

APPENDIX

Individual Reports from the Review Team

SCIENCE CONSISTENCY REVIEW Written Statement

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The sections on Fuel Treatments and Forest Ecosystem Management are largely commentary on the discussions we had at the Davis meeting. The section on species viability, my particular area of expertise, is based both on these discussions and on a more careful appraisal of the DSEIS.

Fuels Treatments

A major goal of the S2 alternative is to remedy fuel buildup, particularly in wildland interface zones (WUIs) and in strategically placed area treatments (SPLATs). Models predict that thinning in SPLATS will slow or stop intense, stand-replacing fires.

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.

The removal of vegetation layers, snags, and down wood will impact many elements of biodiversity. The tradeoff supposedly is that the remaining forest will be protected from stand-replacing fires and impacted species will thereby have more potential habitat. However, the fuel 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.

Instead of universal thinning standards, a district ranger will have the discretion to tailor thinning to local conditions, at least within broad, regional guidelines. The flexibility to meet local conditions is certainly scientifically justifiable—the Sierra Nevada is a very heterogeneous region, and a one-size-fits-all approach makes little sense.

Under S2, in addition to thinning smaller trees and brush, a few big trees will be taken to pay for the treatments. While this looks reasonable enough from an economic standpoint, the USFS usually seems to have too few personnel to do adequate performance monitoring or to enforce timber sale rules if they are violated, so there is no real safeguard that only a few big trees actually will be felled. The more likely scenario is something that resembles a clear cut. However, this is not a scientific issue.

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.

Forest Ecosystem Management

The “desired future condition” (DFC) for the Sierra Nevada’s forests is their pre-European settlement state. The assumption is made that thinning to reduce fuels will help the forests reach this DFC. 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?). A forest that is in this condition may indeed resemble a pre-settlement state, but it seems to be far better to focus on these goals than to pursue one that is unachievable and sounds suspiciously like Sierra Club propaganda.

Silviculture and single-species management rather than the forest ecosystem as a whole seem to be the focus of the DSEIS. I find this to be odd, because ecosystem management is the stated goal of the USFS, and excellent research on forest ecosystems is being done by USFS scientists. 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?

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.

Species Viability

General Issues

Species viability issues of particular concern involve forest carnivores (Pacific Fisher, Marten, Sierra Nevada Red Fox, Wolverine), birds (Northern Goshawk, California Spotted Owl, Great Gray Owl, Willow Flycatcher.), and amphibians (Cascades Frog, Northern Leopard Frog, Foothill Yellow-legged Frog, Mountain Yellow-legged Frog, and Yosemite Toad).

While I am generally supportive of giving local managers latitude in carrying out fuels treatments, I am afraid that flexibility in local resource management has a high probability of leading to further decline of many of these species. Almost all sensitive species issues need to be addressed on a regional scale, and species management must be coordinated across ranger districts and national forest boundaries. Managing small and declining populations is challenging, and to do so successfully under local control requires that each district ranger and his/her staff be completely informed about recent research on every species of concern in the district. Effective management also requires careful monitoring that goes beyond simply documenting status and trend but instead focuses on identifying the factors that are responsible for the species’ decline. Under local control, monitoring activities will vary in quality and intensity from administrative unit to administrative unit

and be very difficult to coordinate across the species range. This lack of coordination will make viability evaluation very difficult since cumulative effects will be very hard to assess. Finally, once the factors causing species decline are identified, managers need to work to reduce or eliminate them. This usually requires unpopular decisions that are even more difficult to implement at a local level.

Thus, a comprehensive, region-wide conservation strategy should be developed for each of these species. Each plan 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. Because of the focus of Alternative S2 on flexibility in local resource management, development of these conservation strategies takes on increased importance.

Meadows and Riparian Zones

All of the above-mentioned species except for the forest carnivores and the Spotted Owl are associated at some stage of their life cycles with meadows or riparian areas. Most of these vegetation types in the Sierra Nevada have undergone substantial degradation due to livestock grazing, water diversions, road building, and other activities in the past, and they are currently major focal points for ranching and recreation. Although Critical Aquatic Refuges will be designated under S2 if populations of sensitive amphibians are discovered, I doubt if much local effort will be devoted to discovering these populations.

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.

Alternative S2 does not provide enough emphasis on the restoration of degraded meadow habitat including the removal or relocation of roads and other activities that impact meadow hydrology and overall meadow ecology. Once meadows are restored and populations are stabilized, there is a reasonable probability that grazing and recreation can be managed compatibly with species viability.

Willow Flycatcher

Alternative S2 allows “development of a site-specific management plan to address grazing management where occupied willow flycatcher (sic) exists. These alternative management strategies are locally determined and are designed to provide sufficient protection for this species.” 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.

