SCIENCE CONSISTENCY REVIEW REPORT— 29 September 2003

REVIEW OF:

DRAFT SUPPLEMENTAL ENVIRONMENTAL IMPACT STATEMENT, SIERRA NEVADA FOREST PLAN AMENDMENT

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James M. Guldin and Peter Stine
Review Administrators

INTRODUCTION

On 30-31 July 2003, a science consistency review (SCR) team was convened by the Pacific Southwest Research Station in Davis CA, to evaluate the Draft Supplemental Environmental Impact Statement (DSEIS) for the Sierra Nevada Forest Plan. This science consistency review report summarizes the SCR team's findings.

A streamlined process for the conduct of science consistency reviews (Guldin and others, in press) provided a template under which the team worked. Team members were given copies of the DSEIS prior to the SCR review meeting. At the meeting, discussions were held among the team, the technical experts and designated representatives of the Pacific Southwest Regional Forester responsible for the DSEIS, and the review administrators. Those discussions led to the identification and development of specific elements or topics within the DSEIS that warranted individual scrutiny by one or another of the team members. These elements represent a distillation of the crucial scientific topics addressed in the DSEIS, as viewed by the team. The context for that scrutiny was the standardized set of science consistency evaluation criteria (Guldin and others, in press):

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?

Team members were then asked 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. Team members were asked rate any of the element x criterion cells in the matrix that they felt qualified to respond using a yes/no answer, with supplemental explanations about the rating. That rating was conducted by each team member individually over a subsequent four week period after the meetings, and was forwarded to the review administrators.

The review administrators then prepared this draft, based on reviewer comments in the following manner. Reviewer comments were parsed by the review administrator into individual review comments that matched, or nearly matched, a given cell of the element x criterion review matrix in the appropriate issues table. Those comments are tagged by a letter-number reference that links the cell entry to a footnoted explanation by the reviewer. Upon revision of the DSEIS and/or preparation of the Final SEIS , attention to the explanations of the reviewer's concern about science consistency that are included in the footnote will be key to resolving the reviewer's concern. As a reference, the Appendix contains all of the original reviews submitted to the review administrators.

Some cells of the matrix contain both yes and no suggestions, offered by different reviewers. The review administrators did not suggest one comment over the other, but included both for consideration of the technical experts responsible for any revision of the DSEIS.

Not every cell in the matrix contains review comments. Any part of the matrix that was not rated by any of the reviewers can be held to be consistent with available scientific information with respect to this draft, since the reviewers felt no need to comment on them.

One final point deserves mention. This SCR review team did not specifically address issues associated with the northern spotted owl relative to the DSEIS. Our understanding is that a separate effort is underway to obtain a review of the science information in the DSEIS relative to that particular species.

As envisioned in the process for the conduct of science consistency reviews, this report will be made available to the Regional Forester and the technical experts responsible for preparation of the document. At this point the interim recommendation of the review team is that science consistency has not been attained in the current DSEIS. The science consistency review is not decisional, and the Regional Forester has the authority to decide whether to undertake a revision of the DSEIS and/or incorporate revisions into a Final SEIS 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 science information by addressing the attached comments and especially the individual reviewer comments in the footnoted tables.

RESULTS OF THE REVIEW

The review team developed a number of elements for consideration at two levels—general comments and specific elements subject to review. Under the specific elements to review, four categories emerged during the initial meeting of the review team, and were used to structure this science consistency review draft—fire and fuels management, forest ecosystem management, species viability, and synthetic issues.

The scope of the review was limited to the DSEIS. Most reviewers were familiar with the antecedent Final Environmental Impact Statement (FEIS) for the Sierra Nevada Forest Plan (SNFP) and the FEIS was available as a reference, as needed. However, review of that document was explicitly excluded from consideration in this review. A Science Consistency review of the 2001 FEIS was conducted by a team of scientists (including six members of this current team) and their comments were included in a report dated December, 2000. Explicit exclusion of the 2001 FEIS led to some problems of independence and confusion with the DSEIS, as noted by members of the review team, which generally emerged in the general comments but some of which are included in the specific comments as well.

General comments

Overall, review team members judged the DSEIS to be generally consistent with available scientific information. There are some exceptions to this blanket statement of consistency related to 1) completeness and documentation of bibliographic citations in the DSEIS, 2) 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, and 3) concern that the overall DSEIS in general, and the section that presented the standards and guides tables in particular, was sufficiently confusing so as to not allow a reviewer to clearly understand their intent. These issues were discussed at the July 30-31 meeting with the technical experts and designated representatives of the Pacific Southwest Regional Forester. They were already aware of these concerns and acknowledged the need to address them in future iterations of the document.

The bibliographic citation comment captures two sets of concerns. The first is a linkage issue with the original SNFP FEIS. That document contains a bibliography, and technical experts charged with preparing the DSEIS undoubtedly referred to that original FEIS bibliography. As a result, the citations included in the DSEIS do not stand alone; in some cases it was very difficult to determine whether or not the relevant information was used because references cited in the FEIS were not carried forward and cited in the DSEIS and many citations of unpublished material were not traceable to a source or a person. The review team collectively agreed that it would be better to include a bibliography in the DSEIS in which all publications cited in the text can be listed, regardless of whether they had been cited in the 2001 FEIS. The second issue is one of omission, in that some references cited in the text of the DSEIS citations were published after the release of the EIS, and thus neither the EIS nor DSEIS included them in the bibliography. In the attached SCR tables, reviewers listed a number of citations for consideration by the technical experts. If both of these concerns are met in a revision of the DSEIS or the Final SEIS, the bibliography of the DSEIS would stand alone; reviewers thought his would be a positive outcome.

It was generally agreed that the DSEIS was difficult to read, and especially to interpret with respect to the standards and guides tables. Several reviewers offered specific examples of instances where it was difficult to interpret what was denoted or connoted in the entries in the standards and guides tables, and some opined that it was difficult to determine whether consistency with available science was able to be evaluated because the standards and guides tables were difficult to interpret and to crosslink. At the very least, reviewers suggested that the tables somehow denote when a blank cell carries meaning, and when it does not.

Elements related to Fire and Fuels Management

The first specific set of elements reviewed by the team fell under the topic of fire and fuels management (noted as Element A). Concerns were raised during the SCR team meeting about six major issues related to fire and fuels management; 1) fire effects and ecology, 2) the use of SPLATs as a viable fuels management approach, 3) treatment of fuels, 4) air quality issues, 5) the use of prescribed fire for purposes of restoration of fire regimes, and 6) the use of fire surrogate treatments. Table 1 lists these elements according to the review criteria.

Key findings of the review team fall in a number of cells of the review matrix. First, there was no element in the entire science consistency review in which more reviewers found opportunity to comment than in A1, the fire effects and ecology element, in light of the first review criterion querying whether available science information had been considered. Several reviewers added specific instances of sources for additional consideration and incorporation that, in their respective opinions, would strengthen the overall DSEIS. Fire effects in Sierra Nevada forests are significantly complex and merit thorough discussion of the available scientific evidence. The DSEIS is not clear on how the intended objective of restoring natural fire regimes to the Sierra Nevada will be accomplished. The linkage between fuels treatments and anticipated changes in forest function and structure leading to restoration of natural fire regimes needs detail and clarity. Uncertainty in outcomes needs to be described and subsequent management implications should be revealed.

The literature on SPLATs was generally viewed favorably, with only one reviewer offering a suggestion for additional literature review. On the other hand, several reviewers suggested that the uncertainty criterion fell short of consistency, largely through comments that suggested that the risks associated with that uncertainty were difficult to understand or poorly documented. SPLATs are a theoretical concept that requires field testing to confirm the efficacy of the concept. How will the uncertainty surrounding the outcome of this management strategy be addressed? This should be discussed. Other questions about fuels treatment were tied to questions of management implications or proposed response to perceived risks and uncertainty.

No elements in the overall review were as conflicting as those provided under elements A4-A6, in which the review team provided conflicting advice about whether the element was consistent with science. The DSEIS needs to more effectively present the overall fuels management strategy that includes how and when surface and ground fuels will be addressed. There is much discussion about treatment of the ladder and crown fuels through a more aggressive thinning from below strategy but little discussion about how treatments intend to address the surface and ground fuels. The roles of different kinds of fuels and their relative proportion or contribution to the fuels hazard should be more thoroughly discussed. Considering the importance of fuels treatments in this DSEIS, this topic deserves further discussion and clarification.

Related to the above issue is the implication within the proposed management direction that mechanical thinning has ecological equivalence to the physical and ecological effects of fire. Despite the practice of broadcast burning and/or pile burning of slash after mechanical treatments, there is still some important scientific uncertainty around the ecological differences of mechanical thinning and prescribed burning. The DSEIS does not do a thorough job of addressing or acknowledging this issue. There is a large research program that has been underway for several years in a number of locations throughout the United States that specifically attempts to address this issue. Although results are just now beginning to be produced, the SEIS should acknowledge what is known on this topic and discuss the implications of uncertainty.

We are also concerned about how the proposed fuels strategy is going to contend with the smoke issues. Given the need to ultimately treat so many acres with prescribed fire, even if not until second entries into stands in many cases, how will this be reconciled with smoke budget and burn day limitations? This is not an easy issue but the success of the overall fuels management strategy will require solutions to this quandary. There is some research and literature on the topics of smoke produced from wildfires, prescribed fires, and how a smoke budget may relate to a successful fuels management strategy that employs some combination of both mechanical thinning as well as prescribed fire. This available science on these topics needs to be more thoroughly revealed.

Elements related to forest ecosystem management

The second area reviewed by the SCR team scrutinized elements related to forest ecosystem management (Table 2), noted as Element B. Most of the reviewers' specific comments related to element B1, the most numerous of which raised questions about whether the appropriate citations were included and whether the consequences of risk and uncertainty were appropriately established. There are still shortcomings with the articulation of pre-settlement or historic forest conditions and how this provides guidance for future management direction. Vague descriptions of desired future conditions of forests leave many questions for what managers should be attempting to accomplish. A clear and scientifically defensible discussion of desired forest conditions (e.g. function, structure, composition, resiliency, etc.) that incorporates natural disturbance factors that play important and unavoidable roles in the Sierra Nevada forest ecosystems, should be presented as a preface to the proposed management strategy. Subsequently, the management strategy should be described in a manner that demonstrates how it can lead towards these conditions.

Management towards pre-settlement conditions implies significant restoration efforts such as addressing the restoration of forest function, including fire regimes. Re-creation of pre-settlement forest structure alone will not accomplish the underlying objectives. Re-creation of pre-settlement forest stand structure may be an important management objective leading towards the desired future condition but the document should consider the restoration of pre-settlement forest function as a companion objective. This is not adequately addressed in the document.

The concerns about completeness of literature citation were based on whether the literature about the use of group selection silviculture in Sierra Nevada mixed conifers was completely captured. One reviewer noted several recent references that dealt specifically with this subject and that would profoundly inform the issue were not included in the discussion. The general sentiment of the team calls for more disclosure of how prescribed management direction is anticipated to accomplish realization of the above stated objectives and how this will specifically contribute to the solution of identified problem issues including old forest restoration and restoration of natural fire regimes.

Other comments raised by reviewers that fall short of science consistency reflect the question about climate change, and whether the literature and the uncertainty regarding old growth restoration and maintenance were adequately captured. Changes in future climate conditions could have important consequences for the appropriate forest conditions to manage towards as well as what the appropriate tools might be for accomplishing desired conditions.

