Appendix C

Scientific Advisory Board Final Report and Advisories

C. Scientific Advisory Board Final Report and Advisories

This appendix has three parts. Part 1 is the final report of the Scientific Advisory Board (Board), Part 2 is a summary of how the Forest Service used the advisories, and Part 3 is a complete list of the Advisories issued by the Board.

Part 1: The Final Report of the Scientific Advisory Board

THE GIANT SEQUOIA NATIONAL MONUMENT

SCIENTIFIC ADVISORY BOARD

FINAL REPORT

July 15, 2003

In the Beginning

On April 15, 2000 the President of the United States issued a Proclamation in which he declared, "The rich and varied landscape of the Giant Sequoia National Monument holds a diverse array of scientific and historic resources. Magnificent groves of towering giant sequoias, the world's largest trees, are interspersed within a great belt of coniferous forest, jeweled with mountain meadows. Bold granitic domes, spires, and plunging gorges texture the landscape." He concluded that it would be in the public interest to reserve such lands as a national monument to be known as the Giant Sequoia National Monument.

The Secretary of Agriculture was to prepare a management plan within 3 years. The Secretary in consultation with the National Academy of Sciences was to appoint a Scientific Advisory Board to provide scientific guidance during the development of the initial management plan. Board membership shall represent a range of scientific disciplines pertaining to the objects to be protected, including, but not necessarily limited to, the physical, biological, and social sciences. The Board was appointed, has served, and herewith respectfully submits its Final Report.

Introduction

Landscapes held in public trust are difficult to manage; a living National Monument subject to increased public use presents additional challenges. These landscapes are subject to regional and global effects outside the manager's control, such as global climate change

and air pollution. They are also subject to innumerable local variables, most of whose effects are difficult to predict. The giant sequoia groves and their surrounding ecosystem are fiercely loved by many; although the goals may be broadly similar, the objectives and policies of these giant sequoia lovers are often sharply at odds.

The Proclamation challenges the Board to work with the Forest Service in establishing a Management Plan that balances the need to restore and counteract the effects of a century of fire suppression and logging, increased human use of the Monument, and preservation of the essential features that led the President to proclaim the Monument for similar use and appreciation in the future.

Acting in accordance with the Proclamation, in January of 2001 the Secretary of Agriculture appointed a Scientific Advisory Board:

Dr. Jeanne Nienaber Clarke, political scientist (The University of Arizona);

Dr. David M. Graber, ecologist (Sequoia and Kings Canyon National Parks);

Dr. Karen M. Nissen, anthropologist/archeologist (California Department of Transportation) nonvoting ex-officio member;

Dr. Douglas D. Piirto, forester (California Polytechnic State University);

Dr. Nathan L. Stephenson, plant ecologist (U.S. Geological Survey);

Dr. Daniel R. Tormey, hydrologist (ENTRIX Consultants);

Dr. Paul E. Waggoner, scientist (The Connecticut Agricultural Experiment Station);

Dr. George M. Woodwell, ecologist (Woods Hole Research Center) resigned May 30, 2003.

At the request of the Tribal Council of the Tule River Indian Reservation the Secretary of Agriculture raised Dr. Nissen to a full voting member of the Board.

Procedures

At the invitation of the Designated Federal Official, Sequoia National Forest Supervisor Arthur L. Gaffrey, the Scientific Advisory Board convened for the first time on June 12-13, 2001. The meeting was held at Hume Lake, a recreational facility contained within the boundaries of the northern section of the Giant Sequoia National Monument. At this initial meeting, the Supervisor and members of his staff provided the Board with a history and overview of the establishment of the Monument, and conducted a field trip to nearby points of interest in the Monument. In a letter dated June 8, the Board had received the Notice of Intent to prepare a management plan. This was the initial proposal for long-term management of the Monument.

At its first meeting, the members of the Board made several key procedural and organizational decisions. These included:

In accordance with Federal Advisory Committee Act (FACA) rules, it was agreed that the Board would operate in a transparent manner. All of the Board's deliberations would be held in public. Setting aside the first thirty minutes of each Board meeting to hear from the public would encourage public participation, in the form of written and oral comments. It was further decided that contacts with Board members, on the part of the public, would be made through the Sequoia National Forest Supervisor's office. Lobbying individual Board members was discouraged.

Careful and complete documentation, in the form of written minutes, agendas, maps, and other materials supplied to Board members would be maintained by the Sequoia National Forest Supervisor's Office in Porterville, California. Also the Minutes of subsequent meetings and appended documents were posted on the Forest Service web site http://www.fs.fed.us/r5/sequoia/gsnm/sab.html. In this way, opinions expressed by Board members that did not result in the adoption of an advisory were still contained in the record.

Decisions made by the Scientific Advisory Board would be fully deliberated before being voted upon. Only decisions arrived at by a full consensus of all Board members present would be considered as formal decisions by the Board. Individual members would vote on an issue only when they participated in its full deliberation.

A Chairperson and a Vice-Chairperson were elected. Dr. Paul Waggoner was elected Chair and Dr. Jeanne Clarke was elected Vice-Chair. The duties of the Chair, in consultation with the Vice-Chair, included the customary ones of establishing agendas, of presiding at Board meetings, and of working closely with Forest Supervisor Arthur Gaffrey and his staff to find the most productive use of the Board's time and resources.

A second meeting followed closely after the first. It was held at the River Island Country Club near Springville, California, on July 17-18, 2001. The published notice for the meeting provided for 5-minute statements to the Board by citizens, and seven individuals made verbal and written statements.

After the June meeting the Board studied the June 8 Notice of Intent and made several critical decisions at the July meeting. A presentation by Forest Service staff on how it was implementing the presidential mandate to draft a management plan for the Monument led to considerable discussion by Board members about the agency's planning process and where the Board fit in to that process. Some members questioned whether the staff's decision solely to use the Environmental Impact Statement (EIS) process, as mandated by the 1969 National Environmental Policy Act (NEPA), to meet its mandate was the correct procedure. Debate centered on whether there should be a "stand alone" management plan or whether the plan would be identical to the outcome of the EIS process, i.e., a draft and then a final environmental impact statement for the Giant Sequoia National Monument.

After considerable discussion, and in light of the facts that the EIS planning process already was underway and that the Notice of Intent had been issued by Forest Supervisor

Gaffrey, the Board decided that it could be most effective by rendering advice to agency planners in "real time." In other words, the Board would deliberate on substantive issues and procedures generated by and through the EIS planning process. Its deliberations, however, would not be limited to issues raised in this manner. The Board would also deliberate fully on the management implications contained in the Presidential Proclamation and their scientific bases.

It must be noted that the issue of whether there should be a management plan that was to some degree distinct from the EIS kept coming up throughout the Board's two-year tenure. Certain interested members of the public, and some Board members, felt strongly that the management plan should be a stand alone document. At the Board's final meeting, held March 12-13, 2003 in Visalia, California, advice to that effect was rendered to the Forest Service by Advisory XXVII.

An important practice was adopted by the Board to make its guidance pointed, timely, and hence cogent. This was to render advice to the Forest Service in the form of discrete "Advisories":

(1) ISSUE

(2) FACTS

(3) IMPLICATIONS FOR GIANT SEQUOIA NATIONAL MONUMENT

(4) ADVICE

The Board did not believe its role was to develop the Management Plan. Rather, it sought to weigh scientific evidence in forming advisories on specific issues. The "Facts" relevant to the issue are intended to highlight this evidence. The Board sought to consider issues and deliver advice before the Forest Service completed its plan, so that the advice could affect the planning process.

The Scientific Advisory Board held a total of six two-day meetings over a period of nineteen months. At the first meeting the Board received the June 8 Notice of Intent and at the second offered guidance prompted by the Notice. At the third the Board offered guidance on the significant issues developed by the Forest Service. The Board devoted the fourth meeting to understanding the human dimensions of natural resource planning. Invited speakers and the Vice Chair made presentations on social science research relevant to the management of the Monument. The fifth meeting focused on the Issues and Alternatives developed by the Forest Service.

The Board's last meeting was convened in Visalia on March 12-13, 2003 to critique the Forest Service's DEIS, and Management Plan. After adopting Advisories about the Draft, the Board planned its Final Report to the Secretary of Agriculture. The Final Report would transmit the twenty-seven Advisories adopted by the Board as well as summarize issues the Board addressed and how they were addressed.

After the Advisory procedure was established in July 2001, each Board meeting featured the Forest Service accounting to the Board their response to the Advisories. At its final meeting the Board fully examined the Forest Service response as recorded on pages 4 and 5 of the Minutes of March 2003. After the examination the Board adopted Advisory XXII on heeding its Advisories.

In his statement to the Board at the end of the final meeting the Designated Federal Official said the Forest Service would consider the Advisories submitted by the Board and prepare the Final Environmental Impact Statement. The Board decided that it would not convene another meeting unless special need arose, but members would be available individually to help the Forest Service with the plan.

After the preceding description of the Board's processes and procedures, what follows is a summary of the major issues addressed by the Board, many of which resulted in the issuance of a formal advisory to the Forest Service.

Issues Addressed by the Scientific Advisory Board

The lodestar for the Board's deliberations was the Presidential Proclamation of April 15, 2000, establishing the Giant Sequoia National Monument. This document specifies the reasons why the Monument was created, the current ecological conditions of the Monument, and what elements will be contained in the Secretary of Agriculture's Management Plan for the Monument. Virtually all of the Board's deliberations related to the Proclamation. The Forest Service in its NEPA process raised many issues. Other issues were raised by the Board, or by comments during Board meetings and field trips. The Board debated giant sequoia ecology and management, fire and fuels management, watersheds and appropriate units of land management, impacts to areas outside the Monument by the Plan, biophysical attributes affected by the plan, transportation, recreation, local, national, and public trust interests, collaborative management, and others. On some issues, the Board could offer consensus advice to the Forest Service. These issues are discussed in the following sections.

Sequoia

Of course the central feature of the Monument are the giant sequoias themselves, inspiring respect and awe through the ages. On the issue of how best to achieve giant sequoia restoration and regeneration, as well as on other issues, the Board drafted formal advisories aimed at being neither too narrow nor too broad in scope. That is to say, the Board struggled continually – and appropriately so – with its mandated mission of rendering practical and useful advice based on the best available science, while at the same time not losing sight of the broader issues involved in the Forest Service's proper management of the Monument. There existed what, hopefully, was a healthy tension between construing the Board's mandate narrowly and specifically, on the one hand, and broadly and generally, on the other. For deliberation about the size of gaps to encourage regeneration of the giant sequoia and about diameter limits for cutting trees, see pages 6 to 16 of the Board Minutes for March 12-13, 2003. For consensus guidance see Advisories I, II, III, V, XI, and XXIV.

Fire

The Proclamation notes that many forested areas of the Monument "... need restoration to counteract the effects of a century of fire suppression and logging." The primary tools available for forest restoration are prescribed fire and mechanical thinning. However, the Proclamation directs that trees can be removed "... only if clearly needed for ecological restoration and maintenance or public safety."

This limitation on tree removal within the Monument was set against a backdrop of a much broader -- and often intense -- national debate on how to deal with problems of forest health and catastrophic wildfires in the West. The Board's Advisory XX defined treatments, both mechanical and fire. Early in its work, the Board quickly reached agreement that a central issue facing the Forest Service was to clearly establish the proper roles of prescribed fire and mechanical thinning (tree cutting) in the Monument. The Board's consensus was perhaps reflected most succinctly in Advisory IV, which urged development of a conceptual "decision tree" to make transparent how the Forest Service would decide whether prescribed fire or mechanical thinning would be used on a particular piece of ground. Rephrased, the Board urged the Forest Service to make explicit which combinations of circumstances would lead to mechanical thinning being considered "clearly needed for ecological restoration and maintenance or public safety." In the Board's final meeting, in which it commented on the DEIS, it reaffirmed in Advisory XXVIII its conviction that the Forest Service needed an explicit model transparently revealing the circumstances under which prescribed fire and mechanical thinning would be used. The Board adopted fully six other Advisories about the interrelated issues of fire, air quality, deciding whether to reduce danger by controlled burning or mechanical treatment, maintaining access for burning and treatment, and a local market for timber removed by treatment. See Advisories VIII, IX, XIII, XIV, XXIII, and XXIV.

Watersheds

The Monument contains multiple watersheds, the waters of which support numerous beneficial uses, both inside and outside of Monument boundaries. A watershed is a natural management unit for evaluating the physical and social consequences of management decisions. For example, concern that logging would degrade the water supplied by the Kaweah River watershed provoked the editor of the *Visalia Delta* to begin writing editorials in the late 1880s condemning the wholesale cutting of sequoias, thus inspiring the creation of National Parks and National Forests upstream. Maintaining the integrity of watersheds, and the biophysical system they support, faces the challenge that the waters cross political boundaries. Giant Sequoia National Monument, Sequoia National Forest, Sequoia and Kings Canyon National Park, Tule River Indian Reservation, lands managed by the state of California, and private lands are all entwined in a network of watersheds. In Advisory X, the Board urged the Forest Service to consider the cumulative watershed effects of different management actions, ranging from fuels treatment to transportation and recreation planning. The draft EIS partially responded to this advisory, but the Board issued Advisory XXV to illustrate additional approaches to further consider the effects of recreation and transportation.

The Board recognized that specific management actions performed in accordance with the Management Plan would require more detailed watershed effects analysis, but urged a bounding-level analysis in the DEIS to illustrate the scale of watershed restoration that the individual alternatives imply.

Animals

Several hundred species of mammals, birds, reptiles, and amphibians are found in the Monument. Most of these are widely distributed. However, the shrinking of old growth forest in the Sierra Nevada has considerably reduced populations of the relatively short list of vertebrates that depend upon late-successional conifer forests (LSOG), individual large decadent trees, snags, or logs, and those associated with montane meadows and riparian zones. Advisory XII identifies those vertebrate species and urges Monument managers to pay close attention to their habitat requirements, especially when conducting fuel reduction activities. In addition, the Board urges the Forest Service to monitor the animal species themselves, not simply their habitat, to provide for adaptive management. While fuels management is necessary to prevent stand-destroying fires that obviously would further reduce LSOG habitat, the Board advises that care be exercised that a population of large trees must be sustained and that the integrity of meadows and riparian zones be protected.

People

Another fertile area for the Board's deliberations involved human use and activity on the Monument lands. The Proclamation states: "The monument also has many archaeological sites recording Native American occupation and adaptations to this complex landscape, and historic remnants of early Euro-American settlement as well as the commercial exploitation of the giant sequoias. The monument provides exemplary opportunities for biologists, geologists, paleontologists, archaeologists, and historians to study these objects." In its recognition that humans are an integral part of the Sierra Nevada ecosystem, and have been for millennia, the Proclamation stipulates that the management plan for the Monument "will provide for and encourage continued public and recreational access and use consistent with the purposes of the monument." The Proclamation further states, "No portion of the monument shall be considered to be suited for timber production, and no part of the monument shall be used in a calculation or provision of a sustained yield of timber from the Sequoia National Forest. " Finally, the Proclamation calls for the development of a transportation plan, but with the stipulation that: "No new roads or trails will be authorized within the monument except to further the purposes of the monument." With a few exceptions, "motorized vehicle use will be permitted only on designated roads, and non-motorized mechanized vehicle use will be permitted only on designated roads and trails." The Proclamation clearly states that the Monument's 327,769 acres shall no longer be used for commercial timber production, but that educational, scientific, recreational, and aesthetic uses shall continue.

Accordingly, the Board discussed several key issues relating to human use and enjoyment of the Monument. These included: Recreational carrying capacity to ensure

a high quality visitor experience without damaging the giant sequoia groves; continued equestrian use of the Monument; continued cattle grazing on portions of Monument lands; the optimal mix of developed and undeveloped recreational sites; regional economic impacts of National Monument designation of these 327,769 acres; and alternative modes of transportation. The Tule River Indian Reservation requires special consideration as a sovereign nation. Advisories XIV and XIX reflect some of those considerations. The over-arching concern, which connected these disparate issues, was how to ensure a variety of public uses consistent with protecting the giant sequoias and other objects of interest in the Monument.