Forest Carnivores in General

The potential impacts of fuels treatments on forest carnivores is not adequately addressed. For example, the thickets of brush and small trees that will be cleared are important habitat for many of the small mammals that serve as prey for these species.

A second item that has not been explored is the relationship between large and medium-sized (meso) carnivores. When large carnivores are removed from an area, smaller carnivores increase in abundance (meso-carnivore release). For example, if coyotes disappear from remnants of natural vegetation surrounded by suburban areas, populations of foxes and feral cats increase to the detriment of many native species of small birds, mammals, and reptiles. The other side of this phenomenon (meso-carnivore suppression) has been observed in Yellowstone; when wolves were re-introduced, the coyote population declined dramatically resulting in increases of several species of meso-carnivores. It is quite possible that the forest carnivores of the Sierra Nevada are being suppressed by larger predators, particularly mountain lions. A whole-ecosystem approach to forest carnivore management would include investigating this possibility.

Fisher

Fisher habitat is usually described as dense forest at low to mid elevations, and the assumption is made that Fishers are currently habitat limited. However, there is a strong possibility that they are prey-base limited as well. The USFS made an intensive effort in the 1950s and 1960s to kill porcupines, one of the Fisher's preferred prey items. The rationale was that porcupines kill small trees. The program was successful, and porcupine density has been drastically reduced. As a result, the small trees are now the targets of the fuels treatments, and the fisher has declined throughout most of the Sierra Nevada.

Conclusions

1. *Is the relevant scientific information considered?* In general, yes, although I have identified above a number of issues that could use more attention or were not included. For example, the Willow Flycatcher report (cited above) was dated March, 2003, probably early enough to be incorporated into the DSEIS. The lack of a whole-ecosystem perspective also is troubling. 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.
2. *Is the scientific information reasonably interpreted and accurately presented?* Yes, although there seemed to be little effort expended to integrate relevant information from different disciplines (e.g., silviculture and conservation biology). Again, there is a lack of a whole-ecosystem perspective.
3. *Are the uncertainties associated with the relevant scientific information acknowledged and documented.* In general, yes. Species viability questions always include a huge amount of uncertainty, and the S2 alternative is generally acknowledged to increase this level. The only way that this level of uncertainty can be addressed is through adaptive management, and I'm afraid that USFS culture is not ready to embrace this approach seriously yet.
4. *Are the relevant management consequences identified and documented, including associated risks and uncertainties?* There was very little effort made to identify the whole-ecosystem

consequences of management actions. Thinning fuels not only can impact the habitats of a few sensitive species but also has the potential to affect forest sustainability in numerous, often counterintuitive, ways. I understand that forest service personnel will be provided with increased training in ecology. This can't happen too soon.

Please note: I am commenting only on those elements about which I have a reasonable level of competence and familiarity. I forego comments on those elements that I expect will be covered more thoroughly by another member of the team. I am concentrating on perceived defects and more-or-less ignoring areas where I don't see a science consistency issue. If our joint product is missing pieces at the end of the month, I'll try to locate and add additional elements.

Introduction: The use of scientific information in the original Sierra Nevada Forest Plan Amendment was exemplary for a planning document of this scope and impact. The Supplement offers little new knowledge, as one might expect, since only a few years have passed. Without an excessively laborious examination, I can only assume that the *scientific* interpretation of the research and literature discussed in the original document has not changed except where clearly so indicated in the SDEIS. The organization of the SDEIS makes it quite difficult to analyze for the four elements of science consistency. The bits are scattered throughout the document.

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: **There is no mechanism provided for monitoring leading to adaptive management.**

1. 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.

2. 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?

I expect that Jennings will address the incomplete treatment of foothill yellow-legged frogs. These have been reduce to a small number of tiny and endangered populations south of the Tahoe N.F.

The threats of introduced salmonids and bullfrogs are not discussed, although they are discussed in widely-distributed grey literature. There are so few populations on the forests that each could be managed uniquely.

3. The treatment of fisher discusses the uncertainties regarding habitat requirements, 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.

4. I could find no means 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.

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Science Consistency Review Comments, Sierra Nevada DSEIS
 Prepared by Sally Haase, Research Forester, PSW, Forest Fire Laboratory, Riverside, CA

Categories	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	For what is given, usually yes	No	Mostly
2. SPLATs Strategy as a Viable Fuels Management Approach (includes identifying and scheduling treatment entries, in space/time)				
3. Thorough and Adequate Treatment of Fuels (types of fuels, follow-up requirements)				
4. Air quality implications/issues related to overall and long-term treatment strategies				
5. Use/Role of prescribed fire for purposes of restoration of fire regimes				
6. Fire surrogates; relationships between mechanical vs. fire treatments				

A. Fire and Fuels Management

I tried to use the table to evaluate the information but there is so much lacking and the organization is so difficult to follow that I have felt like I have been spinning my wheels in trying to accomplish anything on this.

