K.1 Introduction

K.1.1 Background

On October 23, 2008, the National Park Service released the Grand Canyon National Park Draft Environmental Impact Statement (DEIS) and Assessment of Effect for the Fire Management Plan for public review and comment. The DEIS was designed to provide a comprehensive look at impacts to the human environment from fire activities at GRCA, and to evaluate various alternatives. The release of the DEIS initiated a formal 90-day public comment period, ending January 21, 2009. Public meetings to provide an overview of the DEIS and accept public comment were held in (December 2, 2008); Flagstaff, AZ (December 3, 2008); and Tusayan, AZ (December 4, 2008). Approximately 28 people attended the meetings. A press release, website updates (Planning Environment and Public Comment (PEPC) website), and public meetings were used to request public input and to disseminate information about draft alternatives and their impacts. During the public comment period, the NPS received 10 submissions total from public meetings, via PEPC website, by email, and by regular mail from the public, agencies, organizations, and businesses. NPS conducted separate meetings with affiliated tribes regarding the DEIS and the Section 106 programmatic agreement (PA). Substantive comments are addressed in the Final Environmental Impact Statement Fire Management Plan (EIS), as revisions in this (FEIS) text, or as responses to comments addressed in this appendix.

Respondents invested considerable time and effort to submit comments on the DEIS. Comments covered a wide spectrum of thoughts, opinions, ideas, and concerns. The most commonly addressed themes included cumulative impacts, adaptive management, fire severity changes in the action alternatives, and impacts to MSO critical habitat. Comments were determined to be either substantive or nonsubstantive. National Environmental Policy Act (NEPA) regulations require that responses be provided to substantive comments. Comments are substantive if they:

- Challenge accuracy of analysis
- Dispute information accuracy
- Suggest different viable alternatives
- Provide new information that makes a change in the proposal

In other words, substantive comments raise, debate, or question a point of fact or policy. Comments in favor of or against the proposed action or alternatives, or comments that only agree or disagree with NPS policy, are not considered substantive. (NPS Director's Order 12). Nonsubstantive comments are comments that offer opinions or provide information not directly related to issues or impact analyses. Also if comments were repeated they were not necessarily added as new substantive comments because they were already addressed in this appendix.

From the 10 submissions received on the DEIS, 115 individual substantive comments were extracted. Per NEPA guidance, these comments were summarized and are presented along with a response, per issue or impact topic, in this appendix.

K.1.2 Methodology For Collecting Comments

The NPS interdisciplinary planning team (IDT) read all comments and determined whether comments were substantive or nonsubstantive. Pursuant to the NEPA, responses were prepared for all substantive comments, and the content of this FEIS also demonstrates responsiveness to public input. The methodology consisted of:

A coding structure was developed in the PEPC database to help sort comments into substantive and nonsubstantive and then to separate them into general headings, as used in this appendix, based on groupings from the EIS or issues/concerns brought forward through public comment.

As each submission was read, distinct comments were identified and given a code based on, among other things, the topics addressed and whether the comment was substantive or nonsubstantive (according to criteria set forth in Council on Environmental Quality regulations). Submissions could, and often did, contain several comments.

Each submission was added into PEPC as text. Substantive and non substantive text were pulled from the submission and entered into the comment database. For each comment in a correspondence, codes assigned by one IDT member were validated by another IDT member, along with the submission code and type, the name and address (if available), and the text of the comment, if substantive.

The database was used to help construct the substantive issues. Opinions, feelings, and preferences of one element or one alternative over another, and comments of personal and philosophical nature were all read and analyzed. All comments were considered, whether people voiced the same concern or a single person or organization raised a technical point.

The team analyzed the comments and then grouped comments with similar subject matter to prepare responses for each subject matter group. Some of the more detailed comments appear verbatim in this document, while others were summarized, reflecting the content of several similar comments. Responses to comments were collaborated with professionals in the respective fields (i.e., air quality, fire ecology, wildlife and habitat) for analysis and response. Comment summaries and responses were reviewed by the interdisciplinary planning team for accuracy and completeness.

Reading, coding, and analyzing comment letter contents assisted the team in determining if substantive issues raised by the public warranted further modification of alternatives or further analysis of issues and impacts. With information provided through the public review process, GRCA revised the adaptive management section, added more analysis to the cumulative impacts, and clarified the moderate high/high severity 30% cap for MSO restricted habitat.

Although the content analysis process attempted to capture the full range of public concerns, it is acknowledged that comments from people who chose to respond do not necessarily represent the sentiments of the entire public. Further, public comment is not a vote-counting process; emphasis in this process was on comment content rather than number of times a comment was received.

K.1.3 Organization Of Comments And Responses

Appendix K is divided into two sections as follows

Substantive Comments and Responses Substantive comments are summarized in this section including comments received from agencies, tribes, organizations, businesses, and individuals. A response to each substantive comment is presented. The comments are grouped within categories and are not ordered sequentially. This is a result of providing the reader with comments grouped by topic or of comments that have been combined because they are similar.

Copies of Letters from Agencies and Tribes In accordance with NPS policy (NPS Director's Order 12, section 4.6), only formal consultation letters received from Federal, state, local agencies and American Indian tribes are reprinted in full in this section. American Indian tribes' consultations on a government to government and section 106 are captures during pan tribal meeting and the programmatic agreement which will be finalized prior to the decision document. Letters received and reprinted are from (in order of presentation in the document)

- U.S. Environmental Protection Agency
- Advisory Council on Historic Preservation

K.2 Substantive Comments and Responses

Comment	Response
EPA Comments	
Page 3-50, section 3.3.1.1. The 8 hour ozone standard was revised in March of 2008. The text should be changed to reflect this. Table 3-12 already includes this information.	• *3.3.1.1 Air Quality Regulatory and Management Constraints, Air Quality, Federal Constraints, has been updated.*
Page 3-51, first paragraph. The FEIS should be revised to provide an explanation of what constitutes "high" levels of ozone (relative to the NAAQS, for example), and to indicate whether there is ozone monitoring at the Canyon.	• *3.3.1.1 Air Quality Regulatory and Management Constraints, Air Quality, Compliance with Federal and State Air Quality Standards, has been updated.*
Page 3-51, paragraph below the italicized paragraph. Arizona's regional haze State Implementation Plan was submitted in December 2003. The December 2007 update has not been submitted yet. The FEIS should state this.	• *3.3.1.1 Air Quality Regulatory and Management Constraints, Air Quality, Grand Canyon Visibility Transport Commission, has been updated.*
Page 3-53, section 3.3.1.4. The FEIS should be expanded to include some quantitative information on emission levels from mobile sources. This information should not be difficult to obtain as long as there are good estimates of the number of park visitors who come via motor vehicles.	• *3.3.1.4 Emissions Related to Fire Management, Air Quality, Other Emissions Sources, has been updated.*
To minimize smoke and adverse impacts, on air quality from actions to maintain desired conditions, EPA supports, the use of a combination of fire- and non-fire fuel treatments. We recommend a commitment in the final environmental impact statement (FEIS) to employ the full range of treatment methods, including non-fire practices wherever appropriate, in the future to maintain desired conditions.	• *Fuel reduction is only one aspect of desired conditions, and non-fire treatments do not provide some of those other benefits (e.g., nutrient cycling, pest management) and can cause or exacerbate other impacts (e.g., soil compaction, spread of exotic species). The park does remain committed to achieving all desired conditions using a combination of treatment types.*
EPA supports avoidance and minimization of effects on sensitive resource areas. We recommend the FEIS describe specific avoidance and minimization measures. For example, consider the use of buffer zones for riparian, wetlands, springs, and meadow resources; equipment exclusion zones; and fire retardant exclusion zones.	• *4.4.2.5 Mitigation of Effects, Soils and Watersheds, has been updated.*
We recommend the FEIS include a short section describing potential climate change effects for the Grand Canyon region, effects on the Fire Management Plan, and possible adaptation measures. For example, describe whether there may be changes in treatment schedule, types of treatments favored, any shift in vegetation types to be treated, or a reliance on adaptive management to annually adjust to climate change.	• *4.2.1.7 Longer-term Effects and Climate Change, Vegetation, has been updated. New information has been added to 2.6.4 Adaptive Management.*

Comment	Response
Adaptive Management	
While certain adaptive management components (assessment, monitoring, research, etc.) have been described throughout the DEIS, we feel that the description of the adaptive management process to be employed is piecemeal, highly generalized, and insufficient. GCNP is perfectly positioned to develop and employ an integrated and systematic adaptive management program with specified feedback loops and decision criteria. We respectfully request that additional consideration be given to the adaptive management elements of the fire plan.	• *New information has been added to 2.6.4 Adaptive Management*
The DEIS discusses the basic tenants of adaptive management but fails to detail how this management will be integrated into on the ground activities nor how it will inform future planning efforts. We would appreciate additional information on exactly how the NPS intends to monitor fire projects, how you will collect and use data, and what the budget implications of doing this will be.	• *The GRCA fire monitoring plan (in draft, June 2009) will be part of the Fire Management Plan, and outlines protocols for the fire effects monitoring program as well as the Composite Burn Index burn (CBI) severity monitoring. This information, along with the Fire Management Plan, will be made available on the GRCA website at completion. Implementing adaptive management and tools should not impact fire monitoring budget.* • *New information has been added to 2.6.4 Adaptive Management*
The DEIS does not use adaptive management and fails to adequately review past mistakes what worked and what did not and then to incorporate it into this plan. For example, it does not address how canopy loss that is a frequent feature of previous burn activity on the North Rim can be reduced.	• *New information has been added to 2.6.4 Adaptive Management. The park considers canopy loss part of a mixed-severity fire regime, and that this mixed-severity fire regime is the fire regime for mixed-conifer and spruce-fir forest types. Please see 2.4.1.1 and 2.4.2.1 for information about fire regimes for spruce-fir and mixed-conifer forest types, respectively.*
In Chapter 2, adaptive management is mentioned as a "desired condition" only for spruce-fir forest and pinyon-juniper vegetation (see Sections 2.4.1.3 and 2.4.4.3). The DEIS should explain why adaptive management isn't equally important for mixed-conifer and ponderosa pine forests (Sections 2.4.2.3 and 2.4.3.3).	• *Thank you for finding this error. The adaptive management process will be used for all forest types. Adaptive management is equally important for all forest types, so it will be added to sections missing that information.*
Given past failures of management fires in GRCA's spruce-fir forest (both suppression fires began as either prescribed or wildland fire-use fires), the DEIS should limit future management fires to less risky weather percentiles and attempt innovative burning methods to avoid large patches of landscape-scale crown fire.	• *The park agrees that the management of fires is risky. Fires can be active for many weeks or months during unforecasted weather events. The Poplar Fire was a fire-use fire that started after the monsoons, which means the peak portion of fire season was already past. The decision to manage the Poplar Fire under a wildland fire-use strategy was determined using a current weather forecast along with the most current seasonal weather forecast. As long-term weather forecasting becomes more accurate, long-term fire modeling will also become more accurate. Management decisions for all GRCA fires use best available forecasts, but unforecasted events can occur which increase the risk and challenges of managing fire. The park has*

Comment	Response
Adaptive Management	
	been working on utilizing innovative burning methods to improve the effects of prescribed fire projects. Those methods have come from the adaptive management process and many discussions with various resource staff members. • *Please review the revised adaptive management section in 2.6.4 in the FEIS.*

Comment	Response
Exotic Species	
Continued monitoring is important, especially with respect to *Bromus tectorum* (cheatgrass) spread. We have seen cheatgrass spread on Powell Plateau following the fire in 2003 but I think the "beefaloes" are the major culprit for spreading cheatgrass seed across the North Rim.	• *New language has been added to 4.2.3.5 to clarify exotic plant species monitoring.* • *Monitoring is a mitigation measure listed in 4.2.3.11 Mitigation of Effects. GRCA is working on an Exotic Plant Management Plan (out for public review February 24 to March 27, 2009). A decision document is expected in 2009.*
The Grand Canyon Trust, working with Northern Arizona University, have recently developed several scientifically rigorous landscape scale datasets describing predicted cheatgrass occurrence, forest structure characteristics, and fire behavior/hazard/risk characteristics for the entire Kaibab Plateau. These datasets serve as best available science describing forest, fire, and cheatgrass characteristics for the larger Plateau. We respectfully submit hardcopy representations of these datasets in the attached Appendix, and request that you incorporate these datasets to the maximum degree practicable in finalizing the DEIS (especially the cumulative effects section thereof). We are willing to transfer the GIS datasets underlying these maps as soon as is practicable for you. Additionally, and importantly, we offer these datasets as key elements of a data foundation supporting landscape scale, cross jurisdictional coordination across the Kaibab Plateau. We expect that complete implementation of this DEIS will both require and facilitate the development of a coordinated and collaborative landscape scale, Plateau wide fire management and restoration planning effort, especially focused on higher elevation mixed conifer and spruce fir forests which exist contiguously across the GCNP/NKRD boundary. We are more than willing to work with GCNP, NKRD, and other stakeholders to facilitate analysis and implementation of cross boundary fire management strategies.	• *New language has been added to 4.2.3.5 to clarify exotic plant species monitoring.* • *In the EIS, two fire behavior models were used, FLAMMAP and FARSITE, to model predicted fire behavior for each alternative (see Appendix F for additional information on methods and assumptions).* • *At the time of analysis, the study area for the FMP DEIS was GRCA's boundaries. The NPS will continue to coordinate and collaborate across jurisdictional boundaries on the Kaibab Plateau.* • *The park is developing an Exotic Plant Management Plan (out for public review February 24 to March 27, 2009). A decision document is expected in 2009.*

Comment	Response
Exotic Species	
Throughout the document, inadequate attention has been paid to potential post fire invasion by non native plant species. We are particularly concerned about invasion of burned areas by cheatgrass, which has the potential to affect type conversion at landscape scales. As described above, we have developed a first of its kind, rigorous, and peer-reviewed prediction of cheatgrass occurrence. Currently, the model we have developed does not extend south of the GCNP/NKRD boundary. We can in a relatively straightforward fashion extrapolate and extend the model into GCNP. We also have the capability to assess the potential impacts of mixed to high severity fire on cheatgrass occurrence. We would be glad to share this dataset with you, and to modify model output to meet your needs.	• *New language has been added to 4.2.3.5 to clarify exotic plant species monitoring.* • *In the DEIS, two fire behavior models were used, FLAMMAP and FARSITE, to model predicted fire behavior for each alternative (see Appendix F for additional information on methods and assumptions).* • *At the time of analysis, the study area for the FMP DEIS was GRCA's boundaries. NPS will continue to coordinate and collaborate across jurisdictional boundaries on the Kaibab Plateau.* • *The park is developing an Exotic Plant Management Plan (out for public review February 24 to March 27, 2009). A decision document is expected in 2009.*
The DEIS is largely silent about potentially significant cumulative effects of cheatgrass spread resulting from livestock grazing and logging operations on the North Kaibab Ranger District together with the Proposed Action. Adherence to best management practices does not ensure that Forest Plan objectives will be met or that significant environmental effects will be prevented. The final EIS needs to address specific methods that will be used to mitigate weed spread, and it must candidly assess their effectiveness. Existing cheatgrass infestations within the project area belie any contention that monitoring and mitigation are sufficient to "prevent adverse effects." GRCA needs to address potentially significant uncertainties that may affect the statement of environmental impacts. See 40 § C.F.R. 1502.24.	• *New language added to 4.2.3 clarifies exotic plant species monitoring.* • *Any potential significant adverse impacts regarding cheatgrass were discussed in Effects Common to all Alternatives. GRCA has determined mitigation measures described in 4.2.3.5 and 4.2.3.11 will lessen significant effects of all exotic species.* • *GRCA is developing an Exotic Plant Management Plan (out for public review February 24 to March 27, 2009). A decision document is expected in 2009.*

Comment	Response
Cumulative Impacts	
Also absent is a discussion of past burns, lack of success with past burns, and how the NPS will attempt to avoid past mistakes. In particular, there is insufficient acknowledgement of difficulty and past lack of success in spruce-fir and mixed-conifer. The key issue that must be reviewed is the frequent occurrence of crown fire in non-crown fire landscapes, i.e., unnatural Outlet and Poplar Fires, as well as Warm Fire in the Kaibab National Forest. The "No Action" alternative is based on fire management activities that occurred from 1993-2005, yet impacts from the previous 15 years of fire management at Grand Canyon are not fully analyzed. Data from	• *New cumulative effects analysis has been added to the vegetation section for environmental consequences. Past and proposed fire severities have been analyzed in the cumulative effects section for each vegetation type for each alternative. GRCA believes the five alternatives were adequately analyzed by using available information from past fires including data on fire effects, Composite Burn Index (CBI) burn severity, fire history, and information from past and present employees who participated in past fire management. In ponderosa pine, there is statistically significant post-fire data available due to the amount of fire activities in those vegetation types. In other areas*

Comment	Response
Cumulative Impacts	
these actions should be included and analyzed in order to inform the public as to the impacts of the proposed alternatives. Unfortunately, these data are not presented in this document. A thorough analysis of the "No Action" alternative should be what informs the proposed action alternatives, including the "Preferred" alternative. The lack of available data has led to an insufficient level of analysis of the "No Action" and all of the action alternatives.	*there is not as much post-burn data because GRCA has not implemented as many fire activities in those vegetation types. 2.6.4 contains new information on adaptive management.*
The acres of spruce-fir habitat within GCNP and the percentage of overall park habitat those acres represent. The data displayed should also include the percentage of coniferous habitat within the park that spruce-fir habitat acres represent. The acres of spruce-fir habitat outside of the GCNP boundaries on the Kaibab National Forest. Current spruce-fir forest structure in greater detail than displayed in paragraphs two and three, on page 2-4. An analysis of the cumulative effects of various fire management tools and fire intensity levels on canopy requires some information on canopy density in terms of distribution and spatial scale. A mean canopy cover of 50% does indicate a dense forest ecosystem. However, the individual stand ranges of 20% to 85% relate to past fire events, insect outbreaks, or topography. Individual stand data is very valuable when designing a specific project and assessing the potential outcomes. Tree densities by structural stage versus average densities. Averages of tree densities down to 2.5 cm (1') dbh, across large landscapes do not actually constitute usable stand structure information. "Structural stage data should be displayed in inches by diameter range and tree densities should be translated into trees per acre. Research papers do use hectares instead of acres, centimeters instead of inches and meters instead of feet for tree height, the standard data displays used by land managers, such as the Forest Service are easier for the public to understand. The NPS has an obligation under NEPA to clearly and consistently display information on which the analysis is based, in a format that is generally understandable to the public. Structural stage data for the Reference, Existing and Desired Conditions sections needs to be displayed in a single table. This section of the DEIS contains contradictory and over-lapping data that cannot be easily compared even when taking into account the upper and lower ranges described in the first paragraph on page 2-8.	• *Chapter 3's Existing Conditions now contain spruce-fir habitat acreage, percent of the total coniferous forest that is spruce-fir, the overall park habitat those acres represent, and spruce-fir habitat acreage in the Kaibab National Forest. GRCA does not measure individual "stands" throughout the forest type nor has the park evaluated forest conditions using stand structure information. GRCA believes spruce-fir structural stage data are displayed clearly with the additional fire effects information and lack of any specific stand structure data in Desired Conditions (2.4.1.3). GRCA received no comments from the public stating they did not understand the metric system. The plan's data format remained consistent with data from research papers used in this analysis.*

Comment	Response
Cumulative Impacts	
Existing condition should show: The acres of ponderosa pine habitat within GCNP and the percentage of overall park habitat those acres represent. The data displayed should also include the percentage of coniferous habitat within the park that ponderosa pine habitat acres represent. The acres of ponderosa pine habitat outside of the GCNP boundaries on the Kaibab National Forest. "Current ponderosa pine forest structure in greater detail than displayed on page 2-7. An analysis of the cumulative effects of various fire management tools and fire intensity levels on canopy requires some information on canopy density in terms of distribution and spatial scale. "Tree densities by structural stage versus average densities. Averages of tree densities across large landscapes do not actually constitute usable stand structure information. "Structural stage data should be displayed in inches by diameter range and tree densities should be translated into trees per acre. The Park Service has an obligation under NEPA to clearly display information on which the analysis is based, in a format that is generally understandable to the public.	• *Chapter 3's Existing Conditions now contain spruce-fir habitat acreage, percent of the total coniferous forest that is spruce-fir, the overall park habitat those acres represent, and spruce-fir habitat acreage in the Kaibab National Forest. GRCA does not measure individual "stands" throughout the forest type nor has the park evaluated forest conditions using stand structure information. GRCA believes ponderosa pine structural stage data are displayed clearly with the additional fire effects information and lack of any specific stand structure data in Desired Conditions (2.4.3.3) GRCA received no comments from the public stating they did not understand the metric system. The plan's data format remained consistent with data from research papers used in this analysis.*
The percentages displayed in Table 4-5, Projected Fire Severity by Fire Category in Ponderosa Pine, appear to be general in terms of what level of severity can be expected with differing tools and given general burn histories. The effects analysis by alternative provides additional discussion, but does not put the projected fire behavior in the context of overall impacts to the ecosystem from cumulative actions.	• *New cumulative effects analysis has been added to the vegetation section for environmental consequences. Past and proposed fire severities have been analyzed in the cumulative effects section for each vegetation type for each alternative.*
Canopy impacts from the Outlet Fire are a good example. Page 4-39 notes that the Outlet Fire, which burned during "very high weather conditions in mixed-conifer and spruce-fir", resulted in "69% of spruce-fir burning at moderate/high to high severity levels. We assume this 69% number refers to spruce-fir acres within the fire boundary. How does the proposed action, in combination with canopy changes from the Outlet Fire and other past actions covered in the DEIS, affect spruce-fir canopy in GCNP? This is the question the effects analysis should answer.	• *New cumulative effects analysis has been added to the vegetation section for environmental consequences. Past and proposed fire severities have been analyzed in the cumulative effects section for each vegetation type for each alternative.* • *The 69% of spruce-fir that burned at moderate/high and high levels refers to spruce-fir in the Outlet Fire perimeter—a very small percentage of the entire spruce-fir habitat.*
The cumulative effects analysis does not contain any additional information regarding how the projected fire severity effects relate to existing conditions. This section simply categorizes the projected impacts. Appendix F, which covers Fire Behavior Modeling: Methods and Assumptions, does not provide any additional information. Table F-1 contains the same percentages of severity for prescribed fire by vegetation type shown elsewhere in the	• *New cumulative effects analysis has been added to the vegetation section for the environmental consequences. Past and projected fire severities have been analyzed in the cumulative effects section for each vegetation type for each alternative.* • *Past high severity areas in the Outlet Fire are now young aspen stands, and even though those areas have gone through a forest-type change, they would*

Comment	Response
Cumulative Impacts	
DEIS. Tables covering fire severity impacts to soils contain proposed treatment acres by habitat type. The data are not displayed, however, in a context that would address our concerns regarding cumulative effects.	*not necessarily be considered high severity today. Because there is no method that has been used to determine present condition of past severity data, GRCA did not complete additional modeling.*
Data from historic fire intervals and fire data collected since 1993 have been used to inform the creation of alternatives. How impacts from recent past actions (1993 to 2000), in combination with current proposals is missing from the analysis, particularly as it relates to canopy structure and the Park's request for an increase in fire severity. The existing condition description for each habitat type is limited to general information regarding increases in tree densities and changes in the fire regime.	• *New cumulative effects analysis has been added to the vegetation section for environmental consequences. Past and proposed fire severities have been analyzed in the cumulative effects section for each vegetation type for each alternative.* • *GRCA does not measure individual "stands" throughout the forest type nor has the park evaluated forest conditions using stand structure information. The park believes that with additional fire effects information and lack of any specific stand structure data in Desired Conditions (2.4.1.3), the structural stage data is displayed clearly.*
Information necessary to determine cumulative effects is missing, inconsistent or fragmented throughout the DEIS so as to make comparisons between the cumulative effects of alternatives unachievable.	• *New cumulative effects analysis has been added to the vegetation section for environmental consequences. Past and proposed fire severities have been analyzed in the cumulative effects section for each vegetation type for each alternative.*
When discussing the existing and desired conditions for mixed-conifer, the DEIS needs to clearly display: "The acres of mixed-conifer habitat within GCNP and the percentage of overall park habitat those acres represent. The data displayed should also include the percentage of coniferous habitat within the park that mixed-conifer habitat acres represent. "The acres of mixed-conifer habitat outside of the GCNP boundaries on the Kaibab National Forest. "Current mixed-conifer forest structure in greater detail than displayed on page 2-5 and 2-6. The range of numbers in the desired condition is much more specific than for spruce-fir. We assume there is more research on which to base the stated desired condition and therefore more data to display. "An analysis of the cumulative effects of various fire management tools and fire intensity levels on canopy requires some information on canopy density in terms of distribution and spatial scale. Individual stand data is very valuable when designing a specific project and assessing the potential outcomes." Tree densities by structural stage versus average densities. Averages of tree densities of a broad nature, across large landscapes do not actually constitute usable stand structure information. "Again, as stated relative to spruce-fir structural stage data should be displayed in inches by diameter range and tree densities should be translated	• *Chapter 3's Existing Conditions, GRCA added mixed-conifer habitat acreage, percent of the total coniferous forest that is mixed-conifer, and overall Kaibab National Forest mixed-conifer habitat acreage. In 3.1.1.3 GRCA added language to better describe this forest type. GRCA does not measure individual "stands" throughout the forest type nor has the park evaluated forest conditions using stand structure information. GRCA believes that with additional fire effects information and lack of any specific stand structure data in Spruce-Fir Desired Conditions (2.4.1.3), the structural stage data is displayed clearly. GRCA received no comments from the public stating they did not understand the metric system. The plan stayed consistent with the data format from research papers used in this analysis.*

Comment	Response
Cumulative Impacts	
into trees per acre. Research papers do use hectares instead of acres, centimeters instead of inches and meters instead of feet for tree height, however the standard data displays used by land managers, such as the Forest Service are easier for the public to understand.	

