our research (e.g., Kirk and Zielinski 2009, Moriarty et al. in prep.). Unfortunately SPECTRUM does not produce spatially explicit results, so may not be useful to

address this problem. Bottom line: calculations about the amount of fisher and marten habitat affected by treatments in WUIs, for example, should consider both the *absolute amount o*f habitat affected as well as the additional effects of fragmentation on the *spatial configuration* of residual habitat.

Modeling in SPECTRUM

I am not qualified to review the approach to modeling future forest conditions using SPECTRUM (nor future wildlife habitat conditions). However, I strongly suggest that these results be reviewed by an independent entity since many of the conclusions rest on the veracity of these analyses, and the assumptions that must accompany them. I'm compelled to suggest this because of inconsistencies that occasionally appear in the text. For example, on page 488, the authors' state: "*modeling has shown increases in old growth habitat and in large trees > 30" in the future for all alternatives*". This is hard to reconcile with the fact that, elsewhere in the document, the authors discuss how much habitat for old-growth associated species will be lost under some alternatives. It is hard to understand how the projection re: large trees can be realistic when 14% of the monument is in 'high' fire susceptibility category [pg. 147, Vol. 1] and some alternatives will fail to address the fire threat compared to others. Won't the increase in fire that is forecast under some alternatives reduce old-growth habitat and threaten the large-tree component? I also remain skeptical that old-growth habitat will increase under all alternatives when, under alternative F, trees of all sizes can be removed in the interest of restoration. My skepticism stems, in part, from the authors' belief – contrary to the science summarized in North et al. (2009) – that "*thinning and fuels treatments… may better protect forest canopies, <u>including those…. found on north-facing slopes and riparian zones</u>*" (underlining added). Again, it is hard to envision a future where, under all alternatives, old-growth habitat will increase when thinning may be applied equally on north and south-facing slopes and in riparian and non-riparian zones. Perhaps much of this depends on how 'old-growth habitat' is defined, but I would prefer – at least for the fisher – that the analysis consider instead how treatments will affect predicted fisher resting habitat directly, using a resting habitat model linked to plot data (i.e., Zielinski et al. 2004a, 2006). I encourage the forest supervisor and regional forester to make sure that the modeling details are reviewed by a competent peer reviewer, so that they are confident that conclusions, such as the one outlined above, follow directly from the modeling results.

Cumulative Effects Analysis

I see no evidence of a serious cumulative effects analysis in this document. Perhaps this is not required in a programmatic document, but the superficial approach to CEA seems a disservice to the concept. It would seem appropriate, when discussing a CEA, to acknowledge how tree diameter frequency distributions had changed over the last 50 - 100 years (e.g., Franklin and

Fites-Kaufman 1996, Bouldin 1999) and how each of the alternatives would affect the recovery of the large tree component. This would also be the place to document that changes in fire regimes that have influenced the goals and issues represented in the DEIS. A map illustrating where the most extensive fires and timber harvests have occurred in the last 50 years would be very helpful, especially when contrasted with areas where fuels treatments are likely in the future.

It seems like a bit of a cop out to state that all that is necessary to account for past actions is to characterize "existing conditions" (e.g. pg. 76 and 86 in Specialist Report; pg. 428, Vol. 1). This would appear to lead to a "shifting baseline syndrome" (Pauly 1995) where we continue to degrade the quality of our landscapes and are willing to continue this pattern because each subsequent CEA dismisses the previous degradations as "existing conditions". The result is that we don't respect, or act to reverse, *gradual* declines in environmental conditions.

Additional Comments

1. Specialist Report, pg. 65. Regarding wolverine. Missing reference to the published work on the recent wolverine observation (Moriarty et al. 2009) and to a paper that published a predictive wolverine habitat model that applies to the Sierra Nevada (Aubry et al. 2007).

2. Specialist Report, pg. 67. Martens were included as part of the original fisher study on what is now the monument. Reports on the habitats they used, etc. are very relevant site-specific information that should be reference in the DEIS. The reference is Zielinski et al. (1997) and was sent to Robin Galloway and Steve Anderson in the mid-1990s. A pdf is available upon request.

3. Specialist Report, pg. 72. Any discuss of risk factors to marten should cite the abundant literature on their sensitivity to forest fragmentation (details in my general comments above) as well as the recent paper we published that revealed the fragmented nature of marten populations in the northern Sierra Nevada (Zielinski et al. 2005)

4. Specialist Report, pg. 74; Vol. 1 pg. 482. The authors overlooked an important paper we published on the lack of effects of OHVs on martens in the Sierra Nevada (Zielinski et al. 2007).