Elements related to species viability

The species viability issue included a number of reviewer suggestions that addressed the individual elements associated with species of concern (Table 3), noted as Element C. Element C1, pertaining to montane meadow and riparian ecosystem management and restoration, attracted the most reviewer attention within this element, largely because of deficiencies in the scope of the science information presented in the DSEIS, and the reviewers' feeling that assessments of uncertainty and risk were incomplete. Several reviewers suggested additional literature citations for integration into the DSEIS as background information for development of alternatives. Other reviewers suggested a more detailed explanation or provision for monitoring the effects of the alternatives in light of the risk and uncertainty associated with their proposed implementation.

The team made a particular point that species at risk in montane meadow systems could be addressed more effectively through a more holistic ecosystem approach. By this we mean that conservation issues for such species should be approached and analyzed by addressing physical and biological ecosystem function (e.g. through development of conceptual models that identify hydrological cycles, energy and nutrient cycles, trophic relationships, etc.), thereby understanding key ecological relationships and limiting factors that may influence population performance of species of concern. Such analyses can and should include management activities such as grazing which is identified as a key issue. We believe more effective management strategies can be developed when more thorough understanding of system function is created. The discussions on willow flycatcher and Yosemite toad in the DSEIS focused directly on some specific management concerns (e.g. effects of grazing on viability of these taxa) with little or no mention of the contextual issues of overall habitat integrity in montane meadow systems. Further elaboration on these broader issues in the decision document would help the reader understand the potential influences of the management issues on habitat integrity that are the subject of concern to the Forest Service.

Some discussion amongst the team during the July team meetings led to the development of the invasive species element. However, it was not addressed by any of the reviewers' written comments.

Several reviewers commented on specific concerns associated with the element of fisher and marten ecology and responses of those species to management. These concerns and/or comments included suggestions for citing additional literature, more thorough interpretation of the available literature, capturing the risk and uncertainty of our knowledge in the alternatives, and more clear provisions to account for potential effect of management actions in light of risk and uncertainty. Our knowledge base on fisher and marten, particularly for this portion of their range (the southern most extent for both taxa) is fairly sparse. This relative lack of information results in a relatively high degree of uncertainty regarding a number of important ecological factors related to these species in the Sierra. For example, it is unclear what habitat conditions both marten and fisher require to survive and reproduce at a rate that would sustain their population (let alone expand in the case of fisher). It is quite possible, as one member of the team has cited, that forest carnivore populations respond to elements of their habitat/environment only indirectly related to structural features of the vegetation that are being preserved. Sources of mortality that may affect population stability are also unclear. This makes it difficult to, in turn, understand how such species will respond to the proposed treatments. These sources of scientific uncertainty should be discussed in the context of risks to the population that could be increased through more aggressive fuels treatments. We do not know that proposed fuels treatments will have negative impacts on marten and especially fisher populations but the point is that we cannot be sure that they will not either.

Elements related to synthesis issues

Several elements were grouped into a catchall category called 'synthesis issues', for lack of a better term to unite them (Table 4). The greatest number of comments in this category dealt with concerns about the implications of climate change in regard to the Sierra Nevada, and on the possible effects of climate change on proposed management strategies. A number of additional citations were proposed for incorporation in the DSEIS that might shed more light on the potential ramifications of proposed management alternatives that will result from the implementation of the SEIS. The team realizes that dealing with this complex issue of how vegetation in the Sierra Nevada may change over the next few decades due to apparent changes in temperature and precipitation is perhaps overwhelming at this stage of the planning process. However, we believe that it would be prudent for this decision document to acknowledge this phenomenon and its potential effects on vegetation communities and hydrologic cycles. There is apparently some important uncertainty associated with the outcomes of management activities when considered in light of the potential effects of climate change. It would be logical for the decision document to acknowledge these potential uncertainties and explain how they will be dealt with in the future. This acknowledgement could include a commitment, as part of an adaptive management strategy, to seek further scientific evidence on the potential implications of climate change for informing future planning cycles for both individual Forests as well as future efforts to provide management guidance collectively to all Forests in the Sierra Nevada ecoregion.

There was a separate element in this category that pertained to adaptive management (i.e. research and monitoring strategies coupled with management objectives) that enable adaptive management to proceed. A few reviewer comments were sufficiently general that the best means to summarize them was to insert them in this element. However, research and monitoring in an adaptive management context were also raised in a number of the elements already presented, especially in those instances where the concern was captured in the context of a specific resource-related element. The reviewers see the concept of adaptive management as an important institutional process to acknowledge and ultimately address those instances where science information is incomplete or contradictory. Reviewers see implementation of an adaptive management strategy as an agency response based in the concept that research and monitoring can reduce or palliate those risks and uncertainty with respect to the response of a species or resource element to a management regime. Any revision of the DSEIS should address in greater detail both the question about what level of detail is appropriate in an EIS with regard to the different kinds of research and monitoring associated with situations of scientific risk and uncertainty, and the nature of the adaptive management process that would be triggered in the event that research and monitoring reveals unintended or unanticipated effects.

This concept is the one that probably resonated most loudly amongst the members of the team. It is important that the SEIS clearly define what is intended by invoking the concept of adaptive management. There are various interpretations of what such a concept really means in practice. Part of the requirements of successful adaptive management involves at least some level of design for data collection. Depending on the question being addressed, the credibility of the information will depend on some kind of experimental design. In the face of scientific uncertainty there should be structured efforts that can produce defensible data to inform future iterations of management direction.

A final thought on the expectations of adaptive management, albeit outside the strict scope of a science consistency review. We recognize that adaptive management is difficult to execute, particularly with the scope and complexity of the problems in the Sierra Nevada. Nevertheless, beginning with a limited set of questions and a true dedication to learning, this kind of program can prove to be very valuable, both scientifically in informing management decisions and socio-politically in involving interested parties. It will require, however, dedication of sufficient resources to support the necessary efforts. We urge you not to underestimate the resources necessary to make this work successfully.

SUMMARY

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

First, reviewers thought this DSEIS should be a stand-alone document, not tiered to the FEIS. The DSEIS bibliography should include all citations mentioned in the text, figures, and tables of the DSEIS itself. Similarly, reviewers thought a glossary specific to the DSEIS would add to its independent stature.

It may be too large a task for revision of the standards and guides tables to better inform the reader as to the meaning of entries within a cell, especially a blank entry, and to crosslink tables more effectively so as to render the document more interpretable. This is not a criticism of the science consistency of the DSEIS, but rather a point of observation that the evaluation of science consistency was made more difficult by the fact that the DSEIS is somewhat confusing. Confusion in conveying the true content of this decision document could be a significant problem for many readers.

Specific concerns raised by reviewers regarding the consistency of the DSEIS with available science information are shown in Tables 1-4, with explanatory footnotes that capture reviewer concerns. Some of these can be quickly dispensed with by relatively straightforward editing, additions, or revisions. A few of the comments are more substantive in scope and will require a more substantive reply.

Finally, the science consistency review process is designed to be iterative, but decisions about editing the DSEIS and subsequent review are at the discretion of the responsible official. If requested to do so, the DSEIS science consistency review team will review any revisions the responsible official might make, and offer comments about whether a revised DSEIS is consistent with available scientific information.

LITERATURE CITED

Guldin, James M.; Cawrse, David; Graham, Russell; Hemstrom, Miles; Joyce, Linda; Kessler, Steve; McNair, Ranotta; Peterson, George; Shaw, Charles G.; Stine, Peter; Twery, Mark; Walter, Jeffrey. 2003. The Science Consistency Review: A Tool To Evaluate the Use of Scientific Information in Land Management Decisionmaking. Publication FS-772. Washington, D.C.: U.S. Department of Agriculture, Forest Service, Washington Office. 29 p. (In press.)

REVIEW TABLES

Table 1. Specific elements under the fire and fuels management issue reviewed by the science consistency review team. A ‘no’ indicates that one or more of the reviewers found the element to be inconsistent with available science information for the given criterion. A ‘yes’ indicates that one or more of the reviewers found the element was consistent with available science. A ‘n/a’ indicates no comments from any member of the review team. Letter-number references refer to footnotes appended to the table as explanatory notes about the yes/no rating for the given cell.

Table 2. Specific elements under the forest ecosystem management issue reviewed by the science consistency review team. A ‘no’ indicates that one or more of the reviewers found the element to be inconsistent with available science information for the given criterion. A ‘yes’ indicates that one or more of the reviewers found the element was consistent with available science. A ‘n/a’ indicates no comments from any member of the review team. Letter-number references refer to footnotes appended to the table as explanatory notes about the yes/no rating for the given cell.

Table 3. Specific elements under the species viability issue reviewed by the science consistency review team. A ‘no’ indicates that one or more of the reviewers found the element to be inconsistent with available science information for the given criterion. A ‘yes’ indicates that one or more of the reviewers found the element was consistent with available science. A ‘n/a’ indicates no comments from any member of the review team. Letter-number references refer to footnotes appended to the table as explanatory notes about the yes/no rating for the given cell.

Table 4. Specific elements under “synthesis issues” reviewed by the science consistency review team. A ‘no’ indicates that one or more of the reviewers found the element to be inconsistent with available science information for the given criterion. A ‘yes’ indicates that one or more of the reviewers found the element was consistent with available science. A ‘n/a’ indicates no comments from any member of the review team. Letter-number references refer to footnotes appended to the table as explanatory notes about the yes/no rating for the given cell.

Key to the Table (Names of Reviewers):

B – Peter Brussard
G – David Graber
Ha – Sally Haase
He – Bob Heald
J – Mark Jennings
K – Ruth Kern
M – Bill McKillop
Q – Jim Quinn
R – Mark Reynolds
S – Carl Skinner
W – Jan van Wagtendonk

Table 1. Specific elements under the fire and fuels management issue reviewed by the science consistency review team. A 'no' indicates that one or more of the reviewers found the element to be inconsistent with available science information for the given criterion. A 'yes' indicates that one or more of the reviewers found the element was consistent with available science. A 'n/a' indicates no comments from any member of the review team. Letter-number references refer to footnotes appended to the table as explanatory notes about the yes/no rating for the given cell.

ELEMENTS	REVIEW CRITERIA			
	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?
A. Fire and Fuels Management				
1. Fire Effects/Ecology in Sierran Forests (under different conditions of forest structure, composition, etc.)	No-B2, H1, H3, H9, H10, K1, S1, S9, W1 Yes-M1	n/a	No: S1	n/a
2. SPLATs Strategy as a Viable Fuels Management Approach (includes identifying and scheduling treatment entries, in space/time)	No-R1	Yes-M1	No-H7, S2, W2, He7,	No-B3
3. Thorough and Adequate Treatment of Fuels (types of fuels, follow-up requirements)	No: W3	No: S3	n/a	No-G1, G5
4. Air quality implications/issues related to overall and long-term treatment strategies	Yes: M2 No: S4, W4	n/a	n/a	n/a
5. Use/Role of prescribed fire for purposes of restoration of fire regimes	No: K2, W5 Yes: M3	n/a	n/a	n/a
6. Fire surrogates; relationships between mechanical vs. fire	Yes-B1, M4 No-H8, S5, W6	No-H2	n/a	n/a

treatments				

Table 1 footnotes:

B1: There is certainly a scientific consensus on the need for reducing fuel loads, although the role of mechanical thinning instead of prescribed burns is still under debate. As long as mechanical thinning is used prior to an initial burn, burning is done regularly thereafter, enough fuel is removed from each treatment area, and enough of the landscape is treated to make a difference, the fuel treatments are supported by the available science.