The use of horses and mules (saddle and packstock) on the Monument is a traditional activity. In Advisory XVI, the Board found that this activity has the potential to damage important wildlife habitat through overgrazing of meadows and damage to streambanks and streamside vegetation. Social conflict between stock users and others has been a problem in the Sierra Nevada. However, the Board found that both ecological impacts and social conflicts can be satisfactorily controlled through appropriate management practices such as regulation, segregation, or local or temporary closures if these are part of a monitoring and adaptive management strategy. Consequently, the Board did not find use of pack and saddle stock to be incompatible with the purposes of the Monument.

In addition to drawing upon the expertise of individual Board members, and that of federal agency personnel, one of the Board's meetings consisted of a two-day Social Science "Field Trip." The Board heard presentations from a five-member panel drawn from academia, the public sector, and the private sector. Three were outdoor recreation specialists, one was an economist, and one was a political scientist. All five had considerable knowledge of either the social, political, and economic issues concerning the giant sequoia and the southern Sierra Nevada ecosystem, or the drafting of management plans, or both.

A number of Advisories were adopted as a result of the Board's attention to the human factor involved in managing the Monument. See Advisories V, XIV, XV, XVII, and XIX.

Science

The Scientific Advisory Board considered how scientific research could help attain the proclaimed purposes of the Monument. Advisory XVIII counseled that only research capability on the ground could assure the necessary place-based understanding of the Monument's ecology and society. Advisory XXIX counseled that the hoped-for adaptive management depended on monitoring.

Vision, Visualization and Understanding: Development of a Stand Alone Management Plan

The eloquence of the Presidential Proclamation can launch the Monument but not sustain it. Nor can lawsuits sustain it. Only citizens' conviction that it is a national

treasure as well as Monument will do the job. And that conviction must stand on understanding.

Before engaging architects, clients see renderings of alternate visions that show what they will get for their money. Clients will not hire an architect who presents them only with the number of nails and lumber to do the job. Clients want a rendering, or model, of what the dwelling will look like. Using this analogy, the Board asked the Forest Service: What vision does the Forest Service render for the future of the Monument? What will a visitor see in the Monument after a decade or century of the proposed management for the Monument? The Board urged the Forest Service to develop a stand-alone Management Plan, with geographic illustrations, that clearly lays out this vision. Advisory XXVII finds that the EIS alone is inadequate to this purpose, and it provides a suggested content of a stand-alone Management Plan that would convey the Forest Service's vision for the future of the Monument.

Further, does the Forest Service display reasoning to convince a citizen that the management will fulfill the vision? And is the reasoning presented in the plain language required by the National Environmental Policy Act, and more importantly, essential for the citizens' conviction that must sustain the Monument for centuries? Advisories XXI, XXVI and XXVII provide the Board's guidance.

Lessons Learned

As the government charters other advisory boards and the boards take up their duties, all may want to know the lessons this Science Advisory Board of a Monument learned on its way to the conclusion of a Final Report. The first lesson was learning how the Proclamation and Charter that specified scientific advice on the management plan focused its deliberations. As written above, each meeting began with the reading of that duty and was reinforced by a prop always on display, a toy truck with *sideboards*.

At all meetings, the deliberation on draft advisories, assigned to and written by an individual Board member, comprised the core of the Board's work. The importance of this procedure cannot be over-emphasized. Whether one agrees or disagrees with the substance of the Advisories adopted by the Board, the procedure of making individual assignments on a specific issue, to be drafted in advance of Board meetings, worked exceptionally well. Relatively little time was spent on seemingly endless deliberations that went nowhere. The Board Chairperson was diligent in making specific assignments, and Board members were diligent in following through on those assignments.. The Board conveyed the Advisories to the Designated Federal Official soon after each meeting, and he posted them publicly on http://www.fs.fed.us/r5/sequoia/gsnm/advisories.html. By this procedure the Board intended to accomplish its mission to provide relevant, scientifically grounded advice to the Forest Service during the development of the initial Giant Sequoia National Monument management plan. See the chartered purpose of the Board at http://www.usda.gov/ocio/directives/DR/DR1042-136.htm.

The Board sought to be relevant and effective by submitting its advice while it could be profitably used. The Board deliberated issues raised by the current stage of the Forest Service planning process. The outline--Issue, Facts, Implications for the Monument, and Advice--kept the advice pointed and appropriate to the mission of scientific guidance. Each Board meeting featured the Forest Service accounting to the Board their response to the Advisories. The Forest Service responded further in Appendix F of its DEIS. And at its final meeting the Board fully audited the Forest Service response and adopted Advisory XXII about heeding Advisories. These measures surely made the advice more cogent and useful.

Another important decision was made at the Board's second meeting, and that was to hold its meetings in, or in close proximity to, the Monument. This allowed the Forest Service, the Park Service, the California Department of Forestry and Fire Protection and the Tule River Indian Reservation to conduct informational field trips for the Board and for members of the public. It encouraged public participation and attendance at Board meetings by local and regional residents of the area surrounding the Giant Sequoia National Monument. Substantial attendance at all of the Board meetings—including Tulare County supervisors and the chairman of the Tribal Council--suggests that this decision was a productive one. Board members got acquainted with numerous members of the public and listened to their opinions in both formal statements and in informal settings. All participants were able to see examples of the concerns and suggested management actions in the field. Of particular value was the opportunity to view the different approaches to the management of giant sequoia groves by the National Park Service, the Forest Service, the Tule River Indian Tribe, and the State of California. A newspaper editor who attended most of the meetings thanked the Board for its public deliberations that helped the public grasp the planning process.

In the End

The Giant Sequoia National Monument Scientific Advisory Board represented the range of sciences for managing this ecosystem, and developed twenty-seven advisories by unanimous consent. As such, these are issues upon which there should be broad agreement as Monument management proceeds. Other issues were more contentious or were not strictly scientific; on these issues the Board could not provide unanimous advice. If, however, the application of the Board's Advisories does narrow areas of disagreement over management of the Monument, then perhaps negotiation rather than litigation can bridge the lessened gap.

It is not up to the Board to conclude whether it was successful in finding the appropriate level of analysis, in all cases. Reviews by others of this report and the Advisories that are appended will answer that question. But suffice it to say that the Board was ever cognizant of the necessity of staying within the bounds of objective, scientifically grounded, discourse when rendering its advice. Like a legislature opening with a prayer, the Board began its meetings with a recital of its purpose proclaimed by the President: "To provide scientific guidance during the development of the initial management plan."

The Advisories

The Board's Charter states, "The advice of the Board shall consist of the consensus of its members, representing a range of scientific disciplines including the physical, biological, and social sciences." This advice was adopted after public deliberation as required by FACA. As explained above it was transmitted "in real time" to the Forest Service and public. For the Secretary of Agriculture the Advisories are collected together in this, the Board's Final Report.

Part 2: The Advisories

This section presents the Advisories issued to the Forest Service by the Scientific Advisory Board. Advisories are presented in the following format:

- Issue or Question
- Facts
- Implications to the Monument
- Advice

I. Priority of Objects.

Issue:

Given the numerous objects of interest to be protected and/or promoted in the Giant Sequoia National Monument, as noted in the presidential Proclamation, how should the Forest Service set priorities among the objects to be protected, especially when protection of one object conflicts with another?

Facts:

Scientists have delineated the range of the giant sequoia species, and have discovered key natural elements and objects within the sequoia's ecosystem. The giant sequoia itself can be considered an indicator species for the ecosystem. The purpose of the Monument, as stated clearly in the Proclamation creating the Monument, is to protect the giant sequoia and its ecosystem. This must be considered as the top priority in drafting a management plan for the GSNM. However, the Proclamation also mentions other objects. It mentions protecting unusual geological formations, such as caves. It also seeks to preserve the historical record, including its use by Native Americans and Euroamericans. Finally, the Proclamation states that the Monument will be open to public/recreational/educational use to the extent consistent with preservation (and natural regeneration) of the giant sequoia. Ecosystems science seeks to uncover the interrelationships among all elements within the ecosystem. It is no easy task identifying all the subtle relationships that comprise the whole; nevertheless, the goal is to identify the essential elements that allow for the healthy functioning of the entire ecosystem. Ecosystems management is the applied component of ecosystems

science. It uses ecosystems science to manage in a holistic manner, as opposed to one that encourages a single, or dominant, use.

Implications for the Monument:

As the designated management agency, the Forest Service is encouraged to continue using ecosystems science to uncover the essential natural, physical, and historic elements within the Monument boundaries. Ecosystems management does not allow for rigid, or hard and fast, prioritization of one object over another; rather it seeks to foster diversity and to employ adaptive management. Given the large geographic extent of the Monument, it is possible to identify sub-areas that will allow for different management goals and emphases. However, it must always be kept in mind that the overall purpose of the Monument is the protection of the giant sequoia species. This includes its natural regeneration. If a use conflicts with that goal, then it must be reconsidered.

Advice:

The Forest Service should use ecosystems science as the basis for its management plan for the Giant Sequoia National Monument. Its management plan should be characterized by: interrelation of the parts to the whole; fostering the natural diversity of the ecosystem; and allowing for public use, education, and enjoyment of the Monument to the extent consistent with protection and preservation of the giant sequoia species.

II. Eras

Issue:

What shall we call the eras before and after the sequoia forest changed during the 19th Century?

Facts:

Pollen records within the present groves show that giant sequoias began to increase dramatically with the onset of a slight global cooling at the end of the Altithermal era thousands of years ago (Antevs 1948, 1955; Anderson 1994, Anderson and Smith 1994). Though pollen records reflect small changes in the proportions of species to the present, the most dramatic changes were completed by about A.D. 900 (Graumlich 1993). From A.D. 900 to 1875, both climate and fire regimes continued to vary (Hughes and Brown 1992, Graumlich 1993, Scuderi 1993, Swetnam 1993).

From 900 AD into the 19th Century, California Indians manipulated the environment with fire to promote vegetation regeneration, for hunting, to capture insects for food, and for other activities (Blackburn and Anderson 1993; Anderson and Moratto 1996; Lewis 1973; Bean and Lawton 1973). Indigenous tribes have occupied California for at least 12,000 years (McGuire and Garfinkel 1980; Moratto 1984; Hull and Moratto

1999). They did not suppress natural fires, and their intentional burning produced landscapes more open than in the 20th Century. Some tribes considered giant sequoias important and to be protected (Powers 1877, reprinted by Heizer 1976: 398). Euroamerican contact, the gold rush, and settlement in the 19th Century ended much tribal manipulation of the giant sequoias and other ecosystems.

The loss of fire due to disruption of traditional tribal practices plus subsequent fire suppression profoundly changed the forest. At 68 sites in the parks adjacent to the Monument, the median year of last natural fire was 1875 (Caprio et al. 1997). The year 1875 also roughly corresponds to the time that logging and its effects began to become prevalent in the southern Sierra Nevada (Otter 1963).

Implications for the Monument:

For four reasons, ca. A.D. 900 – 1875 provides a useful reference period for change (see Stephenson 1999):

Indians used fire to manage the forest;

Logging had not yet become prevalent;

Forest composition (but not necessarily structure) was similar to that of the present; and

Climate, though variable, included periods similar to the recent climate.

Advice:

Call the era ca. A.D. 900-1875, of similar climate and Indian use of the forest, "pre-1875". Call the period since that time "post-1875".

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III. Desired Conditions.

Issue:

What are desired conditions for vegetation?

Facts:

We have already entered climatic conditions that have no recent precedent, and pollution and pest conditions with no known precedent. For example, current atmospheric CO_2 concentration is the highest it has been in at least 420,000 yrs, and perhaps 20 million years (Intergovernmental Panel on Climate Change (IPCC) 2001). Global temperature is rising, and the 1990s was probably the warmest decade in the last 1,000 years (Mann et al. 1998; IPCC 2001). In the Sierra Nevada, current temperatures are also rising, and are among the warmest of the last millennium (Graumlich 1993). Global average temperature is projected to increase an additional 1.4 to 5.8 C (2.5 to 10.4 F) by 2100 (relative to 1990), at a rate that is likely to be unprecedented in the last 10,000 years (IPCC 2001). Layered on top of these ongoing changes are other immediate stressors that have no precedent, such as air pollution and introduced pathogens.

Implications for the Monument:

The Proposed Action's desired condition for vegetation is too rigidly defined. Restoring and maintaining vegetation within a pre-1875 range of variability may soon become undesirable or impossible. It may become undesirable because pre-1875 vegetation conditions may soon become less stable or resilient to ongoing and unanticipated changes than some other set of vegetation conditions. It may become impossible because certain species, combinations of species, or vegetation structures simply may not be able to survive in future conditions.

Advice:

The overriding desired condition for vegetation is one that exhibits both stability and resilience, while best maintaining native biodiversity. That is, the overriding goal for vegetation is the ability to resist stressors (stability) and to recover from stresses once they occur (resilience). The Proclamation itself speaks of "restoring natural forest resilience" in the Monument.

For the near future and because environmental conditions have not yet deviated radically from pre-1875 conditions, the goal of restoring stability and resilience can be met by using the pre-1875 mosaic of vegetation as a reference (Stephenson 1996). For example, many forested areas of the Monument are denser and have much more

surface fuel now than in pre-1875 times. Restoring pre-1875 forest densities and fuel loads would make these forests more stable (e.g., resistant to being severely altered by wildfire, droughts, pathogen outbreaks, or air pollution), and more resilient (more able to rebound from such stressors when they occur).

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Stephenson, N. L. 1999. Reference conditions for giant sequoia forest restoration: structure, process, and precision. Ecological Applications 9:1253-1265.

IV. Restoration of the Natural Fire Regime.

Issue:

Can fire alone be used to reach the desired condition for the giant sequoia groves and their surrounding ecosystem?

Facts:

Fire often is a useful tool for restoring giant sequoia groves and other fire-adapted ecosystems (Hardy and Arno 1996; Stephenson 1996, 1999). However, issues such as human safety, air quality, water quality, endangered species, cumulative impacts with other management actions, current and desired forest structure, and current fuel loads mean that fire alone cannot always be used to achieve desired forest conditions (Weatherspoon 1996; Fulé et al. 1997; Piirto and Rogers 1999). In areas where fire alone cannot be used to achieve desired conditions, mechanical thinning often proves to be a useful alternative (Weatherspoon 1996).

Implications for the Monument:

It is unrealistic to use fire alone to reach desired conditions in all areas of the Monument. In some areas, mechanical thinning will be needed, and is allowed “if

clearly needed for ecological restoration and maintenance or public safety" (Clinton 2000).

Advice:

Develop a decision tree to help determine which methods of forest restoration and maintenance should apply at different locations. Consider factors such as the following:

Ecological Need

- Number of fires missed by an area
- Reduced biodiversity
- Deviation from pre-1875 structure, composition, and process

Hazard

- Fuel load
- Fire ladders
- Ignition probability
- Stand density
- Adjacent vegetation
- Vegetation mosaic

Risk

- Objects of Interest
- Public Safety
- Traditional uses by tribal members of Tule River Reservation and other Native Americans
- Recreation
- Water Quality
- Erosion potential
- Air Quality
- Endangered species

Feasibility

- Access
- Economic
- Social Acceptance References

References:

Clinton, W.J. 2000. Establishment of the Giant Sequoia National Monument: a Proclamation by the President of the United States of America. April 15, 2000.

Fulé, P. Z., W. W. Covington, and M. M. Moore. 1997. Determining reference conditions for ecosystem management of southwestern ponderosa pine forests. Ecological Applications 7: 895-908.

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Weatherspoon, C. P. 1996. Fire-silviculture relationships in Sierra forests. Ch. 44 in Sierra Nevada Ecosystem Project: Final Report to Congress, Vol. II, Assessments and scientific basis for management options. Centers for Water and Wildlands Resources, University of California, Davis.