Comment	Response
MSO Critical Habitat	
The DEIS indicates that GRCA misunderstands what constitutes Critical Habitat for threatened Mexican spotted owl ("MSO"). It states at page 4-185, "not all mapped habitat qualifies [as critical habitat], as one or more constituent elements (tree density or steeper slopes) may be lacking." In fact, the entire mixed conifer forest type is MSO Critical Habitat if it occurs in a mapped Critical Habitat Unit ("CHU"), even if all primary constituent elements are not present. See MSO Recovery Plan and 69 F.R. 53131 (August 31, 2004). CHU CP-10 overlaps nearly all of GRCA, including the entire north rim. See map at: http://www.fws.gov/southwest/es/mso/critical_habitat/map4.html.	• *The statement mentioned, found in 4.2.5.13, Impact Analysis, Effects Common To All Alternatives, Special Status Wildlife Species Likely Affected, Mexican Spotted Owl, has been updated in the FEIS.* • ***Justification*** *The response to a very similar question is found on page 53185 of 50 CFR Section 17 (Final Designation of Critical Habitat for the Mexican Spotted Owl): "As stated in the critical habitat designation section, the critical habitat designation is consistent with the Recovery Plan and includes areas within the mapped boundaries that are protected or restricted habitat and include one or more of the primary constituent elements. Protected habitat is areas where owls are known to occur or are likely to occur. Protected habitat includes: (1) 600 acres around known owl sites within mixed conifer forests or (2) pine-oak forests with slopes greater than 40 percent and where timber harvest has not occurred in the past 20 years. Restricted habitat includes areas outside of protected habitat which owls utilize for foraging and dispersing. Restricted habitat includes mixed conifer forest, pine-oak forest and riparian habitat types."*
Moreover, in reference to critical habitat, the DEIS incorrectly states that, "not all mapped habitat qualifies, as one or more constituent elements (tree density or steeper slopes) may be lacking" (pg 4-185). It is our understanding that all mixed-conifer qualifies as critical MSO habitat when it occurs in a critical habitat unit.	• *The statement mentioned, found in 4.2.5.13, Impact Analysis, Effects Common To All Alternatives, Special Status Wildlife Species Likely Affected, Mexican Spotted Owl, has been updated in the FEIS.* • ***Justification*** *The response to a very similar question is found on page 53185 of 50 CFR Section 17 (Final Designation of Critical Habitat for the Mexican Spotted Owl): "As stated in the critical habitat designation section, the critical habitat designation is consistent with the Recovery Plan and includes areas within the mapped boundaries that are protected or restricted habitat and include one or more of the primary constituent elements. Protected habitat is areas where owls are known to occur or are likely to occur. Protected habitat includes: (1) 600 acres around known owl sites within*

Comment	Response
MSO Critical Habitat	
	mixed conifer forests or (2) pine-oak forests with slopes greater than 40 percent and where timber harvest has not occurred in the past 20 years. Restricted habitat includes areas outside of protected habitat which owls utilize for foraging and dispersing. Restricted habitat includes mixed conifer forest, pine-oak forest and riparian habitat types."
The DEIS also presents four different numbers for total amount of mixed conifer acreage in the park: 37,083; 37,272; 37,647; and 37,777 acres. Because the amount of mixed conifer habitat type is unclear, the number of acres of potential habitat that will be impacted by higher severity fire is not readily apparent.	• *These numbers are approximations and vary depending on data type used. The NPS does not believe this small variation changes the analysis (the approximately 700-acre discrepancy constitutes less than 2% of the mixed-conifer habitat type amongst the four figures cited). We were unable to locate the cited figures in the EIS; however, and more importantly, in 3.1.1.3, GRCA now defines MSO restricted habitat as 27,100 acres.*
Considering the lack of data and the past failures in these habitat types, we are concerned that this alternative will significantly reduce habitat for Mexican Spotted Owl and other species dependent on these ecosystems. Though the DEIS claims that none of the alternatives will result in impairment of Park resources, we do not find justification for that claim, particularly in the MSO analysis. We urge the Park to clearly demonstrate the expected level and acreage of impairment of MSO habitat and designated critical habitat. If the level of impairment is as high as expected, we recommend that the alternatives be modified to significantly reduce the effects.	• *The NPS will continue consultation and coordination with the USFWS to ensure impacts are defined in the FEIS.* • *4.1.2.7 discusses impairment analysis requirements. An impairment decision was made for applicable impact topics for each alternative (Chapter 4). Impairment determinations presented in the FEIS indicate that no impairment of park resources or values is expected from activities associated with the fire management program under any alternative. In addition, the monitoring and implementation plan will determine and implement measures required to reduce impacts.*
Depletion of multi-layered forest structure through management-ignited prescribed fire can degrade MSO Critical Habitat, particularly if burning causes high severity fire effects on vegetation. Prescribed firing operations therefore should not be implemented in Critical Habitat over wide areas in the same management unit in a single decade (Agee 1993).	• *GRCA recognizes some fire will adversely or beneficially affect MSO critical habitat, and has also added mitigation measures minimizing adverse impacts. (See 4.2.5.6 Mitigation of Effects, 4.2.5.3 Impact Analysis, and 4.2.5.16 Alternative 2 Preferred Alternative, Special Status Wildlife Species). All fire was suppressed at the smallest size possible for more than a century, and as fire seasons lengthen, the threat of large future fires under "in-season" weather conditions in untreated areas increases. Keeping areas untreated for additional decades will only create additional risks to firefighters, greater losses of forest vegetation, and increased threats to public safety. GRCA will continue to coordinate and consult with the USFWS through the Endangered Species Act (Section 7) consultation process.*
A final EIS should accurately disclose effects of the preferred alternative on MSO and its Critical Habitat. Required disclosure items include: "How much mixed conifer forest habitat exists in CHU CP-10." How much Critical Habitat will be affected, positively or adversely, by proposed actions." How	• *New information was added to Section 2.6.4 Adaptive Management.* • *The FEIS now includes summarized information regarding the mentioned items due to the sensitive nature of location information for a threatened*

Comment	Response
MSO Critical Habitat	
much Critical Habitat will be unaffected or remain untreated." Cumulative effects of past, ongoing, proposed, and foreseeable management activities on Critical Habitat and recovery potential of MSO. The final item listed above is most important because the purpose of Critical Habitat is to facilitate recovery of the listed species, not merely to host a viable population. An adequately hard look at cumulative effects will necessitate a population-scale analysis.	*species. A more comprehensive analysis and discussion of this information is included in the final programmatic Biological Assessment for the Fire Management Plan being submitted to the Fish and Wildlife Service.*

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Departure from historic fire regimes is a key tool in the effects analysis. Given this situation, the research needs stated in the DEIS become critical. In theory, all of the alternatives in the DEIS would move the park closer to fire return intervals, based on any amount of prescriptive fire. The issue of data accuracy and reliability becomes critical in the effects analysis. Generally speaking, the DEIS goes to great length to determine and display how fire will behave, under different conditions in each vegetation type. Our concerns relate to how these data then informed the creation of alternatives.	• *In 2.3 Process for Formulating Alternatives, the ID Team developed a full range of alternatives using goal and objective descriptions and desired conditions. Data used for analysis are adequate to fully analyze these alternatives. Where data were lacking for this effort, best professional judgment used assumptions and extrapolations from scientific literature, other park units that manage fire-dependent ecosystems, and personal observations of park staff.*
The DEIS states that wildland fire-use fires in ponderosa pine can generally be expected to support little crown fire, except where a "high departure" from historic fire conditions exists. On page 4-20, the DEIS goes on to define this condition as 24% of the vegetation type in the park. According to Figure 4-2, a high level of departure in ponderosa pine would be 14%. The inclusion of moderate/high at 8% and moderate at 2%, does bring the number to 24%. Based on stated natural range of variability and fire interval objectives this seems to be an error.	• *After comparing the information in Figure 4-2, and the information in "Effects Common to All Alternatives - Ponderosa Pine - Vegetation, Composition, Structure, and Fuels", the park found a typo the text. The information in Figure 4-2 is correct. The high level of departure is 14% not 24% as stated in the vegetation, composition and fuels section. The park has changed the 24% to 14% to maintain accuracy and has determined that this change does not influence the rest of the analysis.*
The DEIS describes fire regimes and their ecological condition at very coarse scales and without analysis supporting key claims. For example, it is not possible for a reader to understand why GRCA claims that 42% of mixed conifer forests exhibit "high" levels of departure from their historical fire regime. DEIS at 4-7 and 4-9 (Figure 4-2). The analysis presents no supporting evidence in the form of observed fire occurrence, effects, or suppression effectiveness data. Map 4-1 indicates that all mixed conifer forests at GRCA feature a mixed-severity fire regime (Fire Regime III) with a 35-100+ year fire frequency. Id. at 4-8. The DEIS does not qualify the	• *A categorical approach was applied to assigning departure from historic fire regimes for current conditions. Others have used a quantitative approach of fire return interval departure. There is some GRCA fire return interval data available, but there are several limitations to this approach. First, since fire return interval data are not available for many park areas, and there is at least a moderate level of uncertainty associated with some areas with historic fire data (e.g. spruce-fir), an inconsistent application of approach would have resulted (see Chapter 3 Affected Environment). Secondly, fire*

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Fire Regime	
ecological scale of fire frequency assumed to characterize Fire Regime III. Whether the frequency measure is return interval (point scale) or rotation (area scale) matters greatly to the characterization of historical fire regime (Agee 1993) and condition class (Schmidt et al. 2002). What method does GRCA use to characterize fire regimes and condition class? Its description of a "quantitative" methodology makes no sense.	*return interval data available for GRCA and much of the Southwest is reported in percent of trees scarred. This reporting type is useful for assessing very broad trends and climate-fire relationships. However, it complicates spatial comparison of recent fire numbers versus a historic fire return interval, because there is an unknown spatial scale associated with historic fire return interval (Falk and Swetnam 2003, McKenzie et al. 2006). Further, comparing mean values does not recognize a "distribution of variability" approach to looking at historic fire regimes. Finally, this is only one aspect of historic fire regimes. Equally important are fire severity and other regime characteristics. Due to these considerations, a categorical approach was applied. After review and analysis of extensive data and literature, GRCA considers analysis included best available science in relation to management goals and objectives.* • *GRCA used the National Fire Plan Fire Regime Condition Class and Definitions with added criteria from the analysis subject-matter expert. A categorical approach was applied to assigning departure from historic fire regimes for current conditions. Fire return interval data since 1910, years since most recent fire, spatial scales, distribution of variability, fire severity, other fire regime characteristics such as slope and aspect, and historic and current stand composition and dynamics were all used to characterize or classify categories of fire regimes and condition class.* • *GRCA does not necessarily intend the historic fire regime description to be an absolute measurement of spatial scale or return interval, but rather a review of best available science, ongoing research, and fire effects monitoring data to describe a considered reference condition by which to compare current condition of vegetation structure, dynamics, and health. Additional management considerations are important to EIS development such as current predicted fire behavior measured against park resource values like cultural resources, air quality, wilderness characteristics, wildlife habitats, social and political constraints, etc.*
The number of fires since 1910 by itself is not meaningful to a characterization of fire regime or condition class unless supplemental data permits comparison of ignition density and frequency as well as the spatial dimension of fires and their biological effects post-1910 to the pre-suppression era. The final EIS should include data from the "fire history atlas" mentioned at DEIS page 4-7, and it should refine the "quantitative"	• *There are several assumptions and associated uncertainty levels that underlie the spatial portrait of historic fire regimes. First, GRCA assumed that there is no singularly perfect spatial portrayal of historic fire regimes. In part, this is because it is well documented that fire patterns change across thousands or even hundreds of years in concordance with broad and local scale climatic patterns (Swetnam 1990, Swetnam and Betancourt 1990,*

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methodology for assigning fire regime and condition class values to various ecological settings and vegetation communities.	*Swetnam and Baisan 1996). The term historic is general, and with well-established fluctuations in climate, vegetation, and fire over hundreds of years in the past, it is important to define the bounds of historic as applied here to historic fire regimes. Often times, the most detailed information on historic fire and vegetation is from the more recent period of the last several hundred years. Often trees are still alive that became established during this time. These trees can preserve some record of fires in fire scars, and some information on overall stand composition from age-structure. Some Southwest fire reconstructions have yielded even longer historic reconstructions based on careful dendrochronological sampling of remaining dead trees (snags or logs). These and paleoecological data provide information for longer time periods than the last several hundred years. Given the fact that climate is never static, and that it is possible and likely that the near or long-term future may include a change in climate, GRCA has also looked at fire regimes over a longer historic timeframe of a thousand years to provide a more dynamic view of historic fire and vegetation patterns. Based on the analysis, GRCA is aware of the assumptions included in describing or categorizing landscape-scale fire regime, and has determined to use best available science to formulate best management practices and alternatives for future management of GRCA landscapes.* • *The fire atlas provided the number of fires that have occurred for each vegetation type using the current vegetation layers from 1910 to 2007. The criteria used to determine departure from historic fire regime included the number of fires in the fire atlas and the years since the most recent fire. The determination of departure from historic fire regime (low to very high) was developed by combining the criteria listed above. The thresholds for each vegetation type changes as those vegetation types relate to the broad categories in the National Fire Plan Fire Register Condition Classes and Definitions (Table 4-1).*
To the degree that the DEIS characterizes historical fire regimes according to presumed average fire frequency, it unrealistically simplifies the disturbance ecology of the local landscape and overlooks issues of scale that must be accounted for in any credible analysis rooted in ecological science. This inevitably yields miscalculation and skewed risk assessment.	• *GRCA has used these historical fire regimes for a number of years. The park does not believe characterization of historical fire regimes will skew risk assessments or yield. Information about historical fire regimes comes from several peer-reviewed papers for each forest type, and each paper gives ranges to described historical fire regimes. See 1.3.2, 1.3.3, 1.3.4 and 4.2.1.3. See also (Swetnam and Betancourt 1990, Swetnam and Baisan 1996,*

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	Sugihara et al. 2006, Fulé et al. 2003b). • *Table 1-1 reflects the National Fire Plan Fire Regime Classes, and is meant to be a general guide for assessment of landscape and stand-level vegetation and fire interactions. The terminology is referred to as FRCC (Fire Regime Condition Class). In FRCC methodology, a landscape is defined as the contiguous area within delineation large enough to include the variation in vegetation conditions of the natural fire regime. The terminology includes fire frequency as well as characteristic fire severity reflecting percent replacement of dominant overstory vegetation. Grand Canyon recognizes that as a classification or descriptive system it was not designed to be absolute.*
Here and elsewhere, the DEIS uncritically incorporates results of Fule et al. (2003a) without examining the methods and assumptions by which they achieved those results. With regard to "Fire-initiated forest stands [being] indicative of stand-replacing fire events ..." (Section 2.4.1.1, paragraph 3), it is important to more carefully consider what Fule et al. (2003a) wrote. For example, Fule et al. (2003a) stated that their "...fire-initiated groups or patches ...may have contained many fire survivors." Therefore, it must be questioned whether these stands- groups-patches truly originated by stand-replacing fires on the order of the moderate/high and high severity fires described elsewhere in the DEIS. Indeed, documentation of these stands-groups-patches by Fule et al. (2003a) was based solely on the assumption that "When the oldest trees were the fire-susceptible species POTR, PIEN, or ABLA [i.e., quaking aspen, spruce, and subalpine fir], the plot was classified as fire-initiated". This assumption needs verification (for example, spruce and subalpine fir can regenerate below a canopy of quaking aspen). In short, uncritical reliance on Fule et al. (2003a) led in part to misinterpretation of fire regime reference conditions in GRCA's spruce-fir forest.	• *2.4.1.1 includes information about fire regimes in the spruce-fir forest type from more than one reference. There was no reliance on just one reference, but the supporting evidence of a stand-replacement fire regime comes from the combination of several references including Mayer et al. (1995), Fulé et al. (2003)a, Merkle 1954, White and Vankat 1993, and Lang and Stewart (1910). Due to inclusion of several references describing the stand-replacement fire regime, GRCA does not believe it misinterpreted the fire regime for spruce-fir forest type.*
Gross misinterpretation of the historic role of fire in mixed conifer forest is exemplified by the statement on 4-34, paragraph 2, lines 2-3: "There would be some beneficial impact from any fire in this [mixed conifer] type in moving toward a reduced likelihood of uniformly high severity fire." This would justify additional ecologically disastrous fires such as the Outlet Fire (with a 13 km2 patch of stand- replacing fire) and Poplar Fires, as well as the Warm Fire in adjacent Kaibab National Forest.	• *Fire frequency abruptly decreased in the 19th century, leading to increases in fuel loads (Fulé et al. 2004), and horizontal and vertical fuel continuity. Therefore, conditions for the crowning component of the mixed-severity fire regime increased across landscapes, and fires in mixed-conifer forest now may become larger crown fires than the former small-patch, mixed-severity fires (White and Vankat 1993, Fulé et al. 2003a, 2004, Mast and Wolf 2004). Recent GRCA fires with crown-fire patches are the 2000 Outlet*

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	Fire and the 2003 Poplar Fire. Analysis of the Outlet Fire indicates that 94% of the area burned by crown fire was in patches larger than present before Euro-American influence. • *During analysis, GRCA did not try to mimic historic fire events for today's mixed-conifer forest. Structure and fuel loading today is very different than historically. Some large patches of high and moderate/high severity fire effects are not desired conditions (2.4.2.3), but potential for all of the mixed-conifer forest type to burn under high severity fire exists with today's fuel conditions. The idea is that mixed severity fire effects (unburned, low, moderate/low) with some large patches of high and moderate/high severity may keep some or all of the mixed-conifer forests from experiencing a fire in which close to 100% of that forest type burns with high severity. The park believes the Outlet Fire may have had undesirable fire effects, but does not believe the fire to be ecologically disastrous. GRCA also believes potential exists for wildfire to burn 100% of the mixed-conifer forest with only high severity fire effects. Therefore, the park desires to mitigate that potential impact even if all future mitigating fires are not all beneficial.*
Page 4-6, next to last paragraph states: "It was infeasible to model spatial effects of wildland fire-use fires or suppression wildland fires ..." Given the major influence of both types of fires, this would seem to prevent modeling from addressing the question of whether proposed management actions would lead toward or away from the Historic (Natural) Range of Variation, particularly in spruce-fir and mixed conifer forests. More explanation of the statement cited above is needed.	• *Models are used to determine predicted fire behavior for each alternative. Where data was lacking, best professional judgment prevailed using assumptions and extrapolations from scientific literature, other park units that manage fire-dependent ecosystems, and park staff observations. Models used for this EIS represent the best available data. See Appendix F.2.* • *Although the EIS discusses whether proposed management actions would lead toward or away from the Historic (Natural) Range of Variation, the park will be working toward desired conditions defined in 2.4.1.3, 2.4.2.3, 2.4.3.3, and 2.4.4.3. The adaptive management process (2.6.4) will be used after each managed fire to improve the decision process to manage fires to move GRCA forests toward desired conditions.*
Recent decreases in tree densities in unburned spruce-fir and mixed conifer forests (see pages 3-3 and 3-5) would seem to have gotten stands closer to historic conditions. This should be discussed in the DEIS, particularly as it might reduce the need for higher severity management fires. Also, this mortality would seem to have decreased departure from the Historic (or Natural) Range of Variation, which in the DEIS appears to be measured only by time, not by structural and compositional information. The DEIS should	• *There is no mention that a large portion of spruce-fir forests are far from historic conditions. 2.4.1.2 describes current structure and composition in the natural range of variation similar to structure before Euro-American influences. Desired conditions do discuss the desire to restore topographic heterogeneity and return stand-replacing fire events similar to reference conditions described in 2.4.1.1. The park did consider structure and*

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have developed an index of departure that accounts for this potentially important phenomenon.	*composition when evaluating potential fire behavior in the FLAMAP and FSPRO models.*
Section 3.1.1.3 concludes with the correct statement that "In general, areas of management fires involving small-scale patches of different fire severities are likely closer to the natural range of variability, although research is needed to test this hypothesis." However, "current and best-available information" and a balanced perspective on recent fires in mixed conifer forest should have included another statement from the original draft provided to the interdisciplinary team: "In contrast, areas of large-scale crown fires are outside the natural range of variability."	• *The park believes that the most current and best-available information was used to describe the mixed-conifer vegetation in 3.1.1.3. The sixth paragraph in 3.1.1.3 provides that balance by describing the small patch size and the lack of "extensive crown fire" prior to fire exclusion (See Fulé et al. 2003a, Fulé et al. 2003b, Brown et al 2001).*
Portions of the DEIS incorrectly describe what current science shows about the historical fire regime of GRCA's spruce-fir forest. This appears to be a conscious change of emphasis from the description provided in the original draft of the vegetation portions of Chapter 3 Affected Environment (which was also used in portions of Chapter 2. Problems initially show up in Section 1.3.2 Wildland Fire Conditions at Grand Canyon National Park. As indicated in Table 1-2, the fire regime of GRCA's spruce-fir forest is classified as Type III Regime Class with a fire frequency of 35-100+ years. Placement in this class is faulty because research findings … indicate a mean fire return interval of 8 to 31 years (actually 9-31 years). Given that this frequency does not fit the Type III Regime Class, the fire regime of Grand Canyon's spruce-fir forest is Type 1-111. This designation would deservedly add greater emphasis on surface fires and result in less emphasis on the crown fire component of mixed-severity fires. The DEIS discrepancy between scientific data and assumption has ramifications for conclusions drawn later in the DEIS because it overemphasizes the role of stand-replacing fire in GRCA's spruce-fir forest. The misinterpretation of the fire regime of spruce-fir forest appears again in Section 2.4.1.1 Reference Conditions, which focuses on the fire regime and, after the first sentence, incorrectly emphasizes stand-replacing fire, leading to the error that such fires had an important role in GRCA's spruce-fir forest. In part this was achieved by misleading revisions ... The other part was achieved by incorrect interpretations of Fule et al. (2003a). The critical misinterpretation is that this section of the DEIS divides the landscape into	• *Table 1-1 reflects the National Fire Plan Fire Regime Classes and is meant to be a general guide for assessment of landscape and stand level vegetation and fire interactions. The terminology is referred to as FRCC or fire regime condition class. In FRCC methodology, a landscape is defined as the contiguous area within a delineation that is large enough to include the variation in vegetation conditions of the natural fire regime. The terminology includes fire frequency as well as characteristic fire severity reflecting percent replacement of dominant overstory vegetation. Grand Canyon recognizes that as a classification or descriptive system it was not designed to be absolute. The primary consideration for the use of Fire Regime Class III in the GRCA spruce- fir forest is that burn severity is described as mixed, and not restricted to low or high. Grand Canyon suggests this fire regime class is more descriptive of historical and predicted burn severity, particularly with having refined fire return interval data that is site specific to the park.* • *Table 1-2 describes the mean fire return interval of the spruce-fir at 8-31 years and a fire regime class of III which is different than what is in Table 1-1, which describes fire frequency for a fire regime class of III at 35-100 years. There is no fire regime class that correlates exactly to the GRCA spruce-fir forests and its fire regime. As was said earlier, Table 1-1 is meant to be a general guide for assessment of vegetation and fire interactions. The park focused more on the severity column of Table 1-1 to describe the mixed severity fire regime of spruce-fire and determined that the most accurate fire regime class to describe GRCA spruce-fir is regime class III, even if it is not exact.* • *The park does not believe that there is an over-emphasis of the stand-*

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different forest types "...from ponderosa pine to spruce-fir forests." In contrast, Fule et al. (2003a) focused on the landscape as a whole. Indeed, the title of publication is "Mixed-severity fire regime in a high-elevation forest ...". While Fule et al. (2003a) did discuss variation within this forest, the clear emphasis is on mixed-severity fire across the largely spruce-fir landscape, not necessarily within individual forest types; again, see the title of the publication. In contrast, the DEIS divides the landscape and focuses on "truer spruce-fir stands", thereby overemphasizing the role of stand-replacement fire. In short, incorrect interpretation on Fule et al. (2003a) led in part to misinterpretation of fire regime reference conditions in GRCA's spruce-fir forest.	*replacement fire regime. References to a mixed severity fire regime occur in the first and third paragraphs in 2.4.1.1. The desired conditions listed in 2.4.1.3 also list both the stand-replacement fire regime and a mixed severity fire regime.*

Current modeling suggests that past fires that had amounts and patterns of stand-replacing fire outside the Historic (Natural) Range of Variation burned at high weather percentiles (Chapter 4, Tables 4-12, etc.). This strongly suggests that prescriptions for management fires need to be more cautionary, yet Alternatives 2-5 involve burning at higher levels of intensity/severity. This is key aspect of these alternatives, and it leads to the conclusions that these alternatives, if implemented, would lead to impairment of Park resources.	• *The park decided the following items justified both the need for the acceptance of higher severity limitation (action alternatives) and why the current program limitations on severity are insufficient (alternative 1)*
	  ○ *severity data from past fires in the mixed conifer forest*
	  ○ *FLAM Map modeling of fire types under current conditions*
	  ○ *GRCA employees knowledge of forest conditions, fuels, and wildland fires on the North Rim*
	  ○ *fire suppression experience in similar fuels in the west*
	• *The park develops a prescription to meet the specific objectives for each burn unit in a burn plan. There is an interdisciplinary review of each burn plan along with the review and recommendation/approval by several additional park staff including the Park Superintendent. Prescriptions and mitigations features included in the EIS are meant to be side boards; individual project prescriptions are often more refined, and are developed to meet project objectives. The park will continue to use the adaptive management process during the planning, implementation, and review of each prescribed burn.*
	• *4.1.2.7 of the Grand Canyon Fire Management Plan EIS contains a discussion of the requirements of an impairment analysis. An impairment decision was made for applicable impact topics for each alternative (Chapter 4). The impairment determinations presented in the EIS indicate that no impairment of park resources or values is expected to occur from activities associated with the fire management program under any of the alternatives. In addition, the monitoring and implementation plan will determine and implement measures required to reduce impacts.*

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Reference Conditions	
The objective of "Returning stand-replacing fire event characteristics to the range described in reference conditions" requires further definition.	• *Desired conditions for spruce-fir were created to develop a diverse vegetative landscape with variable tree densities through ecosystem processes. They were not developed to be quantitatively specific, but to give a general guideline for managing and monitoring natural ecosystem processes. Fire characteristics are defined in reference conditions by aspect, time of year, and climate. See 2.4.1.3.*
Incorrect description of key aspects of Reference, Existing, and Desired Conditions of GRCA's mixed conifer forest led to incorrect conclusions that, if implemented, make impairment a near-certainty. Problems initially show up in Section 1.3.2 Wildland Fire Conditions at Grand Canyon National Park. As indicated in Table 1-2, the fire regime of GRCA's mixed conifer forest is classified as Type Ill Regime Class with a fire frequency of 35-100+ years. Placement in this class is faulty because research findings (given in this table!) indicate a mean fire return interval of only 5 to 19 years. Given that this frequency does not fit the Type Ill Regime Class, the fire regime of Grand Canyon's mixed conifer forest is Type 1-111. This designation would deservedly add greater emphasis on surface fires and result in less emphasis on the crown fire component of mixed-severity fires. The DEIS discrepancy between scientific data and assumption has ramifications for conclusions drawn later in the DEIS because it overemphasizes what the "current and best-available information" says about the role of stand-replacing fire in GRCA's mixed conifer forest.	• *Analysis of existing data, which included scientific literature, on-site monitoring data, historic records and photos, and current management direction, provided the basis for descriptions of Reference, Existing, and Desired Conditions for Grand Canyon's mixed-conifer forest. Descriptions in the DEIS are both quantitative and qualitative, and assumptions had to be made to conduct the analysis. Assumptions included the idea that unplanned ignitions would burn under various weather parameters that would produce various burn severities and effects to resources. If an assumption were made to burn existing mixed-conifer forest stands under extreme weather conditions, and large acres of high burn severity resulted, the park would not consider this an impairment of dynamic vegetation resources. An example would be the 2000 Outlet Fire that burned under extreme weather conditions with very high sustained winds. Outlet Fire results show minimal soil losses or detrimental impacts to soil as indicated by immediate post-burn flush of dense aspen in burned mixed-conifer vegetation stands. However, Grand Canyon recognizes unplanned ignitions will burn under a variety of weather and fuel conditions, resulting in varying fire effects. Grand Canyon has planned ignition prescriptions that will burn under more temperate conditions, producing additional varying fire effects.* • *Table 1-1 reflects the National Fire Plan Fire Regime Classes and is meant to be a general guide for assessment of landscape and stand-level vegetation and fire interactions. Terminology is referred to as fire regime condition class (FRCC). In FRCC methodology, a landscape is defined as the contiguous area within delineation large enough to include variation in vegetation conditions of the natural fire regime. The terminology includes fire frequency as well as characteristic fire severity reflecting percent replacement of dominant overstory vegetation. Grand Canyon recognizes that as a classification or descriptive system, the FRCC was not designed to*