B2: The fuels treatments are based on fire behavior models that have not been tested extensively in the field, particularly under extreme weather conditions. This is important, but it is not adequately addressed. Perhaps some mention should be made of the fire that burned through various thinning and burning treatments at the Blacks Mountain Experimental Forest in the Lassen National Forest last September. Here is some empirical evidence that fuels removal works, at least under this particular set of circumstances.

B3: Implications of the effects of fuels treatments. It was stated at the meeting that most of the thinning will occur in places that are already roaded so road construction will be minimal. However, I am uncomfortable with this assertion. If the model dictating the placement of SPLATs says one should be placed in location X and there is no convenient road, either a road will be built or the SPLAT will be located at a less effective place. If fuels reduction is the overriding goal, the road will probably be built. Thus, it seems to me that the impacts of road building on species viability, habitat fragmentation, erosion, sedimentation, etc., need to be addressed much more thoroughly. A recent issue of Conservation Biology has a special section on this topic.

G1: There is no mechanism provided for monitoring leading to adaptive management. Most of the changes I see in the Supplement are changes in management practices that reflect a different philosophy than the ROD, rather than a differing interpretation of scientific information. In particular, the SDEIS accepts more risk of undesirable outcomes in the short term than does the ROD in exchange for more rapid correction of fuels and the possibility of more commodity extraction through more aggressive management and greater flexibility in methods. Because there is a greater risk of an undesirable outcome (esp. in the short run), these practices need to be paired with a vigorous adaptive management strategy so that mid-course corrections can be made and catastrophic outcomes avoided. While there is provision in the ROD and in S1 for collection of monitoring data, I don't see a means to effectively integrate the results into management practices in the appropriate time scale. I want to repeat this point because I consider it to be the most important weakness in the planning documents:

G5: No means were proposed in the document for predicting the production and life-cycle of large snags and logs with proposed fuels treatments. Fuel-reduction burning and reintroduction of regular fire to mixed conifer, in particular, can be demonstrated by existing literature to lead to accelerated growth due to reduction in competition and enhanced nutrient cycling, burning of some large trees will lead to increased production of snags and logs, and more frequent fires will likewise increase the consumption rate of these ecological amenities. But I find no reference to models that would predict what future pools of snags and logs would like like under the different treatments.

H1: The DSEIS is lacking in scientific information regarding fire effects, fuels and prescribed burning. If it is referenced in the FEIS then the citation should also be referenced here. Shouldn't this document be able to stand alone, to some degree?

H2: There needs to be more discussion regarding the use of prescribed fire in relation to using the fire surrogate (mechanical thinning) treatments. It is difficult to determine what outcomes are expected from these management options in relation to the alternative action options. In the "vegetation density, composition" section there is reference to both "good and bad" effects or results of fuel treatments but only "bad" is discussed. The "good" need equal time in discussion. There are a number of publications regarding this topic that discuss the positive effects. This same section also implies a single treatment of prescribed fire or thinning. This would be a good place to discuss the need for multiple entry treatments in some locations (WUI possibly) and what stand changes can be expected from this process.

H3: Regarding the completeness of citation and literature: On DSEIS p.104, there is discussion on fire acres and intensity. It was difficult to determine if the fire was wild or prescribed. I assume that it is wild fire. The discussion on fire intensity doesn't appear to compare the effects between prescribed and wild very clearly. The point needs to be made that "low intensity" prescribed burns can produce "high severity" around bases of mature trees and subsequent mortality due to the fuel loadings at the base of these trees. There was no discussion regarding the need for mitigation in these situations that I could find. The pros and cons of using different burning prescriptions should be discussed also in regards to expected results and in the management decision process even if it is at forest level. Also there is not a single citation for the statements made in this section except for the table source for 3.1.2c and there should be more to have more credibility.

H7: There doesn't appear to be a clear incorporation of how the SPLATs are going to impact or not impact the connectivity of the LS/OG forests. Also there is a lack of scientific supported conclusion of how the Alternatives will affect the forest and vegetation health section.

H8: Under 4.2.4 there is no discussion of the effects of prescribed fire and different prescriptions when used in conjunction with mechanical treatments. This seems like a necessary option for some locations within the Sierra (WUI). It appears that it is one or the other not both as a treatment. The "follow-up" treatments are not discussed either. Even if they are local decisions it seems that the scientific basis should be presented so that the local manager can make the best decision with direction. There is more current research underway that summarizes this type of discussion and can be cited as such.

H9: When discussing fire intensity again, there is no referenced material for the statements given. The effect can result where under "non-lethal" fires old mature trees are killed and the small suppressed saplings survive. The reference for these statements should be included. Again there need to be a definition for "lethal, mixed lethal and non-lethal."

H10: Under S&G #5--The common fuel loads for the conifer forest type and the hardwood and plantation vegetation fuel type will not produce the final result in relation to stand survival from a wildfire. Again there isn't a reference to how these calculations were derived. It seems that the sections before of the amendment should substantiate the conclusion and directions given.

K1: The information may have been used to inform the plan, but it certainly isn't cited. The information that was cited is reasonably interpreted and accurately presented, along with related uncertainty, but the management implications are not adequately explored.

K2: The discussion of use of prescribed fire for purposes of restoration of fire regimes is quite thin in the DSEIS. My sense is that this is well established in forest management practices (there certainly is a wealth of research on this topic, none of which is mentioned in the DSEIS). I do not know to what extent this needs to be spelled out in the current planning process. If this needs to be spelled out, then the answers to questions 1 & 4 are no. For the information that has been incorporated (primarily inherent in standards and guidelines for Fire), the interpretation and acknowledgement of risks seems appropriate.

M1: The SPLAT strategy is appropriate in terms of cost-effectiveness. It is also appropriate from an ecological viewpoint because it will result in a diversity of ecosystem conditions. Fuels removals will slow down the rate of fire-spread and reduce fire intensity for any given set of circumstances. It is a reasonable expectation that project managers will be required to strike a balance between fire hazard reduction and minimization of site disturbance.

M2: Air quality issues are properly considered.

M3: Prescribed fire is assigned an appropriate role as a follow-up treatment after fuel loadings have been reduced by mechanical means.

M4: Broadcast burning of slash after mechanical treatment is a safe means of achieving the benefits of prescribed burning

R1: The results of the recent Lassen Forest fire, described in a New York Times article, which spread into a SPLAT and significantly changed in behavior and results, should be analyzed and incorporated into the DSEIS for implementing the SPLAT strategy. A summary of the actual data suggesting a recent 'pulse' of reproduction in California Spotted Owls should be presented in the DSEIS. Recent studies published and unpublished by Dave DeSante, Rodney Siegel on bird communities in various timber management treatments and of post-fire ecosystems in the southern Sierra should be incorporated into the DSEIS.

S1: In general, relevant scientific information is considered and adequately interpreted. However, there are several important papers and points referenced in the Sierra Nevada Science Review Team Report (SNSR) (USDA Forest Service 1998) for which there is no evidence they were considered in the FEIS or the SDEIS in regards to Fire and Old Forests. These papers discuss several aspects of fire/old forest relationships, fire/climate relationships, and landscape fuel management strategies that are not fully considered or discussed in the environmental documents. A list is provided. Because of these omissions and the lack of analysis to test the strategies chosen against other potential strategies, it cannot be determined if uncertainties associated with the relevant scientific information were adequately considered nor if relevant management consequences and associated risks are adequately displayed.

- (with respect to fire effects/ecology in Sierran Forests) In general, much scientific information is considered and adequately interpreted. However, there are some important papers that have not been considered.
- Since a stated objective is to attempt to restore more natural fire regimes to the Sierra Nevada, it doesn't appear that the implications of achieving that objective for 'old forests', 'aquatic/riparian', coarse woody material requirements (snags and logs), air quality, and other potential conflicts with wildlife habitat requirements are fully disclosed. Many papers that would have provided information in this regard are recommended in the SNSR and appear on the attached list.
- One important paper (and others have been published since the SNSR report) deals with the landscape patterns of stand structural conditions as related to long-term fire regimes (Taylor and Skinner 1998). This study is also partly a basis for recommendations on landscape-scale fuels treatment patterns recommended by Weatherspoon and Skinner (1996) that are not discussed in the report. These patterns are important for understanding the long-term patterns/networks of 'old forest' conditions that may have developed and are more likely to be sustainable over the long term.
- On another subject, upper montane fire regimes are not adequately displayed and discussed. Taylor 1993 and Taylor 2000 describe a very different fire regime than is provided in the table on page 93, Chapt. 3, Affected Environment in regards to degree of change from historic conditions due to management activities.
- On page 88, Chapt. 3, Affected Environment, 1st paragraph is a reference to a personal communication from Franklin that was actually published in Weatherspoon (1996) and Weatherspoon and Skinner (1996). These are two papers mostly (not entirely) ignored throughout the documents that have relevant information. In this case they would be much more appropriate references than a pers. com. It may be they were ignored because many saw them as limiting their discussion to DFPZs that were incorrectly interpreted as being primarily wide linear fuelbreaks.

S2: It is not clear if the available scientific information was interpreted accurately and without bias. The SPLATs strategy (SS) has a strong theoretical base in the scientific literature and this is referenced in the FEIS. The FEIS also notes that the SPLATs strategy has not been tested in the field (however, there is no landscape strategy that has been tested in the field). It is not clear to what extent an attempt was made to compare the SS to the landscape strategy (DFPZs - defensible fuel profile zones) proposed by Weatherspoon and Skinner (1996) in SNEP. Some of the discussion in Weatherspoon and Skinner (1996) centered around recent research on the landscape patterns of stand structures that developed under historical fire regimes (Taylor and Skinner 1998; Beaty and Taylor 2001) that are important from the perspective of restoring natural fire regimes. This concern for the topographically related patterns created by historical functioning fire regimes is generally ignored in the SPLATs strategy.
-In a letter to the Regional Forester (9/11/2000 – I believe this is cited as Weatherspoon and Skinner 2000 – but it isn't clear since it isn't in the reference section), Phil Weatherspoon and I expressed strong concerns with strict spatial application of the SS since this would ignore influences of topography – 1) on fire behavior, 2) long-term patterns of forest development, and 3) draw into question the practicability of implementing and maintaining treatments.
-Though some modeling was done to look at the efficacy of the SS for the FEIS, it does not appear that analyses were done to compare to other strategies (e.g., Weatherspoon and Skinner 1996) for that document. Further, no modeling has been done for the SDEIS to evaluate the efficacy of the suggested SS, compare with other potential strategies, and test whether changes in wording in the proposed standards and guides will provide improvement over the FEIS.

-I see this as one of the largest problems with the SDEIS. The available scientific tools were not used to compare the new alternative – S2 – with previous alternatives to see if the new alternative will make any difference. Additionally, the SPLATs strategy does not appear to have been compared to any other type of strategy.