V. Prioritizing Areas of Land.

Issue:

Is there a need to prioritize areas within the Monument for management action?

Facts:

Neighboring Sequoia and Kings Canyon National Parks have found that re-establishing pre-1875 fire regimes and forest structure is a lengthy and difficult process (Caprio and Graber 2000). Sequoia and Kings Canyon National Parks are considered to be among the leaders in restoring fire to coniferous forest ecosystems. After three decades of prescribed burning, fire regimes approaching pre-1875 frequencies have been established in some, but not all, areas of the Parks. Limitations to the rate at which fire has been re-introduced have included understaffing, air quality restrictions, and weather (W. Kaage, personal communication, July 2001).

Additionally, the need for management action varies across the landscape (Caprio et al. 1997; Keifer et al. 2000). For example, fuel loads and the consequent risk of severe wildfire vary greatly with location on the landscape.

Implications for the Monument:

Restoration of fire regimes and forest structure in the Monument may take many decades, and in fact may never be fully complete. Additionally, some areas will need management action more urgently than others.

Advice:

Areas within the Monument must be prioritized for management action. There is value in using an explicit, quantitative scheme to identify areas most in need of management action, such as restoring pre-1875 fire regimes and forest structure (Caprio et al. 1997; Keifer et al. 2000). Such a scheme would probably consider (but not necessarily be limited to) some weighted combination of:

- HAZARD of catastrophic stress, such as stress by severe wildfire. Factors to consider would likely include (but not necessarily be limited to) fuel load, ignition probability, stand density, fire ladder, adjacent vegetation types, and current vegetation mosaic.
- RISK to values and objects of interest. Factors to consider would likely include (but not necessarily be limited to) water quality, erosion, sensitive species, public safety, ceremonial and traditional uses, and identification as objects of scientific or historical interest.
- ECOLOGICAL NEED. Factors to consider would likely include (but not necessarily be limited to) number of fire cycles missed, biodiversity, and deviation from pre-1875 vegetative structure, composition, and function.
- FEASIBILITY. Factors to consider might include (but not necessarily be limited to) economic, site access, legislated land designations, and social acceptance.

It is unreasonable to expect that a thorough, fine-grained prioritization of management areas will be included in the first Monument management plan. However, at a minimum, the plan should include the determination to set priorities plus the factors to be considered for prioritizing areas or, better yet, a quantitative scheme to be used in the prioritization.

References:

Caprio, A., C. Conover, M. Keifer, and P. Lineback. 1997. Fire management and GIS: a framework for identifying and prioritizing fire planning needs. Proceedings of the Conference on Fire in California Ecosystems: Integrating Ecology, Prevention, and Management. Nov. 17-20, 1997, San Diego, CA. (http://www.nps.gov/seki/fire/pdf/sd97_frid.pdf)

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VIII. Air Quality

Issue:

Prescribed burning may increase short-term smoke emissions and affect public health.

Facts:

The San Joaquin Valley Air Basin is classified as a serious non-attainment area for the health-based National Ambient Air Quality Standards for particulate matter with an aerodynamic diameter of 10 microns or less (PM-10). As such, the San Joaquin Valley Unified Air Pollution Control District (District) was required by the Federal Clean Air Act to prepare an Attainment Demonstration Plan (Plan). The Plan sets forth the direction and framework, including the emission control strategies that the District needs to implement, to achieve attainment of the National Ambient Air Quality Standards. The Federal Clean Air Act requires that the Plan develop Best Available Control Measures for prescribed fire.

On March 23, 2000, the California Air Resources Board amended Title 17, Agricultural Burning Guidelines (which became Smoke Management Guidelines for Agricultural and Prescribed Burning). To implement the new Title 17 requirements, District Rule 4103 (Prescribed Burning and Hazard Reduction Burning) was promulgated on June 21, 2001.

As a serious non-attainment area for PM-10, the San Joaquin Valley Air Basin has low tolerance for additional smoke. Yet the Giant Sequoia National Monument inevitably will contribute smoke to the Basin, regardless of management approach (e.g., see Cahill et al. 1996). At one extreme, if no forest restoration efforts were undertaken and all fires were fought aggressively, the Basin would still experience episodes of moderate to extreme smoke from wildfires that inevitably escape control and burn through dense, unrestored (and hence fire-prone) forest. (Indeed, wildfires in the Sequoia National Forest produced an average of nearly 2,500 tons of PM-10 per year from 1981 through 1995 [Forest Service 2001].) On the other hand, management actions that restore forest conditions that are less prone to uncontrollable wildfires, whether those actions emphasize prescribed fire or mechanical means, will also produce smoke. For obvious reasons, use of prescribed fire alone inevitably produces smoke, though the timing and quantity are much more controllable than that produced by wildfires. (Additionally, prescribed fires generally produce less smoke per acre than wildfires [Forest Service 2001].) Mechanical means of restoring forest structure and reducing fire hazard must deal with slash and dead surface fuels, and often the most pragmatic and cost-effective way of dealing with some or all of these fuels is by

burning, again producing smoke. Additionally, mechanical approaches to forest restoration can contribute to PM-10 through increased dust production, though this contribution is probably minor relative to that of smoke.

Implications for the Monument:

As suggested in the Scientific Advisory Board's Advisory IV, smoke production should be one of the factors considered in developing management alternatives for forest restoration.

Advice:

Game out scenarios of PM-10 production using various combinations of management approaches to forest restoration, including a "wildfire only" scenario. The approach taken in the Sierra Nevada Forest Plan Amendment (Forest Service 2001) provides a good model for gaming various scenarios. The analysis might proceed roughly as follows, though these suggested steps are not meant to be prescriptive:

Produce three scenarios of future air quality standards in the San Joaquin Valley:

(1) Assume (i) current standards are retained, (ii) assume a realistic scenario in which standards become more restrictive for smoke production by prescribed fire, and (iii) assume a realistic scenario in which standards become less restrictive for smoke production by prescribed fire.

(2) For a typical range of conditions in forests that require restoration, calculate the likely production of PM-10 (from both smoke and dust), in tons per acre, that would be produced by prescribed fire alone, mechanical means (and any associated burning), and wildfire.

(3) For each of the three scenarios of future air quality standards, game out the maximum area of forest that could be restored annually using various combinations of prescribed fire alone and mechanical means (along with any associated burning). Additionally, game out possible smoke production from wildfires alone, assuming that no forest restoration is undertaken (perhaps using past wildfires to help estimate possible future wildfires).

(4) Use the information gained in (1) and (3), in concert with other factors as suggested in the Scientific Advisory Board's Advisory IV, to develop management alternatives for forest restoration that are within current and future potential air quality standards.

References:

Cahill, T. A., I. I. Carroll, D. Campbell, and T. E. Gill. 1996. Air quality. Chapter 48 (pages 1227-1261 *in* Sierra Nevada Ecosystem Project: final report to Congress, vol. II, Assessments and scientific basis for management options. Wildlands Resources Center

Report No. 37, Centers for Water and Wildlands Resources, University of California, Davis, California, USA. (http://ceres.ca.gov/snep/pubs/web/PDF/VII_C48.PDF)

USDA Forest Service. 2001. Air quality. Section 3.7 (pages 323-354) *in* Sierra Nevada Forest Plan Amendment, Final Environmental Impact Statement, Vol. 2. USDA Forest Service, Pacific Southwest Region.

IX. Undesirable Fire Effects

Issue:

Fuels reduction strategies in the Sierra Nevada Forest Plan Amendment may not adequately protect the giant sequoias and mixed conifer ecosystem from catastrophic fire. (For the purposes of this Advisory, "catastrophic fire" is defined as fire of an extent and severity beyond that which is consistent with the values for which the Monument was created.)

Facts:

Page 18 of the January 2001 Record of Decision (ROD), Sierra Nevada Forest Plan Amendment Environmental Impact Statement (EIS), states regarding Giant Sequoia National Monument that "Lands within the monument are subject to the decisions made through this ROD. However, the monument management plan, and subsequent plan amendment, may modify this direction to protect the values for which the monument was created." Thus, if the fuels reduction strategies in the Forest Plan Amendment EIS are determined to inadequately protect the giant sequoias and mixed conifer ecosystem from catastrophic fire, the Monument management plan can deviate from the Plan Amendment.

The Plan Amendment (ROD p. 4) generally prescribes that, outside of the 0.25-mile wide urban-wildland defense zone and for trees greater than 6 inches in diameter at breast height (dbh), forest canopy cover reduction is not to exceed 20%, and that canopy cover is not to fall below 50%. Additionally, trees greater than 20 inches dbh generally are to be retained.

One of the goals stated in the Monument proclamation is to restore "natural forest resilience" (Clinton 2000). Some foresters, forest ecologists, and others believe that in some areas of the Monument, the standards set forth in the Forest Plan Amendment may be too restrictive to meet this goal with regard to catastrophic wildfire, and to protect other objects of interest in the Monument. Yet, no quantitative analysis has been conducted specifically to test this belief.

Implications for the Monument:

It is possible some areas of the Monument, the Forest Plan Amendment standards may be too restrictive to meet the intent of the Monument proclamation. A quantitative analysis needs to be conducted to test this possibility.

Advice:

Conduct a quantitative test of the possibility that the Forest Plan Amendment standards are too restrictive to meet the intent of the proclamation. The test might proceed as follows:

1. Define acceptable levels of risk of catastrophic wildfire that are consistent with the goals of the proclamation. For example (and for illustrative purposes only), under 95th percentile August weather conditions, less than 35% of the general coniferous forest landscape, and less than 20% of giant sequoia grove area, is susceptible to wildfire that would kill more than 70% of all trees greater than 20 inches in diameter at breast height (dbh). Other possible approaches to defining acceptable levels of risk can be found in Shulman and Gelobter (1996), Piirto and Rogers (1999), and elsewhere.
2. For at least 10 randomly selected Monument watersheds that contain >500 acres of mixed coniferous forest (at least 7 of which contain sequoia groves), project forest structure and fuels that would follow treatments that adhere to the Forest Plan Amendment standards. (The number and sizes of watersheds suggested here are for illustrative purposes, and may need to be altered to meet the goal of this Advisory.)
3. Using FARSITE, BEHAVE, or similar fire behavior and spread models, for each of these watersheds after fuel treatments, model the potential effects of a wildfire burning under 95th percentile weather conditions for August.
4. Compare the results with the previously defined acceptable levels of risk.
5. Use the preceding comparison in concert with other considerations (as suggested in the Science Advisory Board' s Advisory IV http://www.r5.fs.fed.us/giant_sequoia/documents/adv.pdf]) to determine whether the standards outlined in the Sierra Nevada Forest Plan Amendment need to be modified to meet the goals of the Monument.

The biggest limitation to this analysis is likely to be existing data. Regardless, every attempt should be made to conduct a similar quantitative analysis.

References:

Clinton, W. J. 2000. Establishment of the Giant Sequoia National Monument: a proclamation by the President of the United States of America. Apri1 15, 2000.

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USDA Forest Service. 2001. Sierra Nevada Forest Plan Amendment, Final Environmental Impact Statement. USDA Forest Service, Pacific Southwest Region.

X. Impairment of Watersheds

Issue:

Will increased numbers of visitors, recreation infrastructure, and methods of fuels treatment lead to impairment of watershed functions?

Facts:

The Monument contains multiple watersheds, the waters of which support numerous beneficial uses, both inside and outside of Monument boundaries. The watershed is the natural management unit for evaluating the physical consequences of management decisions. Although many interests cross watershed boundaries, managing the functionality of the underpinnings of the biophysical system most logically occurs at the watershed level. The scale of the action under consideration will define the watershed scale of analysis.

Recreational activity and associated infrastructure can alter water quality and watershed functions (Kattelmann 1996, Moyle and Randall 1996). Areas of more intensive recreational use and development have the greatest potential for impairing water quality. The sources of such change include roads, trails, intensive use of riparian areas, septic systems, and antiquated infrastructure, among others (Kattelmann 1996).

Restoration of the natural fire regime also has the potential to affect Monument watersheds, based upon both past management activities and current or proposed management activities. High-severity wildfire has diverse effects on watersheds and the aquatic environment. Direct short-term effects can include loss of streamside and upland vegetation and alteration of soil characteristics (Brown 1990, Minshall et al. 1990, Swanson 1991, Rieman and Clayton 1997, Poff 1996). Indirect effects can include increased flooding, increased sediment erosion and deposition, increased stream temperature, decreased fish and macro-invertebrate abundance, and alteration of instream habitat (Brown 1990, Minshall et al. 1990, Novak and White 1990, Swanson et al. 1987, Swanson 1991, Ewing 1996, Rieman and Clayton 1997). Although many effects of high-severity fire on streams may be considered adverse in the short term, the effects improve with time. Fire has a critical role for creating and maintaining landscape characteristics, habitat and species diversity, and life history complexity (Brown 1990, Rieman and Clayton 1997, Gresswell 1999).

The alternatives to wildfire, prescribed burning and mechanical treatments, have less severe direct and indirect effects to watersheds than does high-severity wildfire. The relatively low intensity of prescribed fires results in less post-fire soil erosion and change to soil structure, if the fire remains within prescription. Mechanical treatments have variable effects on soil erosion and alteration of soil conditions, depending upon

the method used. These effects range from less than to greater than prescribed fire (Kattlemann 1996, Poff 1996).

The Forest Service currently applies a method of cumulative watershed effect (CWE) analysis (Berg et al. 1996, Menning et al. 1996). The method quantifies the effects of past management activities and current or proposed management activities. The threshold of concern (TOC) is defined in the method as an indicator that an unacceptable level of stream degradation could occur. The TOC is a measure of the watershed's tolerance for disturbance, and when approached indicates that more rigorous, field-based, analysis is required prior to the management activity.

Management activities in the Monument would likely lead to an exceedance of the TOC of some subwatersheds. Of particular concern for fuels treatment are the urban interface zones, where subwatersheds at or near the TOC would also be the focus of greater fuels management. Of concern for recreation is increased use and development of already developed areas, where watersheds are already at or near the TOC.

Implications for the Monument:

The methods used to achieve the desired conditions in the Monument may result in the degradation of some streams or watersheds to above their TOC. If Clean Water Act or state water quality standards may be violated, then the use of fuel control methods or types of recreation could be restricted to certain geographic areas.

Advice:

Use the CWE analytical framework as a basis for predicting the effects of recreation on watersheds. The current CWE analytical tools will need to be expanded beyond consideration of sediment transport in order to allow the flexibility to address chemical water quality and water use as appropriate. Consider restoration of existing water quality impairment in conjunction with management plans for expanded recreational use. The scale of watershed under analysis may need to be expanded from the current approach depending upon the extent of the proposed actions.

The CWE analysis is also a primary element of determining the effect on watersheds of different methods of fuel treatment (Advisory IV, *Restoration of the Natural Fire Regime*). The existing CWE model focuses on the impacts of timber harvest; it will need to be expanded to include quantification of the other methods of fuel treatment that may be proposed for the Monument, including prescribed burning and wildfire. Include a determination of the potential effect of severe wildfire on subwatersheds in prioritizing areas requiring fuels treatment (Advisory V, *Prioritizing Areas of Land*).

Watersheds may require restoration in conjunction with management actions to ensure that the TOC is not exceeded. Use the determination of areas most in need of fuels treatment and most likely to be the focus of recreational use (Advisory V, *Prioritizing Areas of Land*), together with existing information on subwatersheds near the TOC, to

develop a prioritization of watersheds that should be restored to conditions well below the TOC. Of those watersheds near or above TOC, first consideration for restoration should be given to areas in the Ecological Zone of Influence for giant sequoia groves, then the urban interface zone, then the remainder of the Monument (Advisory I, *Priority of Objects*).