5. Specialist Report, pg. 77. In regard to fisher, the authors do not cite the work conducted on the Sequoia National Forest (now monument) that described the CWHR types actually used by fishers (our progress reports and Zielinski et al. 2004b). This is an example of local data that is overlooked in favor of generic literature.

6. Specialist Report, pg. 79. The authors' claim that there is "*some evidence of recent population expansion*" yet the data from the Southern Sierra Population Monitoring Program have not yet been analyzed. This conclusion may end up being correct, but is premature based on the existing science. In fact, a careful examination of the data in Table 1 shows that the percent of

sample units with detections are actually *less* in the most recent assessment than they were in the beginning, for 2 of the 3 subregions.

7. Specialist Report, pg. 80. The authors fail to cite the most current paper on the distribution of carnivores in the Sierra Nevada: Zielinski et al. (2005). This also includes considerable new text on the conservation of martens and fishers that is relevant.

8. Specialist Report, pg. 81. Risk factors. It is biased and unbalanced to list roads first, and to overemphasize their effects – based on the published literature. Since the beginning of the era of published literature on fishers in California, timber harvest has been described by almost all authors, as the primary risk factor for fishers. Yes, roads can be a threat as well, but they do not deserve the majority of the text in a short section on Risk factors. The authors should review the current draft of the Interagency Fisher Conservation Assessment to understand the current view on the risk factors. In my understanding of the literature, roads are given way too much credence in the Specialist Report and DEIS and timber harvest – and its effects on resting structures and dense cover – too little.

9. Specialist report, pg. 82. Example of statement without necessary reference: "*Canopy closure retention guidelines for spotted owls and northern goshawks maintain habitat characteristics also preferred by fisher*". Where is the literature citation, or a description of the logical arguments that support this conclusion? Another example is on pg. 124 in regard to downed logs. Where is the literature citation for the specific standard: "*Retain approximately 132 cubic feet per acre of well-dispersed down logs. Ideal log size is 20 inches in diameter and 20 feet in length*". Ideal in respect to what, wildlife use (if so, where is the citation?) or in respect to the logistics and practicality of providing such logs?

10. Specialist report, pg. 123. Exempting WUI defense zone from snag retention is a risk to fisher and marten habitat. The magnitude of this risk could be evaluated using the type of approach represented in the new work by Thompson et al. (in prep.) that, I understand, is also being developed specifically for the monument (C. Thompson, pers. comm..). This approach uses the expected composition and configuration of female fisher home ranges as a 'reference condition' against which to compare the future condition of treated watersheds or landscapes (or allocations, such as WUIs). Note also, that using this approach to evaluate the effects of a project is a better match to the scale of treatments than using a regional/landscape model like either the CBI model (Spencer et al. 2008) or Davis et al. 2007 (i.e., relevant to text on pg. 144).

11. Vol 1. Pg. 120. Where are the citations to support the statement that using a 8-12" diameter limit would increase fuels, not reduce them? This seems to contradict the synthesis of science embodied in North et al. (2009). Same could apply to the assertion that treating surface fuels only ("non-logging" alternative) would be insufficient to address fuels. Where are the citations to support these decisions? If they are not based on science, but instead on economics, than this too should be stated.

12. Vol 1, pg. 429 (Environmental Consequences). Where are the citations to support the following statement?: "*These management treatments [thinnings]; however would distribute fewer impacts over a larger area, and over a longer period of time, than expected from sudden large and serve wildfires*." Why should we believe this? There is no reference to published literature to support this and no reference to analyses that were done to confirm.

13. Vol. 2, pg. 213. A proposed mgmt direction for "Old Forest Habitat" is to "*Mimimize old forest habitat fragmentation*". This recognizes the negative effect of fragmentation, but none of the analyses in the Specialist Report or the DEIS evaluate the potential effects of the alternatives on habitat fragmentation. Perhaps this will only be done at the project level, but this is only one scale. Fragmentation occurs at a regional, landscape, watershed and stand scales. Methods for assessing changes in indices of fragmentation are well established, but none are mentioned here, – in reference to proposed mgmt direction – or in Vol. 1 where the effects of treatments in WUIs on fisher and marten habitat are evaluated. The authors of this document obviously recognize the threat posed by habitat fragmentation, and the basis in science for this threat, yet it is not analyzed in the DEIS nor are methods for future analysis at the project level described in Vol. 2.