S3: It is not clear that the entire process of completing and maintaining fuels treatments is included in the treatments envisioned. Often, mechanical thinning alone is not sufficient to adequately reduce fire hazard (van Wagtendonk 1996) and regularly needs to be followed up with some time of surface fuel treatment – commonly prescribed fire. Additionally, when fire is used alone to achieve the fire hazard reduction, one usually needs to expect several applications to achieve desired conditions – 1) initial entry to consume surface fuels and kill small trees, 2) next entry to consume accumulation of small dead trees, kill a few more small trees, kill germinating shrubs, and 3) finally to consume dead trees. The process from beginning of treatment to completion may take up to 10 yrs. This needs to be explicitly recognized in the documents and may change the scheduling and amount of area that can be claimed as actually 'treated' over the course of the planning period.
-Fuel treatment standards are shown as specified tons/acre rather than as a fire behavior (flame length, spread rate, etc.) standard. This seems strange as simple tonnage may or may not achieve desired conditions from place to place. It may be easier for managers to apply some simple cook-book-like figures. However, changing fire behavior is the target in reducing fire hazard, so fire behavior should be set as the standard and the fuels treated sufficiently, as determined by local professionals, to achieve a target fire behavior. To set a simple tonnage seems quite arbitrary and unsupportable.
-The standards for tonnage also specify fuels levels for up to 3" material only. Larger material is ignored. This doesn't make sense. Fire effects are governed by the overall consumption of fuels – not just the smaller fuels consumed in the flaming front. The total fuel bed needs to be considered in regards to the desired structure that is necessary for stands to survive fires and provide conditions to support fire suppression operations.
-It appears to be assumed in the document that the complete package of treatments will be done to achieve desired fire behavior conditions. Most studies of wildfires and pre-fire conditions show that surface fuels are the highest priority, then ladder fuels, and then canopy fuels (Weatherspoon and Skinner 1995; Omi and Martinson 2002). This is often contrary to the economics of doing the work, however, if the objectives of fire behavior modification are to be achieved these priorities should be explicitly stated.

S4: There needs to be a discussion of how requirements for clean air will likely conflict with goals for restoration of fire regimes. There are several papers that can help speak to this that are not considered (Leehouts 1998; Huff et al. 1995).

S5: The relevant science indicates that we do not understand the trade-offs between using mechanical treatments vs. fire for 'restoration' of fire resistant stand structures. This needs to be more explicitly displayed and add references to the ongoing research that is designed to address this problem (e.g., National Fire and Fire Surrogates Study - http://www.fs.fed.us/ffs/, Weatherspoon and Skinner 2002).

S9: The following are references cited in the Sierra Nevada Science Review Team Report (SNSRTR) (1998) that are either 1) not used, 2) are used but do not appear in the bibliography, or 3) are used but major points the papers made are ignored in either the FEIS or SDEIS. The SNSRTR made points with references that were considered important for consideration in National Forest planning for the Sierra Nevada.

USDA Forest Service 1998. Sierra Nevada Science Review: report of the Science Review Team charged to synthesize new information of rangewide urgency to the national forests of the Sierra Nevada. USDA Forest Service, Pacific Southwest Research Station, July 24, 1998, Sacramento. Available online: http://www.fs.fed.us/psw/publications/other/sierra/ The section(s) of the SNSRTR that specified the point is enclosed in square parentheses -i.e., [ ].

Anderson, K. 1997. California's endangered people and endangered ecosystems. American Indian Culture and Research Journal 21:7-31. [Hardwoods, Fire]

Anderson, K., M.G. Barbour, and V. Whitworth. 1997. A world of balance and plenty: Land plants animals, and humans in a pre-European California. Pgs 12-47 in R.A. Guttierez, R.J. Orsi, editors, Contested Eden: California Before the Gold Rush. California History Society, University of California Press, Berkeley CA. [Hardwoods, Fire]

Bekker, M.F. 1996. Fire history of the Thousand Lakes Wilderness, Lassen National Forest, CA, USA. Master of Science Thesis. Department of Geography, The Pennsylvania State University. {This has been subsequently published as: Bekker, M.F., and Taylor, A.H. 2001. Gradient analysis of fire regimes in montane forests of the southern Cascade Range, Thousand Lakes Wilderness, California, USA. Plant Ecology 155:15-28.) [Old forests, Fire]

Caprio, A.C. and T.W. Swetnam. 1995. Historic fire regimes along an elevational gradient on the west slope of the Sierra Nevada. Pgs 173-179 in: J.K. Brown, R.W. Mutch, C.W. Spoon, and R.H. Wakimoto, technical coordinators, Proceedings of the Symposium on Fire in Wilderness and Park Management. Gen. Tech. Rept INT-GTR-320. USDA Forest Service, Intermountain Research Station. [Old forests, Fire]

Dolph, K.L., S.R. Mori, W.W. Oliver. 1995. Long-term response of old-growth stands to varying levels of partial cutting in the eastside pine type. Western Journal of Applied Forestry 10:101-108. [Old forests]

Leehouts, W. 1998. Assessment of biomass burning in the conterminous United States.
Conservation Biology (online) 2(1):1 URL: http:/www.consecol.org/vol2/iss1/art1. [Fire]

Martin, R.E. and D.B. Sapsis. 1992. Fires as agents of biodiversity: Pyrodiversity promotes bidiversity. Pgs 150-157 in R.R. Harris and D.E. Erman, technical coordinators, H.M. Kerner, editor, Proceedings of the Symposium on Biodiversity of Northwestern California. Wildland Resources Center Report No. 29. [Fire]

Minnich, R.A., M.G. Barbour, J.H. Burk, and R.F. Fernau. 1995. Sixty years of change in California conifers forests of San Bernardino Mountains. Conservation Biology 5:902-914. [Old forests]

Norman S. and A.H. Taylor. In press. Variation in fire-return intervals across a mixed-conifer forest landscape. Paper presented to: Fire in California Ecosystems: Integrating Ecology, Prevention, and Management. Nov 17-20, 1997, San Diego CA. (This has been subsequently published as: Norman, S., and Taylor, A.H. 2002. Variation in fire-return intervals across a mixed-conifer forest landscape. In Symposium on fire in California ecosystems: integrating ecology, prevention, and management. Nov. 1997, San Diego, CA. pp. 170-179. Edited by N. Sugihara, M. Morales, and T. Morales, Associate for Fire Ecology, [NA], Miscellaneous Publication No. 1.) [Old forests]

Sapsis, D.B. and R.E. Martin. 1994. Fire, the landscape, and diversity: A theoretical framework for managing wildlands. In Proceedings of the 12th Conference on Fire and Forest Meterology, Oct. 26-28, 1993. Jekyll Island, Georgia. Society of Foresters Publication 94-02, Washington D.C. [Fire]

Skinner, C.N. 1997. Toward understanding of fire history information. Pgs 15-22 in: What is Watershed Stability? Proceedings of the Sixth Biennial Watershed Management Conference, Oct. 23-25, 1996, Lake Tahoe CA./NV. Water Resources Center Report No. 92, Centers for Water and Wildland Resources, University of California, Davis. [Old forests]

Skinner, C.N. in press. A preliminary investigation of fire history in riparian reserves of the Klamath Mountains. Paper presented at Fire in California Ecosystems: Integrating Ecology, Prevention, and Management, November 17-20, 1997, San Diego, CA. (This has been subsequently published as: Skinner, C.N. 2002. Fire history in riparian reserves of the Klamath Mountains. In Proceedings - Fire in California Ecosystems: Integrating Ecology, Prevention, and Management. Nov 1997, San Diego, CA. pp. 169-169. Edited by N. Sugihara, M. Morales, and T. Morales, Association for Fire Ecology, [Place of publication not available], Miscellaneous Publication No. 1.) [Aquatic resources, Fire]

Skinner, C.N. and C.P. Weatherspoon. 1996. Plantation characteristics affecting damage from wildfire. Pgs 137-142 in Proceedings 17th Annual Forest Vegetation Management Conference, Jan. 16-18, 1996, Red Lion Inn, Redding CA. [Fire]

Solem, M.N. 1995. Fire history of the Caribou Wilderness, Lassen National Forest California, USA. Master of Arts Thesis, Department of Geography, The Pennsylvania State University. [Old forests, Fire] (This was subsequently published as: Taylor, A.H., and Solem, M.N. 2001. Fire regimes and stand dynamics in an upper montane forest landscape in the southern Cascades, Caribou Wilderness, California. Journal of the Torrey Botanical Club 128: 350-361.)

Stine, S. 1996. Climate, 1650-1850. Pgs 25-30 in Vol. II, Assessments and Scientific Basis for Management Options, Sierra Nevada Ecosystem Project, Final Report to Congress. Centers for Water and Wildland Resources, University of California, Davis CA. [Fire]

Taylor, A.H. 1993. Fire history and structure of red fir (Abies magnifica) forests, Swain Mountain Experimental Forest, Cascade Range, northeastern California. Canadian Journal of Forest Research 23: 1672-1678. [Fire]

Taylor, A.H. 1995b. Forest expansion and climate change in the mountain hemlock (*Tsuga mertensiana*) zone, Lassen Volcanic National Park, California, U.S.A. Arctic and Alpine Research: 207-216. [Fire]

Taylor, A.H. & C.N. Skinner. In press. Fire regimes and landscape dynamics in a late-successional reserve, Klamath Mountains California USA. Forest ecology and management. (This was subsequently published as: Taylor, A.H., and Skinner, C.N. 1998. Fire history and landscape dynamics in a late-successional reserve in the Klamath Mountains, California, USA. Forest Ecology and Management 111: 285-301.) [Old forests, Fire, Spotted Owls]

Thornburgh, D.A. 1995. The natural role of fie in the Marble Mountain Wilderness. Pgs 273-274 in: Proceedings of the Symposium on Fire in Wilderness and Park Management. Gen. Tech. Rept. INT-GTR-320. USDA Forest Service Intermountain Research Station, Ogden UT. [Old forests]

van Wagtendonk, J.W. 1996. Use of a deterministic fire growth model to test fuel treatments. Pgs 1155-1165 in Vol. II, Assessments and Scientific Basis for Management Options, Sierra Nevada Ecosystem Project, Final Report to Congress. Centers for Water and Wildland Resources, University of California, Davis CA. [Fire]

Weatherspoon, C.P. 1996. Fire-silviculture relationships in Sierran forests. Pgs 1167-1176 in: Vol. II, Assessments and Scientific Basis for Management Options, Sierra Nevada Ecosystem

Project, Final Report to Congress. Centers for Water and Wildland Resources, University of California, Davis CA. [Fire]
Weatherspoon, C.P. and C.N. Skinner. 1995. An assessment of factors associated with tree crowns from the 1987 wildfires in northern California. Forest Science 41:430-451. [Fire, Spotted owls]
Weatherspoon, C.P. and C.N. Skinner. 1996. Landscape-level strategies for forest fuel management. Pgs 1471-1492 in Vol. II, Assessments and Scientific Basis for Management Options, Sierra Nevada Ecosystem Project, Final Report to Congress. Centers for Water and Wildland Resources, University of California, Davis CA. [Fire]
Weatherspoon, C.P. and C.N. Skinner. In press. An ecological comparison of fire and fire surrogates for reducing wildfire hazard and improving forest health. Paper presented to: Fire in California Ecosystems: Integrating Ecology, Prevention, and Management. Nov. 17-20, San Diego CA. (This has been subsequently published as: Weatherspoon, C.P., and Skinner, C.N. 2002. An ecological comparison of fire and fire surrogates for reducing wildfire hazard and improving forest health. In Proceedings - Fire in California Ecosystems Symposium. Nov. 1997, San Diego, CA . pp. 239-245. Edited by N. Sugihara, M. Morales, and T. Morales, Association for Fire Ecology, [NA], Miscellaneous Publication No. 1.) [Fire]
Additional pertinent papers not used in the report
Nothing in the References from the Dead Wood Conference of 1999 - Laudenslayer, Jr., W.F., Shea, P.J., Valentine, B.E., Weatherspoon, C.P., and Lisle, T.E. (Editors). 2002. Proceedings of the symposium on the ecology and management of dead wood in western forests. Nov. 2-4, 1999, Reno, NV. USDA Forest Service, Pacific Southwest Research Station, Albany, CA, General Technical Report PSW-GTR-181.
Beaty, R.M., and Taylor, A.H. 2001. Spatial and temporal variation of fire regimes in a mixed conifer forest landscape, southern Cascades, California, USA. Journal of Biogeography 28: 955-966.
Huff, MH and others. 1995. Historical and current forest landscapes in eastern Oregon and Washington. Part II: Linking vegetation characteristics to potential fire behavior and related smoke production. General Technical Report PNW-GTR-355. USDA Forest Service, Pacific Northwest Research Station, Portland, OR.
Taylor, A.H. 2000. Fire regimes and forest changes along a montane forest gradient, Lassen Volcanic National Park, southern Cascade Mountains, USA. Journal of Biogeography 27: 87-104.