Chapter 3:

First off, the entire document 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? Personal communications are valid citations but they need to be cited as such and complete.

I feel that 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.

In Chapter 3, "shade-intolerant" needs to be reviewed for consistency (p.88) and there seems to be only one school of thought presented in regards to global climate change and the expected effects of the management action alternatives to that single viewpoint.

The information in the tables in Chapter 3 is sometimes duplicating the effort. Also it would be helpful to have the criteria for some of the categories (hazard risk (blank?), condition class, etc.) discussed so that the information in the tables can be processed easier.

Later in that chapter (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.

I also noticed 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.

Chapter 4:

Again, 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.

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.

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 summarize this type of discussion and can be cited as such.

When discussing fire intensity again, there is no referenced material for the statements given. I know for a fact that the opposite can result where under "non-lethal" fires old mature trees are killed and the small suppressed saplings survive. That is why they need to show the reference they are basing these statements on. Again there need to be a definition for "lethal, mixed lethal and non-lethal"

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".

There is no reference to the model used to estimate the PM₁₀ outputs. The paragraph discussing Alternatives on p.168 have conflicting statements. Two of the "S1"s should be "S2"s in the discussion. Need to double check typos in the discussion.

Standard & Guidelines:

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. It isn't clear to me how they came up with the estimates from what I previously read.

Science Consistency Review Comments, Sierra Nevada DSEIS
Prepared by Bob Heald,

I have 30 years experience in research and management of Sierra Nevada mixed conifer vegetation utilizing a wide assortment of methods and objectives, My primary expertise is in the area of silviculture, in particular group selection, mixed species plantations and giant sequoia. I provided instruction in group and single tree selection to the Region 5 Silviculture Certification Program for over a decade. In addition I have 25 years experience as a wildland firefighter and use of prescribed fire. I am currently a cooperating scientist in the Fire and Fire Surrogate research project.

I was provided copies of the following documents:

- Sierra Nevada Forest Plan Amendment: Final Environmental Impact Statement & Record of Decision January 2001 (CD-ROM)
- Sierra Nevada Forest Plan Amendment: Management Review and Recommendations March 2002
- Sierra Nevada Forest Plan Amendment: Draft Supplemental Environmental Impact Statement June 2003

I utilized the three documents before, during and after our discussion as references but did not attempt a comprehensive review of the entire documents. The discussions were well facilitated by Peter Stein and Jim Guldin. National Forest staff were present and provided background information and readily responded to all questions, including the offer of additional information as appropriate. The discussions were open and wide ranging. We were asked to consider the following general questions:

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

As with any review, it is much simpler to note and document potential weaknesses, particularly from a narrow disciplinary view, than to provide a balanced report that appropriately sets those possible shortcomings in the context of a generally understandable and thorough document. Furthermore, no two-day discussion and brief report can serve to bring me up to the level of expertise about the entire project that would be required for a comprehensive review. Finally, it is difficult to evaluate the science of a document that purports to discuss the consequences only of proposed changes in management direction without thorough knowledge of what may be well documented in the plan status quo. So, take the following critical comments as they are intended, a smattering of observations some of which may offer the seeds for improvement.

#1 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. (Draft Attached)

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.

#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.

Now on the areas where I am increasingly less expert.

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.

There appears to be a concern about disrupting habitat connectivity by $\geq 30\%$ 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%.

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.

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”.

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.

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”.

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 90th 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.

Bob Heald
Director, Center for Forestry
College of Natural Resources
University of California, Berkeley

I have been reading through all the documents as time permits. Given our meeting a month ago and the directions outlined in your July 21, 2003 e-mail, my comments are as follows (of course reflecting my review of amphibian issues).

1. **Is the relevant scientific information considered?** Yes, to the point when the document was being drafted. However, there are other items to consider since the draft was produced. They are as follows:

A). You should state that the overall goal is to try to maintain native amphibian and reptile distributions in the Sierra Nevada as they are today as much as possible. It is not feasible to do much enhancement to increase ranges other than the removal of exotics (mainly introduced trout) from selected areas. Some native amphibians (such as frogs and toads) may disappear due to introduced diseases and pathogens that we currently know little about.

B). 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.

C). A number of newer papers are pertinent to the above statements (deal with Sierra Nevada amphibians) that are not cited in your draft. I will include these at the end of the letter.

D). It seems that the authors go way overboard in trying to make up for the damage to amphibian meadow habitats caused by livestock grazing. I think the best way to deal with this is to determine which areas livestock grazing is to be continued and let that be the course of action. In those areas where livestock grazing is not to be continued, then efforts should be concentrated on habitat restoration for remaining amphibian populations. This is especially true in meadows (such as Highland Lakes) where headwater cutting has drained many meadows making breeding habitats much less suitable for Yosemite toads. Projects to restore meadow habitats (=recharge peat bogs) will go a long way in restoring suitable toad habitats in the Sierra Nevada. The basic message here is that livestock grazing and Yosemite toads/mountain yellow-legged frogs do not mix.