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Reference Conditions	
	be absolute. • *Primary consideration for use of Fire Regime Class III, is that burn severity is described as mixed, and not restricted to low or high. Grand Canyon suggests this fire regime class is more descriptive of historical and predicted burn severity, particularly with having refined fire return interval data site-specific to the park.* • *4.1.2.7 contains a discussion of impairment analysis requirements. An impairment decision was made for applicable impact topics for each alternative (Chapter 4). Impairment determinations presented in the EIS indicate that no impairment of park resources or values is expected from activities associated with the fire management program under any of the alternatives. In addition, the monitoring and implementation plan will determine and implement measures required to reduce impacts.*
The misinterpretation of the fire regime of mixed conifer forest appears again in Section 2.4.2.1 Reference Conditions. The statement "At higher elevations research shows a mix of about 20% fire-initiated mixed-conifer stands (indicative of stand-replacing fire events) and about 80% non-fire-initiated stands" apparently is based on Fule et al. (2003a). With regard to the contention imbedded within this sentence, that "...fire-initiated mixed-conifer stands [are] indicative of stand-replacing fire events...", it is important to more carefully consider what Fule et al. (2003a) wrote. For example, Fule et al. (2003a) stated that their "...fire-initiated groups or patches ...may have contained many fire survivors." Therefore, it must be questioned whether these stands-groups- patches truly originated by stand-replacing fires on the order of the moderate/high and high severity fires described elsewhere in the DEIS. Indeed, documentation of these stands-groups-patches by Fule et al. (2003a) was based solely on the assumption that "When the oldest trees were the fire-susceptible species POTR, PIEN, or ABLA [i.e., quaking aspen, spruce, and subalpine fir], the plot was classified as fire-initiated". This assumption needs verification (for example, spruce and subalpine fir can regenerate below a canopy of quaking aspen). It also should be recognized that the percentage of fire-initiated mixed conifer stands in the landscape (20% or something less) was not the product of individual fires, but was the cumulative effect of many pre-1880 fires that molded the landscape. In short, uncritical reliance on and misunderstanding of Fule et al. (2003a) led in part to misinterpretation of fire regime reference	• *Species mentioned in the comment, including PIEN (Engelmann spruce), ABLA (subalpine fir), and POTR (aspen), are considered spruce-fir forest rather than mixed-conifer forest in the EIS. Topography, edaphic conditions, climate conditions, and fuels condition all influence fire behavior across a landscape or in a stand or vegetation patch even with stand-replacement fire conditions. Vegetation survivors in high burn severity polygons do not necessarily indicate burn severity classification should be moved from high to moderate or low. To clarify scientific literature use such as Fulé et al (2003a), Grand Canyon assessed applicable scientific literature as a whole to provide EIS descriptions. This literature, combined with on-site data collection, current vegetation and fuel conditions, and park management goals and objectives are the basis for interpretation and application of "best available science."* • *The EIS describes not only Fulé's work but other work as well to describe a range of stand densities with the final statement: "The 1935 survey may indicate there were park areas with densities greater than reported by Lang and Stewart (1910) or reconstructed by Fulé et al. (2003, 2004). These plots indicate GRCA landscape pattern heterogeneity" (last paragraph before 2.4.2.2). The EIS covers a variety of information from low to high density from multiple sources to give a description of reference conditions.*

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Reference Conditions	
conditions in GRCA's mixed conifer forest. Uncritical consideration of other methods of Fule et al. (2003a) also led the DEIS to incorrect conclusions in Section 2.4.2.1 Reference Conditions. The DEIS cites Fule et al. (2003a) for the statement that "Research also indicated that past forests were less dense and had lower basal area than contemporary forests" and that "[t}otal tree densities ranged from 150 to 337 trees/ha." However, as described in B.4 above, Fule et al. (2003a) used forest reconstruction techniques to attempt to determine tree densities and basal areas present in 1880; however, reconstruction of these values in mixed conifer forest is likely inaccurate. Fule et al. (2003a) stated that "...reconstructions are reliable..."only if dead tree evidence is present on the site ..." The problem is that not all 1880 trees >I inch diameter are present, alive or dead, 123 years later. The original text provided the DEIS interdisciplinary team included the following precaution regarding forest reconstruction: "...the accuracy of reconstructed values is uncertain in Mixed Conifer Forest, where evidence of 19th century trees may be lacking because of decomposition with moist conditions"; however, this was eliminated from the DEIS and values reported by Fule et al. (2003a) were accepted uncritically. (Inaccuracy of the density values reported by Fule et al. (2003a) is apparent when they are converted to the average area occupied per tree of 18 X 18 feet to 27 X 27 feet -and it applies to trees as small as I-inch diameter, in a forest with no evidence of landscape-scale crown fire in the years shortly before 1880.)	
Perhaps most critically, Section 2.4.2.1 Reference Conditions lacks description of the small-scale vegetation mosaic that evidence indicates characterized reference conditions of GRCA's mixed conifer landscape. While this is described at the beginning of Section 2.4.2.2 Existing Conditions, it is a critical part of reference conditions and should have been included in Section 2.4.2.1 to have been recognized as such. Any description of the fire regime of reference conditions should note that nearly all fires were only surface fires and likely only in the driest years did individual fires have both a surface and crown fire component. Therefore, fires were likely of mixed severity primarily in a temporal sense, not always in a spatial sense. In contrast to reference conditions, the DEIS attempts to justify all fires being of mixed severity in a spatial sense. An essential aspect of the fire regime of reference conditions that is not addressed anywhere in these	• *The reference conditions description includes general information about the landscape, and did not go into further detail. The mixed-conifer existing conditions description does go into greater detail as GRCA determined the importance of these details were greater because they were considered during development of alternatives, mitigations, and fire effects modeling. The first sentence of 2.4.2.1 states that mixed-conifer vegetation experiences frequent surface fires. The park agrees that the fire regime in mixed-conifer is mixed severity. Stand-replacing fire patches size was not part of reference conditions but is part of the vegetation description in 3.1.1.3. Desired conditions include maintaining a mixed-severity fire regime, restoring topographic heterogeneity of vegetation types, and limiting high severity patch size.*

Comment	Response
Reference Conditions	
sections on mixed conifer forest is information on the size of patches of stand-replacing fire. As indicated in the draft provided the interdisciplinary team, Fule et al. (2003b) wrote that "no large patches (>I-2 ha) that might have originated from stand- replacing fires" were observed in their study area of GRCA mixed conifer forest.	
Section 2.4.2.2. Current Conditions clearly indicates how misleading statements, errors, misinterpretations, and omissions in the previous section on reference conditions led to misconceptions regarding current conditions. Here are examples: a. The second paragraph of this section utilizes erroneous reconstructed values for density and basal area as a touchstone for comparison of current conditions. b. A relatively minor error, but one that is indicative of problems with the section on mixed conifer forest is that Fule et al. (2004) is again mis-cited as a source of data on tree densities. c. Paragraphs 3 and 4 misrepresent the situation regarding fire impacts on Grand Canyon mixed conifer forest by (1) ignoring fire effects on the vegetation mosaic described at the beginning of this section and (2) under-reporting the effects of landscape-scale crown fires such as the Outlet Fire. The DEIS states, "In some mixed-conifer stands, resulting fire effects will mimic historic fire effects through fire-initiated stands." Evidence indicates that this is incorrect, as recent fires have produced patches of stand-replacing fire that far exceed the -4-2 ha patch size documented by Fule et al. (2003b). The original draft provided for the DEIS indicated that 85% of the patches of stand-replacing fire in the Outlet Fire were >2 ha and that "A single patch covering 13 km2 accounted for 69% of the area burned by crown fire" in the Outlet Fire." This "current and best-available" science is ignored by the statement in the DEIS that "The 2000 North Rim Outlet Fire has a range of effects ..." The key point is that overall percentages of different fire severities do not reflect the fact that recent fires (also including the Poplar Fire in GRCA and the Warm Fire in adjacent Kaibab National Forest) homogenize what once had been complex small-scale mosaic landscapes (White and Vankat 1993, Fule et al. 2003b).	• *Outlet Fire severity data is discussed in 2.4.2.2, and in Tables 4-4, 4-6, 4-8, 4-10, and data emphasis is same for percent of low and high severity fire. GRCA never suggests the effects of the Outlet Fire are part of desired conditions. Desired conditions include maintaining a mixed-severity fire regime, restoring vegetation type topographic heterogeneity, and limiting high severity patch size. GRCA believes the best available information was used for this analysis, and the description of existing conditions is unbiased and not misleading.*
Pinyon-Juniper vegetation. 1. The third sentence in Section 2.4.1 Reference Conditions is an incorrect, misleading revision of what was provided in the first draft of the vegetation portions of Chapter 3. The accurate statement as submitted was "Another review hypothesized that different fire regimes occurred in the three Pinon-Juniper subtypes: frequent surface fire carried	• *A detailed account of this review that includes points listed in the comment is provided in 3.1.1.5. The sentence in 2.4.4.1 has been changed to provide a clearer summary of information.*

Comment	Response
Reference Conditions	
by grasses in grass savanna, moderately frequent crown fires carried by shrubs and trees in shrub woodland, and very infrequent crown fires carried by trees in forest (Romme et al. 2003)."	
Ponderosa pine forest. 1. Section 2.4.3.1 Reference Conditions inappropriately includes information from Fule et al. (2002b). This source is inappropriate because it considered only small ponderosa pine patches in a high-elevation landscape dominated by spruce-fir vegetation, not the landscapes of ponderosa pine forest at lower elevation that is the subject of Section 2.4.3.	• *The correct references that were used in the analysis are Fulé et al 2002a, Fulé et al 2003b, NPS 2000. The last sentence that includes the reference material from Fulé 2002b was removed. It was not used in determining the desired conditions.*
Ponderosa Pine This section on reference conditions should include the critically important point that the historic fire regime produced only very small patches of stand- replacing fire, limited to <2 hectares, according to Fule et al. (2003b).	• *2.4.3.1 states that ponderosa pine habitat indicated this ecosystem was maintained by frequent low-intensity fires that burned across the landscape. The section continues to discuss that large surface fire have occurred since European settlement 2.4.3.3 also states that "Rare stand-replacing fires generally occur in small patches".*
Ponderosa Pine Section 2.4.3.2 Existing Conditions inappropriately includes information from Swamp Ridge, which is an area of mixed conifer forest.	• *The information about ponderosa pine density averages in 2.4.3.2 was used to assist the interdisciplinary team with the development of desired conditions for ponderosa pine. This information helped determine the desired ponderosa pine densities for the landscape in upper elevation forests on the North Rim. This information also helps describe the North Rim landscape in which ponderosa pine is a dominant species, but there is no pure ponderosa pine forest. The dominant overstory species in the Swamp Ridge area is ponderosa pine and the park used this data because of the dominance of the ponderosa pine in the overstory. The Swamp Ridge area has experienced several large fires since 2000 and the fire effects data shows increases in ponderosa pine density percentages and the reduction of fir encroachment.*
Uncritical consideration of other methods of Fule et al. (2003a) also led the DEIS to incorrect conclusions in Section 2.4.1.2 Existing Conditions. The DEIS cites Fule et al. (2003a) for the statement that "...past forests were significantly less dense with significantly lower basal area than contemporary forests." Fule et al. (2003a) used forest reconstruction techniques to attempt to determine tree densities and basal areas present in 1880; however, reconstruction of these values in spruce-fir forest is inherently inaccurate. FuIe et al. (2003a) stated that "...reconstructions are reliable ..."only if dead tree evidence is present on the site. The problem is that not all 1880 trees >I inch diameter are present, alive or dead, 123 years later. The original text	• *The information discussed in 2.4.1.2 is from a peer-reviewed periodical. All peer-reviewed periodicals are open for interpretation. However the park chose to provide the information from the article.*

Comment	Response
Reference Conditions	
provided the DEIS interdisciplinary team included the following precaution regarding forest reconstruction: "...the accuracy of reconstructed values is uncertain in Spruce-Fir Forest, where evidence of 1880 trees may be lost because of decomposition with moist conditions"; however, this was eliminated from the DEIS and values reported by Fule et al. (2003a) were accepted uncritically. (Inaccuracy of the density values reported by Fule et al. (2003a) is apparent when they are converted to an average area occupied per tree of 27 X 27 feet -and it applies to trees as small as I-inch diameter, in a forest with no evidence of landscape-scale crown fire in the years shortly before 1880.)	
The DEIS, especially in Chapter 4, generally fails to describe the current risk of landscape-scale crown fires in GRCA's spruce-fir forest. The DElS should explicitly acknowledge that remnants of the topographic diversity that was an important aspect of reference conditions are still evident in the unburned parts of the landscape. It should also state that these remnant conditions are at risk (as stated in the draft provided the interdisciplinary team, that "...conditions for the crowning component of the mixed-severity fire regime have increased across landscapes, and fires in Spruce-Fir Forest now have greater potential to become landscape-scale crown fires dissimilar to the formerly patchy mixed-severity fires (White and Vankat 1993, Fule et al. 2003a)"). Therefore, while future fires will result in a range of severities on the landscape, it will be in a pattern far different from the Historic (Natural) Range of Variation. In contrast to what is concluded in Chapter 4 Environmental Consequences, loss of these remnant reference conditions through landscape-scale crown fires, all of which began as either prescribed or wildland fire-use fires, is impairment of GRCA resources	• *The park believes that the description of the expected fire behavior in the spruce-fir forest is accurate. Topographic diversity will continue to contribute to on-site vegetation diversity and resulting fire effects. The combination of modeling from FARSITE and FLAMAP and the information in 2.4.1.2 describe that the spruce-fir and the expected fire behavior is diverse in forest structure and fire intensity.* • *2.4.1.2 describes the existing conditions and explains the increase in density that would create different fire behavior and effect than what was experienced historically. The section also describes the forest conditions as within "the natural range of variation". The referenced material used to develop section 2.4.1.2 do not state that the fire severities will be in a pattern "far different" than what occurred historically. Please see text below taken directly out of 2.4.1.2.* • *"Fulé et al. (2003a) indicated that past forests were significantly less dense with significantly lower basal area than contemporary forests. Translating this stand density to fuel characteristics changes expectations for resulting fire behavior and post-fire effects. Some current spruce-fir stands are decadent with a growing fuel ladder understory of fir and spruce. These stands are not likely to support running crown fire. Passive crown fire will occur, but higher dead-and-down fuel loading will cause additional post-fire mortality through tree bole girdling. In some spruce-fir stands, resulting fire effects from passive crown fire and additional mortality from tree girdling will mimic historic fire effects through fire-initiated stands. In spruce-fir stands with full tree crowns and less understory tree ladder fuels from younger age class trees, running crown fire will only be supported in high to extreme conditions such as 97th percentile weather. It is expected that more*

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Reference Conditions	
	surface fire will be sustained, burning dead-and-down fuels. Some tree mortality will occur from girdling caused by fire burning understory duff and litter." • *"Various authors have suggested that current structure and composition of Southwest spruce-fir forests are in the natural range of variation present before Euro-American influence. They reasoned that, 1) the fire exclusion period has been shorter than fire intervals for a presumed crown-fire regime (White and Vankat 1993, Dahms and Geils 1997, Laughlin et al. 2005), and 2) stands may have been little affected by historic livestock grazing (Dahms and Geils 1997). Wherever fire exclusion was effective, there would be fewer early successional stands, shifts toward Engelmann spruce and subalpine fir in aspen stands (Moir 1993), greater fuel loads (Fulé et al. 2004), and increased landscape homogeneity (White and Vankat 1993, Fulé et al. 2003a). However, for the surface/passive crown fire portion of this mixed-severity fire regime, evidence indicates fire suppression has been effective, promoting dead-and-down fuels build-up and live ladder fuels."* • *2.4.1.3 describes desired conditions and does not state the desire to mimic historic fire effects. This section considers the current stand structure and the suppression of past naturally ignited fire, possible future climate changes, possible future management changes, and possible future fire management constraints and opportunities like changes to air quality regulations .* • *4.1.2.7 of the Grand Canyon Fire Management EIS contains a discussion of the requirements of an impairment analysis. An impairment decision was made for applicable impact topics for each alternative (Chapter 4). The impairment determinations presented in the EIS indicate that no impairment of park resources or values is expected to occur from activities associated with the fire management program under any of the alternatives. In addition, the monitoring and implementation plan will determine and implement measures required to reduce impacts.*

Comment	Response
Desired Conditions	
Alternative 1 plans to treat 57% of the mixed-conifer vegetation during the planning period. Under this alternative the Park Service plans to treat the 42% designated with a high level of departure from the natural fire regime with prescribed fire. In addition 20% of the wildland fire use acres are expected to occur in this habitat type. While we are very supportive of NPS efforts to develop new prescribed fire prescriptions for mixed-conifer, based on achieving variable spatial patterns, it is unclear if the current desired condition definition can be the basis for these actions. Our concerns and comments regarding mixed-conifer expressed elsewhere in this document, apply to all of the alternatives.	• *GRCA developed desired conditions for all forest types, then developed a reasonable range of alternatives. During analysis of alternatives, it became clear that Alternative 1 would not take the park toward the defined desired conditions for some forest types, not because of the acreage treated, but due to limitation of a mixed-severity fire. Alternative 1 has severity limitations, and does not allow for a mixed-severity fire regime which occurred historically in mixed-conifer. Part of the vegetation analysis shows this alternative will not move these forests toward those defined desired conditions, and thus it was determined that adverse affects would occur. Defined desired conditions were used to help determine and define impact thresholds for vegetation (4.2.1.4)*
The desired condition statement for mixed-conifer forests in the DEIS starts out describing how fire will behave given current forest conditions, as opposed to the forest structure and ecosystem functions that the Park Service hopes to achieve. Then the desired condition evolves into a fairly specific description of stand structure, with a goal of reducing tree densities "by smaller size classes and tree species". As we stated in comments on spruce-fir, structural stage data needs to be displayed in a comprehensive and easy to use manner. When the data is scatter throughout the document, with multiple citations, the NPS needs to be very clear as to how these specific desired condition ranges were determined. The range of tree densities for the desired condition statement in the DEIS (shown below), does not relate to the densities discussed in the historic condition. At this point we cannot offer specific comments on contradictory and overlapping numbers. For Example: Park Service Approximate Desired Condition for Mixed-Conifer: "Maintain approximately 18.4 to 24 trees per acre (tpa) of 16+inch dbh size classes of ponderosa pine. (This was displayed as inches and acres in the DEIS) "Tree densities greater than 31 cm (12.2 inches) dbh should range from 54 to 105 trees/ha (22 to 42 tpa). We assume that this number would also include the larger diameter trees stated for the first bullet point. How do these two desired conditions relate to each other? "Trees greater than 24.4 inches dbh should be maintained at 6.4 to 12.8 tpa. How does this desired condition relate to the tree densities in the previous two bullet points? We support the goal of reducing small diameter trees that have increased due to disruption of the natural fire regime, as well as seeking to	• *The first part of the second paragraph of mixed-conifer desired conditions (2.4.2.3) describes current structure, so that section was moved to existing conditions (2.4.2.2). The second paragraph of spruce-fir desired conditions (2.4.1.3) describes current structure, so that section was also moved to existing conditions (2.4.1.2). The description of the specific desired stand structure came from several different sources. The intent of the desired stand structure is not to replicate historic stand structure. MSO critical habitat components, historic stand structure data, and professional judgment by an interdisciplinary team were used to come up with specific desired stand structure information. GRCA will keep these numbers consistent, and has added measurements in metric as well in 2.4.2.3. The intent of overlapping numbers in bulleted statements was to emphasize that, of the 54-105 trees/ha, 46-60 trees/ha are of the larger size class. The fire management program has and will continue to look at past burns to determine what tools and tactics were successful in moving toward desired conditions. See 2.6.4 for new adaptive management information.*

Comment	Response
Desired Conditions	
restore topographic heterogeneity. The DEIS needs to use data from past and current burns to determine what specific fire tools can be used to achieve this goal and how successful past attempts have been.	
Section 2.4.1.3 Desired Conditions includes the statement: "Return stand-replacing fire event characteristics to the range described in reference conditions." …the role of stand- replacing fire is incorrectly described in the section on Reference Conditions. Adoption of the DEIS would lead to excessive stand-replacing fire, which would result in impairment of GRCA's spruce-fir forest.	• *The park does not believe there is an over-emphasis of stand-replacement fire regime as references to a mixed severity fire regime in the first and third paragraphs in section 2.4.1.1. The desired conditions listed in 2.4.1.3 also list both stand-replacement fire regime and a mixed severity fire regime.* • *4.1.2.7 contains a discussion of impairment analysis requirements. An impairment decision was made for applicable impact topics for each alternative (Chapter 4). Impairment determinations presented in the EIS indicate no impairment of park resources or values is expected from activities associated with fire management program under any of the alternatives. In addition, the monitoring and implementation plan will determine and implement measures required to reduce impacts.*

Comment	Response
Fire Severity	
The DEIS must review past mistakes, such as high mortality and crown fire in previous burns, and discuss how such high mortality might be avoided in the future.	• *The fire management program consistently performs an After-Action Review for each fire event. This review informs the park what types of methods or tools were effective, and where improvements can be made for future fire activities. This is part of the adaptive management process that occurred recently and will continue into the future. New information has been added to 2.6.4 Adaptive Management. Also see revised mitigation measure for mixed-conifer in 2.9.1.* • *The park considers canopy loss part of a mixed-severity fire regime. See 2.4.1.1 and 2.4.2.1 for information about fire regimes.*
"The No Action Alternative assumes a similar or slightly higher level of suppression would occur as occurred 1993-2005" (DEIS Ch.2-39). "Alternative 2, Mixed Fire, assumes a similar or slightly higher level of suppression would occur through the life of the plan as occurred 1993-2005" (DEIS Ch.2-42). Though a larger portion of the Wildland-Urban Interface (WUI) area will be mechanically treated, the WUI is a very small percentage of the park (1.22% WUI and 1.27% Secondary WUI, Pg. 2-33) and thus a very small part of the overall management plan. The critical difference	• *The NPS believes that data from the FLAMAP model (Tables F-5, F-6), reference conditions for spruce-fir and mixed-conifer forests (2.4.1.1, 2.4.2.1), current conditions (2.4.1.2, 2.4.2.2) , and their susceptibility to passive and active crown fires, past fire history data from recent fires in mixed-conifer fuel type (Table 4-6 and 4-8), and current levels of departure of historic fire regime (Figure 4-2) provide justification for greater fire severities.* • *GRCA has never implemented a prescribed fire in spruce-fir forests to date,*

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between Alternative 1 and Alternative 2 is that the Preferred Alternative will widen the range of severity and allow for higher fire severity. The DEIS does not provide the necessary justification for the greater fire severities, however. The current approach to mixed-conifer and spruce-fir has not been successful, yet there is little difference between current efforts and the proposed "Preferred" alternative. In fact, the "Preferred" alternative intensifies the same treatments in these habitat types and could mean that this plan exacerbates problems including high mortality in these ecosystems.	*but has managed a small number of acres under a wildland fire-use strategy. Goals of prescribed fire and wildland fire-use in spruce-fir are to move those forests closer to a defined desired condition described in 2.4.1.3 (a mixed-severity fire regime). The rest of the fire history has been from wildfire, so implementation of prescribed fire in spruce-fir is a new approach. With addition of a prescribed fire program in mixed-conifer, GRCA believes the preferred alternative allows for a mixed severity fire regime. The fire management program consistently performs an After-Action Review for each fire event. This review informs GRCA on what types of methods or tools were effective, and where improvements can be made for future fire activities. This is part of the adaptive management process occurring recently, and will continue into the future. See 2.6.4.*
When considering how these diverse studies have been used to determine reference conditions it would be useful to know how the NPS is defining stand size and characteristics when discussing stand replacing events. The definition on page 6 of the glossary only refers to the total consumption of vegetation related to fire intensity. Typically both moderate and high severity fire in spruce-fir and mixed-conifer are considered stand replacing events because of the high percentage of canopy loss. Given the lack of structural stage data displayed in this section of the DEIS, it is difficult to determine how the stated desired conditions will affect on-the-ground conditions.	• *Lack of* stand *structure data included in use of the term* stand-replacing *has caused some confusion, but the term* stand-replacement fire *is an accepted term in the firefighting community. GRCA will look at Composite Burn Index (CBI) burn severity data and use this data to develop several mitigations including limit of high and moderate/high severity fire in the mixed-conifer forest type. For the mixed-conifer forest type, desired conditions include stand structure targets (2.4.2.3) intended to give an indication of projected on-the-ground conditions. For the spruce-fir forest type, reference conditions indicate as much as 71% of the current forest may have been fire-initiated. Given this, the expectation is that portions of the spruce-fir forest could enter early successional stages consisting of aspen and/or shrubs in the years immediately following higher severity fire events.*
Given classification difficulties and the lack of evidence revealing "large" areas of fire-originated trees, it is hard to understand how Fulé's research on the North Rim can then be used to create a fire management plan that calls for a 30% rate of mortality from high severity fire.	• *Overall, fire effects under most weather conditions would result in a patchy or complex spatial fire behavior and severity pattern which would result in a beneficial trend toward the natural range of variability. Under high and very high weather conditions, there is a moderate to high level of uncertainty whether fire patterns would be within, or trend toward, the natural range of variability. It is likely that some fires did burn under very high weather conditions in the spruce-fir type. The patchier nature of most fires and relatively longer fire free intervals on at least more mesic slopes would lead to larger patches of high severity fire during very high weather conditions, similar to what researchers (Fulé et al. 2003a) surmised from park fire history and vegetation reconstructions. Due to uncertainties about how large these fire patches may have been, GRCA did not call for any rate of*