W1: Very little mention of the extensive literature about wildland fire use is made. Although the Forest Service is a relative newcomer in the application of fire use in California, there is a large body of literature and experience in the National Park Service. It would be an act of ignorance to not take advantage of this experience and this effective management tool to reduce fuels and return fire to the Sierra Nevada ecosystems where it has played a role for millennia.

W2: Although SPLATS have worked in the modeling environment, there is great uncertainty about their effectiveness in the field. There remain many unanswered questions. In addition, no mention is made of the absolute requirement that SPLATS must be maintained in perpetuity in order to be effective, similar to a fuel break. A splat will only slow a fire down; the magnitude of that reduction is dependent on the fuel that exists at the time of the fire. Conversion to a flashier fuel, although with less load and perhaps crowning potential, will actually increase the rate of spread.

W3: One of the myths of fuels treatments is that all you have to do is thin the trees. Taken to its ridiculous extreme, one can prevent forest fires by cutting down all the forests. True, thinning can reduce the crown bulk density; thereby reducing crown rate of spread to the point where a crown fire is prevented. Equally if not more important are treatments that reduce surface fuels to decrease the flame length and that increase the height to live crown to keep those flames from reaching the crowns. These aspects of fuel reduction are not given adequate treatment.

Fuel management objectives are stated in terms of tons per acre targets for 0-3 inch surface fuel load that could exceed those for Fuel Model 11 (light logging slash). Using only load masks the fire behavior of leaving such large amounts of fuel in the forest. For example, Using only load masks the fire behavior of leaving such large amounts of fuel in the forest. For example, using Fuel Model 11, an effective wind speed of 10 mph and a dead fuel moisture of 8 percent can produce flame lengths in excess of 3 feet, a rate of spread over 5 chains per hour, and a fire line intensity of 120 Btu/sec/ft^2. It would be more appropriate to state the targets in terms of fuel load and fire behavior.

W4: One of the excuses used by the District rangers that they could not use prescribed fire was that the prescription window was too narrow, especially with regard to smoke. This attitude ignores the fact that the National Park Service is able to find adequate windows for burning thousands of acres adjacent to many of these same forests. Documentation regarding burning windows and weather conditions are not presented.

W5: Very little mention of the extensive literature about prescribed fire is made. Although the Forest Service is a relative newcomer in the application of prescribed fire in California, there is a large body of literature and experience in the National Park Service. It would be an act of ignorance to not take advantage of this experience and this effective management tool to reduce fuels and return fire to the Sierra Nevada ecosystems where it has played a role for millennia.

W6: The preliminary results of the Fire and Fire Surrogate study have not been included in the documents. It would seem premature to launch into a management program before the results of a study designed to answer the fire surrogate question is completed.

He7: The location of SPLATs is potentially compromised by the dual reliance of fire hazard reduction and economic value production. There is no explicit mechanism to balance a clear direction to be effective with SPLATs relative to fire hazard reduction and an equally clear direction to generate timber revenue. The Supplement states projects should be “cost effective to maximize the number of acres that can be treated under a limited budget” and “generate revenues through commercial forest products to increase the number of acres that can be treated with available appropriated funds”. Taken at face value these are unbounded objectives that could be taken to mean that quantity of acres and revenue were preferred solutions rather than quality of fire severity reduction. I find none of these directions inappropriate, nor do I believe that relaxation in Standards and Guidelines are problematic. Rather there appears to be a lack of management direction on how to balance these potentially competitive goals. Without this direction, staff will not be comfortable assessing what level and type of activities will result in positive performance reviews. Since the obvious target of fewer severe fire acres is inappropriate in the near term, the result may be negotiated acreage, timber volume or value targets disassociated with any true performance value. One possible direction to forests or ranger districts would be to develop a set of potential SPLATs ranked by effectiveness in reducing severe wildland fire risk, then and only then, utilizing common capital budgeting algorithms, develop a package of treatments that effectively utilizes available funds. This need not become an analysis paralysis process.

As a corollary the extent, cost, and effectiveness of "Forest Health" thinning is similarly unbounded." There are no estimates of acreage that could be accomplished as forest health thinning under alternative S2 because … no overall regional goals are being set" page 155. How would staff balance the added surface fuel hazard associated with these activities with SPLAT placement and extent?

While there is recognition that SPLATs will likely need follow up treatments, the table on page 164 appears to grossly underestimate the extent required. Given the imperative of surface fuel reduction to reach SPLAT objectives, it is unlikely that mechanical treatments alone will be effective. Without mechanical treatment, prescribed fire treatments will likely need multiple entries to become effective SPLATs. Both types of follow treatments will likely need to be accomplished within a decade. This is clearly indicated by the Fire and Fire Surrogate study initial results. If true there is also a gross underestimate of funds required.

Table 2. Specific elements under the forest ecosystem management issue reviewed by the science consistency review team. A 'no' indicates that one or more of the reviewers found the element to be inconsistent with available science information for the given criterion. A 'yes' indicates that one or more of the reviewers found the element was consistent with available science. A 'n/a' indicates no comments from any member of the review team. Letter-number references refer to footnotes appended to the table as explanatory notes about the yes/no rating for the given cell.

ELEMENTS	REVIEW CRITERIA			
	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?
B. Forest Ecosystem Management				
1. Definition and Rationale for Desired future condition of forests (e.g. provision for a mosaiced landscape)	No-He1, He4, He6,	N0-He2	No: M5, He2,	No-B4, K3, He2
2. Provisions for maintenance/restoration of ecosystem processes	No-B5, K4	No: S6	No: M6	No-b6
3. How Management will accommodate gross longterm perturbations (e.g. climate change, forest health, "range of natural variability", carbon sequestration, stand structure and sustainability)	No: K5, He5,	n/a	n/a	No: M7
4. Old forests restoration and maintenance (e.g. historical structure and distribution, attainment under SPLATs strategy, old trees as a component of old forests)	No: H6	n/a	No-He3,	n/a

Table 2 footnotes:

B4: While there are ample data to support the notion that many pre-settlement forests in the Sierra Nevada were open, composed of large trees, and had very little understory and that this structure was maintained by frequent ground fires, it is impossible for any management plan to recreate pre-settlement conditions. The climate has changed, the composition of the atmosphere has changed, the human population of the Sierra is increasing rapidly, and there are too many competing uses and demands on the forests. It would be far preferable to focus on managing for (1) current utility (is the forest providing a good balance of timber, range, watershed, recreation, and biodiversity values?), (2) future potential (are management practices impacting the forest's ability to provide these in the future?), and (3) resilience (does the system have the capacity for self-maintenance and self-regeneration after perturbations?). The DSEIS should referencing a commitment through monitoring to quantify the achievement of management goals.

B5: In particular, effects of fuels treatments on processes at the ecosystem (e.g., nutrient cycling) community (e.g., seed and spore dispersal, pollination) and population (e.g., dispersal and gene flow) levels are poorly addressed. For example, what will be the impacts of fuels treatments on rodents that are not only prey items for sensitive owls but also are important dispersal agents for the mycorrhizae that are key facilitators of tree growth?

B6: Inadequate attention is paid to monitoring the effects of fuels treatments on the ecosystem as a whole. These changes need to be documented at both the SPLAT level and the landscape level by recording pre-treatment conditions (photopoints and a vertebrate species list at each SPLAT and an aerial photograph of the watershed at a minimum) and then monitoring post-treatment changes every few years. This is the only way the USFS will be able to tell (1) if a SPLAT network in a watershed actually works when the fire inevitably comes and (2) what the network's long-term effects on the forest and its biota actually are.

H6: the section on old growth and fires risk and hazard does not have statements substantiated with scientific reference. And if there is, they are not referenced in the bibliography. There is mention of the affect of air pollution on decreased tree vigor and fuel accumulation, but I suspect there is as much research to show that this increase in accumulation is resulting from the reduced rate of decomposition due to the drought cycle we are in but it isn't discussed.

He1: The three documents consulted have grossly different approaches to providing scientific references. The EIS provides an extensive list. The Management Review lists cited references but clearly draws on staff expertise to produce conclusions that are not referenced. The Supplement EIS provides references at the end (not by chapter) some of which repeat those in the EIS and others which are new leading to uncertainty about which reference list is appropriate to use in evaluating this question. I have opted to offer the following additional references:

-Battles, John J. et al. 2001. The effects of forest management on plant species diversity in a Sierran conifer forest. *Forest Ecology and Management* 146 (2001) 211-222: www.elsevier.com/locate/foreco

-York, R.A. et al. 2003 Edge effects in mixed conifer group selection openings: tree height response to resource gradients. *Forest Ecology and Management* 179 (2003) 107-121. www.elsevier.com/locate/foreco

-York, R.A. et al. 2003 Group selection management in conifer forests: Relationships between opening size and tree growth. In Press Canadian Journal of Forestry.

I also encourage a review of the references provided in these publications, particularly those by Olsen, McDonald and Stephens concerning group selection which appear to be also absent from the review document references.