Maintaining the integrity of watersheds, and the biophysical system they support, faces the challenge that the waters cross political boundaries. Giant Sequoia National Monument, Sequoia National Forest, Sequoia National Park, Tule River Indian Reservation, CDF-managed lands, and private lands are all entwined in the network of watersheds. The Giant Sequoia Ecology Cooperative could serve as a basis for informing integrated management of watershed issues. If the Monument maintains a full-time scientific presence (Advisory XVIII, *Scientific Presence*), then this position would be a natural focal point for transforming the deliberations of the Cooperative into management advice for the Monument.

References:

Berg, N.H., K.B. Roby, and B.J. McGurk. 1996. Cumulative Watershed Effects: Applicability of available methodologies to the Sierra Nevada. In: Sierra Nevada Ecosystem Project: Final Report to Congress, vol. II, chap. 2. Davis, CA: University of California, Centers for Water and Wildland Resources.

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XI. Sequoia

Issue:

The limitation on crown canopy reductions and tree diameter size removal may not provide adequate opportunities to meet desired ecological conditions for the giant sequoias and the associated mixed conifer ecosystems. The Desired conditions are: 1) create openings to establish young giant sequoias; and 2) create a vegetative mosaic of age and size classes.

Facts:

Fire disturbances create gaps, which in turn become patches (i.e., aggregations) of overlapping vegetation in the giant sequoia-mixed conifer ecosystem. Many authors recognize this mosaic pattern as being an important attribute of the groves (Bonnicksen and Stones 1981, 1982 a, b; Stephenson et al. 1991; Stohlgren 1993 a, b). Piirto and Rogers (2000) review in detail the literature on gap and patch size, frequency, and plant community composition.

This vegetation mosaic is composed of differing species in various combinations of size and age classes. The degree to which vegetation renews itself after a disturbance

event is affected by: 1) the extent of the disturbance; 2) Existing vegetation conditions; 3) Site conditions (e.g., slope angle, aspect, soil type, geological and topographic conditions); 4) weather; and 5) alignment of desired conditions to enable plant/tree germination, survival, and optimum growth. This natural successional renewal of gaps and resulting even-aged patches (i.e., cohorts) of vegetation has often been referred to as episodic or pulsed.

The boundaries of gaps and patches in giant sequoia groves are often characterized as being diffuse, without sharp edges with many gaps having living trees that survived the disturbance (Demetry and Duriscoe 1996). Piirto and Rogers (2000) state: "It is critical to realize that in the natural or 'ancient' forest only a few patches (on a scale of a fraction to a few acres) may be dominated by large, old trees. However, large, old trees will be scattered throughout the forest matrix (on a scale of hundreds of acres) giving the entire landscape an 'old-growth', 'ancient forest' or 'late seral stage' character."

However, fires generally have had a fairly predictable pattern of reoccurrence in the Sierra Nevada giant sequoia mixed conifer ecosystems in the 1000-year period preceding Euro American settlement (i.e., pre-1875). It is generally agreed that low to moderate intensity fires in the mixed conifer forest were much more frequent prior to the late 1800s than they are today. Skinner and Chang (1996) summarized data from several authors that describe a reference variability for fire return interval of 1 to 35 years for the giant sequoia-mixed conifer ecosystem. Swetnam et al. (1992) and Swetnam (1993) reported afire return interval for the pre-settlement giant sequoia-mixed conifer forest of 3 to 8 years with a maximum interval generally less than 15 years.

The risk of high severity fires has increased over the last century due to a reduction in the aerial extent of fire in the Sierra Nevadas. Giant sequoia mixed conifer forests now have: 1) more and smaller trees with higher proportions of white fir and incense cedar than were present historically; 2) increased levels of fuel both on the forest floor and as fuel ladders; and in some cases 3) fewer canopy openings (McKelvey et al 1996; Skinner and Chang 1996; Stephenson 1994; Piirto and Rogers 2000); and 4) several orders of magnitude less giant sequoia seedling development as compared to the pre-1875 forest (Stephenson 1994,1996). Stephenson (1994) states: "By far the largest deviations from equilibrium conditions (stationary age distributions) in giant sequoia populations over the last two to three millennia is due to the effects of fire suppression during the last century."

Implications for the Monument:

Adherence to the Sierra Nevada Framework guidelines may not enable gap development through mechanical means as no tree greater than 20 inches can be removed.

Failure to regenerate giant sequoia could adversely affect the long-term sustainability of the giant sequoia ecosystem.

Advice:

A simulation test possibly using the Stand Visualization System (SVS) and/or the Environmental Visualization System (En Vision) should be undertaken to determine how restrictive the Sierra Nevada Framework Guidelines are in achieving desired giant sequoia vegetation structural objectives.. For further information on these visualization/modeling systems contact Robert McGaughey, USDA Forest Service, PNW Station, University of Washington, P.O. Box 352100, Seattle, W A 98195-2100; phone-- (206) 543-4713; e-mail-- bmcgaughey@fs.fed.us

Review and use as a reference the information offered by Demetry and Duriscoe (1996), Piirto and Rogers (2000) and Stephenson (1994,1996) on gap size, gap frequency, and plant community composition for the approximate 20,000 acres of giant sequoia land within the 340,000 acre Monument. It is important to recognize that each grove has its own set of vegetation/ecosystem conditions that will necessitate the development of site/grove specific management prescriptions.

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XII Wildlife

Issue:

Additional mechanical treatments and/or prescribed burning may adversely affect wildlife species that are dependent on late seral/old growth (LS/OG) habitat by reducing the amount of that habitat.

Facts:

Because the Sierra Nevada, and especially the mixed-conifer zone, is a highly disturbance (fire)-driven system, there are relatively few vertebrates commonly considered to be dependent upon the characteristics of late seral forest compared to forests in the Northwest. Those characteristics, which include the frequent presence of large (e.g. >80 cm dbh) trees (generally >100 years old), snags, and logs, a relatively closed canopy with moderated temperatures and humidity, undamaged soil structure, and (generally) un-grazed herbaceous layer. The short list of Sierran vertebrates with suspected LS/OG dependencies includes northern goshawk, California spotted owl, great gray owl, Vaux's swift, white-headed woodpecker, pileated woodpecker, red-breasted nuthatch, pygmy nuthatch, brown creeper, hermit warbler, purple finch, Cassin's finch, evening grosbeak, northern flying squirrel, and Pacific fisher (Graber 1996). There is no evidence that the use of giant sequoia groves by vertebrates differs in any significant way than use of other mixed-conifer stands possessing similar structural attributes, i.e. large trees, open structure, and relatively closed canopy (National Park Service 2001). The greatest species richness occurs in forests that contain both old-growth attributes and forest openings of at least 0.25 ha (Graber 1996). These openings, in their early successional stages, promote the growth of herbs and shrubs, which support vertebrates directly, or indirectly through invertebrate production. Meadows and riparian stringers support species not found elsewhere in the forest, and greatly increase support infrastructure for others by providing a source of water as well as riparian food items not found elsewhere within the forest stand (DeSante 1995, Graber 1996, Moyle and Randall 1996, Wilkerson and Siegel 2001). It is generally accepted that for the Sierra Nevada as a whole, as a consequence of settlement and resource extraction activities, there is substantially more landscape in early-successional stages, and substantially less habitat in late-successional stages than before 1875.

The reasons why a particular vertebrate is dependent upon LS/OG may be a requirement for a nesting, resting, or hibernation site in a large, decadent snag or log (e.g. white-headed woodpecker) (California Dept. of Fish and Game 2000); the effect of moderated climate and large trees (spotted owl, northern flying squirrel) (Verner at al. 1992); un-grazed meadow and large trees (great gray owl) (Hayward and Verner 1994), but in most cases the only compelling information thus far is strong correlation (e.g. Pacific fisher) (Campbell et al. 2000) with LS/OG, without a clear understanding of the causal relationship (Hejl 1994). In addition, brown-headed cowbirds, which parasitize a great many neotropical migrants, do not invade LS/OG more than about 7

km (Rothstein et al. 1984), thus protecting LS/OG-using (not necessarily dependent) species in the interior of large blocks.

Implications for the Monument:

Special status animals, such as spotted owl, northern goshawk, and Pacific fisher presently invoke constraints on fuels reduction in LS/OG habitats (i.e. Sierra Forest Plan Amendment) that would significantly alter their characteristics. In most cases, the specific elements of LS/OG upon which these species may (or may not) be dependent are not entirely understood. Clearly these animals existed prior to fire suppression, although it is possible that they were less abundant than at present. Many of these species are presently far less broadly distributed than records of past decades or centuries indicate. Consequently, their vulnerability combined with uncertainty about what practices might produce further harm argue for the most conservative forest management practices in mature forests, that is those that produce the least change from present conditions. On the other hand, failing to reduce fuels could well eventually result in a stand-destroying fire, completely eliminating LS/OG habitat for a century or more (Verner et al. 1992).

Sequoia and Kings Canyon National Parks have encountered minimal conflict between permitted recreational activities and their support infrastructure, and appear to sustain viable populations of LS/OG-correlated wildlife species, although this has not been verified except for California spotted owl.. Other activities not permitted in the parks, such as off-road driving and hunting, might produce unacceptable levels of disturbance, particularly when nesting or young are present.

Advice:

The Monument should closely follow current and future research on the relationships between LS/OG-correlated species, and stand-structure modification as well as grazing. Direct monitoring of sensitive LS/OG species, *not merely monitoring of habitat*, is called for until those relationships are better understood. The California Wildlife Habitat Relationships System (California Dept. of Fish and Game 2000), however imperfect, is presently the most powerful tool available for predicting which species will be advantaged and which species disadvantaged when habitats are changed in specific ways. Assuming that stand modification through burning or mechanical thinning is detrimental to some of these vertebrate species, science cannot say whether long-term forest health or short-term conservative protection of LS/OG-dependent vertebrates is the correct choice.

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XIII. Local Markets

Issue:

Would the absence of a local market for timber adversely affect the objective of reducing the risk of catastrophic fire in the Monument (by limiting options)?

Facts:

As outlined in the Science Advisory Board's Advisory IV, for numerous reasons mechanical thinning will be needed for forest restoration in some areas of the monument. Mechanical thinning is allowed, "if clearly needed for ecological restoration and maintenance or public safety" (Clinton 2000).

Forest restoration and fuel reduction by mechanical means, when necessary, is very expensive. Past experience suggests that it is unreasonable to expect that all necessary restoration will be subsidized solely by federally appropriated dollars (Stewart 2001, SNEP 1996, Moote 2001). Scientists of the Sierra Nevada Ecosystem Project have discussed the need to economically restore forest conditions that are less prone to catastrophic wildfire (SNEP 1996). Ample precedent exists for trying to recover costs, such as for hazard tree removal in national parks. The cost of the hazard tree removal in national parks often is expected to be at least partly offset by sale of the removed trees, so long as safety or ecological needs alone, not economics, have motivated any tree removal.

Yet partial or total recovery of costs is only realistic when a local market exists (Stewart 2001, Moote 2001). Dr. Stewart stated to the Giant Sequoia National Monument Science Advisory Board that "Lack of a local timber industry will severely constrain what can be done in the monument" (Stewart 2001). Only one mill is still operating in the southern Sierra Nevada today. Based on recent experience in areas where the established forest products industry is eliminated, resource management options are severely reduced and local communities have not developed the necessary infrastructure to compensate for the loss of the existing industry (Stewart 2001, Moote 2001, SNEP 1996, California Forestry Association 2000).

Given that trees will be removed only "if clearly needed for ecological restoration and maintenance or public safety" (Clinton 2000), most removed trees would be in the smaller diameter classes. It is thus unlikely that ecologically motivated forest restoration in the monument will be fully economically self-sustaining, and is likely that supplemental appropriated funds will be needed. Additionally, the quality and quantity of outputs may be insufficient to fully maintain a local market.

Implications for the Monument:

Loss of a local market for timber would reduce options for ecological restoration and fire hazard reduction in the monument.

Advice:

Seek ways of building trust that mechanical thinning, when necessary, is ecologically motivated and not economically motivated, and that economic feasibility is critical to forest restoration efforts.

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XIV. Reservation Roads

Issue:

Should special consideration be given to maintaining roads used by the Tule River Indian Tribe?

Facts:

1. The Tule River Indian Reservation was established in 1873 and contains approximately 55,000 acres of land.
2. The Tule River Indian Reservation is a federally recognized Indian Tribe and is a sovereign government.
3. The Giant Sequoia National Monument (GSNM) bounds more than 50% of the perimeter of the Tule River Indian Reservation.
4. Approximately 15,000 acres of conifer forest managed by the Tule River Indian Reservation form a continuum with the GSNM forest. Approximately 800 of those acres have giant sequoia; four GSNM giant sequoia groves extend into the Reservation.

5. Approximately 9,000 acres of the GSNM are situated within the upper reaches of the Tule River Indian Reservation's watershed.
6. Several U.S. Forest Service roads, including but not limited to 21S94, 21S90, and 21S95, provide critical ingress and egress for Tribal management purposes on the Reservation's eastern boundary with the GSNM (e.g., timber harvesting, forest management, fuels management, fire suppression, emergency evacuation, public works, grazing) and community uses (e.g., access to traditional plant and other material gathering areas, access to sacred sites). The roads provide recreation, cultural resources management, and commercial access for Tribal residents and operations. Baker and Stewart (1996:1358) note: "Since the reservation assumed direct control of its natural resources from the Bureau of Indian Affairs, the reservation's timber management program has sought to balance the economic values of timber with recreational and aesthetic values and the socio-cultural benefits the forests provide the reservation's inhabitants. Timber harvest levels and employment generation are sometimes reduced if planned timber harvests or other resource extraction activities would damage tribally defined ecological, cultural resources or other non-commodity resources."
7. Traditional territory of the tribal groups now residing on the Tule River Reservation included lands now within the GSNM (Gayton 1948a, b; Cook 1960, 1962; Kroeber 1970; Latta 1977; Spier 1978a,b; Wallace 1978). Those lands have archaeological sites and sacred sites important to Tribal members. There are also traditional plant and other raw material gathering areas within the Monument (Baker and Stewart 1996).
8. Approximately 40% of the timber harvested on Tribal lands is transported via National Forest roads located within the GSNM.
9. Long-term road improvements funded by Tribal projects have been made on GSNM roads.
10. Closure of roads accessing Tule River Reservation from the GSNM would result in a loss of jobs and management opportunities on the Reservation.

Implications for the Monument:

Since the Tule River Indian Reservation forest and Monument forest form a continuum, management of Reservation forest affects the risk of fires and pests in the Monument and vice versa. Successful management to sustain the Reservation forest depends on access by roads from the Monument.

Advice:

To ensure that the management plan considers the effects of proposed actions and policies the GSNM management planning team should consult with the Tule River Indian Tribe to identify which roads are important for Tribal use per Presidential Memorandum of April 29, 1994, "Government-to-Government Relations with Native American Tribal Governments", Presidential Executive Order (E.O.) 13175, "Consultation and Coordination with Indian Tribal Governments", E.O. 13007 "Indian

Sacred Sites", the American Indian Religious Freedom Act of 1978, the National Historic Preservation Act as amended, and other legislation and executive orders.

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XV. Building Consensus

Issue:

How to build consensus in situations of long-standing group conflict over natural resources management goals and practices.

Facts:

The newly created Giant Sequoia National Monument is part of a larger natural and social ecosystem that has a relatively long history of conflict over public lands management goals and practices. This conflict dates from at least the 1960s, when a U.S. Forest Service proposal to develop a high-density outdoor recreation site in the Mineral King Valley was challenged in the federal courts by the Sierra Club (Nienaber, 1972). Conflicts over timber production in the 1980s led to a mediated settlement agreement which resolved some issues but not all. Dissent surfaced again as a result of President Clinton's 2000 presidential proclamation creating the Giant Sequoia National Monument. Among its other manifestations is a lawsuit brought by Tulare County, et al. in 2000. A history of conflict in the region has produced a culture of mistrust among parties claiming a vital interest in national forest management.