Comment	Response
Fire Severity	
	mortality. This is clear in the desired conditions description for the spruce-fir forest type and Effects Common to all Alternatives, Vegetation, Spruce-Fir, Chapter 4. • *The 30% mitigation measure came from reference conditions (20% in mixed-conifer), fire suppression in the last 100 years, recent past fire histories and fire severity, and general fuels and forest conditions which gave GRCA the background needed to create a mitigation measure to reduce adverse impacts, but still manage fire as an ecosystem process in mixed-conifer.*
A high percentage of fire-initiated plots only indicate that the forest structure in those plots was created by a high intensity fire event. Alone, it does not indicate the size or percentage of mortality as it relates to the overall ecosystem component, of these "stand replacing" events.	• *Fire-initiated plots indicate there was high intensity fire historically, and although fire sizes may not be available, it's the best information available. Spruce-fir assessment was done qualitatively due to lack of data both historically and currently (recent fire history). This qualitative assessment does not analyze not predict size of high intensity fires.*
Effects common to all alternatives-Ponderosa Pine The DEIS notes that severity mapping commenced in 2000. These data are broken down by vegetation type as displayed in this section of the effects analysis. Once again, we must ask how this section of the DEIS relates to the data limitations discussed on page 4-16. The statements made in the second paragraph of 4-16 seem to contradict the availability of the data displayed and conclusions drawn in pages 4-17 thru 4-24, at least for later years.	• *Data limitations discussed in 4.2.1.9, Fire Effects Monitoring Data, pertain specifically to long-term permanent forest plot monitoring (which began in 1990). These plots are stratified by pre-fire vegetation type, and analysis is conducted on a landscape scale without regard to burn severity. Since GRCA cannot predict burn severity at the plot scale prior to fire, we cannot obtain sufficient sample size at all severity levels to stratify long-term plot data by severity type. Tables 4-4, 4-6, 4-8, and 4-10 are based on a complementary monitoring strategy (which began in 2000) in which GRCA uses a combination of remote sensing imagery and temporary field plots to assess severity in burn units. Data limitations discussed in 4.2.1.9, Fire Effects Monitoring Data, do not apply to this complementary monitoring strategy.*
The DEIS states that severity mapping (since 2000) indicates that most fires in ponderosa pine result in less than 20% moderate/high or high severity impacts. This 20% number is stated to refer to the individual incidents in Table 4-4. While very informative, the DEIS needs to go on to display the cumulative percentage projected by habitat type for each alternative and what percentage of habitat in the park each action represents and impacts. This is especially important given that moderate/high or high severity categories can result in greater than 80% overstory tree mortality.	• *In Chapter 4, new cumulative effects analysis has been added to the vegetation section for environmental consequences for each alternative. Past and proposed fire severities have been analyzed in the cumulative effects section for each vegetation type for each alternative.*
An inconsistency in numbers relating to fire severity in mixed-conifer prompts a question. The desired condition statement for mixed-conifer states that, "Research suggests lower elevation mixed-conifer forests on the	• *Thank you for finding this discrepancy in percentage of historical severity data. The 30% reference has been deleted, and the Fulé et al 2003a information as it appears in 2.4.2.1, has been inserted, which states*

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North Rim experienced frequent surface fires. At higher elevations research shows a mix of about 20% fire initiated mixed-conifer stands (indicative of stand replacing events fire events), and about 80% non-fire-initiated stands." Page 4-34 states that the historic mixed-severity fire pattern for this habitat type would result in 30% of the area burning at high severity over the long term. It is unclear where the increase from 20% to 30% occurred in the analysis. Given the vegetation impact definitions of high severity, we have to assume that the 30% number also refers to stand replacing events.	*"research shows a mix of about 20% fire initiated mixed conifer stands (indicative of stand-replacing fire events)."* • *The park decided the following items justified both the need for the acceptance of higher severity limitation (30%) and why the current program limitations on severity are insufficient* o *severity data from past fires in the mixed conifer forest* o *FLAM Map modeling of fire types under current conditions* o *GRCA employees knowledge of forest conditions, fuels, and wildland fires on the North Rim* o *fire suppression experience in similar fuels in the west*
In the case of Alternative 1, the only proposed project encompasses 19% of the spruce-fire vegetation type. The prescription for all alternatives predicts high to moderate/high severity levels at 40% for prescribed and wildland fire use fires. Under all of the alternatives, nearly 1/5th of the spruce-fir habitat in the park could have canopy mortality greater than 80%. To determine the significance of this action the public would need to know the total percentages of existing canopy loss due to fire, insects or other pathogens. The effects analysis on page 4-38 simply states that the , "Effect would be beneficial, minor and local since only a small portion of the type would be treated (19%)."	• *Since there are no past data on fire-use fires in spruce-fir, effects of potential fire-use fires were determined qualitatively. There were quantitative acreage estimates of fire-use fires in ponderosa pine and mixed-conifer developed because there is a history of past wildland fire-use fires. Since no acres of wildland fire use have occurred in the past, there is an assumption that very little wildland fire use may occur in the future.*
It is also difficult to discern why the NPS is proposing to remove the low intensity fire requirement in the Spruce-Fir habitat type when Figure 4-2 on page 4-9 indicates that only 1% of the Spruce-Fir habitat departs from the Historic Fire Regime in the high intensity area. We did not see a justification for this in the DEIS.	• *The five levels (high, moderate/high, moderate, low/moderate, and low) in Figure 4-2 are not associated with severity. The five levels are associated with level of departure from historic fire regime. This figure reveals only 1% of spruce-fir at a high level of departure from its historic fire regime; the other 99% is at a moderate to low level of departure. Reference conditions listed in 2.4.1.1 suggest spruce-fir forests formerly burned as infrequent stand-replacing fire, and more frequent, less severe ground fires. Since most of the spruce-fir is at a moderate to low level of departure, and the historic fire regime is a mix of severities, managing this forest only for low severity fire effects does not maintain or move this forest type toward desired conditions. We acknowledge that very similar terms are used for severity and departure from historic fire regime; therefore, please recognize that special attention should be given when discerning the information.*
The conclusion on page 4-21, next to last paragraph, last three lines that future mixed-severity fires will "trend toward natural range of variability" is unfounded, because it ignores the history that prescribed and wildland fire-	• *Analysis of all records pertaining to Grand Canyon National Park fires show that the Outlet Fire of 2000 is considered a data outlier within the data*

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use fires in Grand Canyon's mixed conifer forest have led to suppression fires with patch sizes much greater than the 2 hectare historic limit. How can a patch size of 13 km^2, such as occurred in the Outlet Fire, be considered a "trend toward natural range of variability" in a landscape formerly characterized by a topographically determined, small-scale vegetation mosaic? Again, because this major error occurs in a section on Effects Common to All Alternatives, it is a fatal flaw in the analysis of Environmental Consequences of the DEIS, because errors such as this can lead to major errors in evaluating alternatives, especially Alternatives 2-5 that permit high percentages of stand-replacing fire in GRCA's mixed conifer forest. Acceptance of this incorrect view of the natural range of variability in mixed conifer forest will lead to impairment of Park resources In the same paragraph, the DEIS states "...the majority of fires in mixed-conifer vegetation type are thought to be mixed ..." This is incorrect, because the majority of fires are thought to have been surface fires ...4-22...Statements that these landscape-scale fires and future similar fires are "at the high end of natural range of for mixed-conifer vegetation" is contradicted by data, as indicated above.	*set because of the extreme weather conditions that occurred during that fire. However, Fulé states that "post-fire distribution of burn severities appears similar to the distribution of fire-initiated/non-fire-initiated groups at Little Park in 1879, suggesting that fires similar to the Outlet fire are not unprecedented in the high-elevation forest." Fulé goes on to state that "the high severity burning in the Outlet fire was concentrated in the center of the wind-driven burn area (Bertolette and Spotskey 2001), in contrast to the highly mixed spatial pattern of fire-initiated/non-fire initiated groups at Little Park" (Fulé et al 2003). Park fire management history over-the past ten years does not indicate unacceptable impacts to park resources (evaluated through on-site data collection and evaluation), but rather that park management acted appropriately to protect park and neighboring values at risk under conditions occurring at the time of the fire incident. The purpose of the EIS was to evaluate the consequences management proposals could have on park resources and adjacent at-risk values using current fuel conditions combined with existing constraints, resource availability, and technology. The park maintains that current alternatives are most realistic and have the best opportunity to preserve the park's resources unimpaired.* • *The park asserts that mixed fire severity descriptions of historic fire in mixed conifer are accurate. Fulé et al 2003 states "surface fires were common from 1700 to 1879 in the 4,400 ha site, especially on south and west aspects. Fire dates frequently coincided with fire dates measured at study sites at lower elevation, suggesting that pre-1880 fire sizes may have been very large. Large fires, those scarring 25% or more of the sample trees, were relatively infrequent, averaging 31 years between burns. Four of the five major regional fire years occurred in the 1700s, followed by a 94-year gap until 1879. Fires typically occurred in significantly dry years (Palmer Drought Stress Index), with severe drought in major regional fire years. Currently the forest is predominantly spruce-fir, mixed conifer, and aspen. In contrast, dendroecological reconstruction of past forest structure showed that the forest in 1880 was very open, corresponding closely with historical (1910) accounts of severe fires leaving partially denuded landscapes. Age structure and species composition were used to classify sampling points into fire-initiated and non-fire-initiated groups. Tree groups on nearly 60% of the plots were fire-initiated; the oldest such groups appeared to have originated after severe fires in 1782 or 1785. In 1880, all fire-initiated groups were less*

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	than 100 years old and nearly 25% of the groups were less than 20 years old. Non fire-initiated groups were significantly older (oldest 262 years in 1880), dominated by ponderosa pine, Douglas-fir, or white fir, and occurred preferentially on south and west slopes. The mixed-severity fire regime, transitioning from lower-elevation surface fires to mixed surface and stand-replacing fire at higher elevations, appeared not to have been stable over the temporal and spatial scales of this study. Information about historical fire regime and forest structure is valuable for managers but the information is probably less specific and stable for high-elevation forests than for low-elevation ponderosa pine forest." With current forest and fuel conditions the park cannot reasonably manage for historic fire regimes. Existing conditions will dictate burn severity and resulting vegetation response. • *Data interpretation included on-site evaluation, data analysis, literature review, and subject matter expertise in fire management options and resulted in the statement that the landscape-scale fires and future similar fires are "at the high end of natural range for mixed conifer vegetation". The park is sufficiently convinced that this interpretation is currently the best one available.* • *4.1.2.7 of the Grand Canyon Fire Management Plan EIS contains a discussion of the requirements of an impairment analysis. An impairment decision was made for applicable impact topics for each alternative (Chapter 4). The impairment determinations presented in the EIS indicate that no impairment of park resources or values is expected to occur from activities associated with the fire management program under any of the alternatives. In addition, the monitoring and implementation plan will determine and implement measures required to reduce impacts.*
The statement that "...recent wildland fire-use fires in this vegetation show they are either within or at the high end of the natural range of variability for a mixed severity regime in proportion of area burned at different severity levels" appears to be based on the sentence that follows and cites sources for the Pacific Northwest and California. While these areas have mixed conifer forests, they are different in species, climate, landforms, etc. from GRCA mixed conifer forests and should not be used as models for a GRCA Fire Management Plan -DEIS. In the case of different ecosystems, one size of fire severity does NOT fit all, and this critical aspect of the DEIS is yet another clear case where "current and best-available information" was not used. This	• *The reference described below has been deleted but this has not changed the discussions on the natural range of variability in the EIS or the analysis.* • *Paragraph has been changed in the FEIS to read:* *"Reductions in surface fuels, in combination with decreased tree density, particularly in the understory, indicate fire would be less intense and more like historic patterns in treated areas. There would be a beneficial effect of prescribed and wildland fire-use fires on fuels in the mixed-conifer vegetation type under most weather conditions. An exception would be at the 97th weather percentile. Under these conditions, fires would be more*

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misconstruing of the natural range of variability for fire, particularly stand-replacing fire, in GRCA's mixed conifer forest is repeated elsewhere (e.g., page 4-33, paragraph 2, lines 1-2; page 4-34, paragraph I, lines 1-2) and, if accepted, will lead to impairment of Park resources.	*intense, and fire effects more uniformly severe in previously untreated mixed-conifer forests. The number of days per year when these conditions would occur is limited to several days on average (Table 4-2); therefore, likelihood is not great. But fires have burned in mixed-conifer in these conditions previously, as when the Outlet prescribed fire was converted to a suppression fire and encompassed 1,960 acres of which 42% was high or moderate/high severity. On rare occasions when this might occur in previously untreated mixed-conifer stands, fire behavior and effects would be at the high end of the natural range of variability for mixed-conifer vegetation. Large patches of high or moderate/high severity may result and exceed sizes that would have occurred most often historically, because historically, forest structure was more of a mosaic of densities and areas of reduced fuel loads. Spatial complexity is less likely to be within or trend toward the natural range of variability from wildland fire-use fires that burn during 97th percentile weather conditions. Limited recent wildland fire-use fires in this vegetation show they are ~~either~~ ~~within or~~ at the high end of the natural range of variability for a mixed severity regime in proportion of area burned at different severity levels. ~~For mixed severity regimes it is assumed that high- and high/moderate severity area ranges from 30 to 70% of the area (Agee 1993, Sugihara et al. 2006).~~"* • *4.1.2.7 discusses impairment analysis requirements. An impairment decision was made for applicable impact topics for each alternative (Chapter 4). Impairment determinations presented in the EIS indicate that no impairment of park resources or values is expected from activities associated with the fire management program under any of the alternatives. In addition, the monitoring and implementation plan will determine and implement measures required to reduce impacts.*
Fire management will produce rotation periods for stand-replacing fire that will lead to impairment of at least mixed-conifer forest	• *GRCA added specific severity mitigation measures for the mixed-conifer fuel type that would not allow the fire program to exceed 30% high and moderate/high severity effects. This severity limit would mean the fire program would halt all future prescribed burns and future wildland fire-use fires. An aggressive fire suppression program would be the only option for future unplanned fire management. This mitigation would be in effect for the life of this planning document. 2.4.2.3 gives the park direction to, "Manage fuel loads to best influence mixed-severity fire regime and limit high-severity burned patch size."*

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	• *4.1.2.7 discusses impairment analysis requirements. An impairment decision was made for applicable impact topics for each alternative (Chapter 4). Impairment determinations presented in the EIS indicate that no impairment of park resources or values is expected from activities associated with the fire management program under any of the alternatives. In addition, the monitoring and implementation plan will determine and implement measures required to reduce impacts.*
The statement on page 4-20, paragraph 2, lines 2 and 3 that "Presently, an estimated 40% of mixed-conifer type is at low departure from historic fire return interval" would seem to be correct only if the large areas of recent landscape- scale crown fires are included as "low departure". However, these areas do not mimic historic fire patterns that had patchy mixed-severity affects correlated with topography and limiting patches of crown fire to <2 hectares. The statement on page 4-20, last three lines that levels of stand-replacing fire of 12 to 48% are "...within the range of variability of estimated historic distribution for fire severities in this vegetation type" is a untrue according to "current and best-available" science. Even the DEIS, in Section 2.4.2.1 Reference Conditions, implies that stand-replacing fire was about 20%, and the critique in C.2 above indicates that 20% is an over-estimate. This same error is repeated later in this paragraph. Because this major error occurs in a section on Effects Common to All Alternatives, it is a fatal flaw in the analysis of Environmental Consequences of the DEIS, because errors such as this can lead to major errors in evaluating alternatives, especially Alternatives 2-5 that permit high percentages of stand-replacing fire in GRCA's mixed conifer forest. Acceptance of this incorrect view of reference conditions will lead to impairment of Park resources.	• *GRCA objectives are designed to best meet many goals for resource protection and management. The goals and objectives outlined in the current FEIS are designed to allow for resilient forest stands under current conditions while practicing realistic fire management options. Current vegetation conditions and fuel loading indicate that patch sizes of moderate/high to high burn severity may be larger than occurred in the past. These vegetation conditions, combined with wilderness values, air quality values, and protection of values at risk all direct a best management scenario as outlined in the DEIS. The park is not "permitting" the high percentages of stand-replacing fire in the mixed-conifer forests, but rather trying to manage for many values given existing conditions and best available science. Including reference to conditions in the assessment of current landscape structure is a way to understand what appears on today's landscape and to try to articulate how processes and results may change that landscape under existing conditions. GRCA does not feel that a return to reference conditions is the best management option under current conditions and restraints. Given current conditions, constraints, resource availability, and technology the park maintains that current alternatives are most realistic and have the best opportunity to preserve park resources unimpaired.* • *See 4.2.1.10 Effects Common to all Alternatives, Mixed Conifer, Vegetation Composition Structure and Fuels.* • *4.1.2.7 of the Grand Canyon Fire Management Plan EIS contains a discussion of the requirements of an impairment analysis. An impairment decision was made for applicable impact topics for each alternative (Chapter 4). The impairment determinations presented in the EIS indicate that no impairment of park resources or values is expected to occur from activities associated with the fire management program under any of the*

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	alternatives. In addition, the monitoring and implementation plan will determine and implement measures required to reduce impacts.
Even more grievous than the statement described in the previous paragraph is what can only be described as a fabrication that "There is some evidence that extensive high severity fire may have occurred in some of the mixed-conifer type historically..." Note that no source for this is cited -for good reason, because there is no such scientific evidence from GRCA! In fact, all scientific evidence from across the Southwest is to the contrary, as stated in the DEIS itself on page 3-4, last paragraph, lines 1-2: "All studies in the Southwest indicate that crown fires were uncommon and patchy before Euro-American influence.' And again on page 3-5, first paragraph, lines 2-3: "In summary, all Southwest research has indicated that "extensive crown fires were rare to non-existent" prior to fire exclusion (Brown et al. 2001)." So while the DEIS may at times report the "current and best-available information" it doesn't always use it and puts GRCA resources at high risk of impairment.	• *The information is not a fabrication, it is referenced from Fulé et al. 2003a, and the reference is listed at the end of the sentence. This information, along with all other reference information, assisted with the impact analysis for all alternatives. Fulé et al. 2003a states "The Outlet fire, ignited in a prescribed burning operation on May 9, 2000 burned over 5,260 ha on Grand Canyon National and Kaibab National Forest lands SE of Little Park (Bertolette and Spotskey 2001). Within the park, approximately 30% of the fire area burned with low severity (tree scorching but no overstory mortality), 34% with moderate severity, 35% with high severity (complete overstory mortality), and less than 2% unburned (Bertolette and Spotskey 2001, and D. Bertolette, personal communication, 2002). The post fire distribution of burn severities appears similar to the distribution of fire-initiated/non-fire initiated groups of trees at Little Park in 1879, suggesting that fires similar to the Outlet fire are not unprecedented in the high-elevation forest." The same paper goes on to say "Severe burning is historically precedented in many of these forests. . ..."* • *4.1.2.7 of the Grand Canyon Fire Management Plan EIS contains a discussion of the requirements of an impairment analysis. An impairment decision was made for applicable impact topics for each alternative (Chapter 4). The impairment determinations presented in the EIS indicate that no impairment of park resources or values is expected to occur from activities associated with fire management program under any of the alternatives. In addition, the monitoring and implementation plan will determine and implement measures required to reduce impacts.*
The same paragraph includes yet another scientifically invalid statement on lines 14-15: "Historically, mixed conifer is thought to have had a mixed severity pattern, which means that over the long term, typically 30% or more of the area would burn at high severity." If this statement was true, why isn't it included in the description of historic conditions for mixed conifer? If this statement was true, why isn't it supported by data in Fule et al. (2003a) that suggest a value of 20% (which might be an overestimate).	• *Thank you for finding this typo in the percentage of historical severity data. We have deleted the 30% reference and inserted the (Fulé et al 2003a) information as it says on 2.4.2.1, which states that "research shows a mix of about 20% fire initiated mixed conifer stands (indicative of stand-replacing fire events)".* • *The park decided the following items justified both the need for the acceptance of higher severity limitation (30%) and why the current program limitations on severity are insufficient* ○ *severity data from past fires in the mixed conifer forest*

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	○ *FLAM Map modeling of fire types under current conditions* ○ *GRCA employees knowledge of forest conditions, fuels, and wildland fires on the North Rim* ○ *fire suppression experience in similar fuels in the west*
Page 4-35, paragraph 3 states "There would be a potential minor, adverse effect from suppression fires." This statement absurdly ignores impairment of Park resources. And if its effects were minor, why were great costs expended to suppress these fires? Suppression fires such as the Outlet and Poplar Fires in GRCA and the Warm Fire in adjacent Kaibab National Forest have dramatically changed enormous acreages from complex vegetation mosaics to homogeneous expanses that will not return to complex mosaics for more than a century, if at all.	• *The park looked at the conclusions for the effects of suppression fires on fire regime and fire behavior after the planning period. The park then compared intensity thresholds across all alternatives. (See 4.2.1.4 for impact thresholds for vegetation.) Alternatives 2, 4, and 5 all have moderate adverse impacts from suppression fires, and Alternative 3 has moderate to major adverse impacts. After further review, the park concluded that the adverse impacts from Alternative 1 should be in line with Alternatives 2, 4, and 5. This is due to the fact that Alternative 1 has similar impacts from suppression fires after the planning period. The intensity threshold for Alternative 1 was changed from minor to moderate. See first sentence after Figure 4-6 for the revision.* • *4.1.2.7 of the Grand Canyon Fire Management Plan EIS contains a discussion of the requirements of an impairment analysis. An impairment decision was made for applicable impact topics for each alternative (Chapter 4). The impairment determinations presented in the EIS indicate that no impairment of park resources or values is expected to occur from activities associated with the fire management program under any of the alternatives. In addition, the monitoring and implementation plan will determine and implement measures required to reduce impacts.*
I calculated rotation periods for stand-replacing fire for ponderosa pine, mixed conifer, and spruce-fir forests, as well as pinyon-juniper vegetation using data from the DEIS. Because the DElS does not include data on estimated annual area of stand-replacing fire by vegetation type, I made the assumption that past history of stand-replacing fires (as shown in Table 4-4 for ponderosa pine forest, for example) will continue in the future. This assumption is identical to that made by the DElS modelers, except that I assumed that the occurrence of stand- replacing fire due to prescribed fire in ponderosa pine and mixed-conifer forest would be switched due to fire management's shift in emphasis from ponderosa pine forest to mixed conifer forest. In my final calculation for each vegetation type, I took the area of that vegetation type that hasn't been burned in recent stand-replacing fires and divided it by the estimated annual area of stand- replacing fire in that vegetation type. I calculated rotation periods for two scenarios. In the basic	• *The park added specific severity mitigation measures for the mixed conifer fuel type that would not allow the fire program to exceed 30% high and moderate/high severity effects. This limit on the severity would mean that the fire program would halt all future prescribed burns and future wildland fire-use fires. An aggressive fire suppression program would be the only option for the management of future unplanned fires. This mitigation would be in effect for the life of this planning document. 2.4.2.3 gives the park direction to "Manage fuel loads to best influence mixed-severity fire regime and limit high-severity burned patch size".* • *There is only one planned ignition in the spruce-fir forest type and "Various authors have suggested that current structure and composition of Southwest spruce-fir forests are in the natural range of variation present before Euro-American influence. They reasoned that, 1) the fire exclusion period has*

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scenario, I used the percentage figures in the projected fire severity table for each vegetation type (e.g., Table 4-5 for the ponderosa pine forest). I also calculated a "worst-case" scenario, using the highest recorded percentages for stand-replacing fire in the one-year post-fire severity tables (e.g. Table 4-4). For each of these vegetation types, I divided its total area by its estimated annual area of stand-replacing fire. Here are the results (rotation periods are expressed in years): Scenario P:Pine Mixed Conifer Spruce-Fir PJ Basic 213 13 24 1007 "Worst-Case" 61 11 24 184 Recall that these rotation periods express the number of years required for stand-replacing fires to burn the entire area of the vegetation type. Therefore, because only 11-13 years would be required under this DElS for the compete loss of GRCA's mixed conifer forest to stand-replacing fires, it is clear that the alternatives in this DElS are likely to lead to impairment of this Park resource. Similarly, the risk of impairment of spruce-fir forest is very high and the risk of impairment of ponderosa pine forest under the "worst-case" scenario should be of grave concern to the National Park Service.	*been shorter than fire intervals for a presumed crown-fire regime (White and Vankat 1993, Dahms and Geils 1997, Laughlin et al. 2005), and 2) stands may have been little affected by historic livestock grazing (Dahms and Geils 1997)." The park believes unplanned ignitions that may occur in this forest type would be within the range of natural variability as the forests are within the natural range of variation as stated by several authors listed above. This information does not lead the park to believe that there will be major adverse impacts or impairment. The reason behind excluding all but one prescribed fire in the spruce-fir is to manage fire processes from unplanned ignitions. If there was concern that the forest structure was outside of its natural range of variation, then more prescribed fire or other fuel reduction projects would have been proposed. The current and best available research does not tell the park that the forests are outside their natural range of variation as stated above and in 2.4.1.2.* • *The commenter incorrectly assumes that park management would shift fire/fuels reduction emphasis from ponderosa pine vegetation type to mixed-conifer vegetation type. Although the park has proposed some projects in an effort to accomplish goals and objectives, it is inaccurate to assume that proposed projects in the mixed-conifer vegetation type will mirror the scope and frequency of project activity in the ponderosa pine vegetation type.* • *4.1.2.7 of the Grand Canyon Fire Management Plan EIS contains a discussion of the requirements of an impairment analysis. An impairment decision was made for applicable impact topics for each alternative (Chapter 4). The impairment determinations presented in the EIS indicate that no impairment of park resources or values is expected to occur from activities associated with fire management program under any of the alternatives. In addition, the monitoring and implementation plan will determine and implement measures required to reduce impacts.*

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In scoping comments, dated November 14, 2003, the Sierra Club encouraged the NPS to develop alternatives based on the absolute minimum intervention necessary to achieve reintroduction of natural process such as fire. This	• *GRCA recognizes current ecosystem structures and process have been altered to the point that fire might have to be used repeatedly; thus the park developed a prescribed fire schedule in those areas to start the process of*

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would mean the development of a fire policy that has a basis in ecosystem processes. We also noted that the fire management plan should recognize that ecosystem structures and processes have been altered to the point where fire might have to be used repeatedly in the same location before any historic fire behavior could be replicated. While the DEIS notes the idea of changed fire behavior and supports repeated burn cycles, the Desired Condition statements, the Alternatives and accompanying analysis still appear to hang on achieving a single historic condition.	*moving those forest types closer to defined desired conditions. These defined desired conditions are not an endpoint but a direction to move toward, and a reminder to use adaptive management and make changes when forests move away from desired conditions. GRCA feels moving toward desired conditions means the park can continue to minimize intervention, and focus more on ecosystem process and less on restoration of altered ecosystems. Some areas cannot be managed based on the absolute minimum intervention, but may take multiple treatments with prescribed fire and very careful wildfire management planning. These areas include untreated areas in mixed-conifer forests. Fire is the only tool available to park management for restoration of altered ecosystems in proposed wilderness on North Rim, so getting fire back into this forest will involve risk to firefighters and a threat to public safety and the resource. Risk to the resource means there may be some adverse impacts from fire reintroduction in such an altered system as the mixed-conifer. It should also be noted that areas that seem close to desired conditions do not have planned prescribed fires, and management of those areas is based in ecosystem processes with minimum intervention through wildland fire use.*
NEPA requires government agencies to create a reasonable range of alternatives. However, Alternatives 3, 4 and 5 are all entirely unrealistic and would obviously not be the preferred choice of fire managers. The presentation of these single tool alternatives and comparison with a radically different multi-treatment alternative is an unfair basis for comparison. What is needed is a variety of multi-treatment, ecosystem based alternatives. Moreover, in the DEIS the selection of Alternative 2 is certain since fire managers prefer to maximize the "number of tools in the toolbox." It is just as certain that NPS fire managers would not chose an alternative that allowed the utilization of only one of those tools. Therefore, alternatives 3-5 are not truly viable alternatives.	• *The NPS believes the five alternatives are all reasonable and viable, and that each has beneficial and adverse impacts. Alternatives 3, 5, and 2 were selected by the interdisciplinary team during the preferred alternative selection. GRCA and other NPS fire staff selected Alternative 5 as their preferred alternative. Each action alternative allows opportunity for mechanical/manual thinning and prescribed, wildland fire use, and suppression fire. There is no single-tool alternatives listed or considered in this EIS.*
The DEIS states that the desired conditions include restoring topographic heterogeneity of vegetation types and maintaining a mixed fire regime. This represents a good ecosystem driven approach that should have generated an alternative with prescriptions that seek to mimic historic fire behavior related to changes in terrain and species composition. This type of management scenario should have driven the process, not just informed it. We acknowledge that this component of the desired condition statement	• *The NPS believes that a full range of alternatives are provided in the EIS addressing Goals, Objectives, and Desired Conditions described in Chapter 2.* • *During development of action alternatives the desire to restore topographic heterogeneity was a major driver toward how to manage a fire in mixed-conifer. The park chose the Alternative 2 because we believe a strong WFU program and allowance of a mixed fire regime is the best way to restore that*