He2: #2, 3, 4 In general, the discussions of regeneration and group selection would be better informed by review of the above cited documents (Supplement pp 92, 51, 157). The Supplement provides curiously little discussion of the near tripling of group selection acreage in HFQLG region. The science and management practice of group selection in the ¼ acre to 2-acre canopy gap range are well developed for the Sierra Nevada mixed conifer vegetation type with respect to stand structure and composition. The discussions on pages 150 through 158 barely scratch the surface of the opportunities and challenges associated with managing regeneration gaps either in HFQLG or the remainder of the Sierra. Available science clearly documents that ~ one-acre canopy gaps are adequate for regeneration of all native conifers. There is no discussion of the interaction between thinned matrix surrounding gaps and the limiting light environment within the gaps. Clearly light (soil moisture only at canopy gap edges) is the limiting resource for regeneration and substantially increased by reductions in canopy cover of surrounding stands. There is concern about potential effects of group distribution on habitat connectivity yet no guidance is offered to mitigate that potential. I have great concern that the management context of group selection is not conveyed in standards, guidelines or management direction. Indeed, there appears to be an aura of conceptualizing group selection as a one time (five year) effort rather than a sustainable silvicultural system. Well done, group selection clearly offers opportunities to make simultaneous progress toward fuel reduction and movement toward desired future Old Forest Ecosystem structure. The existing discussion provides no direction concerning group distribution pattern, hierarchical prioritization of stand conditions appropriate for group establishment, average group size, stand or 2nd order watershed regeneration intensity, juxtaposition with seed producing trees, exclusion of overstory within gaps, regeneration by planting versus seeding versus coppice, site preparation, vegetation management within gaps, tree density and species composition control within gaps, fuel management within gaps, management of the matrix stand surrounding group openings, future group edge opening strategy, or re-entry period for future gaps. All these are absolutely essential management decisions with well established practical management options that directly impinge on success of the application. Absent guidance on how to at least develop each of these decisions locally, it is impossible to assess the effects of the project. Furthermore, there appears to be no explicit provision for operational funds for even the first critical decade of treatments required to successfully initiate group selection. Experience has shown that prioritization of initial openings in a group selection management regime should focus on correcting existing stand structure and composition problems, not necessarily high timber volume locations. There is no a priori guarantee that group harvest will develop the timber sale receipts needed to finance the decade long sequence of group treatments required for successful establishment of regeneration. There is no explicit recognition that groups will need fuel treatment (as will virtually every regeneration treatment) either in order to effectively function as part of future old forest desired conditions or simply survive potential wildland fires. Table 4.2.4b clearly states that no follow up treatments are planned for the 39,000 acres of group selection created by initial treatments. In this context, group selection may easily become a five-year exercise in frustration rather than a sustentative contribution to desired future conditions. Neither are rigid layered restrictions about “where not to do X” appropriate to guide group selection. What is apparently lacking are positive direction about how to prioritize options in a decision matrix.

The Supplement correctly references Lilieholm (1990) as showing disturbance required for intolerant reproduction and the relative dominance of fir and cedar in selection managed stands. However the reference to “intolerant pines were virtually absent from the small and large sapling classes” fails to include the authors’ (I am a coauthor) explanation that these size classes had not yet developed due to the time since management was initiated in dense young growth stands. Indeed the paper demonstrates that sufficient intolerant regeneration was present to sustainably reproduce the overstory so long as periodic disturbances (selection harvests) were to be continued and understory stocking control initiated.

He3: The desired future condition for old forest appears to have a non-sustainable age class distribution. Simple life table analysis indicates that there is insufficient growing space allocated to regeneration and early life stages to support the intended population of large old trees. While the DFC may be an interim goal, there is no need and much advantage to not creating or exacerbating an unbalanced age class structure. An excess of large watershed scale gaps created by an unnatural fire regime is not sufficient cause to falsely compensate by creating equally unnatural extensive areas without small-scale (0.1 to 1.0 acre) canopy gaps occupied by multiple early to mid seral (0 – 50 year old) vegetation structures.

He4: There appears to be a concern about disrupting habitat connectivity by >= 30 % gaps in forest structure. I am aware of literature to support this effect at the 40% to 60 % level, not at 30%. In addition, there is no clear indication that well distributed small-scale gaps in the Sierra vegetation types could create “discontinuity” at 30%.

He5: The reference to developing “large trees” correlating to increased carbon storage needs explanation. While a single large tree obviously stores more carbon than a single smaller tree, the relationship of surface fuels, fire (natural and prescribed) regimes, large woody debris, complexity of shrub and forb species composition, soil carbon and respiration all have a role in carbon storage. Whether a stand, watershed, or region has more carbon storage depends on a lot more than tree size.

He6: Page 155 states “The effect of stand density reduction on reduced tree competition and increased vigor when clumped versus distributed with thinning is not known.” I believe Stone and Cavallero have studied this issue and written on a topic they refer to as “G Space”.

K3: Ch.4, pg. 148, para. 3 states that the “measure used for addressing consequences to old forest ecosystems…has been refined and replaced with the indicator of progress toward desired conditions for old forest.” As far as I can see, this indicator of progress is described in DSEIS, Ch.4, pg. 151-152, but this discussion does not define how the actual progress toward the desired future conditions will be measured.

K4: While the SNFPA FEIS and DSEIS do an admirable job of including discussions of habitat and forest types rather than single species, there is still inadequate provision for maintenance/restoration of ecosystem processes. The only process that is addressed with any completeness is disturbance (fire, insects, pathogens), while the very important issue of carbon cycling is given less than 3 lines.

Virtually unmentioned are other biogeochemical cycles, decomposition, measures of ecosystem productivity, hydrology, & climate change.

K5: The temporal scope of this plan is fairly limited, though it is beyond my expertise to know how to (or whether there is any point in) expanding the planning horizon. Nonetheless, it is important to consider the effects of long-term and large-scale perturbations (climate change and population growth) and that the long-term consequences of the proposed management actions on large-scale issues such as carbon sequestration, range of natural variability, stand structure and sustainability be addressed.

M5: Pre-European-settlement forest ecosystems were robust against disturbance by catastrophic wildfire and provided habitats for species of current concern. Their character is an important target (desired future condition) for the various alternatives to aim for. It is therefore important that a determined effort be made to provide a best-available estimate of their likely structure (especially tree diameter distributions and density) and acreage by seral stages.

M6: In moving towards pre-European-settlement forest conditions it is not necessary or desirable to attempt to restore all the area of each National Forest to a pre-settlement condition. The desired future condition need refer only to existing forest stands and seral types

M7: Re/ management response under uncertainty and risk: It is appropriate to use estimates of pre-European-settlement forest conditions as the basis for the desired future condition. The desired future condition should be modified if necessary to allow for anticipated changes. For example, if the future climate is expected to be warmer and drier, this will make it necessary to increase the intensity of fuel reduction programs and create more open stands than would be dictated by cooler, wetter climatic conditions.

S6: It should be explicitly discussed that in order to 'restore' fire regimes, fire must be used as a process and quite frequently. 'Restoration' as used in the documents appears to be largely referring to restoring what is thought to be historical structures created by historic fire regimes. To 'restore' fire regimes requires the process of fire – and not just once, but ongoing. Structural restoration helps in restoring a more natural fire regime by facilitating the use of fire. However, structural restoration alone does not restore the fire regime.

Table 3. Specific elements under the species viability issue reviewed by the science consistency review team. A ‘no’ indicates that one or more of the reviewers found the element to be inconsistent with available science information for the given criterion. A ‘yes’ indicates that one or more of the reviewers found the element was consistent with available science. A ‘n/a’ indicates no comments from any member of the review team. Letter-number references refer to footnotes appended to the table as explanatory notes about the yes/no rating for the given cell.

	REVIEW CRITERIA			
ELEMENTS	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?
C. Species Viability				
1. Montane Meadow/Riparian Ecosystem Management/Restoration (e.g. pertains to conservation of Yosemite toad, willow flycatcher, mountain yellow-legged frog, great grey owl)	No-B9, J1, R2, R3, R5, W7, Q2	n/a	No-B8, J2, J4, K6, R4	No-B7, G3, R6, Q7
2. Invasive species management strategy that deals with amphibians at risk	n/a	n/a	n/a	n/a
3. Fisher ecology and response to forest management (thinning, prescribed fire)	No-Q3	No: S7	No: W8	No-G4
4. Marten ecology and response to forest management (thinning, prescribed fire, recreation)	No-H5, Q3	n/a	n/a	n/a

Table 3 footnotes:

B7: The DSEIS should include a tiering to or support for development of a comprehensive, region-wide conservation strategy for each of the species identified in the DSEIS. Ultimately, those plans should include management prescriptions and recommendations, prioritized locations for restoration, a detailed monitoring program, and a method for incorporating monitoring results into local management decisions.

B8: Assessment of uncertainty: Allowing grazing and most recreational activities to continue in areas occupied or historically occupied by any of these species is almost certainly incompatible with population recovery and meadow restoration. Rather than allowing grazing and recreation to continue in these areas, the USFS should explore various conservation strategies that simultaneously address the needs of various user groups. For example, finding alternate grazing areas for impacted ranchers would provide them with long-term economic sustainability while protecting key habitat of sensitive species.

B9: However, a recent assessment of the conservation status of this species (Green, G.A., H.L. Bombay, and M.L. Morrison, 2003, Conservation assessment of the Willow Flycatcher in the Sierra Nevada) does not support the development of local management strategies. Livestock grazing, meadow degradation and drying, and cowbird parasitism are identified as the primary factors causing the Willow Flycatcher's decline. The report concludes that without addressing these factors directly through grazing restrictions, cowbird control, and meadow restoration, along with intensive monitoring of birds and habitat, alternative S2 has a high probability of promoting a continued decline in abundance of this species' population in the Sierra Nevada. This publication should be cited in the DSEIS

G3: The treatment of meadows and riparian areas and their associated sensitive animal species (WIFL, GGOW, BUCA, RAMU) is awkward and inconsistent. The biggest problem is there is no holistic look at these ecocenters. There needs to be a desired future condition for meadows and other wetlands that encompasses structure and function. The present treatment is a species-by-species job that dishonors ecosystem management with piecemeal mitigation strategies that brings long-term sustainability into question. To use one example: The discussion of great grey owl is thorough and accurately reflects scientific knowledge to a point. Provision to retain sufficient meadow biomass to support prey species is fine so far as it goes. But there is no mention of a means to monitor prey directly to determine if this management is effective. If prey were affected instead by changes in hydrology or trampling by livestock, how would the forest have information to revise management practices?

G4: The treatment of fisher discusses the uncertainties regarding habitat requrements, and the risks involved with the short-term and long-term habitat trade-offs for S1 and S2. However, it fails to call for the monitoring and adaptive management (or I can't find it) that would be necessary to discover effects in a timely fashion should they be found to be unsatisfactory. A similar, but less pressing case can be made for marten.

H5: In the discussion of fuel reduction in association with the Marten (3.2.2.2) that the only reference sited did not completely relay the information of the research, such as simply identifying the fuel reduction treatments studied which is a basic part of the needed discussion. I suspect this may also be common throughout other sections of the document.

J1: There is considerable newer information listed for the Yosemite toad, but not the mountain (or Sierra) yellow-legged frog, California red-legged frog, and foothill yellow-legged frog. New information (via Cathy Brown's PSW conservation strategies) should be included. A number of newer papers are pertinent to the above statements (deal with Sierra Nevada amphibians) that are not cited in your draft:

Belden, L. K., and A. R. Blaustein. 2002. Exposure of red-legged frog embryos to ambient UV-B radiation in the field negatively affects larval growth and development. Oecologia, 130:551-554.

Blaustein, A. R., L. K. Belden., D. H. Olson, D. M. Green, T. L. Root, and J. M. Kiesecker. 2001. Amphibian breeding and climate change. Conservation Biology, 15:1804-1809.

Chinchar, V. G. 202. Ranaviruses (family Iridoviridae): emerging cold-blooded killers. Archives of Virology, 147:447-470.

Davidson, C., H. B. Shaffer, and M. R. Jennings. 2001. Declines of the California red-legged frog: spatial analysis of the climate change, UV-B, and pesticide hypotheses. Ecological Applications, 11(2):464-479.

Davidson, C., H. B. Shaffer, and M. R. Jennings. 2002. Spatial tests of the pesticide drift, habitat destruction, UV-B, and climate change hypotheses for California amphibian declines. Conservation Biology, 16(6):1588-1601.