E). 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.

F). 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.

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

2. **Is the scientific information reasonably interpreted and accurately presented?** Yes, but see above. The Yosemite toad section was much more up to date than the other amphibian sections. You just need to tap into Cathy Brown's draft documents and lift out what you need to beef up the other sections.
3. **Are the uncertainties associated with the relevant scientific information acknowledged and documented?** Only to a point. 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). You also need to discuss and cite the contaminants papers I have included below.
4. **Are the relevant management consequences identified and documented, including associated risks and uncertainties?** Yes, at least to the point when the draft was put together. This needs to be updated when you bring the rest of the document up to speed with Cathy Brown's draft documents.

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- 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.
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Science Consistency Review Comments, Sierra Nevada DSEIS
 Prepared by Ruth Kern, Department of Biology, UC-Fresno, Fresno CA

CATEGORIES	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.)	Uncertain	Yes	Yes	Yes
5. Use/Role of prescribed fire for purposes of restoration of fire regimes	Uncertain	Yes	Yes	Uncertain
B. Forest Ecosystem Management				
1. Definition and Rationale for Desired future condition of forests (e.g. provision for a mosaicked landscape)	No	No	No	No
2. Provisions for maintenance/restoration of ecosystem processes	No	No	No	No
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	No	No	No
C. Species Viability				
1. Montane Meadow/Riparian Ecosystem Management/Restoration (e.g. pertains to	No	No	No	No

conservation of Yosemite toad, willow flycatcher, mountain yellow-legged frog, great grey owl)				
D. Synthetic Issues				
1. Implications of Climate Change in the Sierra and possible effects on Management strategies	No	No	No	No

Comments:

A.1. There is a fair amount of important and relevant information concerning fire effects and ecology of fire in Sierran forests not cited, but the apparent intent of the plan to use fire to restore natural conditions and processes seems correctly applied. Thus, the response that I am “uncertain” whether the relevant scientific information has been considered. 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.

A.5. 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.

B.1. The definition and rationale for desired future condition of forests (e.g. provision for a mosaicked landscape) is not adequately covered in the DSEIS. However, as I understand it, this is a portion of the plan that has not significantly changed from the FEIS. The definitions of desired future conditions in Alternative 6 the FEIS are complete, though even here literally none of the relevant literature has been cited to support the rationale behind the standards for desired future conditions in the basic forest types (conifer-dominated forest in westside mixed conifer, hardwood conifer forest in westside mixed conifer, upper montane forest, eastside pine & eastside mixed conifer).

DSEIS, 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. Since the effects have been deemed to not differ between alternatives S1 & S2, the discussion here was seemingly truncated. Again, the intent that I read in the DSEIS seems founded in the appropriate science, but little or none of the foundational literature is actually cited, so I cannot state that the relevant scientific information has been considered.

B.2. This is a classic example of not being able to see the forest for the trees. By necessity of the law institutional culture, plans of this type tend to focus on species-specific at the expense of communities and ecosystems. 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.

B.3. 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.

C.1. While I cannot address the issues of how Yosemite toad, willow flycatcher, mountain yellow-legged frog, and great grey owl will be affected by management and restoration activities in montane meadows and riparian ecosystems, I have reviewed the DSEIS section on aquatic, riparian, and meadow ecosystems (Ch. 4, pgs 159-161) and the standards and guidelines section with an eye to 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.

D.1. Climate change implications not mentioned. See also comments for question B.2.

In general the DSEIS is consistent in its scientific treatments of issues. McKillop's specific comments are shown in italics under the appropriate "Element" provided by Peter Stine on 8/1/03

General Comments/Issues

1. DSEIS Readability/Navigation

It is generally well-written and easily navigable

2. Bibliography in DSEIS, referencing cited material and include in bibliography

3. Glossary in DSEIS

4. Confusing nature of S&G tables

A. Fire and Fuels Management

1. Fire Effects/Ecology in Sierran Forests (under different conditions of forest structure, composition, etc.)

2. SPLATs Strategy as a Viable Fuels Management Approach (includes identifying and scheduling treatment entries, in space and time)

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

3. Thorough and Adequate Treatment of Fuels (types of fuels, follow-up requirements)

4. Air quality implications/issues related to overall and long-term treatment strategies

Air quality issues are properly considered

5. Use/Role of prescribed fire for purposes of restoration of fire regimes

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

6. Fire surrogates; relationships between mechanical vs. fire treatments

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

B. Forest Ecosystem Management

1. Definition and Rationale for Desired future condition of forests (e.g. provision for a mosaiced landscape)

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.

2. Provisions for maintenance/restoration of ecosystem processes

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

3. How Management will accommodate gross longterm perturbations (e.g. climate change, forest health, "range of natural variability", carbon sequestration, stand structure and sustainability)

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.