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will be harder to develop management scenarios for given the difficulty in identifying the gradient from mixed-conifer to spruce-fir and the cost of implementation. This however, is the type of ecosystem driven approach required to meet impairment standards for National Parks.	*heterogeneity into the mixed-conifer.* • *4.1.2.7 contains requirements for an impairment analysis. An impairment decision was made for applicable impact topics for each alternative (Chapter 4). EIS impairment determinations indicate that no impairment of park resources or values is expected from activities associated with the fire management program under any alternative. In addition, the monitoring and implementation plan will determine and implement measures required to reduce impacts.*
The descriptions of Alternatives 2-5 contain many similar distortions of "current and best-available information", but are even worse than Alternative 1, because of higher fire severities allowable (e.g., pages 4-47 through 4-48). Any Alternative that would allow greater amounts of stand-replacing fire would cause even greater departure from the historic range of variation for mixed conifer landscapes and as described above, assure impairment of Park resources.	• *The five alternatives were developed appropriately, and adequately analyzed, including a stable foundation of proposed projects, with justifiable side boards for prescriptions, and mitigation features for each alternative. GRCA recognizes the need to continue incorporation of adaptive management practices. The Interdisciplinary Team revised the adaptive management (2.6.4) to incorporate information about past successes, failures, and difficulties of managing fire in GRCA's forests ecosystems in park management decision-making process.* • *2.4.2.1 describes the historic fire regime in the mixed-conifer forest type as mixed severity. Research shows a mix of surface fire and stand-replacing fire events. 2.4.2.2 describes existing conditions and shows that noticeable increases in canopy cover, fuel loading, conifer seedling survival, and described "the overall forest condition as one of more dense stands." Allowance of more high and moderate/high fire severity come from forest structure changes previously mentioned and listed in 2.4.2.2. The park does not always expect to see historic fire regime in forests that no longer have the same historic fuel loading, and forest structure/condition. 2.4.2.3 describes desired conditions, and does not state the desire to mimic historic fire effects. This section considers current stand structure and suppression of past naturally ignited fires. Desired conditions are* *"The NPS seeks to maintain a climate-adapted, mixed-conifer structure and associated function by managing natural ecosystem processes (fire, insects and disease, drought, etc).* *For fire processes, current forest stand structure will contribute to a bimodal fire regime of primarily surface fire in stands with full canopies and reduced younger-aged understory stems, to passive and sustained crown fire under appropriate weather conditions. Older aged stands with declining or missing tree crowns and dense younger aged understory will*

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	have surface and passive crown fire. Post-burn mortality may increase in these stands because current fuel loading will increase fire residence time (which girdles tree boles). Management actions are specifically intended to reduce tree density by smaller size classes and tree species, reduce total fuel loading as measured across the landscape. *Desired conditions include* • *Manage fire processes by appropriate management response* • *Maintain a mixed-severity fire regime* • *Restore topographic heterogeneity of vegetation types* • *Manage fuel loads to best influence mixed-severity fire regime and limit high-severity burned patch size* • *Collaborate with adjacent agencies in managing cross-boundary fires"* • *4.1.2.7 discusses impairment analysis requirements. An impairment decision was made for applicable impact topics for each alternative (Chapter 4). Impairment determinations presented in the EIS indicate that no impairment of park resources or values is expected from activities associated with the fire management program under any of the alternatives. In addition, the monitoring and implementation plan will determine and implement measures required to reduce impacts.*
Portions of Chapters 2 and 4 that suggest that Alternative 1 (no change) and aspects of other Alternatives that assume that future management will be similar to past management seem to be counter to use of adaptive management. The DEIS should account for this apparent discrepancy.	• *Alternative 1 does assume future fire management will be similar to past management. During assessment of each alternative, it was determined Alternative 1 would not be in the best interest of the park due in part to the lack of the proposed adaptive management process in the EIS. This was clearest when looking at WUI protection and the lack of progress creating defensible space around the WUI without mechanical equipment. The park has and will continue to use the adaptive management process for each fire through the After Action Review (AAR) process and onsite discussions with fire personnel and resource advisors. See 2.6.4 for a recent example of that process.* • *Adaptive management is opportunistic; park managers cannot predict what will be learned, and therefore will be applied to new project plans. The park has used current management practices as the base for future changes informed by new information.*
GRCA's DEIS is as equally conceptually lacking as this analogy. For example alternatives 3-5 are essentially straw men, because no fire manager would	• *The NPS believes all five alternatives are reasonable and viable, and each has beneficial and adverse impacts. The Interdisciplinary Team went*

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truly consider reducing the number of tools in his/her toolbox. Also, because no DEIS would be necessary if fire management was satisfied with the current situation, Alternative 1 is a straw man (albeit one that is required for a DEIS). That leaves Alternative 2 as the obvious, only choice. However, Alternative 2 is fundamentally flawed ecologically because of the high level of stand-replacing fires permitted that will lead to impairment of Grand Canyon resources. As documented above, this fundamentally flawed alternative is supported by fundamentally flawed statements unsupported by "current and best-available information".	*through a choosing by advantage process with an outside contracted mediator. GRCA and other NPS fire staff agreed they could implement any of the alternatives analyzed in the DEIS. The IDT narrowed the preferred alternative selection to two alternatives. Each action alternative allows opportunity for mechanical/manual thinning, and prescribed, wildland fire use and suppression fire. The IDT, during alternative development, determined alternatives needed to have the full range of fire management activities to make them viable. Therefore the IDT determined that there would be no single-tool alternatives listed or considered in this EIS.* • *4.1.2.7 discusses impairment analysis requirements. An impairment decision was made for applicable impact topics for each alternative (Chapter 4). Impairment determinations presented in the EIS indicate that no impairment of park resources or values is expected from activities associated with the fire management program under any of the alternatives. In addition, the monitoring and implementation plan will determine and implement measures required to reduce impacts.*
Page 4-34, last paragraph. Methods such as igniting ridge tops were used in Grand Canyon in 2007 in the Southwest Roost Fire; therefore, one-year results should be available and should be included in the DEIS. How does igniting fires on ridge tops in a mixed conifer landscape affect predicted burn patterns? Such innovative methods need to be a major focus of returning fire to mixed conifer forest. Should ridge top ignitions be followed by ignitions on drier slopes, moister slopes, or valley bottoms to mimic the topographically driven historic fire patterns in spruce-fire and mixed conifer landscapes? As failures of past management fires have shown (the Outlet and Poplar Fires in GRCA and the Warm Fire in adjacent Kaibab National Forest all started as management fires before being converted to suppression fires), traditional methods often do not work and something new must be tried rather than repeat the same mistakes -indeed make worse mistakes in Alternatives 2-5 which would allow for higher levels of fire intensity/severity. Only innovative methods appear to possibly mimic the historic fire regime of mixed-severity fire coincident with small-scale topographic heterogeneity.	• *The five alternatives in the EIS were appropriately developed and adequately analyzed, and included a stable foundation of proposed projects with justifiable side boards for prescriptions and mitigation features for each alternative. The park also recognizes the need to continue incorporation of adaptive management practices. The interdisciplinary team has revised the adaptive management section (2.6.4) to incorporate in the park's management decision-making process information about past successes and failures and the difficulties of managing fire in forest ecosystems at GRCA.* • *The fire management program consistently performs After Action Reviews for each fire event. This review provides the park with information on what types of methods or tools were effective and where improvements can be made in future fire activities The After Action Review is a part of the adaptive management process that began recently but will continue into the future.* • *Currently the park knows of no models that predict fire behavior from firing patterns like the one used on the 2007 SW Roost prescribed burn. There have been several discussions about the successes and failures with the ignition and timing of the SW Roost burn. This burn was a first attempt at igniting burn units with a different pattern than what has been used in the past. The*

Comment	Response
Alternative Development	
	park did not add additional ignition operations nor was the park funded to do multiple burns in the same unit. The questions you bring up in your comments are good questions and they were asked by fire staff a few months after the burn. Discussions about using new firing patterns has occurred and will continue to occur before and after the planning, implementation, and review of each prescribed burn that occurs, regardless of forest type. The results from the SW Roost burn will be considered during development of new burn plans. • *The park considers canopy loss part of a mixed severity fire regime. Please see 2.4.1.1 and 2.4.2.1 for information about fire regimes.*
On page 2-2, paragraph 3, the statement: "These proposed alternatives represent a full range of wildland fire management strategies" is incorrect, because they do not consider a full range of limits on stand-replacing fire in individual forest types, i.e., low, medium, and high levels of moderate/high plus high severity fire. 2. The alternatives presented in Section 2.7 Alternatives Under Consideration should be replaced by alternatives similar to the following: (1) no action, (2) management actions designed to limit the amount of moderate/high plus high severity fire to a low level, (3) management actions designed to limit the amount of moderate/high plus high severity fire to a medium level, and (4) management actions designed to limit the amount of moderate/high plus high severity fire to a high level. This will usefully confront the key issue, allowing clear analysis of alternatives that have large differences in environmental consequences and avoid alternatives that are essentially straw men.	• *Alternative development for this FMP EIS/AEF began with scoping. Prior to the September 2003 Notice of Intent, the NPS mailed a letter to interested parties soliciting written public input on the proposed FMP. In October 2003, a series of open house meetings were held to reaffirm previously identified agency and public issues and to identify new issues and concerns. The action alternatives for this NEPA process were developed from comments and concerns expressed by the public; input from Federal, state, and local agencies; tribal consultation; guidance from existing park plans; policy guidance from the National Fire Plan; NPS and Federal wildland fire management policy; and research, monitoring, protocol, implementation strategies, and experience from the existing fire management program.* • *The GRCA Fire Management Interdisciplinary Team used descriptions of the existing fire management program (Alternative 1, No Action) with proposed program goals and objectives, policies and planning guidance, and public issues and concerns as described in Appendix B to consider individual actions and develop four new alternatives (Action Alternatives 2, 3, 4, and 5). The park developed a reasonable range of alternatives for this EIS. The park also considers that the EIS does cover a full range of fire severities within the alternatives as is displayed with FLAM Map projections under different weather conditions, and with adaptive management.*

Comment	Response
Data	
DEIS Fails to Utilize the Best Available Science. As we discuss throughout our comments, we are concerned about the lack of appropriate data as well as the data limitations and how that has impacted the alternative development and analysis throughout the DEIS. There should be much more available data from the last thirteen years of implementation of the fire plan. If you are not utilizing that available data, how are you making appropriate decisions?	• *The park used approximately 13 years worth of data that reflected information from all vegetation types. Some vegetation types have limited fire history and thus limited park-specific monitoring information. Therefore, the park used available data from those areas, along with professional judgment, applicable research from outside the park, and modeling. Adaptive management and additional monitoring in the future will allow GRCA to continue to evaluate EIS assumptions, and adjust FMP monitoring and implementation aspects as needed.*
The analysis also needs to display the size and number of plots over a specific land area and how this relates to the spruce-fir habitat within the park boundary and on the Kaibab Plateau.	• *Since prescribed fires have not been conducted in the spruce-fir forest type in the past, park-specific data on fire effects to vegetation and fuels components in this vegetation type was limited to information gained from four 0.1 ha permanent monitoring plots burned in unplanned fire events. In addition, approximately 45 temporary Composite Burn Index plots were visited in the spruce-fir vegetation type to calibrate the burn severity data found in Table 4-8. This park-specific data was supplemented with information from published sources to assist with the affects analysis. This supplemental information can be found in the cited material that describes past, current, and desired forest conditions for the spruce-fir forest type referenced in the bibliography. Additional information has been added to the cumulative effects section of each alternative that describes how this information relates to the spruce-fir vegetation type in the park and on the Kaibab Plateau.*
Relatively new studies that the NPS should consider relative to this ecosystem type. See below: " Huffman, D.W., P.Z. Fulé, K.M. Pearson, and J.E. Crouse. In press. A comparison of fire hazard mitigation alternatives in piñon-juniper woodlands of Arizona. Forest Ecology and Management.	• *New information has been added to the Section 2.6.4 Adaptive Management.* • *The NPS agrees that adaptive management in all vegetation types (including piñon-juniper) is unlikely to be successful without adequate monitoring. GRCA currently has 15 permanent piñon-juniper fire effect monitoring plots in four burn units on South Rim. In addition, the park plans to install new permanently marked monitoring plots in each new treatment unit, and to monitor those plots over time. GRCA's adaptive management process incorporates both monitoring results and results from relevant research. The park is aware of the new studies conducted in piñon-juniper woodlands near the park published in the past six months. The park is very interested in these and future research results, and is considering this research as treatment objectives for this vegetation type are refined.*

Comment	Response
Data	
Relatively new studies that the NPS should consider relative to this ecosystem type. " Stoddard, M.T., D.W. Huffman, T. Alcoze, and P.Z. Fulé. 2008. Effects of slash on herbaceous communities in pinyon-juniper woodlands of northern Arizona. Rangeland Ecology and Management 61:485-495.	• *New information has been added to the Section 2.6.4 Adaptive Management.* • *The NPS agrees that adaptive management in all vegetation types (including piñon-juniper) is unlikely to be successful without adequate monitoring. GRCA currently has 15 permanent piñon-juniper fire effect monitoring plots in four burn units on South Rim. In addition, the park plans to install new permanently marked monitoring plots in each new treatment unit, and to monitor those plots over time. GRCA's adaptive management process incorporates both monitoring results and results from relevant research. The park is aware of the new studies conducted in piñon-juniper woodlands near the park published in the past six months. The park is very interested in these and future research results, and is considering this research as treatment objectives for this vegetation type are refined.*
Relatively new studies that the NPS should consider relative to this ecosystem type. " Huffman, D.W., P.Z. Fulé, K.M. Pearson, and J.E. Crouse. 2008. Fire history of pinyon-juniper woodlands at upper ecotones with ponderosa pine forests in Arizona and New Mexico. Canadian Journal of Forest Research 38(8):2097-2108.	• *New information has been added to the Section 2.6.4 Adaptive Management.* • *The NPS agrees that adaptive management in all vegetation types (including piñon-juniper) is unlikely to be successful without adequate monitoring. GRCA currently has 15 permanent piñon-juniper fire effect monitoring plots in four burn units on South Rim. In addition, the park plans to install new permanently marked monitoring plots in each new treatment unit, and to monitor those plots over time. GRCA's adaptive management process incorporates both monitoring results and results from relevant research. The park is aware of the new studies conducted in piñon-juniper woodlands near the park published in the past six months. The park is very interested in these and future research results, and is considering this research as treatment objectives for this vegetation type are refined.*
If effects monitoring data for vegetation types are not stratified into different fire severities, then what data or information is the NPS using to determine effects of different fire severity scenarios on the vegetation type in each Fire Management Unit? Sampling is stratified by pre-fire vegetation types, which is expected to reflect differences in fire patterns and responses to fire. The DEIS goes on to state that different fire types would result in different fire severities. The NPS did start fire severity mapping in 2000, which makes the previous statements in the DEIS very confusing.	• *Fire severity classes, as defined, distinguish areas in a fire that have undergone low, moderate-low, moderate-high, and high levels of ecological change due to fire. Since fire severity classes are based on amount of change from pre-fire condition, effect of each fire severity scenario is included in the definition of burn severity. To understand more specific changes in vegetation due to fire (such as changes to tree density or fuel loading), GRCA uses pre- and post-fire measurements of permanent plots that cannot be stratified by burn severity due to data limitations.* • *Data limitations discussed in 4.2.1.9, Fire Effects Monitoring Data, pertain*

Comment	Response
Data	
	specifically to the long-term permanent forest plot monitoring (begun in 1990). These plots are stratified by pre-fire vegetation type, and analysis is conducted on a landscape scale without regard to burn severity. Since burn severity at the plot scale cannot be predicted prior to fire, sufficient sample size at all severity levels to stratify these long-term plot data by severity type cannot be obtained. Tables 4-4, 4-6, 4-8, 4-10 are based on a complementary monitoring strategy (begun in 2000) in which we use a combination of remote sensing imagery and temporary field plots to assess severity in burn units. Data limitations discussed in 4.2.1.9, Fire Effects Monitoring Data, do not apply to this complementary monitoring strategy.
Effects Common to all Alternatives: Page 4-17 of the DEIS states, "Based on monitoring data collected at GRCA since 2000, conclusions were reached on potential effects to vegetation types from fire." The DEIS notes that not all vegetation types have been monitored due to a lack of prescribed fire in those habitats, such as spruce-fir. Given past data collection efforts, why was monitoring data limited to 2000 and later? In several places the DEIS discusses fire monitoring data collection efforts since 1993 being used to inform the decision making process.	• *There is an error in the date of the collected monitoring data. The date should read 1993, and has been corrected in the EIS (4.2.1.10)*
Common to all alternatives: Pages 3-14 & 3-15, related to special status plant species contain habitat acreage numbers that vary significantly from other displays. Ponderosa pine forest habitat comprises almost 60,000 GRCA acres at a low level of departure from its natural fire regime." According to other tables this should represent about 75% of the ponderosa pine acres.	• *Information in 3.1.2.1, 1st paragraph, first sentence, has been changed to read….Ponderosa Pine forest habitat comprises almost 60,000 GRCA acres, of that approximately 75% is at a low level of departure from its natural fire regime.*
Without use of "current and best-available information", particularly from science, some key assumptions, statement, and conclusions are incorrect, as shown below. Some of the flawed conclusions, if implemented, will lead to impairment of Park resources.	• *GRCA believes the best available information was used for this analysis, and that the assumptions and conclusions are accurate and unbiased. This DEIS was reviewed by park staff including the science and resource management division, the park interdisciplinary team, and members of the NPS intermountain regional office.* • *4.1.2.7 of the Grand Canyon Fire Management Plan EIS/AEF contains a discussion of the requirements of an impairment analysis. An impairment decision was made for applicable impact topics for each alternative (Chapter 4). The impairment determinations presented in the EIS indicate that no impairment of park resources or values is expected from activities associated with the fire management program under any of the alternatives. In addition, the monitoring and implementation plan will determine and implement measures required to reduce impacts.*

Comment	Response
Data	
Page 4-24, paragraph 6, lines 7-8 refer to: "...larger patches of high severity fire during very high weather conditions, similar to what researchers (Fule et al. 2003a) surmised from park fire history and vegetation reconstructions." Also, although Fule et al. (2003a) did not quantify patch sizes, their findings indicated that individual patches were relatively small: "...fire-initiated groups were intermixed with non-fire-initiated groups ..." Evidence that this was a conscious misconstruction is that the DEIS left out the following statement provided to the interdisciplinary team: "Neither remote sensing nor ground reconnaissance on the North Rim revealed large areas of fire-originated trees, such as would be produced by crown fires (Fule et al. 2003a)." The following statement is on page 4-39, paragraph 3, line 11: "Fule et al. (2004) reported increases in crown fire potential since the 1880s ..." While the statement is accurate, the findings of Fule et al. (2004) were based on forest reconstructions such as those by Fule et al. (2003a) and are inaccurate for spruce-fir forests.	• *GRCA does not believe there was a conscious misconstruction about stand-replacement fire size in spruce-fir forests. Nowhere in the document does it state that the park desires to see large patches of stand-replacement fire. The desired conditions listed in 2.4.1.3 also list both stand-replacement fire regime and a mixed severity fire regime.* • *The park believes the statement in 4.2.1.11 Vegetation Composition and Structure after the Planning Period, Alternative 1, Vegetation Spruce-Fir is accurate, and that this statement does not lead to inaccuracies about composition and structure of the spruce-fir forests after the planning period for Alternative 1.*
The DElS makes substantial use of information collected from Fire Effects Monitoring Plots and in several places acknowledges the importance of sample size (number of plots), but frequently does not state the sample sizes upon which conclusions are based. In many places the DElS presents arithmetic means without indicating the range of variation of values around the means ...The Fire Effects Monitoring Program is not yet a statistically valid program, and, at least a few years ago, was making such slow progress that it will take decades for validity to be reached. This also prevents evaluation of many conclusions reached in the DEIS, particularly in the critically important Chapter 4 Environmental Consequences.	• *The GRCA Fire Effects Monitoring Program follows peer-reviewed protocols developed at a national level for all National Park Service units with burnable vegetation. The GRCA monitoring program is one of the oldest programs and has one of the largest forest plot networks in the NPS. Minimum sample size calculations to determine whether this network is statistically valid have been completed since the inception of the program. The GRCA plot network includes enough plots to achieve our desired confidence level and measurement precision for the primary and secondary monitoring variables in the ponderosa pine, mixed-conifer, and piñon-juniper vegetation types. As noted in 4.2.1.10, "Fire-effects monitoring data are limited in the spruce-fir type because prescribed fires have not historically been planned in this vegetation type." GRCA fire effects data are public information.*

Comment	Response
Structural Data Information	
Chapter 4, page 15 also discusses problems with the issue of lack of data and limitations of models used, in this instance on fuel accumulations in untreated areas: Fire-effects monitoring data clearly show surface fuel	• *The model was one of many tools used to determine predicted fire behavior for each alternative. Where data were lacking for this effort, best professional judgment was employed and used assumptions and*

Comment	Response
Structural Data Information	
accumulations after ten years; however, data were limited in number of plots and did not encompass all vegetation types and conditions. Data also did not include measures necessary to estimate crown fuels (canopy base height and canopy bulk density), since they were designed primarily to measure fire effects changes.	*extrapolations from scientific literature, other park units that manage fire dependent ecosystems, and personal observations by park staff. The models used for this EIS represent the best currently available data. See Appendix F, page 2, F.2.* • *The monitoring program measures the effects of fire on vegetation and fuel components, and therefore, does not monitor areas that have not or are not scheduled to burn. Within this framework, fuel accumulation is not measured in untreated areas, and could not be incorporated into the model. Data on fuel accumulation after fire were available for all vegetation types in which fires have previously occurred in the park, but the data were not sufficient to distinguish between fuel accumulations in areas burned under different severity levels and thus representing different fuel conditions. The lack of data on changes in forest condition through time as a result of different severity fires, and the lack of data necessary to estimate crown fuels have led the park to initiate two cooperative research projects with universities to better understand trends in fuel accumulation. Using the adaptive management process, the park will incorporate information from this research into future modeling exercises and implementation decisions.*
Wildlife and Special Status Species General Comments The NPS did an insufficient job of analyzing canopy and structure and lacked structural data in sections of this DEIS dealing with habitat. As stated earlier, averages of tree densities across large landscapes do not actually constitute usable stand structure information. There is also apparently no real population data for most of the species within the Park. Because of this, it is clear that the analysis of the impacts on most species is insufficient.	• *All relevant studies containing GRCA forest structural data were analyzed and clearly summarized in the EIS. The National Park Service does not conduct timber harvests and, therefore, does not maintain individual stand structural data in the same manner as the U.S. Forest Service. All fire effects vegetation plot data were analyzed in EIS preparation.* • *GRCA has incomplete population data on a number of wildlife species in the park. Therefore, wildlife habitat (primarily vegetation) analysis was used for determination of effects on general wildlife species. It is GRCA's belief that as long as sufficient habitat features remain in an ecosystem, wildlife populations will rebound following fire events. Relevant Threatened and Endangered Species population numbers will be used in a Biological Assessment to be submitted to the U.S. fish and Wildlife Service.*
The DEIS points to the difficulties in trying to reconstruct historic forest structure in mixed-conifer. Stating broad ranges of average tree densities indicates the overall increase in tree densities and potential fuel loads, but it needs to be displayed as a part of detailed structural stage data to determine what ecosystem components should be targeted in treatment design.	• *Adding additional specific stand structure constraints decreases likelihood of meeting the first sentence and last bullet of desired conditions that discusses managing natural ecosystem processes (fire, insects and disease, drought etc.), and the major effort should be directed at reducing the large number of small trees, and reestablishing vegetation and fire regime topographic*

Comment	Response
Structural Data Information	
	heterogeneity. Some stand structure data are specific and intended to help perpetuate MSO critical habitat components.