Fellers, G. M., D. E. Gren, and J. E. Longcore. 2001. Oral chytridiomycosis in the mountain yellow-legged frog (*Rana muscosa*). Copeia, 2001:945-953.

Johnson, P. T. J., K. B. Lunde, R. W. Haight, J. Bowerman, and A. R. Blaustein. 2001. *Ribeiroia ondatrae* (Trematoda: Digena) infection induces severe limb malformations in western toads (*Bufo boreas*). Canadian Journal of Zoology, 79:802-804.

Johnson, P. T. J., K. B. Lunde, E. G. Ritchie, and A. E. Launer. 2001. The effect of trematode infection on amphibian limb development and survivorship. Science, 284:802-804.

Johnson, P. T. J., K. B. Lunde, E. G. Ritchie, J. K. Reaser, and A. E. Launer. 2001. Morphological abnormality patterns in a California amphibian community. Herpetologica, 57:336-352.

Johnson, P. T. J., K. B. Lunde, E. M. Thurman, E. G. Ritchie, S. N. Wray, D. R. Sutherland, J. M. Kapfer, T. J. Frest, J. Bowerman, and A. R. Blaustein. 2002. Parasite (*Ribeiroia ondatrae*) infection liked to amphibian malformations in the western United States. Ecological Monographs, 72:151-168.

Kiesecker, J. M. 2002. Synergism between trematode infection and pesticide exposure: a link to amphibian limb deformities in nature? Proceedings of the National Academy of Sciences, USA, 99:990-994.

Knapp, R. A., K. R. Matthews, and O. Srnelle. 2001. Resistance and resilience of alpine lake fauna to fish introductions. Ecological Monographs, 71:401-421.

Matthews, K. R., K. L. Pope, H. K. Preisler, and R. A. Knapp. 2001. Effects of nonnative trout on Pacific treefrogs (*Hyla regilla*) in the Sierra Nevada. Copeia, 2001:1130-1137.

Matthews, K. R., R. A. Knapp, and K. L. Pope. 2002. Garter snake distributions in high-elevation aquatic ecosystems: is there a link with declining amphibian populations and nonnative trout introductions? Journal of Herpetology, 36:962-969.

Pope, K. L., and K. R. Matthews. 2001. Movement ecology and seasonal distribution of mountain yellow-legged frogs, *Rana muscosa*, in a high elevation Sierra Nevada basin. Copeia, 2001:787-793.

Sparling, D. W., G. M. Fellers, and L. L. McConnell. 2001. Pesticides and amphibian population declines in California, USA No one seems to have considered the negative effects of increased avian predators around recreation areas (like ravens and crows around garbage dumps). These creatures are much more common now than in the past and can have a significant effect on young native toads and frogs.of chytridiomycosis in *Rana muscosa* (Camp 1917). Herpetological Review, 32:151-152.

J2: No one seems to have considered the negative effects of increased avian predators around recreation areas (like ravens and crows around garbage dumps). These creatures are much more common now than in the past and can have a significant effect on young native toads and frogs. Similarly, The problems with amphibian deformities and the controversy around them are not discussed at all. There should be a paragraph on the parasite-contaminants-herbicide controversy regarding frog deformities.

J4: Regarding uncertainty in scientific information, an element is missing element here. Someone needs to talk with Roland Knapp and the U.C. Berkeley people about the problem with amphibian die offs due to disease (especially chytrid fungus). This is a great uncertainty right now and can have a profound effect on how we may manage recreation activities in the future (to prevent the spread of the fungus).

K6: The DSEIS section on aquatic, riparian, and meadow ecosystems (Ch. 4, pgs 159-161) and the standards and guidelines section incompletely review the uncertainty regarding factors promoting proper meadow/riparian system function. Again, there are many specifics regarding species-specific habitat protection, but not enough attention is paid to maintaining system health and integrity. In particular, despite the numerous S&G's on aquatic/riparian areas, the overall issue of maintaining and restoring proper meadow hydrology is not directly addressed. If this more general issue could be insured, the problems of erosion, invasive species, etc. will be much attenuated.

Q2: The omissions in documentation are particularly important for the issues in which the SEIS team argues that new information justifies a changes in approach (e.g., owl, willow flycatcher, Yosemite toad population data, as on pp. 3, 28, and in the species impact sections.)

Q3: I did not find the analysis of potential impacts on rare forest carnivores of the greatly modified Standards and Guidelines between those in S1 (the current ROD) and S2 [greatly increased mechanical treatment, including removal of some commercial lumber, outside wildland-urban intermix (WUI) zones] complete or convincing. As the authors note, the original FEIS and ROD considered impacts of thinning on raptors and mustellids uncertain, and therefore adopted a (perhaps unnecessarily) conservative strategy of limiting entries and relying mostly on controlled burning (to which native carnivores are presumably adapted) except near habitation. The recommended practices in S2 substitute mechanical treatment (and multiple follow-up burns) in ways that may reproduce structural properties (e.g. canopy closure and layering) of (possibly) original and sustainable fire regimes. There is of course controversy on degree of ecological equivalence of mechanical vs. fire-based thinning, which the SEIS essentially fails to acknowledge or address. It is quite plausible that some or all forest carnivore populations respond to primarily to elements (disturbance, prey populations, temperature/moisture environment, proximity to roads…) only indirectly related to the structural elements being preserved. Some of these effects are subject to monitoring and experimentation (e.g., at the Teakettle Experimental Forest). The scientific validity of the recommended approach in S2 depends on the implied relatively equivalent effects of fire and mechanical treatment of fuels on carnivore behavior, food, and physiology – which is hardly established. As stands, the document neither references the existing scientific literature (including ongoing PSW studies in the Sierra), nor provides any details on how it might be assessed going forward (see “adaptive management” below), other than to provide a general call for monitoring (Of what indicators? What performance criteria? With which treatments and controls?)

I predict that this issue will prove to be the most important point of scientific controversy raised by this document, and strongly suggest that the authors perform and report on a comprehensive review of existing and ongoing comparisons of effects of fire and mechanical thinning on forest carnivores.

Q6: In light of the information needs to really sort out causality in populations of species constraining fuels policy, I am concerned that too few variable are being considered as subjects for research and monitoring. I noted above that the information marshalled for forest carnivores deals primarily with forest structure, though it is well known that food, nest sites, predators, parasites, etc. can also be critical. I would suggest at least routine direct monitoring of small mammal populations (in the AM experiment spirit) for carnivores.

Q7: Multiple causality may be particularly important in meadow ecosystems (which in my opinion, and that of the SCC for the original FEIS) are less well covered than are old forests. Suitability of meadows for great grey owl forage is certainly less dependent on stubble height (which seems to be the performance variable) than it is on rodent populations, which in turn respond to hydrology directly (flooding) and indirectly (plant community composition). A synthetic view of the among between grazing, water table and channel alteration, meadow composition, and carnivore response is really necessary for scientific understanding and prediction. The univariate S&Gs considered in the FEIS don’t do a particularly good job of addressing multivariate causality, but I don’t think the current document grapples well either. It is appropriate to pass on unresolved problems of this kind to future research and analysis, but it would be useful to do so specifically, and to identify the research resources needed to satisfactorily address it.

R2: In general, sections of the SEIS and SNFPA Management Review and Recommendations pertaining to forest habitats, fire, fuels and vegetation management are superior in science consistency to sections pertaining to mountain meadow habitats, special status species and livestock grazing. A broad, scientifically supported ‘desired future condition’ for forest ecosystems is explicit with general characteristics of late seral attributes of larger trees, mixed age and size structure, greater canopy closure and the opportunity for prescribed and natural fire to be used as a management tool. The sections pertaining to mountain meadow habitats, as in the FEIS, describe a ‘late seral’ desired future condition but generally take a much more piecemeal approach to developing standards and guidelines for special status species without specifying conditions for meadows with high ecological integrity and function. For example, A broad set of desired future conditions for meadow habitats, conjoined with a rigorous restoration, monitoring and adaptive management program, could potentially resolve some of the apparent conflicts between commercial livestock and pack stock grazing and special status species. For example, several lines of evidence seem to support the idea that wet meadows, with persistently high water tables, productive emergent vegetation, and dense and continuous patches of willows support populations of several sensitive species, as well as high diversity and abundance of other meadow dependent species. Specifying a certain proportion of Sierra national forest meadows for restoration to wet meadow habitat may help to sustain willow flycatchers, great gray owls and yosemite toads. Without identifying the desired future conditions for wet meadows, moist meadows and dry meadows, we are missing a great opportunity to restore, monitor and manage these systems in ways that would increase both habitat values and the potential for appropriate amounts of compatible commercial grazing.

R3 It is not clear, based on what is presented in the SEIS, whether Green et al's 2003 conservation assessment of the willow flycatcher has been consistently interpreted, along with previous and on-going studies of willow flycatcher. Although the FEIS lists a large number of potential factors in the decline of willow flycatcher, there is clearly some priority on the factors that the Sierra National Forests can control (e.g. habitat management through grazing).. Any scientifically valid approach to restoration of sensitive species and habitats also includes comprehensive protection for remaining populations of those species and their habitats as well as an aggressive approach to research, monitoring and adaptive management.

R4: The various standards and guidelines related to grazing timing, stubble height and meadow and riparian edge thresholds presented in the SEIS are not well supported by either citations in the documents nor, to my knowledge, by existing studies. These may be ecologically justified standards, but in the absence of definitive studies, some greater acknowledgement of uncertainty is warranted.

R5: The DSEIS should incorporate results from several recent and continuing studies on Sierra meadow ecology and management including Morrison, Bombay et al's on willow flycatchers, Stermer et al's on wildlife habitat of meadows, Weixelman et al's on meadow classification, PRBO – Ryan Burnett et al's on meadow bird populations, Steele on EPA funded meadow restoration, Reynolds et al's on meadow plant, bird, bee, and butterfly populations and several others. Burnett has gathered important new information on the distribution and abundance of willow flycatchers within the northern Plumas Forest and Lassen Forest which would expand the analysis based on 82 nest locations in the central Sierra Nevada. Willow flycatchers in this northern area appear particularly responsive to changes in grazing. A recent symposium on bird populations of Sierra montane meadows sponsored by California Partners in Flight was well attended by ecologists and practitioners interested in meadow restoration and monitoring. The abstracts are available from California Partners in Flight (linked on the PRBO website www.prbo.org) and these various investigators have produced reports and publications which should be incorporated into the DSEIS.

R6: A comprehensive program of habitat protection, restoration, research, monitoring and adaptive management for meadows should be more fully developed in the SEIS.

S7: In regards to 'old forest' conditions – there still seems to be a disconnect between what is likely to have been 'old forest' conditions under a historically functioning fire regime and the definitions of 'old forest' conditions that are often used based upon the conditions that occur today following many decades (nearly a century) of fire suppression and other management activities. There are even some references (page 173, Chapt. 4, Environmental Consequences) to 'natural' stands and 'unmanaged' stands that are neither. In both cases, these conditions are at least partly the result of management activities – especially fire suppression. It is likely these are referring to places that have had successful fire suppression accompanied by limited logging. These types of stands are likely artificially created and maintained, may be difficult to sustain, and are unlikely to be representative of much that occurred under a historical, functioning fire regime. They should be recognized as such.