4. Old forests restoration and maintenance (e.g. historical structure and distribution, attainment under SPLATs strategy, old trees as a component of old forests)

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)

2. Invasive species management strategy that deals with amphibians at risk

3. Fisher ecology and response to forest management (thinning, prescribed fire)

4. Marten ecology and response to forest management (thinning, prescribed fire, recreation)

NOTE: CA spotted owl is being addressed by a group of species experts; recommended to include forest and fire ecologist input to the discussion.

D. Synthetic Issues

1. Implications of Climate Change in the Sierra and possible effects on Management strategies

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.

2. Overall affects of management strategies on the Aquatic Management Strategy

3. Adaptive management process;
 - a. overall strategy, priorities
 - b. performance measures
 - c. mid-course correction procedures
 - d. monitoring plans, protocols, triggers

4. Economic analyses; feasibility of the overall management strategy

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.

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.

Thank you for the opportunity to participate in the Science Consistency Check (SCC) for the Draft Supplemental EIS for the Sierra Nevada Forest Plan Amendment. Many of my comments are more along the lines of overview of scientific approaches than detailed reviews of particular sections of the DSEIR. However I have read the assessments of impacts of the alternatives considered by the supplemental analysis on individual species and ecosystems carefully, and would be happy to respond to questions that might arise from discussions of those sections.

Scientific analysis in the FEIS and the DSEIS

As the chair of the Science Consistency Check for the FEIS, I was somewhat struck by contrasting approaches in the two documents. In drawing conclusions, both suffer from the inevitable heterogeneity and incompleteness of scientific information assembled from a landscape covering millions of acres. As in all landscape-scale conservation analyses, many scientific inferences represent extrapolations from experimental studies conducted on much smaller and more controlled scales, or applications of “best practices” prescriptions derived from models or justified by successful application in other regions or ecosystems types.

Though there was certainly dissent over particular elements, it was the general view of the SCC committee reviewing the draft FEIS that the authors had successfully followed accepted practices of the scientific community in that the relevant mainstream literature was largely reviewed, referenced and appropriately interpreted, most of the important uncertainties were specifically noted, the recommendations were well within the bounds of accepted practices, and the analytical techniques were sufficiently well described that they could be replicated and tested by other investigators. There was inevitably variability in the success with which different topics were covered. Of the specific topics reviewed by the panel, the coverage of available information was probably best for species viability, weakest for riparian and meadow communities, and intermediate for old forests and fire issues. The panel (as in the current SCC) was not charged with providing advice on the policy choices, and did not try to do so. However, it did largely conclude, as conveyed in moderator Mike McCoy’s transmittal letter, that *“The extensive and thoughtful critiques of the Science Consistency Check Team should not mask the underlying reality. The Sierra Nevada Forest Plan Amendment Interdisciplinary and Science Integration Teams have produced a solid, credible, state-of-the-art ecosystem assessment. It represents a substantial improvement over the processes and standards of analysis achieved in earlier Forest Service efforts of comparable scope, and raises the bar for future impact assessments. It can be improved in a number of ways, as can any document so large and complex. However, it should stand up well to public and professional scrutiny.”*

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.

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.)

I should note that the authors discussed many of the shortcomings in documentation openly and at length with both the SCC group and other scientists, and I expect that we will see better documentation in the final document.

Impacts of Alternative S2 (the preferred alternative) on forest carnivores

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.

Adaptive Management

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.)

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.

Ecology

In light of the information needs to really sort out causality in populations of species constraining fuels policy, I am concerned that too few variables 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.

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.

Science Consistency Review Comments, Sierra Nevada DSEIS

Comments by
Mark D. Reynolds
Senior Ecologist for Emerging Projects
The Nature Conservancy

Science Consistency Review Process: process used to determine whether best science has been consistently applied. Four questions to consider:

- 1- is relevant science considered
- 2- is science reasonably interpreted and accurately presented
- 3- are uncertainties acknowledged and interpreted
- 4- are relevant management consequences, including uncertainties, documented?

Overview

The Sierra Nevada Forest Plan Amendment (SNFPA) draft Supplemental Environmental Impact Statement (SEIS) represents a significant change in goals, objectives, and approaches from the SNFPA Final Environmental Impact Statement (FEIS) and Record of Decision (ROD). As such, it is paramount that all relevant science is considered, reasonably interpreted, accurately presented and consistently applied while documenting management consequences and acknowledging uncertainties. Since the approach outlined in the SEIS is acknowledged to have higher risk, especially in the short-term, for sensitive species and habitats, it is imperative that a rigorous, transparent, adaptive management plan is developed. While the FEIS has an extensive treatment of adaptive management, the SEIS treatment of adaptive management does not adequately reflect the higher risk approach. The science consistency of the SEIS would be improved by three main considerations:

- 1 – The consistent use of current ecosystem approaches, ecosystem-level conservation planning, and the inclusion of recent relevant studies
- 2 – A more thorough presentation of monitoring and adaptive management
- 3 - A more thorough presentation of management consequences, particularly for sensitive species and meadow habitats

**General Comments:
Organization, Presentation, Philosophy**

The relationships between the SNFPA FEIS, the SNFPA draft SEIS and the SNFPA Management Review and Recommendations is confusing. The science foundations of the FEIS remain, yet both the interpretation and the new information, supports different goals, approaches, and standards and guidelines in the SEIS and SNFPA Management Review and Recommendations from the SNFPA FEIS. Although what remains and what is changed from the FEIS is often made fairly clear (e.g. the Block A and Block B text of the SEIS Management Review and Recommendations), tracking the supporting science, including studies, data, data interpretation and literature, is confusing. It is often not clear when the FEIS and data therein, are being reinterpreted, or when original studies cited by the FEIS are being reinterpreted (for the most part, interpretations based on new information {e.g. Finney’s work on modeling ‘SPLATS’, the recent ‘pulse’ in reproduction by California Spotted Owls} are clear). Clarity of attribution would be greatly improved by a rigorous standard of literature citation (i.e. re-cite the original studies as well as the FEIS where appropriate) and an expanded literature cited section in the SEIS and SEIS Management Review and Recommendations. Appendix A. in the SEIS has no legend making it difficult to figure out what an ‘x’, blank, or ‘no’ under S1 and/or S2 mean (I’m assuming that an ‘x’ under both S1 and S2 means that the standards and guidelines are unchanged from FEIS to SEIS; an ‘x’ under S1 and not S2, followed by a section with the same objective and an ‘x’ under S2 and not S1 indicates changes in the standards and guidelines in SEIS to meet the objective; an ‘x’ under S1 and a ‘no’ under S2 indicates objectives that were part of the FEIS and are not part of the SEIS; not sure what an ‘x’ under S1 and a blank under S2 means) . This is a very confusing Appendix and would benefit from revision and a clear legend.

The SEIS clearly has a different philosophy of risk, uncertainty and resource management from the FEIS. Where the FEIS was conservative regarding management and sensitive species, the SEIS uses a few recent studies (highly selective – not a comprehensive suite of studies relevant to management of Sierra Nevada ecosystems) as well as a set of social, economic, and political considerations to justify a much more aggressive approach to fuel management and an easing of standards and guidelines to incorporate more local decision authority. Although justifications for these changes are in the SEIS (e.g. SEIS presents results from models suggesting a loss of over 68,000 acres of wildlife habitat per year if threats of catastrophic wildfire are not reduced by mechanical thinning and prescribed burning; SEIS suggests that application of broad standards and guidelines often conflicts with local conditions), the change in philosophy is largely beyond the realm of science. The SEIS clearly acknowledges that a more aggressive fuels strategy, with its associated increase in uncertainties for sensitive species and habitats, as well as the easing of standards and guides to allow for more local decision authority, necessitates a comprehensive adaptive management approach and an even greater commitment of resources to adaptive management than the FEIS.

Comments related to fire, fuels and old forests

The fire and fuels sections of SEIS would be improved by an ecosystem approach to fire rather than such a strong emphasis on fuel and reduction of fire risk. For example, natural and prescribed fires, even catastrophic ones, are patchy in intensity and area burned. From a fire ecology point of view,

this is expected and desired in sustaining natural forest patch dynamics. From a purely fuels point of view, a patchy treatment, whether a result of mechanical thinning or prescribed fire, might fall short of the desired fuels outcome. The SEIS emphasizes extensive mechanical thinning, supported by economic by products, to reduce risk of catastrophic wildfire, when a mix of strategies – SPLATs, aggressive thinning in the WUI, other thinning, prescribed burning and natural fire management – might produce the best overall ecological results.

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 SEIS 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 SEIS.

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 SEIS.

Comments related to mountain meadow habitats and livestock grazing

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.

By emphasizing this piecemeal approach, the Forest Service is missing a great opportunity to develop solutions for conflicts related to special status species and commercial livestock grazing by taking an integrated, adaptive management approach to meadow management. 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.

The SEIS acknowledges that private lands have an important role to play in viability of California Spotted Owl. The SEIS should likewise incorporate the potential role of private lands in sustainable grazing issues in the Sierra Forests. Developing grass banks outside of the Sierra Forests with organizations like California Rangeland Trust and The Nature Conservancy would alleviate some of the pressure to maintain economically viable grazing while developing ecologically sustainable approaches to meadow restoration and management.