Comment	Response
Modeling	
As admitted in this document, there is a lack of data with which to inform the development of the alternatives. In Appendix F, Fuel Modeling the DEIS states: AMSET extensively investigated crown fuel layers provided by GRCA, but determined that layers were not comprehensive enough (areas missing), not updated for fires as was the surface fuel layer, had apparent inconsistencies, and were difficult to understand. AMSET tried to correct inconsistencies and update data for fires, but, in the end, a reasonable layer could not be constructed for the analysis area, thus testing and revision of LANDFIRE data for fires since 2000 begun from scratch. (Appendix F-1)	• *The model was one of many tools used to determine predicted fire behavior for each alternative. Where data was lacking, best professional judgment used assumptions and extrapolations from scientific literature, other park units that manage fire-dependent ecosystems, and personal observations by park staff. Models used for this EIS represent best available data for the information. See Appendix F, page 2, F.2.*
Modeling that is diagnostic needs to be included. a. Modeling needs to explore how recent increases in tree mortality (see pages 3-3 and 3-5) affect fire patterns and needs. How much mortality is needed to change forest structure and reduce (a) the probability of suppression fires and (b) the necessity of higher-risk management fires?	• *GRCA is not aware of data describing the number of trees in park boundaries before and after insect outbreaks, or the number of trees killed by insects whether caused by insect outbreaks or not. Desired conditions listed in the EIS for the spruce-fir forest type does not list specific forest structure information, but concentrates on returning fire to fire-adapted forest and working toward restoring a mixed severity fire regime. Since the park did not include specific stand-structure information to describe desired conditions, no modeling was done to model changes in forest structure. Suppression fire probability of cannot be modeled since the decision to suppress fire goes beyond environmental conditions and includes regional and national preparedness levels, political decisions, and resource availability. High-risk management fires are undefined and not used in this EIS. Risk, including but not limited to snags, weather, lack of safety zones, and high fuel loads is associated with all fires. This was not modeled for the EIS, but each fire considers risk during the wildland fire decision support system process used to determine actions taken on a specific unplanned fire.*

Comment	Response
Fire Management Units	
The development of new Fire Management Units (FMUs) is a step in the right direction as it works towards an ecosystem based approach. However, it would have been more useful if each of the eight new FMUs also had a fire treatment associated with them. If the development of the alternatives was based upon the FMUs, the management prescriptions would have been closer to an ecosystem based management plan.	• *Many FMU have the same fire treatments including prescribed, wildland fire-use, and suppression fire. WUI treatments do not allow wildland fire use, and Fire Islands WFU support only WFU. The eight FMUs were examined independently to determine treatments types appropriate for that area.*
The DEIS is also deficient and inconsistent in its description and analysis of the eight Fire Management Units (FMUs). It would be useful for the final EIS to include a more thorough and clear description of the type and intensity of fire management treatments that will be utilized with each FMU. The action alternatives expand the Fire Management Units (FMUs), but effectively result in little change in environmental impacts. This expansion appears to be more of an operational alteration not an environmental one and merely makes it easier for the NPS to organize its fire operations.	• *The NPS believes FMU descriptions are sufficient. Prescribed fire and thinning projects are listed in the long-term treatment schedules (Appendix D,) and projected fire severity for prescribed, wildland fir- use, and suppression fires are listed in Tables 4-5, 4-7, 4-9, and 4-11. FMU development was partly operationally based as access, political boundaries, and values to be protected are all considerations.*
Common to all alternatives: Table 2-3 on Page 2-21 displays FMU Characteristics for Alternative 1. It does contain acreage numbers for ponderosa pine and mixed-conifer and the percentage of the park these acres represent. There is no corresponding number and percentage for spruce-fir in this table. These acres shown are not the same numbers stated elsewhere in the DEIS. (see next point) ...Table 2-3 shows 42,899 acres of ponderosa pine in FMUs for 3.60% of the park. ...Table 2-3 on Page 2-21, (FMU Characteristics for Alternative 1) shows mixed-conifer covering 92,150 acres or 7.73 percent of the park. " Fire management unit characteristics displayed in Table 2-5 on pages 2-33 & 2-34 contain acres for each FMU and the percentage of the park they represent. While habitat types play a role in FMU design, topography and other management designations (WUI) are also featured in FMU acres. As a result, the ponderosa pine habitat might exist in 5 of the 8 FMUs.	• *Current FMUs contain a mixed-conifer FMU that included all North Rim forest types. This mixed-conifer FMU would contain all listed spruce-fir, mixed-conifer, and ponderosa pine, and does not split the acreages for each forest type. New FMUs developed for the action alternatives split forest types into separate units because those areas were recognized as unique. Factors used to create new FMUs are in 2.6.5.* • *There may be ponderosa pine habitat in several FMUs, but the FMUs were not developed based entirely on habitat or forest type. Plant communities were the basis for developing initial fire management units, but then modified to reflect other necessary factors like access, values to be protected, etc. See 2.6.5 for a list of factors.*

Comment	Response
Piñon-Juniper Habitat	
The "Preferred" alternative calls for increasing treatments in the piñon-juniper habitat, however, few fire or fuel studies had been conducted on piñon-juniper ecosystems at the time of the writing of this document. (Several new studies have been published in 2008 and perhaps can be	• *The preferred alternative calls for increasing treatment in the piñon-juniper with additional mechanical or manual thinning. There is no increase in acres with prescribed fire. The increase in piñon-juniper thinning will occur in the Primary WUI FMU. The primary objective for the Primary WUI FMU*

Comment	Response
Piñon-Juniper Habitat	
considered with the FMP DEIS revision.) The NPS has not scientifically demonstrated its rationale for this decision not has it utilized the best available science in order to come to this decision. Environmental information "must be of high quality. Accurate scientific analysis, expert agency comments, and public scrutiny are essential" (40 C.F.R § 1500.1 (b)). What is the basis for the burn plans for the piñon-juniper?	*is to protect human health and safety and private and public property. The rationale behind the decision to increase piñon-juniper thinning is to use reduce torching, spotting and crown fire runs adjacent to the community. There is no increase in burning in piñon-juniper because GRCA is still trying to determine fire type and frequency.* • *Adaptive management will incorporate pertinent new research through the life of the plan.*

Comment	Response
Air Quality	
Another issue to consider is the climate change that has been accelerated by humanity's addition of excess carbon dioxide. Do we really need extra prescribed fires adding tons of greenhouse gases into our atmosphere?	• *Although the exact magnitude of climatic changes at Grand Canyon is difficult to predict, it is an important consideration for fire management. Predicted increases in temperature and water demand will place further stress on park ecosystems. Wildland fire can help reduce these stresses by bringing tree densities down to more natural levels, thus reducing competition for limited soil water. Fire does release carbon dioxide into the atmosphere. Studies at Northern Arizona University have found manual and mechanical thinning decrease carbon dioxide soil emissions one year post-thinning. Another study compared unburned ponderosa forest with a nearby forest that experienced stand-replacing fire. The unburned forest was a net sink of carbon dioxide (removing carbon dioxide from the atmosphere). However, even after ten years and despite establishment of grasses, forbs and shrubs, the severely burned forest was still a net source of carbon dioxide (largely due to continued decomposition of fire-killed trees). Fire management practices, including limits on severity discussed in the EIS, thus have potential to mitigate some climate change impacts by reducing water demand to more historic levels, and to avoid excessive, long-term carbon dioxide production caused by extensive, high-severity fires. (Sullivan et al. 2008; Dore et al. 2008).*

Comment	Response
Fire Operations	
The use of wildland fire requires courage on the part of Fire Managers. No fire is ever allowed to burn without some attendant risk. A clear management strategy with standardized risk assessment method and decision tree, that provides the Fire manager with a strong foundation of policy to support the decision making process, is vital to the exercise of this authority in a manner that will be supported after the fact.	• *1.5.4 briefly describes NPS Management Policies including the Federal Wildland Fire Management Policy. This policy provides direction to use decision-support tools and standardized risk assessments.*
This planning process and resulting document should specify a NEPA process for site specific actions. Annual burn plans, maps, etc. could all be posted to the Park's website so that the agency only has to send a brief mailing or email message to alert the public to available documents for comment.	• *This EIS will be the appropriate NEPA document for actions analyzed in the EIS. There are no plans to do NEPA analysis on a project-by-project basis.*
Ponderosa Pine Page 4-28, last paragraph suggests that fires should not be set above the 90th percentile weather conditions. If this weather limit has been used in the past, it has frequently led to prescribed, fire-use, and suppression fires that exceeded 4% crown fire, an amount highly likely above reference conditions, and this calls into question the accuracy of the modeling. If 90th percentile limits were not used in the past and if alternatives allow continuation of this policy, the alternatives -and policy -should be changed.	• *The 90% weather limit has not been used in the past. Modeling used to create Table 4-12 includes first entry, second entry, third entry, and even fourth entry prescribed fire units. Each of these multiple entry units have burned in the past 15 years. Most fires listed in Table 4-4 are first entry, meaning those areas do not have any recent fire history and were in a high level of departure from historic fire regime. The Powell WFU is an example of a fire in an area with a recent fire history, and results of that fire show only 1% of the fire area was determined to have moderate/high or high fire severity effects. The Outlet Prescribed Fire, a first entry prescribed burn with no fire history over the past 100 years, shows an increase in severity, and may have exceeded reference conditions. Forest conditions on fires listed in Table 4-4 are different than forest conditions for future prescribed burns, so it should be expected that predicted fire severity in Table 4-12 would be different than actual fire severity information listed in Table 4-4.*
Page 4-28, paragraph 2: Here and elsewhere, these values need to be expressed on an annual basis. Otherwise, they are meaningless without knowing the time frame of this document, and this time frame is not specified. This is a fatal flaw, because it is impossible to fully judge the different alternatives without annual figures.	• *The values about fire treatment acres under available treatment strategies cannot be listed on an annual basis as unplanned start; their potential to grow depends on current environmental conditions staffing levels, the national fire situation, political decisions, and other variables. Figure 1-1 shows that every fire season from 1993 to 2006 is highly variable in acres and fire types. This variability will probably continue. Predicting fire sizes and types is not done nationally, regionally, or in the park, as there are too many un-forecast variables that determine fire sizes and fire types, and there is no model available to predict specifics of such events.* • *In Appendix D, proposed treatment schedules for planned projects are*

Comment	Response
Fire Operations	
	specified annually. The schedule outlined may change based on weather conditions, resources, and management direction. The Fire Management Plan will be in place for the foreseeable future. The multi-year fuels treatment plan (non-fire treatment projects and prescribed projects) is dynamic and updated annually; new projects will fit in the FMP intent and purpose, and project-specific requirements (Section 7 consultation, Section 106 consultation via Programmatic Agreement, air quality permits, etc.) will be completed prior to project implementation. Adaptive management continually incorporates new information; if the park proposes changes outside the scope of this EIS (and/or other project-specific requirements), new NEPA work will be considered.

Comment	Response
Consultation and Coordination	
Contact FAA prior or during prescribed fire or fire use activities. This way when pilots call in to FAA, FAA will know if this is an activity that the park is already aware of.	• *GRCA's fire management program has added FAA to the fire notification list.*

Comment	Response
Wilderness	
It is unclear to us the level of use for roads that are closed to the public but open for fire management. The plan states: "Approximately 58 miles of primitive roads in 300-foot-wide, non-wilderness corridors are open to mechanized travel and provide access to trailheads and scenic overlooks (NPS 1998b). All other unpaved roads or trails are not open to motorized vehicles or bicycles. Exceptions (e.g., for fire management) are governed by the minimum requirement decision process (see Appendix A)." What will this mean on the ground and how will those activities affect the wilderness character? Are there additional roads that should be considered for total closure? Are there roads that are unnecessary altogether? Was this considered?	• *The Fire Management Program has committed to stop using roads not open to the public for administrative use on North Rim. The only vehicle use would be from an emergency event. This commitment occurred during the planning phase of the FMP.* • *The Fire Management Program no longer opens, maintains, or uses unpaved administrative roads on Walhalla Plateau, the road to Tiyo Point, or the Widforss Road (W1-C). The fire management program has committed to stop using these roads under the Minimum Requirement Analysis. The entire W-1 and W-1A (Range Road) roads are still open to the public along with the W-4 road, and the fire program opens, maintains, and uses those roads during fire season.* • *Any roads still open to the public, but defined as recommended for total closure in the Final Wilderness Recommendation, are outside the purview of this plan. All road closures are defined in the Superintendent's*

Comment	Response
Wilderness	
	Compendium.
The Park's "fire road" closures need to be effectively enforced. The GRCA Draft Wilderness Plan (USDI 1998:76-77), reiterating provisions of the 1980 Wilderness Recommendation, points out that the six so-called "fire roads" within the proposed wilderness of Grand Canyon National Park (Tiyo Point, Komo Point, Walhalla Glades, Francois Matthes Point, Widforss and W-1 from the landfill to its junction with the Point Sublime Road) are (or should be) closed to public and administrative mechanized transport. These routes constitute nonconforming intrusions within the proposed wilderness and administrative use of mechanized transport or tools, if any, should be evaluated in the context of the minimum requirement concept. Non-emergency administrative use should not continue to be permitted on these routes.	• *The Fire Management Program no longer opens, maintains, or uses unpaved administrative roads on Walhalla Plateau, the road to Tiyo Point, or the Widforss Road (W1-C). The fire management program committed to stop using these roads under the Minimum Requirement Analysis. The entire W-1and W-1A (Range Road) roads are still open to the public along with the W-4 road, and the fire program opens, maintains, and uses those roads during fire season.*
We urge the implementation of the Park[1]s wilderness recommendation regarding closure of the so-called [3]fire roads[2] within the proposed wilderness of Grand Canyon National Park. The GRCA Draft Wilderness Plan (USDI 1998:76-77), reiterating provisions of the 1980 Wilderness Recommendation, points out that the six so-called [3]fire roads[2] within the proposed wilderness of Grand Canyon National Park (Tiyo Point, Komo Point, Walhalla Glades, Francois Matthes Point, Widforss and W-1 from the landfill to its junction with the Point Sublime Road) are (or should be) closed to public and administrative mechanized transport. These routes constitute nonconforming intrusions within the proposed wilderness and administrative use of mechanized transport or tools, if any, should be evaluated in the context of the minimum requirement concept.	• *The Fire Management Program no longer opens, maintains, or uses unpaved administrative roads on Walhalla Plateau, the road to Tiyo Point, or the Widforss Road (W1-C). The fire management program committed to stop using these roads under the Minimum Requirement Analysis. The entire W-1and W-1A (Range Road) roads are still open to the public along with the W-4 road, and the fire program opens, maintains, and uses those roads during fire season.*

Comment	Response
Across Park Boundaries	
As a logical solution we endorse using the Fire Point road as the primary fire break between the Park and portions of the National Forest.	• *Fire Point road has been, and will continue to be, evaluated on a case-by-case basis for use as a break for fires on or near Swamp Point. Grand Canyon and the North Kaibab Ranger District have combined fire management staff (North Zone Fire Organization) so fire management activities can be planned and implemented across agency boundaries. This will help North Zone staff define project boundaries at natural fire breaks and established road corridors instead of at jurisdictional boundaries.*

Comment	Response
Across Park Boundaries	
The effects of jurisdictionally fragmented management are most noticeable and compelling on the Kaibab Plateau. We strongly suggest that additional analysis be conducted and coordination/collaborative mechanisms be established with an explicit intent of bolstering fire management and/or restoration activities coordination across the GCNP/NKRD boundary. We believe such efforts are necessary to address fire related issues that manifest at the landscape scale, such as fire spread into and out of the park, post fire invasive species establishment and spread, landscape scale canopy dependent species habitat characteristics, post fire watershed characteristics, wildlife movement corridors, etc.	• *Grand Canyon and the North Kaibab Ranger District combined fire management staff (North Zone Fire Organization) so fire management activities can be planned and implemented across agency boundaries. This will help North Zone staff define project boundaries at natural fire breaks and established road corridors instead of at jurisdictional boundaries. This organization is new, but will continue to improve, to blur jurisdictional boundaries, start planning for projects with appropriate boundaries, and create long-term landscape-scale plans that don't focus on property boundaries. At this time the same organization type is not available for the South Kaibab, but GRCA will continue to discuss the possibility.*

Comment	Response
General	
Portions of the DEIS are fundamentally flawed because they do not rely "…on current and best-available information." Section 1.4 of the DEIS states several Goals and Objectives of GRCA's Fire Management Program, including Goal 4: "Promote a science-based program that relies on current and best-available information." The DEIS should have been conceived and written to this standard, but it is not. In fact, some of the following examples indicate preparation of the DEIS included avoidance of "…current and best-available information." The interdisciplinary team guiding preparation of the DEIS (see Table 5-1) did not include anyone with expertise in GRCA forest vegetation…"	• *The park believes the best available information was used to develop the DEIS. The writing of this DEIS has taken several years and, as new information was published, it was reviewed. If the new information would not improve the analysis it was not included.* • *Interdisciplinary team (IDT) participation was assigned by the Superintendant's office. The assigned IDT included needed expertise in EIS and FMP planning and implementation. The IDT used any and all available information to inform the planning effort. Although a vegetation specialist, by title, was not on the team, the team had the necessary qualifications to make informed recommendations to the Superintendent's office. Staff with experience on suppression, prescribed, and wildland fire-use fires served on the IDT. It was important IDT members had both on-the-ground fire experience and knowledge of scientific literature. Two fire ecologists who worked on DEIS development have experience studying fire and vegetation interactions while on fires and in research. Both fire ecologists used their knowledge and experience to create a DEIS that would allow GRCA to manage fire using all available tools. The AMSET team also contained specialists who not only studied vegetations and fire, but had similar experience working on and watching wildland fires. GRCA used appropriate staff with the best available information.*

Comment	Response
General	
Original version: Little research has been done on fire regimes of Southwestern Spruce-Fir forests (Moir 1993, Swetnam and Baisan 1996, Allen 2002). Misleading revision: Existing research for Southwestern fire regimes in spruce-fir forests includes work from Moir 1993, Swetnam and Baisan 1996, Allen 2002 and others. (Section 2.4.1 .I, paragraph 1)	• *GRCA does not believe statements made in this comment are misleading. Various authors developed and reviewed the EIS. Document editing did not intend to add misleading statements nor was there any intent to mislead the public through interpretation of referenced material. The FEIS includes less emotional and value-laden verbiage than was in sections of the previous internal draft document.*
Despite almost three years between when the draft was submitted and the DEIS was finished, the interdisciplinary team did not ask for an updated version to include "current ...information" (including new research on GRCA…). No one else appears to have provided "current...information," because the DEIS includes only one journal article on vegetation published after 2006.	• *The park believes the best available information was used to develop the DEIS. The writing has taken several years and, when new information was published, it was reviewed. If the new information would not improve the analysis it was not included. Incomplete forest vegetation data have not been made available to the team that developed the DEIS.*
Incorrect description of key aspects of Reference, Existing, and Desired Conditions of GRCA's spruce-fir forest led to incorrect conclusions that, if implemented, make impairment likely.	• *The park believes the best available information was used for this analysis, and that the assumptions and conclusions are accurate and unbiased. This EIS was reviewed by park staff including the science and resource management division, the park interdisciplinary team, and members of the NPS intermountain regional office.* • *4.1.2.7 of the Grand Canyon Fire Management Plan EIS/AEF contains a discussion of the requirements of an impairment analysis. An impairment decision was made for applicable impact topics for each alternative (Chapter 4). The impairment determinations presented in the EIS indicate that no impairment of park resources or values is expected t from activities associated with the fire management program under any of the alternatives. In addition, the monitoring and implementation plan will determine and implement measures required to reduce impacts.*
The DEIS states "Various Grand Canyon reconstruction studies. .." This misleadingly suggests that there are several such studies; however, there is only one study focused on mixed conifer forest: Fule et al. (2002a). One other included mixed conifer as part of a highly varied landscape dominated by spruce-fir forest: Fule et al. (2003b).	• *The term "various" has been deleted to eliminate the implication there was several reconstruction studies.*
Original version: However, there is little, if any, evidence of a similar crown fire regime in the Southwest. Misleading revision: There is some evidence suggesting a stand-replacement fire regime occurred in the Southwest. (Section 2.4.1 .1, paragraph 2)	• *The park does not believe that the statements made in the EIS are misleading. Various authors have developed or reviewed the EIS. This document was not edited with the intention to add misleading statements nor was there any intent to mislead the public through the interpretation of referenced material. Mercle 1954, White and Van Kat 1993, and Lang and Stewart*

Comment	Response
General	
	1910 provide support for a stand-replacement fire regime in spruce fir in the southwest (see 2.4.1.1)
Original version: A crown fire regime has also been proposed (but not documented) for GRCA (Merkle 1954, White and Vankat 1993). Misleading revision: The critical parenthetical statement was eliminated (Section 2.4.1 .I, paragraph 2)	• *The park does not believe that the statements made in the EIS are misleading. Various authors have developed or reviewed the EIS. This document was not edited with the intention to add misleading statements nor was there any intent to mislead the public through the interpretation of referenced material.*
Original version: In addition, some historical accounts can be interpreted as suggestive of past crown fire. For example, Lang and Stewart (1910) stated that the Kaibab Plateau in general contained "vast denuded areas, charred stubs and fallen trunks and the general prevalence of blackened poles" and that "old fires extended over large areas at high altitudes, amounting to several square miles." However, like many early descriptions, the comments of Lang and Stewart (1910) are open to interpretation. For example, "vast denuded areas" may have referred to extensive meadows (parks) that early observers could have assumed were originally formed by fires. In addition, charred stubs, fallen trunks, blackened poles, and large burned areas are evidence of fire, but not necessarily crown fire. Indeed, Lang and Stewart (1910) also reported, "Evidence indicates light ground fires over practically the whole forest". Misleading revision: All sentences (those in bold) describing a plausible alternative to crown fire were eliminated, misleadingly leaving only one interpretation where two were expressed. (Section 2.4.1 .I, second paragraph)	• *All peer-reviewed historical periodicals are open for interpretation. However the park chose to provide the information from the article.*

K.3 Agency and Tribal Letters

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION IX
75 Hawthorne Street
San Francisco, CA 94105-3901

January 27, 2009

Steve Martin
Superintendent
Grand Canyon National Park
Attn: Office of Planning and Compliance
P.O. Box 129
Grand Canyon, AZ 86023

Subject: Draft Environmental Impact Statement for Grand Canyon National Park Fire Management Plan, Coconino County, Arizona (CEQ# 20080448)

Dear Mr. Martin:

The U.S. Environmental Protection Agency (EPA) has reviewed the above-referenced document pursuant to the National Environmental Policy Act (NEPA), Council on Environmental Quality (CEQ) regulations (40 CFR Parts 1500-1508), and our NEPA review authority under Section 309 of the Clean Air Act. Our comments are provided in accordance with the EPA-specific extension of the comment deadline date from January 21, 2009 to February 4, 2009 granted by Christopher Marks, Deputy Fire Management Officer, on January 14, 2009. We appreciate the additional time to review the DEIS.

EPA commends the comprehensiveness of the draft environmental impact statement (DEIS). We have rated this DEIS as Lack of Objections (LO) (see enclosed "*Summary of Rating Definitions*"). Alternative 2 Mixed Fire Treatment Program is the National Park Service's preferred alternative because it maintains management flexibility, refines the Fire Management Units, and includes additional options of mechanical and manual treatment. The focus of Alternative 2 is on restoring and maintaining Park ecosystems with prescribed and wildland fire-use, and reducing hazard fuels in Wildland-Urban Interface areas using prescribed fire and non-fire treatments.

While EPA supports the proposed action, we have a few recommendations which are provided in our enclosed detailed comments.

1

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We appreciate the opportunity to review this DEIS. When the FEIS is released for public review, please send one (1) hard copy and one CD to the address above (mail code: CED-2). If you have any questions, please contact me at (415) 972-3521, or contact Laura Fujii, the lead reviewer for this project. Laura can be reached at (415) 972-3852 or fujii.laura@epa.gov.

Sincerely,

Kathleen M. Goforth, Manager
Environmental Review Office
Communities and Ecosystems Division

Enclosure: Detailed Comments
Summary of Rating Definitions

cc: Deborrah Martinkovic, Arizona Department of Environmental Quality
Scott Copeland, National Park Service

EPA DETAILED COMMENTS ON DEIS GRAND CANYON NATIONAL PARK FIRE MANAGEMENT PLAN, COCONINO CO., AZ, JANUARY 27, 2009

Air Quality

Commit to the use of both fire- and non-fire fuel treatments to maintain desired conditions. The DEIS states that fire will be used as fully as possible to maintain desired conditions once areas have been restored through non-fire fuel treatment (pg. 4-269). EPA's Interim Air Quality Policy on Wildland and Prescribed Fires, Fire Treatments (April 23, 1998, chapter V.A.1.c), states that a combination of treatment methods may be the best approach to achieving the desired resource benefits with minimum air quality impacts. Combinations of treatments may include mechanical pretreatments to thin the fuel load prior to the use of fire.

Recommendation:
To minimize smoke and adverse impacts on air quality from actions to maintain desired conditions, EPA supports the use of a combination of fire- and non-fire fuel treatments. We recommend a commitment in the final environmental impact statement (FEIS) to employ the full range of treatment methods, including non-fire practices wherever appropriate, in the future to maintain desired conditions.

Update and revise air quality information. The air quality information in the DEIS needs to be updated to reflect current conditions and regulations.

Recommendation:
The following information should be updated in the FEIS:

- Page 3-50, section 3.3.1.1. The 8 hour ozone standard was revised in March of 2008. The text should be changed to reflect this. Table 3-12 already includes this information.
- Page 3-51, first paragraph. The FEIS should be revised to provide an explanation of what constitutes "high" levels of ozone (relative to the NAAQS, for example), and to indicate whether there is ozone monitoring at the Canyon.
- Page 3-51, paragraph below the italicized paragraph. Arizona's regional haze State Implementation Plan was submitted in December 2003. The December 2007 update has not been submitted yet. The FEIS should state this.
- Page 3-53, section 3.3.1.4. The FEIS should be expanded to include some quantitative information on emission levels from mobile sources. This information should not be difficult to obtain as long as there are good estimates of the number of park visitors who come via motor vehicles.

Water Resources

Describe specific avoidance and minimization mitigation measures for sensitive resources. The FEIS indicates that mitigation of soil and watershed effects will include protection of aquatic habitat, riparian and wetland areas, meadows, and other sensitive resource areas by defining and avoiding these areas, especially with wheeled vehicles and fire retardant application (pg. 4-292).

Recommendation:
EPA supports avoidance and minimization of effects on sensitive resource areas. We recommend the FEIS describe specific avoidance and minimization measures. For example, consider the use of buffer zones for riparian, wetlands, springs, and meadow resources; equipment exclusion zones; and fire retardant exclusion zones.

Climate Change

Describe climate change effects and adaptation measures. A number of studies specific to the Colorado River Basin have indicated the potential for significant environmental impacts as a result of changing temperatures and precipitation.[1] While the DEIS mentions climate change and the benefit of ecological restoration of plant communities in promoting their adaptation to change (pps. 4-13, 4-279), it does not provide a discussion of climate change scenarios for the Grand Canyon National Park, effects on the Fire Management Plan, or potential adaptation measures.

Recommendation:
We recommend the FEIS include a short section describing potential climate change effects for the Grand Canyon region, effects on the Fire Management Plan, and possible adaptation measures. For example, describe whether there may be changes in treatment schedule, types of treatments favored, any shift in vegetation types to be treated, or a reliance on adaptive management to annually adjust to climate change.

[1] For example, Colorado River Basin Water Management: Evaluating and Adjusting to Hydroclimatic Variability (2007); The Colorado River Basin and Climatic Change, Linda L. Nash & Peter H. Gleick (1993) (EPA Publication 230-R-93-009).

2

U.S. Environmental Protection Agency Rating System for Draft Environmental Impact Statements Definitions and Follow-Up Action*

Environmental Impact of the Action

LO – Lack of Objections

The U.S. Environmental Protection Agency (EPA) review has not identified any potential environmental impacts requiring substantive changes to the proposal. The review may have disclosed opportunities for application of mitigation measures that could be accomplished with no more than minor changes to the proposal.

EC – Environmental Concerns

EPA review has identified environmental impacts that should be avoided in order to fully protect the environment. Corrective measures may require changes to the preferred alternative or application of mitigation measures that can reduce these impacts.

EO – Environmental Objections

EPA review has identified significant environmental impacts that should be avoided in order to provide adequate protection for the environment. Corrective measures may require substantial changes to the preferred alternative or consideration of some other project alternative (including the no-action alternative or a new alternative). EPA intends to work with the lead agency to reduce these impacts.

EU – Environmentally Unsatisfactory

EPA review has identified adverse environmental impacts that are of sufficient magnitude that they are unsatisfactory from the standpoint of public health or welfare or environmental quality. EPA intends to work with the lead agency to reduce these impacts. If the potential unsatisfactory impacts are not corrected at the final EIS stage, this proposal will be recommended for referral to the Council on Environmental Quality (CEQ).

Adequacy of the Impact Statement

Category 1 – Adequate

EPA believes the draft EIS adequately sets forth the environmental impact(s) of the preferred alternative and those of the alternatives reasonably available to the project or action. No further analysis of data collection is necessary, but the reviewer may suggest the addition of clarifying language or information.

Category 2 – Insufficient Information

The draft EIS does not contain sufficient information for EPA to fully assess environmental impacts that should be avoided in order to fully protect the environment, or the EPA reviewer has identified new reasonably available alternatives that are within the spectrum of alternatives analyzed in the draft EIS, which could reduce the environmental impacts of the action. The identified additional information, data, analyses or discussion should be included in the final EIS.