Group conflict over natural resources management, especially pertaining to the 29% of the nation's land which is managed by the federal government, is not confined to the Giant Sequoia National Monument lands. Scholars have documented the intensification of conflict over the past twenty years in numerous areas in the West; they have correlated an increase in group conflict with significant human population increases, with increased affluence of residents, and with increased individual mobility in the Sunbelt states of the New West (Wilkinson, 1992; Duane, 1996; Davis, 2001).

Researchers also have documented increases in recreational/visitor use on the Sierra Nevada public lands over the past ten years and more (Daniels and Gimblett, 2001; Duane, 1996; USFS/SNF n.d.). Each year shows an increase in recreation visitor days (RVDs) over the previous year. At the same time new modes of recreational use - e.g., snowmobiles and off highway-vehicles - have developed, and these groups of recreationists demand consideration of their interests by federal land managers (Valenzuela, 2001), along with traditional users such as hikers, backpackers, equestrian users, bicyclists, and motor vehicle drivers. Federal land managers have seen an absolute increase in the numbers of constituency groups claiming an interest in, or use of, the public lands (Clarke and McCool, 1996). It is a social trend beginning about twenty years ago. In a number of regions this has led to a condition of political and social gridlock.

In response to these social and political changes, new techniques of consensus building have emerged, including alternative dispute resolution, environmental conflict resolution, and collaborative management. These new approaches have been successful in a number of locations, including the Carson National Forest in New Mexico and some Bureau of Land Management lands in Colorado (Baker, 2001; Udall Institute for Environmental Conflict Resolution, 2001).

Implications for the Monument:

The creation in 2000 of a new federal land management entity, the Giant Sequoia National Monument, provides U.S. Forest Service managers with a unique opportunity to go beyond traditional public participation techniques in both drafting and

implementing a management plan for the Monument. A long history of conflict in this region also indicates that a new approach beyond so-called public meetings might prove fruitful. The current NEPA/EIS process is a necessary one, but not a sufficient one, to win the community acceptance of the management plan for GSNM and so avoid future gridlock.

Collaborative management techniques have been employed successfully in several cases (Gray, et al., 2001; Frentz, et al., 1999; Cortner and Moote, 1999). Key features of this approach include:

1. Involve the public early in the process.
2. Use diverse and continuing methods of involvement - e.g., field trips to specific sites in the Monument with small groups.
3. Create ongoing forums for information sharing and for group learning.
4. Utilize fully the local expertise of Monument lands, their condition, and their history. Create "buy-ins" for interested parties.
5. Use All-Party Monitoring after the management plan has been adopted.
6. Foster cross-jurisdictional planning and implementation of significant projects and activities.

Advice:

U.S. Forest Service managers for the Giant Sequoia National Monument should consider using collaborative management methods, and/or similar techniques, to reach a consensus on the initial management plan for the Monument, and in implementing the plan.

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XVI. Equestrian

Issue:

Shall the Forest Service continue to allow equestrian recreational use?

Facts:

There is a long tradition of private packs and saddle stock, and commercial pack operations in the southern Sierra Nevada. Until relatively recently, horses were the principal form of transportation away from roads. Pack stock is still used heavily for transport in the management of Sierran public and private lands. Individuals who are not fit to hike are dependent upon horses to visit backcountry; for other it is simply a deeply held customary practice. However, stock can have several significant impacts: Among these are consumption of herbaceous vegetation, especially in meadows, leading to changes in biomass, productivity, and species composition; introduction of invasive alien plants in feed; trampling and shearing of moist and delicate soils such as wet meadows and stream banks; damage to trails; deposition of urine and feces, attracting flies, and creation of dust that impinges upon enjoyment by hikers.

Implications for the Monument:

In recent years that has been significant social conflict between stock users and those opposed to stock use in the high Sierra. Recent studies such as the Sierra Nevada Ecosystem Project have emphasized the fragility and importance of meadows and stream corridors; these studies are reflected in the Sierra Nevada Forest Plan Amendment. Research has been conducted in the Sierran national parks on using residual biomass as an indicator of acceptable grazing levels. Other published research discusses hoof print and shearing impacts on sensitive substrates.

Advice:

These social and ecological concerns should be acknowledged and dealt with in the planning process. Scientific questions have to do with the basis of social conflicts, and the relationship between stock use levels and ecological impacts. Scientific inspection does not produce an apparent conflict between traditional recreational stock use and the purposes of the Monument. Appropriate regulation, segregation, or local or temporary closures may adequately ameliorate most social and ecological concerns about pack and saddle stock while continuing this customary activity in the Monument.

XVII. Transportation Plan

Issue:

The transportation plan will largely determine the pattern and volume of public use on the Giant Sequoia National Monument. The issue is whether the Forest Service's June 8, 2001, Proposed Action considers a full range of transportation alternatives.

Facts:

The Presidential Proclamation of 2000 establishing the Giant Sequoia National Monument states that the management plan "shall contain a transportation plan for the monument...." The objectives of such a plan are: (1) To help protect the Giant Sequoia Groves and other significant objects of interest within the Monument; and (2) To provide for educational, scientific, and recreational use. The Proclamation also states that "no new roads or trails will be authorized within the monument except to further the purposes of the monument." The Proclamation is clear with respect to objectives and parameters for the Monument's transportation system.

The Forest Service's June 8, 2001, Proposed Action affirms the objectives stated in the Proclamation. It also describes the agency's Desired Conditions and Management Goals for the existing network of roads and trails within the Monument. It envisions extensive public use of the Monument by providing "well-maintained roads and trails for public access to all national forest system lands within the monument (emph. added)." There is no mention of a public, or mass, transportation alternative that would supplement the primary mode of transportation currently used to visit the Monument.

Forest Service researchers as well as outside researchers have documented a steady increase in recreation visitor days (RVDs) during the past decade on most national forests and national parks in California (SNF data; SNEP 1996; Daniels and Gimblett, 2001). Demographers also have projected a substantial increase in the state's population to the year 2040, with significant population growth in the regions adjacent to the national forests and parks of the Sierra Nevada. If these projections are correct, there will be even heavier use of the public lands than there is today. Long-range, integrated recreation and transportation planning is essential to manage this growth in human use of the resource.

Implications for the Monument:

Numerous outdoor recreation researchers (Daniels, 2001; Valenzuela, 2001) have documented the effects produced by a change in land-use designation - eg., from a national forest to a national monument, or from a national park to a national recreation area. One effect is to increase visibility and therefore to increase visitor use. As the Giant Sequoia National Monument gains greater public visibility, visitor use will very likely increase above the general increase in RVDs on other public lands.

In drafting the management plan for the Monument, planners will need to take into account substantial increases in overall demand for outdoor recreation opportunities, as well as for increasing use of the Monument for educational and scientific purposes. All of this increased human use of the Monument must be accommodated in a manner, which protects the Giant Sequoia groves and other objects of interest. Reconciling these two potentially conflicting goals - resource protection and visitor use/enjoyment - will require the agency to consider a wide range of transportation alternatives, including public or mass transit for the most heavily used areas of the Monument.

In this regard, GSNM planners can learn from the experiences of other land management planners, including those at Yosemite National Park, Mt. St. Helens National Monument, Glacier National Park, and Grand Canyon National Park. Valenzuela (2001) observed that National Monument designation produces a human use pattern that closely resembles National Park designation. Thus Forest Service planners will want to look at how planners at heavily used national parks and national recreation areas have accommodated increased visitor use in devising a transportation system for the Monument.

There also exists an important research opportunity that would measure and evaluate the effects of transportation corridors on Giant Sequoia groves. Understanding how the effects of air pollution, noise, road construction, and proximity of roads and trails do or do not impact the health of groves could be an integral part of the research agenda for GSNM.

Advice:

The range of alternatives in developing the transportation component of the management plan should include a public transportation alternative for the most heavily used areas of the Monument. The plan should take into account substantial increases in visitor use and exploit opportunities for collaboration with nearby communities and businesses plus the National Park. Basic research on the Giant Sequoias and transportation-related impacts should be conducted.

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XVIII. Science for the Monument

Issue:

How shall the Forest Service meet the Monument's local scientific information needs?

Facts:

Among public land management agencies, there has been a long-term trend toward greater and greater reliance on science to support decision-making. This trend is unlikely to diminish or change in the future.

Given the long time-scales of many ecological responses to disturbances and management actions, particularly in forests, continuous long-term research and monitoring are essential to support adaptive management.

A diverse and outstanding cadre of scientists already exists in the Forest Service's Pacific Southwest Forest and Range Experiment Station (PSW). Many of these scientists will be able to meet many of the Monument's needs. However, none of these scientists concentrates solely on the Monument's needs, and all can be diverted to other topics depending on regional research needs.

Experience shows that there is great value in maintaining continuous rather than episodic, on-site rather than absentee research and monitoring programs within

individual land-management units. An on-site scientific presence offers several advantages, including (1) frequent interaction with the land managers, which helps assure the relevance of research and monitoring, (2) enhanced technology transfer to land managers, (3) enhanced ability to maintain long-term studies, and (4) greater ability to advocate, facilitate, and leverage research and monitoring by scientists beyond the Forest Service devoted to the Monument's needs.

Implications for the Monument:

The Proclamation states "These giant sequoia groves and the surrounding forest provide an excellent opportunity to understand the consequences of different approaches to forest restoration." The National Academy of Science made its first recommendation for sustainability, "Develop a research framework that integrates global and local perspectives to shape a "place-based" understanding of the interactions between environment and society". The proclaimed purpose and Monument will benefit from a "place-based" research and monitoring presence.

Advice:

Strive for an on-site research and monitoring presence. Seek and learn from models of successful on-site research and monitoring programs, both within the Forest Service (such as Mt. St. Helens National Monument) and other land-management entities (such as the National Park Service and The Nature Conservancy). Determine whether the Giant Sequoia Ecology Cooperative has an appropriate role to play, and if so, enlist its support.

References:

National Academy of Sciences. 1999. Our Common Journey: A Transition Toward Sustainability. Washington, D.C.: National Academy Press. P. 10.

XIX. Visitor Data

Issue:

How should the Forest Service improve its visitor use database for the Giant Sequoia National Monument?

Facts:

The Presidential Proclamation that designated the Giant Sequoia National Monument (GSNM) clearly emphasizes the importance of the scientific values within the Monument. This is in accord with the fact that the Monument was established under the provisions of the Antiquities Act of 1906 (6 USC 431-433), Sec. 3 which states: “That the President of the United States is hereby authorized, in his discretion, to declare by public proclamation historic landmarks, historic and prehistoric structures, and other

objects of historic or scientific interest that are situated upon lands owned or controlled by the Government of the United States to be national monuments . . .".

The Proclamation notes the following in regard to visitor use: "The [management] plan will provide for and encourage continued public and recreational access and use consistent with the purpose of the monument." It continues in discussion of the management plan that it shall " . . . contain a transportation plan for the monument that provides for visitor enjoyment and understanding about the scientific and historic objects in the monument, consistent with their protection."

The Forest Service's June 8, 2001 Proposed Action notes under the heading Dispersed and Developed Recreation that: "Visitors to the GSNM will find a rich and varied range of recreational and social opportunities enhanced by giant sequoias and their ecosystems, historic and prehistoric artifacts, and unique geological features." The management goals under that heading state that the GSNM will "Provide visitors with a wide range of opportunities for recreation, interpretation, and education related to the objects of interest and the values of the monument. Improve visitor facilities, information, and services to meet projected demand for recreation and visitation . . ." The Proposed Action also has language for visitor use and enjoyment under the headings of Historic and Prehistoric Resources, Transportation System, Caves, and New Management Areas. The Forest Service's Notice of Intent for preparation of the EIS for the GSNM management plan reiterates the need to provide for visitor and recreational use.

In the SNEP report Vol. II, Chapter 19, "Recreation", Duane (1996) notes that the U.S. Forest Service is the largest land manager in the Sierra Nevada; Forest Service lands were reported to account for the majority of Recreational Visitor Days (RVDs—defined as a 12 hour period) on the public lands in the Sierra. Two-thirds to three-fifths of the RVDs occur on land administered by the Forest Service; 9% of the RVDs on Forest Service lands in the Sierra Nevada occur on lands of the Sequoia National Forest. Duane also commented that: "The RVD accounting methodology itself has several significant weaknesses." Those weaknesses included the following:

1. Variable and inconsistent accounting practices between . . . different ranger districts within a single national forest and over time due to changes in personnel and/or methods;
2. Poorly defined RVD accounting classifications resulting in inconsistent classification of some activities (especially new recreational activities as they first emerge); and
3. Highly subjective accounting procedures that exacerbate problems of both classification and accounting (Duane 1996:559-560).

Zinser (1995:274 ff.) discussed the obsolete RIM (Recreation Information Management) system and the current RRIS (Recreation Resource Information System) which is linked to GIS used by the Forest Service.

Implications for the Monument:

The Sequoia National Forest currently lacks adequate information on visitor use for scientific purposes, recreation, or other purposes that are consistent with the uses outlined in the Presidential Proclamation for the Giant Sequoia National Monument. Without good data on visitor use, e.g., recreation, travel through the monument, scenic enjoyment, educational, traditional Native American uses, etc., it will be difficult for the Forest Service to provide for public access and use consistent with the purposes outlined in the Presidential Proclamation and the Forest Service's June 8, 2001 Proposed Action.

Advice:

The Giant Sequoia National Monument Management Plan needs to include a plan to develop good quantitative and qualitative information on visitor use, activities undertaken, and enjoyment of proposed interpretive programs and facilities to comply with the Presidential Proclamation. A comprehensive database would assist in developing methods to accomplish adaptive management within the Giant Sequoia National Monument. The National Park Service at Sequoia and Kings Canyon National Park has developed some methods for assessing visitor use and appreciation which might assist the Forest Service in inventorying visitor use in the Giant Sequoia National Monument. The staff of the Giant Sequoia National Monument should collaborate with staff on those national parks in interpretive and other visitor programs.

Manning (1999:282 ff.) described inventory techniques that could be used to develop an outdoor recreation management framework as well as information on how to develop management objectives and monitoring which could assist the Forest Service in assessing visitor use on the Monument. The Scientific Advisory Board's (SAB) Advisory XVII on the Transportation Plan also reviews presentations to the SAB and the Giant Sequoia National Monument planning team that could assist in development of visitor use assessments that would comply with the Presidential Proclamation. The Forest Service should also consult with the Tule River Indian Reservation for information on their traditional uses of lands within the Monument. The Management Plan should include provisions to acquire better data on visitor use and methods for analysis and use of those data.

Reference:s

Duane, T.P. 1996 Recreation in the Sierra. In Sierra Nevada Ecosystem Project: Final Report to Congress, Vol. II, Assessments and Scientific Basis for Management Options, pp. 557-609. Wildlands Resources Center Report No. 37, Centers for Water and Wildlands Resources, University of California, Davis, California.

Manning, R.E. 1999 Studies in Outdoor Recreation: Search and Research for Satisfaction. 2nd edition. Corvallis: Oregon State University Press.

Zinser, C.I. 1995. Outdoor Recreation: United States National Parks, Forests, and Public Lands. New York: John Wiley & Sons, Inc.

XX. Definition of Treatments

Issue:

How shall a reader understand different treatments of vegetation and fuel named in documents?

Facts:

Creation of the Monument management plan will be aided by the use of clearly defined terms. Particularly, the various tools and approaches for restoring and maintaining vegetation and fuels need simple, descriptive terms.

Implications for the Monument:

It will be beneficial for the Monument to include a glossary with the Draft Environmental Impact Statement and other documents.

Advice:

Include a glossary with the Draft Environmental Impact Statement and other documents as needed. Consider the following definitions related to management of vegetation and fuels.

Prescribed fire is fire set by managers to meet specific objectives. Tools associated with prescribed fire include, but are not limited to, ground-based ignition devices such as drip torches, helicopter-based ignition devices, portable gas-powered water pumps, chain saws, hand tools, fire trucks, and other vehicles.