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). The SEIS presents a less 'cautious' (term used to describe the ROD) approach in reducing risks to willow flycatcher emphasizing a 'meadow-specific' approach. Although the SEIS quotes the draft conservation assessment identifying meadow dessication as the 'single most important proximate factor in willow flycatcher decline in the Sierra Nevada' and that 'restoration of meadow hydrology and reestablishment of healthy willow stands are believed to be the best options for restoring willow flycatcher populations', the (also quoted) need for 'additional research and monitoring'... 'to address potential livestock impacts under current management regimes in the Sierra Nevada' is not emphasized. 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.

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.

The SEIS should carry forward many of the research questions of the FEIS. There are many unknowns regarding meadow ecology and particularly regarding the ecological effects of livestock grazing. Scientists have begun to get some traction on these issues in areas where it has been possible to execute a replicated experimental design with the ability to control and vary grazing treatments. We will not get much further toward understanding if it is possible to restore and maintain the ecological integrity of meadows and simultaneously provide forage for commercial livestock until we have committed to a large-scale, replicated experiment with varied grazing treatments, including removal of grazing from areas with- and without willow flycatchers.

The SEIS 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 SEIS.

Meadows are highly variable and the best hope for restoring and maintaining willow flycatchers and other sensitive species, as well as sustaining other meadow uses, depends (as quoted from the Conservation Assessment of the Willow Flycatcher) on restoring meadow hydrology, reestablishing healthy willow stands and other critical habitat features along with comprehensive protection for remaining populations of those species and their habitats and an aggressive approach to research, monitoring and adaptive management. A comprehensive program of habitat protection, restoration, research, monitoring and adaptive management for meadows should be more fully developed in the SEIS.

Comments related to Species of the Sierra Nevada.

The SEIS does not present adequate scientific justification for not carrying forward several management indicator species from the FEIS. In particular, Wilson's Warbler and Lincoln's Sparrow (incorrectly identified as Lincoln's Warbler in a section of the SEIS) are potentially useful indicators of the ecological integrity of riparian and meadow ecosystems.

Neotropical Migratory birds are not adequately considered in the SEIS, especially given the wealth of recent information, much of it funded by the Forest Service, on this group of animals.

There is no consideration of terrestrial invertebrates (bees, butterflies ants, etc...). Many of which provide important pollinator functions.

Adaptive Management

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.

It is not clear, nor justified by the science of adaptive management, why establishing Federal Advisory Committee was warranted by the FEIS but is not part of the SEIS.

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.

**ELEMENTS of
Sierra Nevada Forest Plan Amendment DSEIS Science Consistency Review
July 30th and 31st 2003, Davis, CA**

General Comments/Issues

1. DSEIS Readability/Navigation
2. Bibliography in DSEIS, referencing cited material and include in bibliography
3. Glossary in DSEIS
4. Confusing nature of S&G tables

A. Fire and Fuels Management

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 was adequately considered nor if relevant management consequences and associated risks are adequately displayed.

1. Fire Effects/Ecology in Sierran Forests (under different conditions of forest structure, composition, etc.)

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.

2. SPLATs Strategy as a Viable Fuels Management Approach (includes identifying and scheduling treatment entries, in space and time)

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.

I do believe the SPLATs strategy can be effective in reducing the extent of severe burns. However, the strategy needs to be modified to fit the topography of the landscape and not strictly follow a mathematical formula derived for a simple computerized landscape. When they are modified in this way, they will likely approach the strategy suggested by Weatherspoon and Skinner (1996).

3. Thorough and Adequate Treatment of Fuels (types of fuels, follow-up requirements)

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 unsupported.

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.

4. Air quality implications/issues related to overall and long-term treatment strategies

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).

5. Use/Role of prescribed fire for purposes of restoration of fire regimes

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 actually 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. It should be clear which type of ‘restoration’ the plan envisions.

6. Fire surrogates; relationships between mechanical vs. fire treatments

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).

B. Forest Ecosystem Management

1. Definition and Rationale for Desired future condition of forests (e.g. provision for a mosaiced landscape)

There are still problems in regards to appropriate definitions of historic forest conditions vs. the definitions used today for target conditions of ‘old forests’ – see discussion above under Fire Effects/Ecology.

2. Provisions for maintenance/restoration of ecosystem processes

Again, 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.

3. How Management will accommodate gross long-term perturbations (e.g. climate change, forest health, “range of natural variability”, carbon sequestration, stand structure and sustainability)

4. Old forests restoration and maintenance (e.g. historical structure and distribution, attainment under SPLATs strategy, old trees as a component of old forests)

There are still problems in regards to appropriate definitions of historic forest conditions vs. the definitions used today for target conditions – see discussion above under Fire Effects/Ecology and the SPLATs strategy.

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)

2. Invasive species management strategy that deals with amphibians at risk

3. Fisher ecology and response to forest management (thinning, prescribed fire)

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.

4. Marten ecology and response to forest management (thinning, prescribed fire, recreation)

Same as above.