Category 3 – Inadequate

EPA does not believe that the draft EIS adequately assesses potentially significant environmental impacts of the action, or the EPA reviewer has identified new, reasonably available alternatives that are outside of the spectrum of alternatives analyzed in the draft EIS, which should be analyzed in order to reduce the potentially significant environmental impacts. EPA believes that the identified additional information, data, analyses, or discussions are of such a magnitude that they should have full public review at a draft stage. EPA does not believe that the draft EIS is adequate for the purposes of the National Environmental Policy Act and or Section 309 review, and thus should be formally revised and made available for public comment in a supplemental or revised draft EIS. On the basis of the potential significant impacts involved, this proposal could be a candidate for referral to the CEQ.

* From EPA Manual 1640 Policy and Procedures for the Review of Federal Actions Impacting the Environment. February, 1987.

Preserving America's Heritage

September 30, 2008

Mr. Steve Martin
Superintendent
National Park Service
Grand Canyon National Park
P.O. Box 129
Grand Canyon, AZ 86023-0129

REF: Fire Management Plan for Grand Canyon National Park
Grand Canyon, Arizona

Dear Mr. Martin:

The Advisory Council on Historic Preservation (ACHP) recently received the additional information in support of your notification regarding the proposed development of a Programmatic Agreement (PA) for the referenced undertaking. Based upon the information you provided, we have concluded that Appendix A, *Criteria for Council Involvement in Reviewing Individual Section 106 Cases*, of our regulations, "Protection of Historic Properties" (36 CFR Part 800), does not apply to this undertaking. Accordingly, we do not believe that our participation in the consultation to develop this agreement is needed. However, if we receive a request for participation from the State Historic Preservation Officer (SHPO), a Tribal Historic Preservation Officer, an affected Indian tribe, a consulting party or other party, we may reconsider this decision. Additionally, should circumstances change and you determine that our participation is needed to conclude the consultation process, please notify us.

Pursuant to 36 CFR §800.6(b)(1)(iv), you will need to file the final PA, developed in consultation with the Arizona SHPO and any other consulting parties, and related documentation with the ACHP at the conclusion of the consultation process. The filing of the PA and supporting documentation with the ACHP is required in order to complete the requirements of Section 106 of the National Historic Preservation Act.

Thank you for providing us with your notification of adverse effect. If you have any questions, please contact Kelly Yasaitis Fanizzo at 202-606-8583, or via email at kfanizzo@achp.gov.

Sincerely,

Raymond V. Wallace

Raymond V. Wallace
Historic Preservation Technician
Federal Property Management Section
Office of Federal Agency Programs

ADVISORY COUNCIL ON HISTORIC PRESERVATION
1100 Pennsylvania Avenue NW, Suite 803 Washington, DC 20004
Phone: 202-606-8503 ▯ Fax: 202-606-8647 ▯ achp@achp.gov ▯ www.achp.gov

K.4 Public Comments

The GRCA FMP should be approved and supported. Their use of fire as a key component of the ecosystem processes is visionary and serves as an example for other fir mgmt agencies.
I am particularly excited about their plans to introduce fire a mixed-severity fire regime on the high stretches of the plateau. This is difficult to do, but we can't learn about this system unless we use fire experimentally in mixed conifer and spruce-fir systems.
Our research on the North Rim suggests to us that the benefits of WFU far outweigh any perceived costs. Plant diversity and productivity have increased, fuel loads have decreased, and wildlife habitat has been improved (esp. for cavity nesting birds). These forest are now much better able to withstand future fires, which are inevitable in a warming and changing climate.
GRCA should continue to use fire in all forests that historically has either frequent, mixed-severity, or even stand replacing fires. However, continued monitoring is important, especially with respect to Bromus tectorum (cheatgrass) spread. We have seen cheatgrass spread on Powell Plateau following the fire in 2003 but I think the "beefaloes" are the major culprit for spreading cheatgrass seed across the North Rim.
I'd be happy to answer any questions you may have about our research on the North Rim.

Daniel Laughlin-Public meeting

I am more inpressed with Alternatives 3 and 5 than with your preferred Alternative 2.

I am a retired employee of Grand Canyon National Park and therefore I am quite familiar with the Fire Management Plan, at least as it has been. In my opinion, prescribed fire has ruined much of Grand Canyon's forests for at least this generation. I will never see the forests of the North and South rim as beautiful as they once were.

I certainly understand the reasoning for prescribed fire to thin forests, reduce fuel load, preserve plant and animal diversity, etc. but I think we've had enough prescribed fire.

Fire tends to destroy our ability to enjoy Grand Canyon. It obscures the view for many people. I was an Interpreter on the South Rim and came into contact with many visitors. Don't worry, I preached your line about why fire is important, but now I don't have to do that. The general public has a hard time accepting that the Park Service is burning the forests and destroying the view for thousands of entrance fee paying visitors. For the last few years there have been times when fire caused the air quality in the canyon to become unhealthy. Those who had made reservations to hike in the canyon were suddenly confronted with risking their health in order to hike in the Grand Canyon.

Grand Canyon National Park was created to preserve the Grand Canyon - not its forests. Does it make sense to destroy people's ability to enjoy the Grand Canyon in order to keep its forests up-to-date in its fire regime?

You have been using prescribed fire since the 1970's. Most of the forests has been burned in the last 40 years at least once. Perhaps prescribed fire is still necessary close to buildings but not everywhere.

Another issue to consider is the climate change that has been accelerated by humanity's addition of excess carbon dioxide. Do we really need extra prescribed fires adding tons of greenhouse gases into our atmosphere?

I have found that, whenever there is a fire-use-fire, visitors are much more willing to accept it when I say that that fire was started by lightning, and, since its a natural fire, NPS is letting it burn naturally in order to maintain health in the forest. I am much more comfortable with natural fire-use-fires as long as the conditions are right to let it burn. In a national park, forests should be as nature makes them, not what fire management thinks they should be.

My wife and I have found several trails on the North Rim that have been destroyed by fire. I would like to see Fire Management use some of their resources to restore these trails. Please restore the Kenpatrick Trail, the trail from down Fuller Canyon from Harvey Meadow to the Old Bright Angel, and the trail from Point Imperial to Saddle Mountain.

Thank you for considering my thoughts on the proposed Fire Management Plan. I hope you will drop the planning for more prescribed burning and limit fire management to allowing certain natural fire use fires, limited prescribed burning, and mechanical thinning.

Keith Green

1

Fire regime condition class

The DEIS describes fire regimes and their ecological condition at very coarse scales and without analysis supporting key claims. For example, it is not possible for a reader to understand why GRCA claims that 42% of mixed conifer forests exhibit "high" levels of departure from their historical fire regime. DEIS at 4-7 and 4-9 (Figure 4-2). The analysis presents no supporting evidence in the form of observed fire occurrence, effects, or suppression effectiveness data. Map 4-1 indicates that all mixed conifer forests at GRCA feature a mixed-severity fire regime (Fire Regime III) with a 35-100+ year fire frequency. Id. at 4-8. The DEIS does not qualify the ecological scale of fire frequency assumed to characterize Fire Regime III. Whether the frequency measure is return interval (point scale) or rotation (area scale) matters greatly to the characterization of historical fire regime (Agee 1993) and condition class (Schmidt et al. 2002).

What method does GRCA use to characterize fire regimes and condition class? Its description of a "quantitative" methodology makes no sense. The DEIS states at 4-7,

Categories of departure from historic fire regime were applied based on the number of fires since 1910. This approach was applied to assign departure from historic fire regimes for current conditions. Proportions of different severities (unburned, low, moderate, and high) were summarized by vegetation type and fire category (prescribed, fire use, suppression).

The number of fires since 1910 by itself is not meaningful to a characterization of fire regime or condition class unless supplemental data permits comparison of ignition density and frequency as well as the spatial dimension of fires and their biological effects post-1910 to the pre-suppression era. The final EIS should include data from the "fire history atlas" mentioned at DEIS page 4-7, and it should refine the "quantitative" methodology for assigning fire regime and condition class values to various ecological settings and vegetation communities.

Fule and others (2003) note aspect dependence as a key spatial parameter of the historical fire regime in high elevation forests at Little Park on the GRCA north rim. Fire-scarred large trees were concentrated at upper slope positions on south and west aspects, reflecting a history of repeated low-severity fires. In contrast, other topographical settings featured age structure and composition that suggest high-severity fires created early-successional vegetation communities at fine spatial scales. Moreover, temporal fire occurrence data closely tracked regional climate cycles as most evidence of large fire occurrence correlated with periods of regional drought. Frequency of large, ecologically significant fires measured at a spatial scale of 4,400 hectares ranged from 11 to 94 years. In mixed conifer forest types, fire intervals ranged from 1 to 28 years at a point scale (Fule et al. 2003:472).

Ranges in fire regime attributes, such as spatial extent and temporal frequency, are more meaningful influences on ecosystem structure and function than mean values commonly reported as central tendencies in fire history studies. The latter are mathematical abstractions that do not exist in nature and tend to obscure actual landscape variation and ecological process (Veblen 2003, Whitlock et al. 2003). Climatic phenomena compound temporal variation in fire regimes. Over centennial and millennial timescales, climatic oscillations driven by shifts in solar radiation, orbital proximity of Earth to the sun, and the spatial distribution of polar ice caps influence fire frequency variation at regional and local scales, confounding their predictability (Alaback et al. 2003) (Figure 1 - displayed in mailed hard copy version only). Disturbance and succession patterns thus exhibit lagged interactions with climate changes, and therefore exist in disequilibrium with current climate (Allen et al. 2002). Thus, plant communities featuring older vegetation may reflect recruitment responses to climatic conditions that no longer exist:

"Assumptions that climate is stable (or that climate differences are unimportant) between the reference (historical) and current periods may lead to inaccurate or incomplete interpretations for management" (Millar and Woolfenden 1999:1214).

Reference conditions focused on the pre-settlement period presume a Little Ice Age climate, which lasted from about 1400-1900 CE (Figure 1). Ecosystems inferred from that period responded to a different climate than now exists. Mann and others (1999) show that the last decade of the 20th century was the warmest of the past millennium. Running (2006) anticipates continued warming with important implications for ecosystem management. Warmer periods that preceded the Little Ice Age may be a more appropriate analogue to the present (Millar and Woolfenden 1999). Even if it were possible to establish what park forests looked like in 1850, restoration of forest structure that existed during the Little Ice Age makes little sense for the current climate period. Indeed, restoration using any single historical period as a model probably is not appropriate. Rather, understanding what kinds of changes have occurred and how ecosystems respond to change offers clues on how to manage for adaptability and resilience (Millar and Woolfenden 1999).

To the degree that the DEIS characterizes historical fire regimes according to presumed average fire frequency, it unrealistically simplifies the disturbance ecology of the local landscape and overlooks issues of scale that must be accounted for in any credible analysis rooted in ecological science. This inevitably yields miscalculation and skewed risk assessment. Furthermore, even if historical fire frequency in the analysis area were well-understood, far less is known about past spatial dimensions (including shape, refugia and edge habitats) and the severity patterns of fire disturbance (Morgan et al. 2001). Different elements of landscape structure respond to changes in disturbance size, frequency and intensity at variable temporal rates and in spatially heterogeneous patterns (Turner et al. 1988). Therefore, it is necessary to measure several landscape characteristics in order to attribute observed changes over time to an altered fire regime (Baker 1992).

Changes in landscape pattern must be evaluated in the context of local disturbance history (Baker 1989). Without an area-specific assessment of historical ignitions that were attacked and extinguished, as well as some estimate of expected fire extent and severity patterns that might have occurred in lieu of fire suppression, which can be accomplished through fire weather reconstructions and FARSITE simulations, it is impossible to conclude that observed ecological trends result from fire exclusion.

Over time and space, fire creates diverse complexes of habitats and shifting plant communities over multiple scales (Brown 2000). Variation in the historical fire regime is a critical aspect of ecosystem dynamics and function. In particular, stand-replacing fires often display patchy effects on vegetation, leaving pockets of unburned habitat that provide refugia and edge habitats, and support unique biological communities and high levels of beta diversity (Arno et al. 2000, Lindenmayer and Franklin 2002).

Mexican spotted owl

The DEIS indicates that GRCA misunderstands what constitutes Critical Habitat for threatened Mexican spotted owl ("MSO"). It states at page 4-185, "not all mapped habitat qualifies [as critical habitat], as one or more constituent elements (tree density or steeper slopes) may be lacking." In fact, the entire mixed conifer forest type is MSO Critical Habitat if it occurs in a mapped Critical Habitat Unit ("CHU"), even if all primary constituent elements are not present. See MSO Recovery Plan and 69 F.R. 53131 (August 31, 2004). CHU CP-10 overlaps nearly all of GRCA, including the entire north rim. See map at: http://www.fws.gov/southwest/es/mso/critical_habitat/map4.html.

3

Depletion of multi-layered forest structure through management-ignited prescribed fire can degrade MSO Critical Habitat, particularly if burning causes high severity fire effects on vegetation. Prescribed firing operations therefore should not be implemented in Critical Habitat over wide areas in the same management unit in a single decade (Agee 1993). Burns should be accomplished under conditions where important structural habitat elements, such as large and old trees, can be protected (Agee and Huff 1986). Monitoring always should follow burning treatments to determine whether management goals have been met and when such activities should cease (DellaSala et al. 1995).

A final EIS should accurately disclose effects of the preferred alternative on MSO and its Critical Habitat. Required disclosure items include:

• How much mixed conifer forest habitat exists in CHU CP-10.
• How much Critical Habitat will be affected, positively or adversely, by proposed actions.
• How much Critical Habitat will be unaffected or remain untreated.
• Cumulative effects of past, ongoing, proposed, and foreseeable management activities on Critical Habitat and recovery potential of MSO.

The final item listed above is most important because the purpose of Critical Habitat is to facilitate recovery of the listed species, not merely to host a viable population. An adequately hard look at cumulative effects will necessitate a population-scale analysis.

Additionally, GRCA needs to complete formal consultation on MSO with the U.S. Fish and Wildlife Service under Section 7 of the Endangered Species Act in order to proceed with the preferred alternative. Consultation is necessary to assure the Center that outstanding issues including designation and management of Critical Habitat, appropriate survey protocols, and mitigation measures are applied to fire management operations that may cause "take" of MSO or its Critical Habitat. We expect the Fish and Wildlife Service to produce a biological opinion for this fire management plan.

Exotic weeds

Aggressive, non-native, invasive plant species can displace native plant communities causing long-lasting management problems. In displacing native vegetation, invasive plant species can increase fire hazards and eliminate wildlife forage. By simplifying native plant communities, weeds reduce biological diversity and threaten rare habitats.

Ground disturbances created by fire lines, roads, backfiring and burnouts, fire camps, helibases and helispots, incident command posts, as well as the activities of personnel, vehicles and equipment during fire management operations facilitate introduction and spread of invasive plants because they expose soil and are vectors for propagules. After fire operations,

"rehabilitation methods that can introduce or promote the spread of non-native plants include tilling or ripping of the soil (Leuschen & Frederick 1999), postfire logging (Greenberg et al. 1994b; Sexton 1998; McIver & Starr 2000), and the application of straw mulch contaminated with weeds (Robichaud et al. 2000; U.S. Department of Agriculture Forest Service 2002a). Use of heavy equipment for contour trenching, terracing, and postfire logging activities (also including road building and skid-pad construction) may produce substantial soil disturbance (McIver & Staff 2000; Robichaud et al. 2000; U.S. Fish and Wildlife Service 2002), with implications for compaction, erosion, sedimentation (Helvey 1980; Helvey et

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al. 1985; Klock et al. 1985), and spread of non-native plants."

Backer and others (2004:941). It is reasonable to predict an increased risk of spread of invasive plants species within burned areas due to the introduction or spread of weed seed from weed sites within or outside of the burned area during fire suppression efforts.

High severity fire effects, to the extent that they occur, also can facilitate weed establishment and spread. As burn intensities increase, survivorship/cover of existing native vegetation declines, reducing, in turn, the effectiveness of local native plant species in their competition with invasive weed species. This can have long-lasting and far-reaching effects:

"The effects of invaders are particularly dramatic when they alter disturbance regimes beyond the range of variation to which native species are adapted (e.g., D'Antonio et al. 1999), resulting in community changes and ecosystem-level transformations (Mack and D'Antonio 1998). Invaders that alter fire regimes are widely recognized as some of the most important system-altering species on the planet (Vitousek 1990, D'Antonio and Vitousek 1992, D'Antonio 2000). An example of a widespread invader that has caused tremendous changes in fire regimes and other ecosystem properties is the alien annual grass Bromus tectorum in western North America. Its invasion across this vast landscape has increased fire frequency to the point that native shrub–steppe species cannot recover (Whisenant 1990). This, in turn, negatively affects animals that require this habitat type for forage and cover. These include the sage grouse (Centrocercus urophasianus) and species such as the black-tailed jackrabbit (Lepus californicus) and Paiute ground squirrel (Spermophilus mollis), which are major prey items for golden eagles (Aquila chrysaetos) and prairie falcons (Falco mexicanus) (Knick et al. 2003). Efforts to restore native plant communities and preinvasion conditions in this shrub–steppe system may be hampered by changes in the spatial and temporal distributions of soil nutrients as well as the high density of the invader's seed bank."

Brooks and others (2004:677 – emphasis added). Weed spread can make fire more difficult, expensive and dangerous to manage, and indirect effects over time can be far reaching and irreversible (678-679).

Cheatgrass (Bromus tectorum) is of particular concern to the Center because it is present at GRCA now, it has a high propensity to spread, and its spread can drastically alter the fire regime of park landscapes. The presence of cheatgrass has important long-term implications for native plant communities. Melgoza and co-workers (1990) studied cheatgrass soil resource acquisition after fire and note its competitive success owing to its ability suppress the water uptake and productivity of native species for extended periods of time. They further note that cheatgrass dominance is enhanced by its high tolerance to grazing (also see Mack 1981).

Cheatgrass is well adapted to fire and often dominates plant communities after disturbance (Young et al. 1969). Its annual life-form coupled with the abilities to germinate readily over a wide range of moisture and temperature conditions, to quickly establish an extensive root system, and to grow early in the spring contribute to its successful colonization (Melgoza et al. 1990). Some native species also exhibit this trait, but greenhouse and field studies show that cheatgrass effectively competes with seedlings of perennial species (Hull 1963, Harris 1967, Evans et al. 1970, Harris and Wilson 1970). In addition, Melgoza and others (1990) show that cheatgrass successfully competes with the native species that survive fire, despite these plants being well-established adult individuals able to reach deeper levels in the soil. This competitive ability of cheatgrass contributes to its post-fire dominance.

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The DEIS is largely silent about potentially significant cumulative effects of cheatgrass spread resulting from livestock grazing and logging operations on the North Kaibab Ranger District together with the Proposed Action. Adherence to best management practices does not ensure that Forest Plan objectives will be met or that significant environmental effects will be prevented. The final EIS needs to address specific methods that will be used to mitigate weed spread, and it must candidly assess their effectiveness. Existing cheatgrass infestations within the project area belie any contention that monitoring and mitigation are sufficient to "prevent adverse effects." GRCA needs to address potentially significant uncertainties that may affect the statement of environmental impacts. See 40 § C.F.R. 1502.24.

Please send me a copy of the final environmental impact statement and record of decision when they are available.

Sincerely,

Jay Lininger, Ecologist
Center for Biological Diversity
P.O. Box 1178
Flagstaff, AZ 86002-1178
Tel: (928) 853-9929
Email: jlininger@biologicaldiversity.org

Attachments and References submitted with mailed hard copy.

Mark W. Belles
9318 Willard Street
Rowlett, Texas 75088

Office of the Superintendent
ATTN: FMP Comments
P.O. Box 129
Grand Canyon, Arizona 86023

11 November 2008

Dear Superintendent,

Regarding the Notice of Availability of the Draft Environmental Impact Statement for the Fire Management Plan, Grand Canyon National Park published in the Federal Register on October 23rd, 2008 (Vol. 73, No. 206), please place my name on the mailing list for this project.

I have read the DEIS have the following comments.

I completely agree with the five goals expressed in the plan. I am gratified that the Park Service has chosen to place the restoration and maintenance of park ecosystems second in importance only to public safety. It is clear from current fire research that the Fire Management Plan for Grand Canyon National Park should firmly embrace the need to restore a natural fire regime to as broad an area of the park as possible. With this over-arching goal in mind, it is clear that Alternative 5 would best achieve this outcome.

The use of wildland fire requires courage on the part of Fire Managers. No fire is ever allowed to burn without some attendant risk. A clear management strategy with a standardized risk assessment method and decision tree, that provides the Fire Manager with a strong foundation of policy to support the decision making process, is vital to the exercise of this authority in a manner that will be supported after the fact.

Please add these considerations/analysis to the planning process.

Respectfully,

Mark Belles

Page 1 of 1

GRAND CANYON TRUST

January 20, 2009

Steve Martin
Superintendent
Grand Canyon National Park
P.O. Box 129
Grand Canyon, AZ 86023-0129

Dear Superintendent Martin:

Please accept these comments regarding the Draft Environmental Impact Statement (DEIS) for the Grand Canyon National Park Fire Management Plan (FMP). These comments are meant to serve as our focused response to the DEIS regarding several major points of interest/concern.

First, we would like to express our support for your efforts to use fire wisely as a restoration and ecosystem management tool within Grand Canyon National Park. We recognize the numerous challenges inherent to fire use and management across the Southwest, and appreciate the efforts you have made on the ground and within this DEIS and its precursors to address the costs and benefits of fire use systematically and responsibly.

In our review of the DEIS, we have noted the following deficiencies which we consider to be opportunities for further analysis and collaboration:

1) **Landscape context** ~ As evidenced by several recent large fires, including the Rodeo-Chediski and Warm fires, unnaturally severe fires are occurring at increasingly broad scales across the Southwest. Any attempts to modify vegetation structure, through the use of fire or mechanical thinning, should explicitly recognize the scale at which such fires have occurred and/or might occur in the future. GCNP's efforts to restore ecosystems with a mix of small tree thinning, prescribed burning, and Wildland Fire Use activities are laudable. However, we feel that any efforts that remain disconnected from fire use and/or mechanical thinning efforts outside GCNP will be, ultimately, inadequate in meeting broader ecosystem goals.

   The effects of jurisdictionally fragmented management are most noticeable and compelling on the Kaibab Plateau. We strongly suggest that additional analysis be conducted and coordination/collaborative mechanisms be established with an explicit intent of bolstering fire management and/or restoration activities coordination across the GCNP/NKRD boundary. We

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believe such efforts are necessary to address fire-related issues that manifest at the landscape scale, such as fire spread into and out of the park, post-fire invasive species establishment and spread, landscape-scale canopy-dependent species habitat characteristics, post-fire watershed characteristics, wildlife movement corridors, etc.

The Grand Canyon Trust, working with Northern Arizona University, have recently developed several scientifically rigorous landscape-scale datasets describing predicted cheatgrass occurrence, forest structure characteristics, and fire behavior/hazard/risk characteristics for the entire Kaibab Plateau. These datasets serve as best available science describing forest, fire, and cheatgrass characteristics for the larger Plateau. We respectfully submit hardcopy representations of these datasets in the attached Appendix, and request that you incorporate these datasets to the maximum degree practicable in finalizing the DEIS (especially the cumulative effects section thereof). We are willing to transfer the GIS datasets underlying these maps as soon as is practicable for you.

Additionally, and importantly, we offer these datasets as key elements of a data foundation supporting landscape-scale, cross-jurisdictional coordination across the Kaibab Plateau. We expect that complete implementation of this DEIS will both require and facilitate the development of a coordinated and collaborative landscape-scale, Plateau-wide fire management and restoration planning effort, especially focused on higher elevation mixed conifer and spruce fir forests which exist contiguously across the GCNP/NKRD boundary. We are more than willing to work with GCNP, NKRD, and other stakeholders to facilitate analysis and implementation of cross-boundary fire management strategies.

2) **Invasive species** ~ Throughout the document, inadequate attention has been paid to potential post-fire invasion by non-native plant species. We are particularly concerned about invasion of burned areas by cheatgrass, which has the potential to affect type conversion at landscape scales. As described above, we have developed a first-of-its kind, rigorous, and peer-reviewed prediction of cheatgrass occurrence. Currently, the model we have developed does not extend south of the GCNP/NKRD boundary. We can in a relatively straightforward fashion extrapolate and extend the model into GCNP. We also have the capability to assess the potential impacts of mixed to high severity fire on cheatgrass occurrence. We would be glad to share this dataset with you, and to modify model output to meet your needs.

3) **Adaptive management** ~ While certain adaptive management components (assessment, monitoring, research, etc.) have been described throughout the DEIS, we feel that the description of the adaptive management process to be employed is piecemeal, highly generalized, and insufficient. GCNP is perfectly positioned to develop and employ an integrated and systematic adaptive management program with specified feedback loops and decision

criteria. We respectfully request that additional consideration be given to the adaptive management elements of the fire plan. We also offer our the services of our volunteer program in providing ongoing, systematic ecological monitoring of fire effects.

4) **Effects on listed species** ~ We are concerned at the likelihood that proposed fire management will negatively affect listed species, including Mexican spotted owl critical habitat. We strongly encourage you to coordinate with the U.S. Fish and Wildlife Service to determine mitigation measures needed to minimize deleterious effects. Furthermore, we recommend that GCNP and invested partners initiate with all due haste research to clarify the use of the Kaibab Plateau by Mexican spotted owl.

5) **Fire suppression** ~ We are concerned that the DEIS does not systematically address the effects of potential fire suppression activities. Given the somewhat stochastic dynamics of fire in higher elevation forests (and given the history of fire management within GCNP), it is quite likely that fire suppression will be necessary. Elucidating the effects of such suppression will help to fully capture the ecological effects of all fire management alternatives.

Thank you for the opportunity to comment on proposed fire management activities within GCNP. We strongly encourage you to address deficiencies in the DEIS related to the issues described above. We look forward to contributing our volunteers, scientific datasets, and landscape-scale restoration and fire management expertise within and beyond the DEIS process.