Hand treatment is manipulation of vegetation and fuels with tools that can generally be both carried and used by one person. These tools include, but are not limited to, chain saws, handsaws, axes, and loppers. Chippers will sometimes be an integral part of hand treatment.

Heavy equipment generally includes large, usually self-propelled machinery that can be used off roads and that usually requires highly trained operators. Heavy equipment includes, but is not limited to, bulldozers, feller-bunchers, cables, loaders, graders, backhoes, and chippers.

Mechanical treatments include both hand treatments and those conducted with heavy equipment.

XXI. Plain Language

Issue:

How shall Alternatives be presented to inform the public and the official who must choose the management plan?

Facts:

The NEPA process intends first to inform the public of intended actions so they may make pertinent comments and thus minimize avoidable harm to the human environment (Council on Environmental Quality (CEQ) 1997). This hoped for outcome will only come if the alternatives are written in the plain language required by regulation 1502.8 (CEQ 1979).

Implications for the Monument:

The public's trust, which is so essential to acceptance of the management plan, will increase if the alternatives are plainly described and the logic of the decision-maker is transparent (regulation 1502.14, CEQ 1979). The test of reasonable range (Bass, Herson and Bogdan 2001) can only be passed if the alternatives plainly differ.

Advice:

In the beginning, succinctly and lucidly state the theme of each Alternative. Forthrightly state the actions, standards and guidelines to execute each Alternative.

Clearly state the actions in the Framework, Mediated Settlement, etc. that are the bases and benchmarks of Alternatives "No Action" and "Proposed Action." Describe them so clearly that the reader can grasp them from the Draft Environmental Impact Statement alone. In this way the Alternative will survive any shift in benchmarks.

References:

Bass, R. E., A. I. Herson and K. M. Bogdan 2001. The NEPA book. Solano Press Books, Point Arena CA. p. 94. The range of alternatives in an EIS should be governed by the "rule of reason". Courts have found ranges both reasonable and unreasonable.

Council on Environmental Quality. 1979. For effective date of NEPA regulations, see question 12a of the Forty Most Asked Questions Concerning CEQ NEPA regulations 47 Fed. Reg. 18026 (March 23, 1981), as amended, 51 Fed. Reg. 15618 (April 25, 1986). Regulation 1502.8 states, "Environmental Impact Statements shall be written in plain language … so that decision makers and the public can readily understand them." Regulation 1502.14 states that the Environmental Impact Statement "should present the environmental impacts of the proposal and the alternatives in comparative form, thus

sharply defining the issues and providing a clear basis for choice among options by the decision maker and the public."

Council on Environmental Quality. 1997. Annual Report on Environmental Quality. In the Report, President Clinton stated, "[Thanks to NEPA] the American public today have the benefit of a wealth of information on the state of the environment and on the potential environmental impacts of major federal actions proposed by the Federal Government. The NEPA is at its core, a mandate for informed, democratic decision making and its contribution to environmental protection is incalculable."

XXII. Heeding Advisories

ISSUE

Does the Draft Environmental Impact Statement heed the Advisories of 2001 and 2002?

FACTS

As the Forest Service developed the Impact Statement during 2001 and 2002 the Science Advisory Board adopted consensus advice at each stage. The Board conveyed the advice formally to the Designated Federal Official of the Service as Advisories, and the Service published the Advisories on the web. After the Service published the Draft Environmental Impact Statement (DEIS) in the winter of 2003, the Science Advisory Board reviewed the DEIS for responses to the consensus advice. The Service did heed advisories as their citation of Advisories in the DEIS showed. On the other hand, the Board finds that more attention to three Advisories would help the Service revise the DEIS into an acceptable Final Environmental Impact Statement.

IMPLICATIONS FOR THE MONUMENT

The Board was specified in the Presidential Proclamation of the Monument. Its duties, chartered by the Secretary of Agriculture, are to provide scientific advice to the Service during the development of the initial management plan, a process that the Service has melded with an impact statement. Heeding the Advisories should improve the management of the Monument. It should improve the substance and public acceptability of the Final Statement and consequent management plan.

ADVICE

The Service would profit from reviewing anew Advisories III Desired Conditions, IV Restoration of the Natural Fire Regime, and V Prioritizing Areas of Land.

XXIII. Defense Zone

ISSUE

Does the Draft Environmental Impact Statement's (DEIS) comparison of alternative fire defense zones around communities adequately consider available evidence?

FACTS

Alternative 3 limits mechanical forest thinning (including hand thinning) to relatively narrow but variable zones around communities and infrastructure. Alternative 3 would "avoid using mechanical treatments except for community protection. A defense zone of approximately 200 feet wide would be used to protect communities and occupied areas" (p. II-23). However, the area treated mechanically could sometimes "range up to 1/4-mile, based on local fire behavior and terrain" (p. II-24).

There is ambiguity in the DEIS that could be taken to mean that an adequate defense zone can only be created in conjunction with relatively extensive mechanical forest thinning, and therefore the limitations on mechanical thinning imposed by Alternative 3 will leave communities at greater fire risk than the other alternatives. For example, the following statements are found in the DEIS. "Overall, Alternatives 3 and 4 would provide less protection to communities than the other alternatives. Defensible space would be created around communities, but wildfire extent and magnitude would not be reduced before reaching the defense zone" (p. IV-17). "Alternatives 3 and 4 have a restoration strategy, however defense zones are very limited compared to other alternatives" (p. IV-14). "[M]echanical treatments, in conjunction with prescribed fire, would reduce the risk of undesirable effects from prescribed fires, such as ... reduced protection to communities ..." (p. IV-15). "Alternatives 1, 2, 5, and 6 would ... [provide] ... the greatest long-term benefits in terms of prevention of and protection from wildfire" (p. IV-91).

However, available evidence indicates that prescribed fire alone in some situations is physically capable of creating conditions that meet the standards of the Sierra Nevada Framework for the urban wildland intermix defense and threat zones. The Framework's desired stand conditions for defense zone include, over 90% of stand area, a minimum height to live crown base of 15, 20, or 25 feet, depending on canopy cover (USDA Forest Service 2001). Kilgore and Sando (1975) reported that average height to live crown base in a sequoia grove changed from 3 feet before a prescribed fire to 16 feet following the fire (see Figure 1 of this Advisory); a more intense prescribed fire would have raised the height farther. Crown bulk density was reduced to roughly 0.06 kg/m^3 by the prescribed fire, at the low end of the 0.05 to 0.15 kg/m^3 range specified by the Framework. Surface fuels were reduced 85%, from 74.7 to 11.1 tons/acre. As a result of these fuel reductions, modeled fire behavior under relatively extreme conditions was dramatically reduced: modeled rate of fire spread dropped from 7.5 to 0.1 ft/min, and reaction intensity from 6,367 to 55 BTU/ft^2/min.

Experience corroborates Kilgore and Sando's findings. For example, fuel reductions resulting from prescribed fires have in one case prevented a wildfire from entering a sequoia grove, and in another case helped cause a wildfire in a grove to drop in intensity, allowing fire crews to contain the fire (Stephenson 1996). For several years, fires will not spread at all in areas that have been prescribed burned (personal observations), meaning that these areas meet the Framework's desired condition of potential flame lengths of less than 4 feet in the urban intermix defense zone.

Importantly, unless surface fuels are also treated, mechanical thinning alone is not as effective at reducing fire intensity and spread as a prescribed fire alone (van Wagtendonk 1996). Thus, to be at least as effective as prescribed fire alone, mechanical treatments (including hand treatments) designed to create a community defense zone will usually need to be followed with prescribed fires.

IMPLICATIONS FOR THE MONUMENT

Contrary to one possible interpretation of the DEIS, limiting mechanical fuels treatments to relatively narrow zones around communities does not in itself automatically result in sub-standard defense and threat zones, and therefore greater risks to communities. This is because mechanical treatments aren't the only available means to reduce fuels. Zones of mechanical fuels reduction, sometimes relatively narrow (depending on local conditions), can be used as anchor points for prescribed fires, and prescribed fires are capable of creating forest conditions that meet the Framework's standards for defense and threat zones. In fact, unless mechanical treatments are followed by thorough treatment of surface fuels (such as through a prescribed fire), prescribed fire may result in fuels conditions that better protect communities.

ADVICE

Revise sections in the DEIS that can be taken to imply that limitation of mechanical fuels treatments to relatively narrow zones around communities automatically results in sub-standard community protection. Treat prescribed fire as a viable option that, like mechanical thinning, has its own set of trade-offs, but that in some cases is physically capable of meeting the Sierra Nevada Framework's standards for defense and threat zones around communities. Reassess the Alternatives in this light.

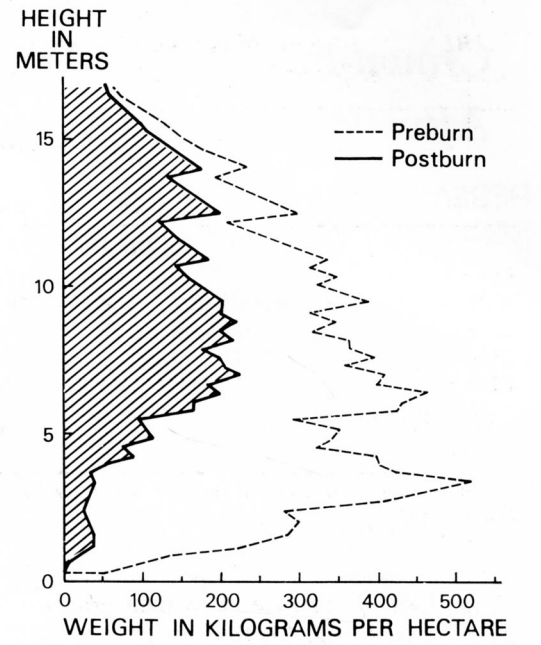

FIGURE 1. *Vertical distribution of oven-dry crown weight before and after burning in a giant sequoia-mixed conifer forest.*

(From Kilgore and Sando 1975)

References:

Kilgore, B. M., and R. W. Sando. 1975. Crown-fire potential in a sequoia forest after prescribed burning. Forest Science 21:83-87.

Stephenson, N. L. 1996. Ecology and management of giant sequoia groves. Pages 1431-1467 in Sierra Nevada Ecosystem Project: final report to Congress, vol. II, Assessments and scientific basis for management options. Wildlands Resources Center Report No. 37, Centers for Water and Wildlands Resources, University of California, Davis, California.

USDA Forest Service. 2001. Sierra Nevada Forest Plan Amendment, Final Environmental Impact Statement: Record of Decision. USDA Forest Service Pacific Southwest Region.

van Wagtendonk, J. W. 1996. Use of a deterministic fire growth model to test fuel treatments. Pages 1155 -1165 in Sierra Nevada Ecosystem Project: final report to Congress, vol. II, Assessments and scientific basis for management options. Wildlands Resources Center Report No. 37, Centers for Water and Wildlands Resources, University of California, Davis, California.

XXIV. Tradeoffs

ISSUE:

In presenting, comparing, and contrasting the alternatives, does the Draft Environmental Impact Statement (DEIS) adequately consider and weigh the ecological tradeoffs between the two primary management tools for forest restoration and fire protection: prescribed fire and mechanical thinning (including hand treatments)?

FACTS:

The proclamation that created the Monument states that tree cutting is allowed "... only if clearly needed for ecological restoration and maintenance or public safety" (Clinton 2000). Informed decisions that meet the spirit and letter of this direction require the support of a thorough enumeration and weighing of the ecological tradeoffs associated with the two major tools for forest restoration and fire protection: prescribed fire and mechanical thinning (including hand treatments). Unfortunately, scientists have not yet thoroughly or systematically explored many of these ecological tradeoffs. Regardless, the best available information must be used.

The DEIS misjudges the relative importances of some of the ecological tradeoffs regarding prescribed fire and mechanical thinning. For example, in weighing the alternatives, great importance apparently is placed on the ability of mechanical thinning to better meet desired conditions for gap size than prescribed fire. Statements such as the following are relatively common. "Alternative 4 is one of two alternatives (in addition to Alternative 3) that would be the least likely to create gap and patch sizes through initial treatments that are within the recommended management variability ranges. This is because ... treatments would be done primarily by prescribed fire" (p. IV-32). "[In Alternative 5,] Mechanical treatment on 60% of the acreage in the giant sequoia groves would help ensure that the size and frequency of gaps are created which are consistent with the desired condition" (p. IV-33). "In Alternative 6, the gaps created would be more likely to be within the recommended management variability than in any other alternative" (p. IV-36). Similar statements can be found on pages II-45, IV-18, IV-30, IV-32, IV-33, IV-34, IV-36, and others, as well as in Table II-1 (p. II-70), which provides a summary comparison of the alternatives.

While the DEIS statements cited above are correct in recognizing that mechanical thinning is more precise than prescribed fire in ensuring that no gap ever exceeds two acres in size, this particular difference between mechanical thinning and prescribed fire is probably ecologically inconsequential. Before 1875, gaps in sequoia forests most often were relatively small; the modal gap size may have been roughly 0.1 ha, to the nearest order of magnitude (Stephenson 1996, Piirto and Rogers 1999). However, occasional gaps could reach 10 ha or more (Stephenson 1996, Piirto and Rogers 1999). Given this wide range of pre-1875 gap sizes, choosing a precise upper limit on gap sizes is somewhat arbitrary. However, especially in light of the significant number of very large gaps created by timber harvesting in the 1980s, it is reasonable to try to keep newly-created gaps smaller than two acres. If, however, prescribed fires

occasionally create gaps larger than two acres (such gaps are "infrequent" according to the DEIS, p. IV-32, and personal observations in Sequoia National Park), these gaps will still fall within the pre-1875 range of variation, and will almost certainly have no ecological effects outside of the pre-1875 range of variation.

In contrast, judging from the narratives in Chapter IV ("Environmental Consequences"), when weighing the alternatives the DEIS seems to place little or no importance on several differences between mechanical thinning and prescribed fire that are much more likely to have ecological significance than ensuring that no gap ever exceeds two acres. For example:

Invasive species: Is either prescribed fire or mechanical thinning more likely to lead to the establishment and spread of non-native invasive species? If so, is the difference likely to be ecologically significant?

Native species: Given the generally poor natural establishment of sequoia following mechanical gap creation (Stephens et al. 1999), will sequoia seedlings be planted, and if so, will only local genotypes be planted? Are there differences between mechanical thinning and prescribed fire in the subsequent establishment or survival of other native plant or animal species?

Soils: What are the differences in compaction, erosion, nutrient availability, and other soil properties between mechanical thinning and prescribed fire, and what are their likely effects on the ecosystem? Are any of those effects likely to exceed the pre-1875 range of variation?

Pathogens: Cut stumps, unless chemically treated, can provide establishment points for *Heterobasidion*, *Armillaria*, and other pathogens that may then spread for decades (e.g., Slaughter and Rizzo 1999, Hansen and Goheen 2000), as can scarring of living trees by heavy equipment or prescribed fire. For either mechanical thinning or prescribed fire, will pathogen establishment and effects likely fall outside of the pre-1875 range of variation? Is prescribed fire more likely to sterilize the soil of pathogens than mechanical thinning?

In weighing the alternatives, the DEIS seems not to have given these issues nearly the importance it gave desired conditions for gap size, even though most of the issues probably have much greater ecological importance than precisely meeting desired conditions for gap size. If the issues listed above were indeed deemed to be of greater ecological significance than gap size, this is not evident from the DEIS.

An additional factor that should be considered is uncertainty. We do not yet know the answers to several of the questions posed above. In the absence of these answers, should extra weight be given toward favoring either prescribed fire or mechanical thinning?

IMPLICATIONS FOR THE MONUMENT:

Perhaps the central issue in creating a management plan for the Monument is finding a proper balance, consistent with the proclamation that created the Monument, between

to two primary management tools for forest restoration and fire protection: prescribed fire and mechanical thinning (including hand treatments). The relative importances that the DEIS apparently gives to the various ecological tradeoffs between prescribed fire and mechanical thinning need to be changed, and these changes need to be incorporated into the evaluation of alternatives.