NOTE: CA spotted owl is being addressed by a group of species experts; recommended to include forest and fire ecologist input to the discussion.

D. Synthetic Issues

1. Implications of Climate Change in the Sierra and possible effects on Management strategies

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.

2. Overall affects of management strategies on the Aquatic Management Strategy

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

3. Adaptive management process;

a. overall strategy, priorities

b. performance measures

c. mid-course correction procedures

d. monitoring plans, protocols, triggers

4. Economic analyses; feasibility of the overall management strategy

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.

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. The section(s) of the SNSRTR that specified the point is enclosed in square parentheses - i.e., [].

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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.

Categories	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.)	Some	Weak	Not always	Not clear
2. SPLATs Strategy as a Viable Fuels Management Approach (includes identifying and scheduling treatment entries, in space/time)	SPLATs specific – Yes Others - No	SPLATs specific – Yes Others - No	No	No
3. Thorough and Adequate Treatment of Fuels (types of fuels, follow-up requirements)	Not clear	Not clear	Not clear	Not clear
4. Air quality implications/issues related to overall and long-term treatment strategies	Weak	Weak	No	No
5. Use/Role of prescribed fire for purposes of restoration of fire regimes	Weak			
6. Fire surrogates; relationships between mechanical vs. fire treatments	Weak	Weak	Weak	Weak
B. Forest Ecosystem Management				
1. Definition and Rationale for Desired future condition of forests (e.g. provision for a mosaiced landscape)	Weak	No	No	No
2. Provisions for maintenance/restoration of ecosystem processes	Weak on fire	'restoration of natural fire regimes' may	Weak	Weak

		be misused.		
3. How Management will accommodate gross longterm perturbations (e.g. climate change, forest health, “range of natural variability”, carbon sequestration, stand structure and sustainability)	Very weak	Very weak	No	No
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	No	No	No
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)				
2. Invasive species management strategy that deals with amphibians at risk				
3. Fisher ecology and response to forest management (thinning, prescribed fire)	No in regards to fire ecology		No	No
4. Marten ecology and response to forest management (thinning, prescribed fire, recreation)	No in regards to fire ecology		No	No
D. Synthetic Issues				
1. Implications of Climate Change in the Sierra and possible effects on Management strategies	Weak	No	No	No
2. Overall affects of management strategies on the Aquatic Management	No in regards to fire ecology			

Strategy				
3. Adaptive management process; a. overall strategy, priorities b. performance measures c. mid-course correction procedures d. monitoring plans, protocols, triggers				
4. Economic analyses; feasibility of the overall management strategy	No		No	No

Science Consistency Review Comments, Sierra Nevada DSEIS
 Prepared by Jan van Wagendonk, August 18, 2003

Categories	(a) Is the relevant Scientific information considered?	(b) Is the scientific information reasonably interpreted and accurately presented?	(c) Are the uncertainties Associated with the relevant scientific information acknowledged And documented?	(d) 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			
2. SPLATs Strategy as a Viable Fuels Management Approach (includes identifying and scheduling treatment entries, in space/time)			No	
3. Thorough and Adequate Treatment of Fuels (types of fuels, follow-up requirements)	No			
4. Air quality implications/issues related to overall and long-term treatment strategies	No			
5. Use/Role of prescribed fire for purposes of restoration of fire regimes	No			
6. Fire surrogates; relationships between mechanical vs. fire treatments	No			

A.1.(a). 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.

A.2.(c). 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.

A.3.(a). 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 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/ft². It would be more appropriate to state the targets in terms of fuel load and fire behavior.

A.4.(a). 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.

A.5.(a). 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.

A.6.(a). 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.

B. Forest Ecosystem Management				
1. Definition and Rationale for Desired future condition of forests (e.g. provision for a mosaiced landscape)				
2. Provisions for maintenance/restoration of ecosystem processes				
3. How Management will accommodate gross longterm perturbations (e.g. climate change, forest health, “range of natural variability”, carbon sequestration, stand structure and sustainability)				
4. Old forests restoration and maintenance (e.g. historical structure and distribution, attainment under SPLATs strategy, old trees as a component of old forests)				

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			
2. Invasive species management strategy that deals with amphibians at risk				
3. Fisher ecology and response to forest management (thinning, prescribed fire)			No	
4. Marten ecology and				

response to forest management (thinning, prescribed fire, recreation)				
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C.1.(a). 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 Wagtenonk, 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).

C.3.(c). 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.

D. Synthetic Issues				
1. Implications of Climate Change in the Sierra and possible effects on Management strategies	No.			
2. Overall affects of management strategies on the Aquatic Management Strategy				
3. Adaptive management process; a. overall strategy, priorities b. performance measures c. mid-course correction procedures d. monitoring plans, protocols, triggers				
4. Economic analyses; feasibility of the overall management strategy				

D.1.(a). Some researchers predict that under a 2XCO₂ 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.