W7: No mention is made of Michaela Huntzinger's recent (2000) MS from UC, Davis entitled, "Effects of fire management on butterfly fauna of the forested Western United States." She found that burning in riparian areas increased butterfly biodiversity.

The blanket application of the 12-inch residual for meadows for great gray owl foraging habitat needs to be applied judiciously. Obviously all meadows will not have the same productivity as the meadows studied by Correigh Greene (1995. Habitat requirements of the great gray owl in the central Sierra Nevada. Unpub. MS thesis, Univ. Calif., Davis. 94 p), but caution is advised in falling below a productivity threshold. On-going research in Yosemite indicates that utilizing 35 percent of the forage in meadows similar to those used by great gray owls results in a 10 percent loss of productivity (Cole, D. N., J. W. van Wagtendonk, M. P. McClaran, P. E. Moore, and N. K. McDougald. 2003. Response of mountain meadows to grazing by horses and mules: Yosemite National Park, California. J. Range Manage. In press).

W8: While the approach to not allowing prescribed burning to be conducted in fisher habitat until definitive research results on the effect of burning large woody debris on fisher prey abundance is completed is a cautious approach, no mention of the consequences associated with doing nothing is made. Lack of fuel treatment in fisher habitat will doom the species to losses from catastrophic fire.

Table 4. Specific elements under"synthesis issues" reviewed by the science consistency review team. A 'no' indicates that one or more of the reviewers found the element to be inconsistent with available science information for the given criterion. A 'yes' indicates that one or more of the reviewers found the element was consistent with available science. A 'n/a' indicates no comments from any member of the review team. Letter-number references refer to footnotes appended to the table as explanatory notes about the yes/no rating for the given cell.

	REVIEW CRITERIA			
ELEMENTS	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?
D. Synthesis Issues				
1. Implications of Climate Change in the Sierra and possible effects on Management strategies	No: J3, K6, S8, W9	n/a	No-G2	n/a
2. Overall affects of management strategies on the Aquatic Management Strategy	No: S9	n/a	n/a	n/a
3. Adaptive management process; a. overall strategy, priorities b. performance measures c. mid-course correction procedures d. monitoring plans, protocols, triggers	No: R8	No: He9	No: Q1	No: R7, Q4
4. Economic analyses; feasibility of the overall management strategy	Yes: M8A No: H10, M8B	No: S10 Yes: M9	No: He8, Q5	n/a

Table 4 footnotes:

G2: The effects of climate change on proposed management practices is not thorough. The discussion in 3.1.1 is reasonable and appropriate, but not adequately followed through in terms of effects in Chapter 4. A means to adapt to vegetation and hydrologic changes from climate isn't provided.

H10: Under B. "economics of fuels treatment" there is no discussion of prescribed fire as a fuel treatment, only mechanical. If prescribed fire isn't considered to a fuel treatment, the heading should reflect that it is "mechanical fuel treatment".

He8: There is discussion of the potential problems of community economic stability but no recognition that a one-time effort in group selection may lead exactly to a wood production "boom then bust".

He9: The Standards and Guidelines section presentation is unnecessarily confusing. The format sometimes uses a "no" in the S2 column to mean the same as a "blank" in that column. Minor wording changes from S1 to S2 convey significant meaning and may not be recognized by even careful readers, I suggest the use of strikeout and underscore in these cases. Occasionally the only difference between S1 and S2 guides are the order of sentences within the guide, not a change at all but it creates the appearance of change. Occasionally, the exact same standard is checked S1 and unchecked for S, then reversed in different rows, even on different pages. Some of the Objective statements are misleading. For example, stating an objective of "maintaining high levels of canopy cover" when the guideline for cover is stated as 40%. Some standards appear virtually impossible. For example, directing mechanical fuel treatments in plantations reduce flame lengths to < 2 feet under 90^{th} percentile fire weather conditions and remain effective for at least ten years. The Urban Wildland Intermix Threat Zone appears to have no standards and guidelines.

J3: There is no discussion about the potential negative effects of climate change on amphibians and reptiles in the Sierra Nevada.

K6: Climate change implications not mentioned.

M8A: The use of the term "economic efficiency" is appropriate because it includes comparison of alternatives, using revenues, costs, levels of appropriated funds, employment , income and, implicitly, tax receipts by federal, state and local governments.

M8B: Information on payments to counties and schools after 2006 should be provided. As I understand it, the Secure Rural Schools and Community Self-Determination Act of 2000 provided a temporary safety net of the states highest three years average. But that provision expires in 2006 and there is no guarantee that Congress will come up with a substitute.

Q1: As it stands, I do not think the draft Supplemental EIS is as successful as a scientific document. Large sections (some details below) contain no reference to primary scientific literature, and it is difficult as a reviewer to determine whether the generalizations offered are supported by credible data. Although some sections (e.g. fire acreage projections, production estimates, some population data) are admirably numerical, the analyses used are not described, and therefore can't be readily reproduced and checked by outside observers. There are almost no statistical analyses of uncertainty (e.g., confidence intervals on graphs), though the document often does a reasonable job of qualitatively acknowledging where knowledge is limited. Some of the missing references and descriptions can probably be found in the FEIS or the Management Review and Recommendations – however they should still be properly referenced in the SEIS, at least to subsection or page of the backup document. Assertions of fact that are undocumented and offered as "commonsense" need to be acknowledged as such.

Q4: In discussions with the SCC team, the DSEIS authors agreed that needed discussion of adaptive management text was missing from the draft, and I am confident that the final document will be much more complete. However the management flexibility envisioned in S2 makes the design of an effective adaptive management plan much more challenging than in the approach envisioned in the ROD.

As a result, it is important to specify how adaptive management is defined, and what demands it will make on ongoing science programs. The literature on adaptive management takes several slightly different approaches on how incremental science-based management is performed. (A good and relatively recent review can be found in a special Adaptive Management issue of the on-line journal Conservation Ecology in 1999). The earliest definitions (e.g., from Holling, Walters, and colleagues at the University of British Columbia) arose in large part from management of marine fisheries, in which quantitative management models were well established, and the challenge was viewed in part as adjusting for environmental fluctuations. This school holds that validating and parameterizing computer models is central to effective adaptive management. In the Sierra Nevada, this formulation might be appropriate for improving the application of fire behavior models, but it is not of much help for species of management concern, where spatial structure and local variation make synoptic numerical population models impractical.

More recently, consensus has shifted more toward the view that an adaptive management program is defined by one or more *controlled* management experiments. Typically, this consist of a series of paired or blocked treatment/no-treatment (/alternate-treatment…) plots or measures laid out to control for other causal factors. Presumably, something of this sort is envisioned in the SPLAT studies mentioned in the DSEIS, though the existing text doesn't specify treatments, response variables, or layout. Results can then be subjected to standard statistical analysis to measure the relative influence (slope) of various causal factors (canopy closure, burn interval, harvest/no-harvest…), their predictability (r^2), and how they vary with setting (e.g., interaction coefficients with altitude or rainfall).

The DSEIS does not address the design issues for adaptive management experiments adequately. Replication is needed to achieve meaningful explanatory power, yet it is not clear how replication will be achieved if treatments are decided project by project on the basis of local knowledge. There need to be controls. Therefore managers and leaseholders will be somewhat constrained in their choices for grazing meadows, since some of them will need to have the main effects removed (e.g., as ungrazed controls.) Response variable need to be identified and measured in repeatable ways. An only a limited number of variable can be treated experimentally – otherwise the size of a factorial design experiment gets out of hand and exceeds the capacity of available personnel and budgets. (And multivariate approaches further constrain local flexibility, since one needs one or more of each treatment for each species in each habitat in each season…) in order to have a reasonable experimental design. The document needs to give more guidance on how local flexibility will be made compatible with adaptive management. (What variables, indicators, performance criteria, measures, etc. are going to be imposed on local experiments to support scientific assessment? Who is going to coordinate them? How will they be made responsive to management information needs? Who will do the analysis and how will it be incorporated into an information management system and made available to management.?)

Many of these issues are more easily addressed in S1. Given highly (overly?) specified Standards and Guides and requiring an adaptive management experiment only when they are waived, one arrives at relatively simple set of univariate experiments (one site with a waiver, one not). [I note that this formulation of adaptive management experimentation is somewhat novel in the literature, but it was viewed as appropriate and scientifically attractive by the FEIS SCC team.]

In short, adaptive management, as defined by the literature and the technical community, can provide powerful tools for management to identify successful practices and remove uncertainty, but it also significantly constrains local flexibility. It is not clear that the S2 discussion has addressed the constraints. (And if there are really no constraints envisioned, it isn't adaptive management, and the document should drop the use of the term.)

Q5: My final, overarching, worry about the adaptive management plan is resources. In the private sector, it is generally thought that in data-driven management, some 5-10% of the resources need to go into information system scoping, performance measures, and information management. While this formula may or may not be directly applicable to forest projects, it does seem likely that the information needs are being underestimated.

R7: It is laudable that the SEIS and SEIS management recommendations recognize that easing standards and guides to allow for more local decision authority necessitates a comprehensive adaptive management approach. Although the broad components of an adaptive management approach are identified (e.g. implementation monitoring, cause and effect research etc.) and the elements of a comprehensive adaptive management approach are presented in the FEIS, the specifics of this monitoring program are not well developed. What exactly is to be monitored? What monitoring results and thresholds will trigger changes in management? Who will determine these thresholds? Who will do this monitoring and how will it be funded? The changes from the FEIS to the SEIS would seem to shift the focus of adaptive management to 1) monitoring SPLAT implementation and responses of wildfire, sensitive species and their habitats, 2) monitoring of local decisions designed to implement the aquatic management strategy, protect sensitive species, while not producing unintended effects on grazing permittees. This change in focus requires a substantial revision of the adaptive management approach presented in the FEIS with a greater attention to monitoring designed to rapidly evaluate effects of the more aggressive and locally determined management of the SEIS and to recommend and adapt specific changes in management.

R8: Recent approaches to effective monitoring and 'measures of success' developed by The Nature Conservancy, Foundations of Success and other conservation organizations are highly relevant and should be incorporated into the SEIS. The ability of the SNFPA to attain multiple, and often conflicting, goals depends entirely on the Forest Service's commitment to effective monitoring and adaptive management.

S8: A weak discussion of climate change can be found in the FEIS with little in the SDEIS. However, there is no discussion of the implications of climate for management of resources and especially water and fire. These are significant problems that are beginning to occur due to climate change and are likely to become significant within the life of the plan. One paper, which references others, suggested by the SNSR for consideration is Stine (1996) in regards to implications for fire management. This should be added to the discussion of why consider climate change.

S9: No discussion of the implications of Skinner (2002 fire in riparian areas).

S10: Under the relaxation of the diameter rules for thinning, it is assumed that more area can be treated because taking of a few larger trees will help offset the costs associated with the treatments. However, there is no evidence that modeling was done based on inventories that would suggest that sufficient acres are available with the appropriate sized trees in appropriate locations to help to increase the potential area to be treated.

M9: Taking some larger trees will clearly help offset costs. Revenues from timber removals together with appropriated funds will allow the treatment of as many acres as possible.

W9: Some researchers predict that under a $2XCO_2$ scenario, lightning strikes will increase by 26 percent (Price, C., and D. Rind. 1991. Lightning activity in a greenhouse world. Proc. 11th Conf. Fire and Forest Meteorology. 11:598-604). If this were to occur, it would have dramatic effects on management strategies in the post-climate changed Sierra Nevada.