ADVICE:

In a single, stand-alone section of the EIS, thoroughly compare and contrast the ecological tradeoffs between prescribed fire and mechanical thinning (including hand treatments).

With reference to this stand-alone section, make evident which ecological tradeoffs between prescribed fire and mechanical thinning were considered important in weighing the alternatives. Deemphasize those that are of little or no ecological consequence, such as the fact that prescribed fire may occasionally create a gap larger than two acres, and emphasize those that might have important ecological consequences, such as invasive species, native species, soils, and pathogens, while considering uncertainty (see above). Reevaluate the Alternatives in this light.

References:

Clinton, W. J. 2000. Establishment of the Giant Sequoia National Monument: a proclamation by the President of the United States of America. April 15, 2000.

Hansen, E. M., and E. M. Goheen. 2000. Phellinus weirii and other native root pathogens as determinants of forest structure and process in western North America. Annual Review of Phytopathology 38:515-539.

Piirto, D. D., and R. R. Rogers. 1999. An ecological foundation for management of National Forest giant sequoia ecosystems. USDA Forest Service, Pacific Southwest Region, publication R5-EM-TP-005.

Slaughter, G. W., and D. M. Rizzo. 1999. Past forest management promoted root disease in Yosemite Valley. California Agriculture 53(3):17-24.

Stephens, S. L., D. J. Dulitz, and R. E. Martin. 1999. Giant sequoia regeneration in group selection openings in the southern Sierra Nevada. Forest Ecology and Management 120:89-95.

Stephenson, N. L. 1996. Ecology and management of giant sequoia groves. Pages 1431-1467 in Sierra Nevada Ecosystem Project: final report to Congress, vol. II, Assessments and scientific basis for management options. Wildlands Resources Center Report No. 37, Centers for Water and Wildlands Resources, University of California, Davis, California.

XXV. Watersheds

ISSUE

Does the DEIS adequately consider the cumulative effects to watersheds from each alternative?

FACTS

The DEIS states on page IV-45 “Intensity, timing, and extent of vegetation management; location, density, and connectivity of campgrounds, facilities, other recreation sites and roads; and grazing are all management activities that have the potential to affect riparian health, and soil and water quality.” This statement is in accordance with Advisory X, *Watersheds*, of the Science Advisory Board (SAB).

To analyze these effects, the DEIS describes the general watershed effects of different types of fuel treatments, wildfire, and roads (DEIS IV-45-IV-47). The presentation of the effects of different fuel treatments (DEIS Table IV-9) is by percentage of watershed area rather than absolute acres. Because the Monument occupies a small percentage of most watersheds, the alternatives appear to have the same percentage of affected watershed, despite an almost two times range in actual treated acreage. In contrast, the miles of roads by alternative (DEIS Table IV-11) are presented by absolute amount rather than percentage area by watershed, and therefore give a clearer presentation of the differences by alternative.

In the analysis, the DEIS applies the general watershed effects to fuel treatments, wildfire, and roads. This approach is appropriate, since the more detailed Cumulative Watershed Effects (CWE) methodology is strictly applicable at a smaller watershed scale that presented in the DEIS, and requires a more precise knowledge of where the disturbance will occur.

The DEIS does not address the effects of recreation on watersheds, and does not overlay the likely areas of management activity and Giant Sequoia Groves with known areas of concern, such as watersheds that are impaired or at risk of impairment, Critical Aquatic Refuges (CAR), and Riparian Conservation Areas (RCA).

IMPLICATIONS FOR THE MONUMENT

The results of watershed analysis provide a method to integrate the effects of the alternatives on water quality, aquatic habitat, and riparian habitat. As such, watershed analysis provides a quantitative indicator of the relative environmental consequence of each alternative.

ADVICE

The watershed analysis in the DEIS is effective, but would be improved by expanding the analysis to include recreation, and to overlay areas of likely management activity with watershed areas of concern. The CWE analytical protocol is better suited to analysis of subsequent specific projects and need not be conducted for the DEIS. For the purposes of the DEIS, however, the general effects noted for each activity can be combined with the total area of disturbance, the probable location, and the susceptibility of the watershed to impairment (using, for example, the degree to which the watershed approaches the threshold of concern). Specific advice follows.

Present the comparison of the effects of different fuels treatments by absolute acreage in addition to percentage of each watershed. Modify this analysis to focus on the first decade, similar to the other resource evaluations.

The effects of roads, recreation, and grazing can be effectively evaluated by overlaying the road map, map of likely increased recreation (Figures II-3, II-4, and a grove map) and existing grazing allotments on a map showing streams near the TOC, watersheds with known impairments, and locations of CARs and RCAs. Use 8.5 inch by 11-inch maps for illustrative purposes where feasible. Describe the relative effect of each alternative based on whether areas of increased use are adjacent to these areas of concern.

Describe the guidelines for establishing appropriate stream and watershed restoration actions that would be required for each management activity. These guidelines are derived from the Framework and are cited in the DEIS. In this way, watershed effects can be considered in evaluating the need for and risk of different activities (SAB Advisory IV, *Restoration of the Natural Fire Regime*), and in prioritizing areas for management action (SAB Advisory V, *Prioritizing Areas of Land*). Compare the alternatives based on the expected watershed effects and on the amount of restoration required under each alternative. For each alternative, use the results of this comparison as an indicator of the feasibility and of relative environmental merit. Reference the monitoring plan as a tool of adaptive management.

XXVI. Reasoning

ISSUE

How clearly is the analysis of alternatives presented? What are the relative cumulative impacts of the alternatives?

FACTS

The National Environmental Policy Act (NEPA) states: “Alternatives including the proposed action. This section is the heart of the EIS. Based on the information and analysis presented in the sections on the Affected Environment and the Environmental Consequences, it should present the environmental impacts of the proposal and the

alternatives in comparative form, thus sharply defining the issues and providing a clear basis for choice…" (40CFR Ch. V, 1502.14).

In this context, DEIS Tables II-1 (Comparison by Issues and Indicators), II-2 (Comparison by Treatment Methods for the First Decade) and II-3 (Comparison by Strategy) are the heart of the document, and depend on the analysis of environmental consequences (DEIS Chapter 4). As a summary tool, the tables are a useful integration of the analytical results, but do not consistently compare consequences. The analytical basis for the summary also requires some modification, as follows.

The **Air Quality** analysis adequately considers the relative effect of fuel treatments, but does not include PM_{10} generation from roads. The Transportation Plans (DEIS Appendix I) can be used to compare the relative air quality effects of each alternative.

Fire, Giant Sequoia, and Social Values regarding vegetative treatment predict areas to be treated based on the SPECTRUM modeling presented in DEIS Appendix H. Neither the logical basis for the model selection of treatments nor the uncertainty of the model is described. The scientific basis for the treatments proposed under each alternative are not clearly presented, as follows:

- The DEIS should acknowledge that the basis for gap and patch frequency is controversial.
- The analysis underestimates the benefits of narrow bands of mechanical treatment around communities, when implemented in conjunction with prescribed fire.
- The relative ecological costs and benefits of prescribed fire and mechanical thinning are not presented in a complete and balanced way.
- The Proclamation prohibition on removal or trees unless "clearly needed for ecological restoration and maintenance or public safety" is not clearly followed in the DEIS. No decision tree (SAB Advisory IV, Restoration of the Natural Fire Regime), or equivalent statement of the criteria for ecological need or public safety, is presented.
- The basis for the size limits proposed in the DEIS is not clearly stated.

The **Recreation** analysis states goals, but does not clearly follow through from the map showing predicted areas of increased use (DEIS Figures II-3 and II-4, pages II-13 and II-14) to the type of use or the desirability of increased use. A clearer statement of what sorts of recreational activity may occur in different areas, using the maps as a basis, would enhance the consideration of air quality, transportation and cumulative watershed affects.

Watersheds are treated in SAB Advisory XXV, *Watersheds II*. The analysis is good as far as it goes, but could be enhanced to include the effects of recreation, and an indication of the amount of restoration that may be required for each alternative.

Wildlife consequences are likely to be beneficial to species of special concern over the long term, by applying Framework guidelines. The review is unclear, however, whether

there may be a bottleneck in the shorter term as a result of the proposed actions. The worst-case effect should be described for each alternative.

ADVICE

The DEIS does not clearly set out the basis for the choice of Alternative 6; DEIS page II-81 states simply "The preferred alternative is Alternative 6." The statement should be enhanced by answering the following questions. What is the rationale for selection of Alternative 6? What are the tradeoffs of benefits and costs that lead to the selection of Alternative 6?

The analysis of environmental consequences requires some modification before a preferred alternative can be selected. Given the concern surrounding the decision, it is important to clearly state areas of scientific agreement and disagreement. If there is disagreement among experts, or a lack of a scientific basis for portions of the review, then these must be clearly stated. NEPA allows for a decision under such circumstances, but the basis must be clear. The consequences of each alternative must be clearly stated in the summary tables of DEIS Chapter 2. Make the monitoring plan (DEIS Appendix E) an Adaptive Management Plan, with a focus on the effects of Program implementation.

As a program EIS, subsequent site-specific projects will tier from this document: "[t]he subsequent reviews need only summarize issues discussed in the broader statement, … and concentrate on the issues specific to the subsequent action" (40CFR Ch. V, 1502.20). Describe the process for evaluating subsequent, site-specific actions. Will any components of subsequent reviews be reduced as a result of the findings of this DEIS?

XXVII. Vision, Visualization, and Understanding

ISSUE

Does the Forest Service's draft environmental impact statement, and its preferred Alternative VI, contain sufficient information in order to visualize the short-term, e.g., ten years, and the long-term, e.g., one hundred years, effects or consequences of the proposed action? Can it be considered a management plan for the Monument?

FACTS

A fundamental problem with the DEIS and preferred Alternative VI as written is that they contain no clearly articulated *vision* of what is the future desired condition of the Monument. Visualization means the ability to communicate to others a vision, or plan, of where the agency is heading and how it shall get there. The theme of Alternative VI is: "Manage entire Monument with the widest range of management strategies" (DEIS, p. II-57). While this approach serves to maximize agency discretion and flexibility, it has not given those outside of the agency sufficient information on which to judge the adequacy or soundness of the plan. Forest Service regulations (36 CFR Parts 217 and

219, November 9, 2000, pp. 67517-18) are in place to balance the need for some degree of management flexibility with the need for collaborative planning, one element of which is building trust.[1] Yet Alternative VI ignores the necessity of striking a balance between these two Forest Service planning elements. Alternative VI verges on saying, "Trust Us", when the historical and current social context is characterized by a profound absence of trust. The management plan yet to be drafted must contain greater overall specificity, and more complete documentation, so that one can reasonably visualize Monument conditions and features after a decade and after one hundred years of management.

IMPLICATIONS FOR THE MONUMENT

The absence of a clear plan serves to further erode trust in the agency's ability to manage the Giant Sequoia National Monument. Proper management of the Monument based on the best available science will be postponed by appeals and litigation should the agency not produce a clearly articulated plan that is more thoroughly documented and/or referenced. Controversial elements of the DEIS must be addressed by explaining more fully why those decisions were made.

ADVICE

1. The Giant Sequoia National Monument planners should present a clearly articulated *vision* of the desired future conditions of the Monument in a management plan that is cohesive, succinct (i.e., 30-40 pages in length, with appendices), and written in a manner that is easily understandable by the public. Use language from the Presidential Proclamation and the Sierra Nevada Framework to describe the plan. Tie the vision to discrete units of land affected or changed by the plan. Use overlay maps and other visualization tools to illustrate the effects of the plan after ten years and into the foreseeable future.
2. Translate the current mix of plans, standards, and guidelines contained in the DEIS into a unified and clearly understandable *implementation plan* that applies to the preferred alternative for the Monument. Explicitly state, and explain, how mechanical removal of trees for "ecological need" will be decided as the plan is implemented.
3. Use adaptive management and all party monitoring to the extent possible. Once the initial management plan is clearly described, including areas of uncertainty, state how monitoring will be used to learn from the different types of vegetative treatments and from other significant management actions. Describe the role of

[1] "The final rule...is designed to facilitate greater public collaboration in all phases of the planning process. The rule expands on the existing requirements for collaboration to expand management choices, create new understanding, build trust, obtain new resources for implementation and monitoring, manage conflict more productively, and more fully informed decisionmaking to ensure the long-term sustainability of national forests and grasslands."

scientists, both within the agency and outside of the agency, in managing the Monument.

XXVIII. Decision Tree

ISSUE

Does the Draft Environmental Impact Statement (DEIS) clearly state its assumptions, weigh the available facts, and transparently state the tradeoffs among the alternatives that led to selection of the preferred alternative?

FACTS

The proclamation that created the Monument states that tree cutting is allowed "… only if clearly needed for ecological restoration and maintenance or public safety" (Clinton 2000). As evidenced by recent articles and editorials in major newspapers, a heated public debate now centers on whether the amount of cutting proposed in the preferred alternative, Alternative 6, is indeed "clearly needed for ecological restoration and maintenance or public safety."

The Scientific Advisory Board, recognizing the central importance of finding a logical and defensible balance between the use of prescribed fire and mechanical thinning (including hand thinning), issued Advisory IV on August 1, 2001. Advisory IV advised the Forest Service to "[d]evelop a decision tree to help determine which methods of forest restoration and maintenance should apply at different locations" (DEIS Appendix F, pp. F-12 – F-14). The Forest Service did not supply such a decision tree in the DEIS, believing instead that the recommended decision tree "would be most applicable at the implementation phase" (Appendix F, p. F-3).

The Monument proclamation's statement that tree cutting is allowed "… only if clearly needed for ecological restoration and maintenance or public safety" implies that prescribed fire is to be the default forest management tool, therefore meaning that use of mechanical treatments is limited to instances when prescribed fire alone cannot meet goals for "ecological restoration and maintenance or public safety." The preferred alternative in the DEIS includes precise estimates of acres treated by both prescribed fires and mechanical means (as do all alternatives), implying that the framers of the DEIS have weighed decisions as to when and where prescribed fire alone can and cannot meet these goals. However, this weighing of decisions and alternatives is not clearly articulated in the DEIS.

For example, the DEIS implies that a major factor leading to the selection of Alternative 6 is that "Fire susceptibility would be reduced on more acres … in the first decade than in any other alternative" (p. IV-19). Table IV-6 (p. IV-14) shows, for example, that Alternative 6 would treat 7,755 more acres of land that is currently in moderate to high fire susceptibility than Alternative 5, and 24,510 more acres than Alternatives 3 or 4. What is not made clear is what exactly is likely to be gained through these extra acres, and how those gains would be weighed against various tradeoffs. For example, of the

extra 7,755 to 24,510 acres treated by Alternative 6, how many of those acres are in the urban defense zone? Based on past wildfire histories, what is the likely associated decrease in probability of harm to human life or property? Of the extra 7,755 to 24,510 acres treated by Alternative 6, how many acres are in the sequoia and mixed conifer forests outside of the urban defense zone? (Table II-1, p. II-70, suggests that in Alternative 6, about 20,700 acres treated in the first decade will be in these forests.) Based on past wildfire histories, how many of these acres, if untreated at the end of one decade, are likely to be affected by wildfire? Again based on past wildfire histories, of those acres that might be affected by wildfire, how many are likely to experience high severity wildfire with effects outside of the pre-1875 range of variation (i.e., extensive stand-replacing fire)? Answers to these questions will quantify what is gained in Alternative 6 in terms of protection to human life and property, and in reduced acres potentially subjected to fire effects that are outside of the pre-1875 range of variation.