14. Vol. 2, pg. 217. "*Biological evaluations should be based on surveys*". The pre-project, or "clearance" survey is an antiquated notion for the conservation of at-risk species. The Forest Service has responsibility for maintaining sufficient habitat for at-risk species, regardless of the presence of the species or not. Instead of pre-project surveys, the FS has begun to shift towards regional-scale population monitoring programs for fishers and martens (see the "Southern Sierra Fisher Population Monitoring Program"). This is a more accepted approach to inventory and monitoring than the ad hoc system that preceded it. The field of conservation biology realized that pre-project surveys led to the loss of habitat because places where the target species happened to be absent often led to more severe management practices than where the target species was detected, leading to an overall decline in the amount of habitat over time. Because suitable habitat is not often saturated, and populations are not always in equilibrium with their habitat, there will always be some suitable habitat that is unoccupied during a survey.

15. Vol. 2. Pg. 356. Modeling Overview. Why weren't any of the models for fisher habitat use developed on the Sequoia NF, or that apply to it, considered here? These include Zielinski et al. 2004, 2006; Davis et al. 2007, Truex and Zielinski 2005, Spencer et al. 2008. An effort should be made to link SPECTRUM or FVS with existing empirical models developed from local wildlife habitat models.

Conclusions

1. Is the relevant scientific information considered?

In general, no. There are numerous incidents, listed above, where current and relevant literature was not consulted (see, in particular, the sections: "Lack of Citations, In General" and "Missing References to Important Literature"). The authors do not appear to extract sufficient inference, in

particular, from the studies conducted on the monument itself (Zielinski et al 1997, Zielinski et al. 2004a,b) nor reference the most current paper on the status of carnivores, and their threats, in the Sierra Nevada (Zielinski et al. 2005). The near final version of the Interagency Fisher Conservation Assessment (= West Coast Fisher Conservation Assessment; WCFCA) has been available for almost a year. There is only one minor reference to this document in the Specialist Report (pg. 87), but this is evidence that the authors had access to it. Two R5 employees – Diane Macfarlane and Rick Truex (on Sequoia NF) were WCFCA team members and could have been consulted. If the assessment had been more thoroughly referenced, some of the issues noted above would not have been a problem. There are also many unsubstantiated statements that are lacking reference to the literature or to analyses that may have resulted in the conclusions. The section on indirect effects (Vol. 1; pg. 395-411) is especially problematic in this respect.

2. Is the scientific information reasonably interpreted and accurately presented?

Generally yes, but there are a number of examples to the contrary. The emphasis on roads as dominant risk factors, compared to timber harvest and vegetation management, is an instance where the central tendency of the literature is ignored. Also, the CBI model (Spencer et al. 2008) is referred to as a potential tool to evaluate the effects of projects, but this is not a recommended function of that model (W. Spencer, pers. comm.). Another example is the general lack of reference to the summary of data represented by North et al. (2009). Statements are made suggesting that the removal of larger trees may be necessary to restore ecological integrity. That this may need to happen on all topographic positions (including north-facing slopes) and in riparian areas represents, in my view, a poor interpretation of the science summarized in North et al. (2009). These are a few examples drawn from my general comments, above.

3. Are the uncertainties associated with the relevant scientific information acknowledged and documented?

Not entirely. Treating 3,000 acres per year (Vol 1., pg. 75, Table 25) is a lot of forest land, especially with an alternative that permits the removal of larger trees (Alt. F), when we don't yet have the science in hand to know the effects on fishers. The uncertainties would be better addressed using simulation approaches, like those advocated by Thompson et al. (in prep.) and Spencer et al. (2008) and by referring to possible positive and negative effects of treatments on important habitat elements (snags, logs, dense canopy). There are also 2 important ongoing studies on the Sierra NF that will, in a few years, give us a better understanding of the effects on fishers of the types of treatments proposed for the monument. These studies, and their future inferences to management decisions like those considered by the DEIS, should be foreshadowed in the document. Recognizing the current studies and their goals, is another way to acknowledge the uncertainties in our current understanding. In general, I found the documents to contain very few descriptions of the analyses that were conducted and, therefore, very little reference to statistical uncertainty. Related issues are addressed in my general comments, above.

4. Are the relevant management consequences identified and documented, including associated risks and uncertainties?

Not very completely. See, for example, the description of risk factors and the role of timber harvest (tree removal) versus roads. Also, the effects of forest fragmentation are well known in the conservation science community, yet there does not appear to be any analysis of the effects of fragmentation, nor foreshadowing of plans to use FRAGSTATS, or any other spatially explicit analytical approach, to evaluate the effects of restoration treatments on habitat continuity. All the analysis appears to be based on simple absolute habitat loss and gain arguments, based on non-spatial analysis in SPECTRUM using simple CWHR classifications. This occurs despite an abundance of new science, much of it produced on the Sequoia NF, that is available to address habitat suitability at various scales. Other issues related to this question are discussed in my general comments, above.

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