For forests outside of the urban defense zone, what tradeoffs were made in Alternative 6 to achieve the gains described above? That is, more acres were treated by mechanical means to achieve the gains – what are the other possible ecologically significant positive and negative effects (and over how many acres) that come with treating the extra acres by mechanical means? Some of these were considered in the DEIS, such as effects on water and wildlife. Others were poorly considered or not considered at all, such as invasive species, soils, pathogens, and uncertainty, as described in Advisory XXIV (Tradeoffs).

Also, additional facts need to be presented to allow the interested public and others to understand potential ecological tradeoffs. For example, large volumes of wood are projected to be removed in Alternative 6. What proportions of this wood will come from plantations, urban defense zones, sequoia groves, and general mixed-conifer forest? For each of these land areas, how many trees per acre, by size class, are projected to be cut?

IMPLICATIONS FOR THE MONUMENT

Only after gains, losses, tradeoffs, and supporting facts are clearly articulated will the interested public and others be able to see and understand the decision-making process that led to the conclusion that the extra acres of mechanical treatments in Alternative 6 are "… clearly needed for ecological restoration and maintenance or public safety." The weighing of gains, losses, and tradeoffs – all within the constraints imposed by the Monument proclamation – will be made clearer by establishing a transparent, conceptual decision-making framework, as briefly outlined in SAB Advisory IV.

ADVICE

The Scientific Advisory Board urges the Forest Service to develop a transparent decision-making framework now, in the planning phase, and to include it in the final EIS. This framework should be presented in a summary form that can easily be grasped by readers, along with more detailed supporting material. Decision flow charts

often are a particularly effective and transparent way to summarize decision frameworks (e.g., Figure 2 in Keeley and Stephenson 2002). (Figure 2 in Keeley and Stephenson should be viewed as an example only, not necessarily as a conceptual framework to be followed.) A possible additional source of supporting material and principles can be found in Allen et al. (2003).

The conceptual decision framework should emphasize the central issue in current public debates surrounding the Monument: how are decisions to be made that mechanical thinning (including hand treatments) is "clearly needed?" For example, the first level in such a decision framework might be relatively straightforward. Prescribed fire will often be too dangerous to use in areas adjacent to buildings and private property; a decision to use mechanical thinning therefore could easily be made and supported using fire model outputs based on site-specific data. Conversely, other areas will be easy to identify in which prescribed fire is the only reasonable option, such as areas that are distant from roads, in legally-designated Wilderness, or on slopes too steep for mechanical thinning.

Subsequent levels in a decision framework are likely to be more complex. In the broad zone in which prescribed fire and mechanical thinning are both physically viable options, how is a decision made that mechanical thinning is clearly needed? Such a decision is likely to weigh many of the considerations brought up under "**FACTS**" (above) and various Advisories issued by the Scientific Advisory Board (particularly Advisory IV).

To further allow the interested public and others to understand potential ecological tradeoffs, present additional information regarding mechanical thinning (including hand treatments). What proportions and absolute areas of ecologically necessary cutting will be in plantations, urban defense zones, sequoia groves, and general mixed-conifer forest? For each of these land areas, how many trees per acre, by size class, are projected to be cut?

References:

Allen, C. D., M. Savage, D. A. Falk, K. F. Suckling, T. W. Swetnam, T. Schulke, P. B. Stacey, P. Morgan, M. Hoffman, and J. T. Klingel. 2002. Ecological restoration of southwestern ponderosa pine ecosystems: a broad perspective. Ecological Applications 12:1418-1433.

Keeley, J. E., and N. L. Stephenson. 2000. Restoring natural fire regimes to the Sierra Nevada in an era of global change. Pages 255-265 in Cole, D. N., S. F. McCool, W. T. Borrie, and J. O'Loughlin, compilers. Wilderness science in a time of change conference -- Volume 5: Wilderness ecosystems, threats, and management; 1999 May 23-27; Missoula, MT. Proceedings RMRS-P-15-VOL-5. Ogden, UT: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station (http://www.wilderness.net/pubs/science1999/Volume5/Keeley_5-30.pdf)

XXIX. Monitoring

ISSUE

Should the Monument employ an ecological monitoring system that differs from or exceeds that called for in the Giant Sequoia National Monument Management Plan DEIS, Appendix E?

FACTS

The Monument will of necessity be employing experimental techniques for ecological restoration. These include prescribed burning and mechanical thinning to reduce unacceptable fuel loads, and to move forest structure and composition towards conditions of stability and resilience. In addition, other activities on the Monument such as grazing, mining, and recreational activities, and the infrastructures that support them, will have significant ecological consequences for the Monument. Furthermore, higher-order stressors such as air pollution and climate changes will continue to function as forcing agents on Monument ecosystems.

IMPLICATIONS FOR THE MONUMENT

Since outcomes (especially long-term) of restoration actions, grazing, mining, and recreation cannot entirely be predicted given the set of conditions described above as well as the absence of robust scientific data in support some of the proposed treatments (e.g. mechanical thinning), it likely will be necessary to employ adaptive management aggressively to steer Monument ecosystems toward desired future conditions, or even to revise those desired conditions. This will, in turn, require high-quality information on a number of ecosystem parameters over time.

ADVICE

The Monitoring plan described in Appendix E is logical in structure, and quite comprehensive (and daunting) in its requirements, reflecting the requirements of the *Adaptive Management Strategy* found in the Sierra Nevada Framework. It does not, however, include all elements appropriate to [management of] the Monument. Chapter III-95 to III-111 makes reference to some sensitive vertebrate species on the Monument, but does not explicitly provide a monitoring program of the organisms themselves (per Advisory XII). The condition of these species and their response to management activities—not simply the condition of their habitat—to Monument activities should be tracked. Likewise, the condition and response of wetlands, including riparian zones and meadows, should be monitored since these ecotypes are of high ecological value and are affected by grazing.

Monitoring by itself is insufficient. A logical adaptive management strategy should be explicitly identified and described to demonstrate how the products of monitoring will be incorporated into modifications of management activities to achieved desired future

condition, and even into revision of those future conditions themselves when they prove inappropriate.

In the particular case of giant sequoia groves, formal exchange of data with other agencies managing groves using varying techniques may prove to be of value, e.g. through the Giant Sequoia Cooperative.

Part 3: The Use of Scientific Advisory Board Advisories in this FEIS

This section summarizes how the advisories were used in the preparation of the Monument Management Plan and its Final Environmental Impact Statement (FEIS) or how they will be used in subsequent planning, implementation, and monitoring activities.

Advisory # and Title	How Advisories Were or Will be Used
I. Priority of Objects	This Advisory reflects the current Forest Service policy for ecosystem management, direction provided in the Presidential Proclamation, and is consistent with the selected alternative. Ecosystem management seeks to foster diversity and to employ adaptive management. Ecosystem science is used as a basis for the Monument Management Plan.
II. Eras	This Advisory is reflected in the Fire and Giant Sequoia issue statements. The desired condition statements, affected environment, and effects have been written to reflect the conditions based upon the two eras identified in this Advisory.
III. Desired Conditions	This Advisory is reflected in the issue statements and the desired condition statements for Alternatives 3 through Modified 6. The overriding desired condition for vegetation is one that exhibits both stability and resilience, while best maintaining native biodiversity.
IV. Restoration of the Natural Fire Regime	This Advisory lists a broad range of factors to consider in applying appropriate management strategies. This Advisory recommends the development of a “decision tree” to assist in determining the appropriate mix of treatments to ensure the re-introduction of fire. The Record of Decision (ROD) includes a “decision tree” that project managers must use to determine if mechanical methods or tree removal are necessary to meet project objectives. The “decision tree” is to be applied at the implementation phase during landscape analysis and project development to assist in identifying the appropriate mix of treatments based on site-specific data. The numerous factors recommended in the Advisory are also considered in the FEIS in the development of alternatives, standards and guidelines, and related management strategies.
V. Prioritizing Areas of Land	The Monument Management Plan addresses priorities in several ways: a range of alternatives is presented; management areas are proposed with unique management direction; issues are identified that address different ecological conditions (e.g., risk of catastrophic fire, desired fire return intervals); different levels of accomplishment are proposed. Fire susceptibility, risk, and hazard, along with fire return interval departure, would most likely be used during implementation of the plan to determine priority areas for treatment.
VI. and VII.	These advisories were not posted.
VIII. Air Quality	This Advisory is reflected to some extent in the Air Quality issue statements, in the description of the affected environment, and in the effects analysis. Air quality standards in California are currently stricter than federal standards.

	Air quality standards are based on mass concentrations and can only be evaluated by predictive dispersion models. The details required for these models are not readily available at this level of planning. Regulatory agencies are more likely to respond with rules either restricting burn days or attempting to improve and localize burn day forecasts to accommodate prescribed burn programs. Production of PM10, by alternative, is included in the analysis. The analysis used the details associated with mechanical treatment and commercial utilization.
IX. Undesirable Fire Effects	This Advisory is reflected in the development of Alternatives 3 through Modified 6 and the associated strategies for reducing the risk of catastrophic fire. This advisory was applied in evaluating reduction of fire susceptibility within the Monument. The effects of implementing Framework standards and guidelines were analyzed in the Fire and Fuels section of the effects analysis. The Spectrum model was used to evaluate wildfire effects by alternative. The model estimated the amount of acres lost to catastrophic wildfire over time, as well as estimated the amounts of acres affected by fires of varying intensities (lethal, mixed lethal, and non lethal).
X. Impairment of Watersheds	This Advisory was applied in the Watershed issue statement. The forest has disclosed areas of concern in Chapter III, the affected environment, and in Chapter IV, the effects section. The relative percentages of treatment proposed in each alternative are documented to assess potential effects in a fashion similar to the Framework FEIS. Potential for *impairment of watersheds* would be evaluated at the subwatershed level during landscape analysis and action would be taken to either reduce the potential for cumulative watershed effects through project modification or mitigation. The forest would assure that all past, present, and reasonably foreseeable management activities (including fuels treatments, recreation, vegetation management, roads and facilities) are accounted for in the cumulative watershed effects analysis at the landscape level. Additionally any wildfir*es* that are of a magnitude to affect water quality, quantity, or timing, or soil erosion, would be included in the accounting of potential watershed effects. Management activities in the Monument would be commensurate with all existing mandates and would be designed at the landscape level for site-specific project implementation.
XI. Sequoia	The Forest Service consulted with regional personnel on appropriate use of the SVS software. It was determined that this software was not designed for broad forest-level planning. Other analytical tools were used. The Forest Service used the listed references to identify desired conditions as well as to describe the affected environment and the effects of the alternatives.
XII. Wildlife	This Advisory is reflected in the Wildlife issue statement and in the Wildlife sections of Chapters III and IV in the EIS. The effects analysis discusses California Wildlife Habitat Relationship modeling. The monitoring plan will track species populations as well as habitat change and status.
XIII. Local Markets	The advice to seek ways of building trust regarding the appropriate use of mechanical thinning is reflected in the development of the Vegetative Treatment Methods issue statement, the development of the range of alternatives, and in the Socio-Economics sections of Chapters III and IV in the EIS. The advice to seek ways to show that economic feasibility is critical to ecological restoration is reflected in the ROD. Figure 1 in the ROD presents a “decision tree” to ensure that site-specific analyses are conducted if mechanical methods are considered for ecological restoration.
XIV. Reservation Roads	The Forest Service maintains a close working relationship with the Tule River Tribal Council to ensure proper consultation and involvement. This Advisory is reflected in ongoing consultation with the Tule River Indian Tribe as the Monument Management Plan was developed. It is reflected in all of the alternatives. It was also used in the development of the transportation plans for the alternatives, as well as the Transportation sections of Chapters

	III and IV.
XV. Building Consensus	This Advisory was used to promote collaborative management techniques in the public involvement process. It is reflected in the Socio-Economics section of Chapter III. Within the time frame allotted for development of the Monument Management Plan, the Forest Service has used a variety of public forums to encourage understanding and involve the public in development of the plan (see the Public Involvement section of Chapter I and the introduction to Appendix A, Response to Comment.).
XVI. Equestrian	This Advisory is reflected in all of the alternatives, as they all allow recreational stock use of the Monument. It is reflected in the Recreation sections of Chapters III and IV of the EIS. Conflicts that arise during implementation will be dealt with on a site-specific basis.
XVII. Transportation Plan	The proposal for a public transportation system in the Monument was considered but not in detail (Chapter II). After consultation with Mark Tabor (National Park Service Alternative Transportation Plan), it was determined that it is too early to anticipate the need for a mass transit system for the Monument. The Transportation Plan will not foreclose the opportunity to develop mass transit when demand and use patterns show a need. The Monitoring Plan will include data collection to help determine the need for mass transit.
XVIII. Science for the Monument	This Advisory is reflected in all of the alternatives to date, as they all emphasize and encourage scientific study in the Monument. Appendix G discusses the approach to scientific study that will be developed as the management plan is implemented. Specifying the organizational structure and location of the research unit is beyond the scope of this planning effort. The Forest will develop a stand-alone proposal to address long-term staffing opportunities and research focus in the Monument. This proposal will be separate from the NEPA decision for this EIS.
XIX. Visitor Data	The FEIS acknowledges (Chapter III) that improved visitor use data is needed. A goal is established (Chapter II) to provide direction to gather this data. The actual development and implementation of inventories are administrative actions that are beyond the scope of this analysis. These actions will be conducted after the final decision is made.
XX. Definition of Treatments	Treatment definitions are included in Chapter II and Appendix H. Recommendations in this Advisory were considered in developing the definitions.
XXI. Plain Language	This advice is reflected throughout the document. Additional references from the Presidential Proclamation and the Framework, as well as visualization tools, have been added to the FEIS for clarity.
XXII. Heeding Advisories	Advisory III (Desired Conditions) was reviewed and the Desired Condition section of Chapter II was revised with input from Scientific Advisory Board members. Advisory IV (Restoration of the Natural Fire Regime) was reviewed and a flow chart to determine appropriate treatment methods was developed for inclusion in the Record of Decision (ROD; see Figure 1 in the ROD). Advisory V (Prioritizing Areas of Land) was reviewed and priorities for management actions were established, partially based on hazard, risk, ecological need, and feasibility.
XXIII. Defense Zone	Discussions of defense zone treatments and their effectiveness have been expanded in the FEIS.
XXIV. Tradeoffs	No stand-alone section of the FEIS is dedicated to comparing and contrasting the ecological tradeoffs between prescribed fire and mechanical thinning. Additional discussion has been added to the FEIS regarding tradeoffs and the uncertainty associated with different methods of treatment, such as invasive species and soil impacts. Many of the tradeoffs are not well

	understood and questions regarding tradeoffs are included in Appendix G (Monitoring, Scientific Study, and Adaptive Management). No specific methods of treatment are determined in alternatives other than in Alternatives 3 and 4, where prescribed fire is the only method allowed in most of the Monument. A flow chart to help determine appropriate treatment methods is included in the ROD (see Figure 1).
XXV. Watersheds	Additional information, such as potential recreation developments, has been included in the evaluation of watershed effects. The alternatives are compared based on the expected watershed effects.
XXVI. Reasoning	The ROD discloses the rationale for the selected alternative for the Monument Management Plan. The FEIS has additional discussions of uncertainty and disagreement. Appendix G discusses the connections between the three components of adaptive management. The process for evaluating subsequent, site-specific actions remains the National Environmental Policy Act (NEPA) process.
XXVII. Vision, Visualization, and Understanding	No separate management plan describing the selected alternative in 30 to 40 pages has been developed. Such a document may be developed following completion of the Monument Management Plan FEIS and ROD. Additional references from the Proclamation and the Framework, as well as visualization tools, have been added to the FEIS for clarity. A flow chart to help determine appropriate treatment methods is included in the ROD (see Figure 1). Appendix G explains the roles of monitoring, research, and adaptive management in the Monument.
XXVIII. Decision Tree	A flow chart to determine appropriate treatment methods was developed for inclusion in the ROD (see Figure 1).
XXIX. Monitoring	Appendix G (Monitoring, Scientific Study, and Adaptive Management) has been expanded to explain the roles of monitoring, research, and adaptive management in the Monument.