Sincerely,

Ethan Aumack
Director of Restoration Programs
Grand Canyon Trust

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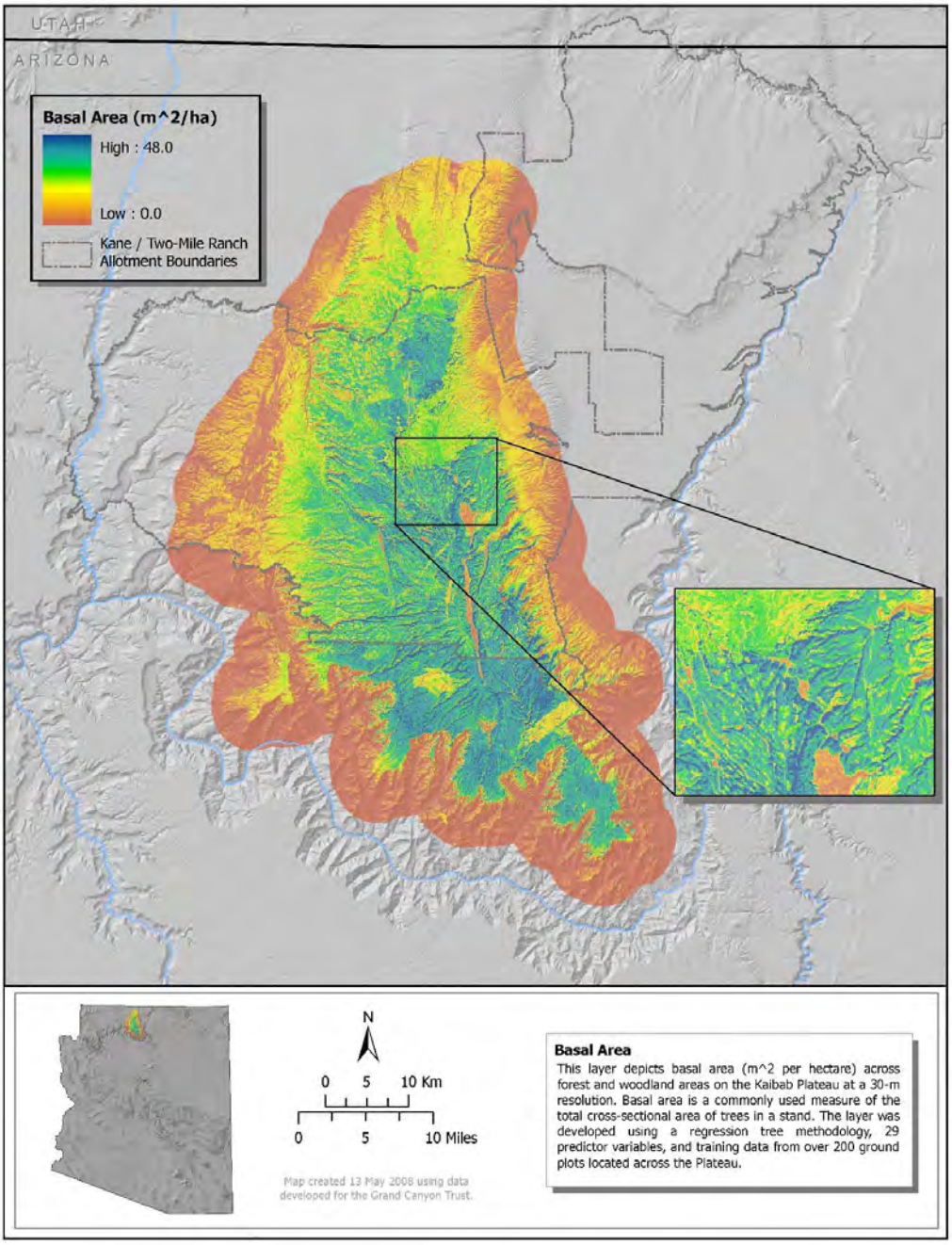
Appendix

Map 1. Basal area characteristics across the greater Kaibab Plateau



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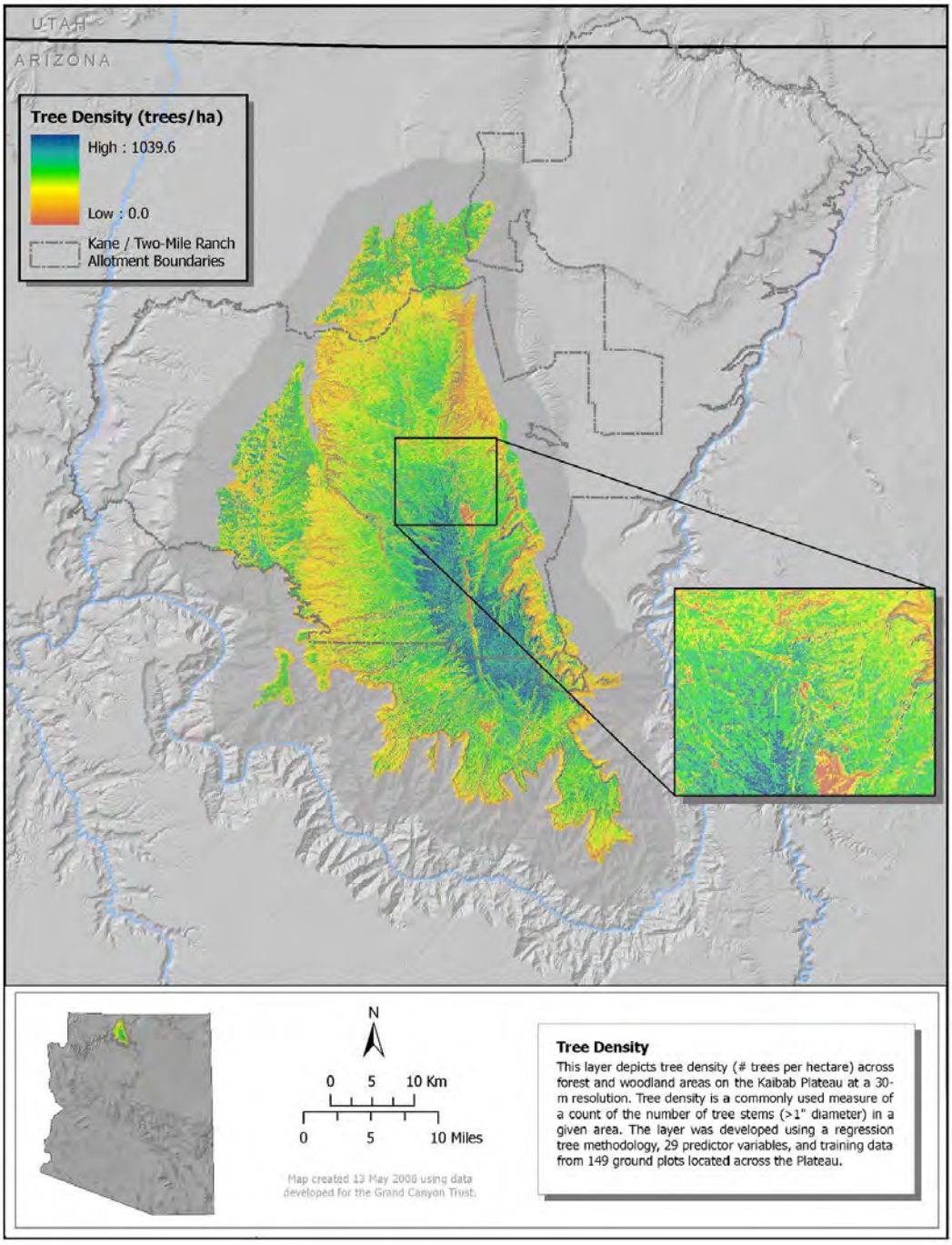
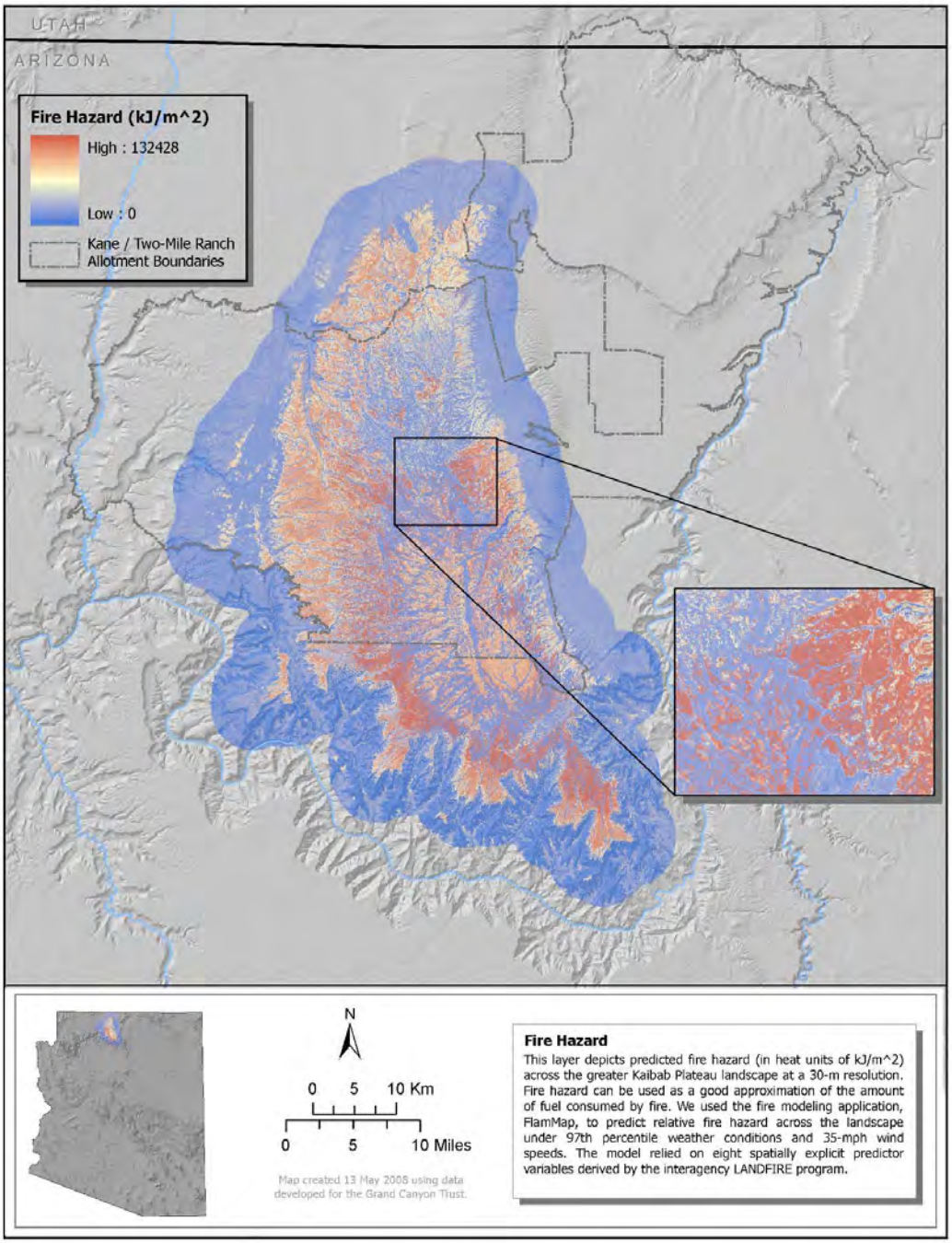
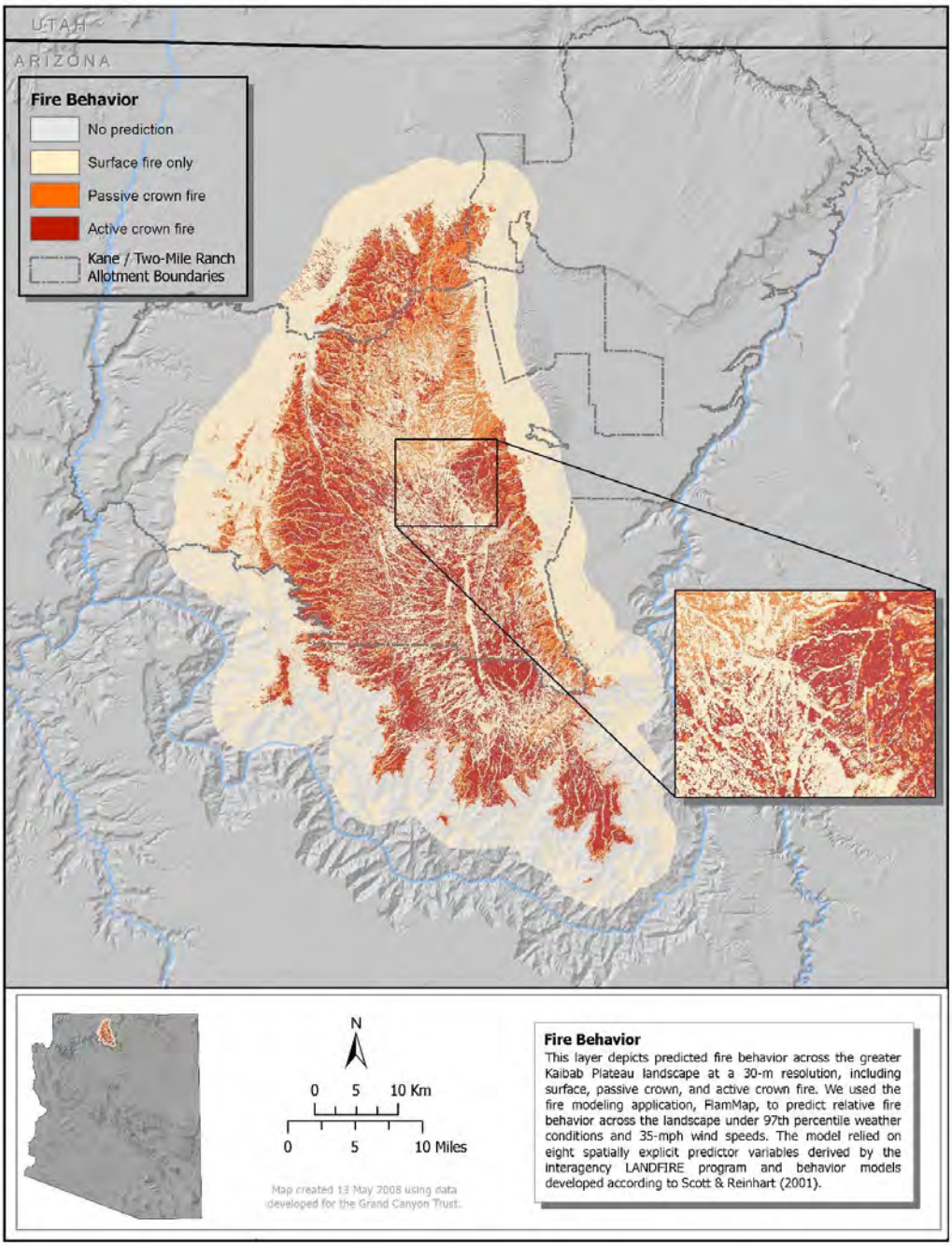
Map 2. Tree density characteristics across the greater Kaibab Plateau



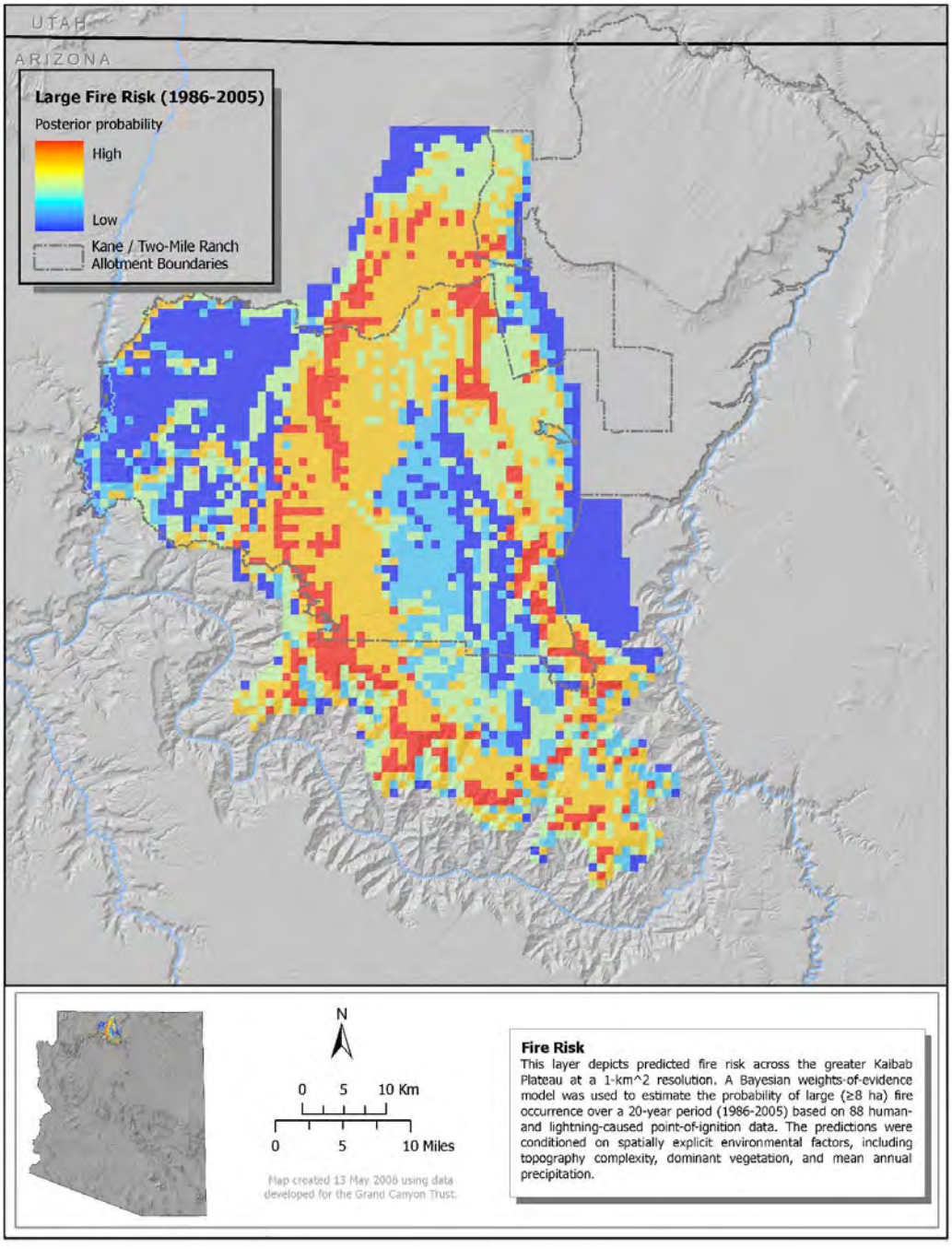
Map 3. Fire hazard characteristics across the greater Kaibab Plateau



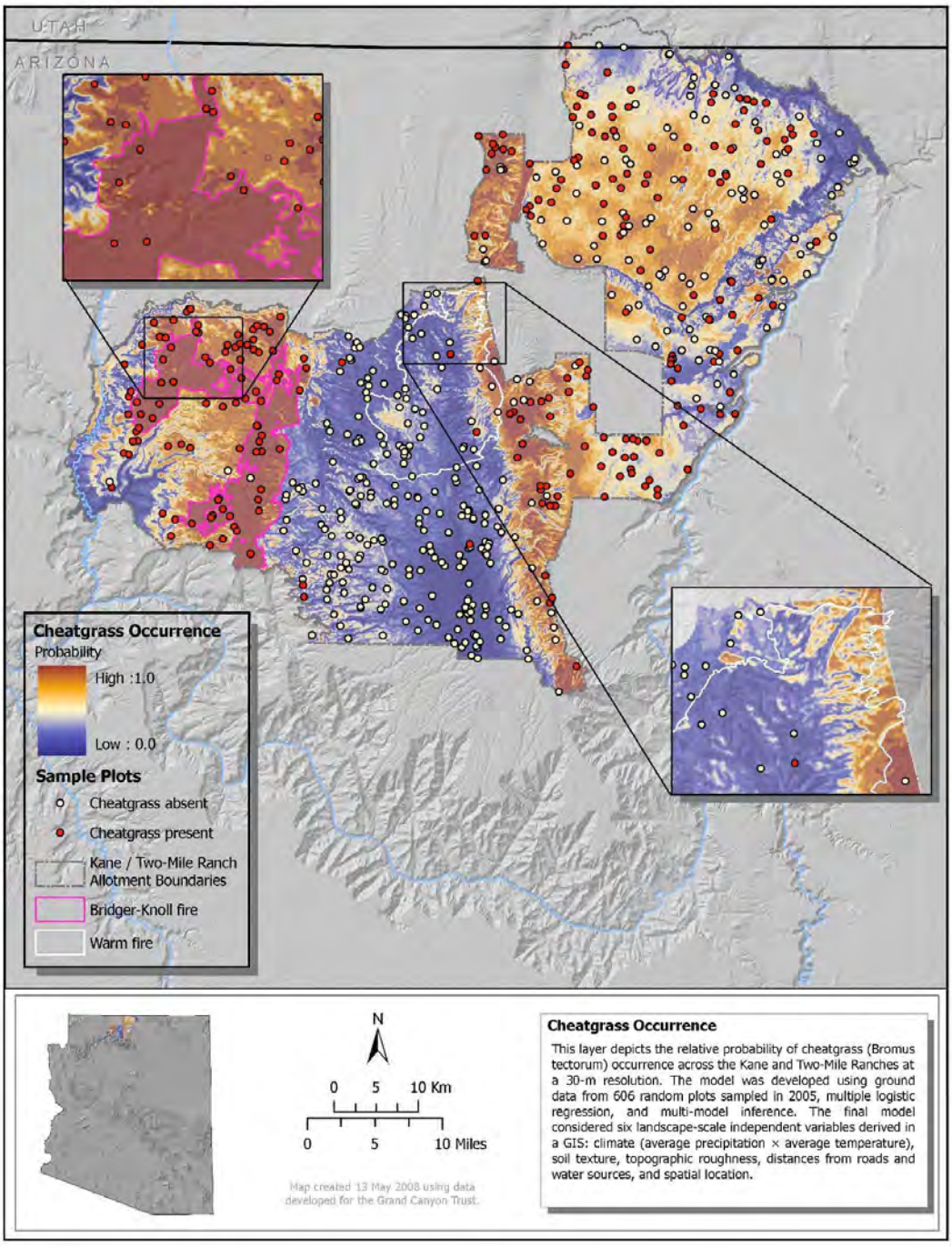
Map 4. Fire behavior characteristics across the greater Kaibab Plateau



Map 5. Fire risk characteristics across the greater Kaibab Plateau



Map 6. Predicted cheatgrass occurrence on the Kane and Two Mile ranches



Steve Martin, Superintendent
Grand Canyon National Park
P.O. Box 12
Grand Canyon, AZ 86023
http://parkplanning.nps.gov/grca.

January 21, 2009

Dear Superintendent Martin,

Thank you for the opportunity to comment on the Draft Environmental Impact Statement for Grand Canyon's Fire Management Plan.

The Grand Canyon Wildlands Council fully supports the reintroduction of natural processes, especially the role of fire in fire-adapted ecosystems. We believe the explicit desired condition for the wilderness forest in Grand Canyon National Park should be ***the perpetuation of park ecosystems and the restoration of natural fire regimes.*** The General Management Plan (GMP, p. 17) clearly states that the agency will strive to restore the natural role of fire within park ecosystems. In addition, the Park's *Resource Management Plan* (RMP:50) commits the agency to reintroduce and maintain fire's natural role in Park ecosystems to the maximum extent possible. NPS Policy (§6.3.9) states that the park's fire management and wilderness management plans must identify and reconcile the natural and historic roles of fire in the wilderness (94% of the Park), and will provide a prescription for response, if any, to natural and human- caused wildfires. If a prescribed fire program is implemented, these plans will also include the prescriptions and procedures under which the program will be conducted within wilderness. Only actions necessary to achieve objectives set forth in the Park's GMP and FMP are justified, and they must employ the minimum methods and techniques required.

- *Ecosystem Conservation*
As written, it appears that the Park Service has not developed a fire policy grounded in ecosystem processes, but rather an operational burn plan. We believe the Park must play a pivotal leadership role in restoring natural fire to Kaibab and northern Coconino plateaus. This requires maintenance and restoration of vital ecological and evolutionary processes, abiotic and biotic, and is ultimately possible only within a natural landscape-scale context, such as the entire Kaibab Plateau (Grand Canyon Game Preserve and Grand Canyon National Park). We applaud the Park's effort to coordinate its fire/restoration program with the Forest Service adjacent to the north and south rims, but we urge the NPS to extend its efforts to include development of explicit conservation goals that transcend agency boundaries.

For example, fire frequencies in wilderness may be too low to produce natural fire regimes. In presettlement times, many lightning fires originated outside of and spread into areas classified as wilderness or parks (Kilgore 1987). In regard to natural fire frequencies, suppression outside park boundaries, such as the

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Kaibab Forest, is essentially fire suppression within (Knight 1991:91). Also, some lightning fires currently ignited in wilderness are suppressed to protect life, property, and cultural resources (NPS 1992:1).

Often, fire suppression within the Park is conducted solely to prevent its spread into the so-called "commercial" forests. In the past, draconian measures, such as bulldozed fire lines within the Park's precious old growth forest, were conducted to limit fire in the heavily logged stands beyond its border. Recent proposals, such as the defunct "Roost" fuel reduction project to "reduce hazardous fuel accumulations in order to restore the area to a more natural and sustainable ecosystem… [and] creating defensible boundaries for prescribed fire and fire use," reveal a persistent inclination to ignore the value of the Park's old growth forest. As a logical solution we endorse using the Fire Point road as the primary fire break between the Park and portions of the National Forest.

Since none of the five alternatives represent a range of ecosystem restoration strategies, we urge the Park to develop a supplemental DEIS that includes additional alternatives based on an ecosystem conservation approach.

- Minimum Requirement
Grand Canyon Wildland Council's supports the adherence to the "minimum requirement" concept. NPS Policy (§6.3.9) states "Fire management activities conducted in wilderness areas [this includes the proposed wilderness of Grand Canyon] will conform to the basic purposes of wilderness." Policy also states "actions taken to suppress wildfires will use the minimum requirement concept, and will be conducted in such a way as to protect natural and cultural resources and to minimize the lasting impacts of the suppression actions." Specifically, law and policy (USDI 2001) obligates the NPS to apply the "minimum requirement concept" of the Wilderness Act to **all management actions** including administrative, scientific and commercial uses within the Park's proposed wilderness (USDI 2001, §6.3.5). Also, Policy advises that "[m]anagement intervention should only be undertaken to the extent necessary to correct past mistakes, the impacts of human use, and influences originating outside of wilderness boundaries" (§6.3.9).

- Fire Roads
We urge the implementation of the Park's wilderness recommendation regarding closure of the so-called "fire roads" within the proposed wilderness of Grand Canyon National Park. The GRCA Draft Wilderness Plan (USDI 1998:76-77), reiterating provisions of the 1980 Wilderness Recommendation, points out that the six so-called "fire roads" within the proposed wilderness of Grand Canyon National Park (Tiyo Point, Komo Point, Walhalla Glades, Francois Matthes Point, Widforss and W-1 from the landfill to its junction with the Point Sublime Road) are (or should be) closed to public and administrative mechanized transport. These routes constitute nonconforming intrusions within the proposed wilderness

and administrative use of mechanized transport or tools, if any, should be evaluated in the context of the minimum requirement concept.

Thank you again for the opportunity to comment on the Draft Environmental Impact Statement for Grand Canyon's Fire Management Plan.

Kim Crumbo, Director of Conservation
Grand Canyon Wildlands Council
P.O. Box 1033
Grand Canyon, AZ 86023

Cc: Kelly Burke, Executive Director, Grand Canyon Wildlands Council

References:

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I support the reintroduction of natural processes, especially the role of fire in fire-adapted ecosystems. However, I believe that the Park Service has not gone in the correct direction. Rather than a fire policy grounded in ecosystem processes, the Park Service has developed an operational burn plan. None of the action alternatives are acceptable. The five alternatives do not represent a range of ecosystem restoration strategies. Please develop a supplemental DEIS that includes additional alternatives based on an ecosystem approach. The DEIS must review past mistakes, such as high mortality and crown fire in previous burns, and discuss how such high mortality might be avoided in the future.

Bettina Bickel

Contact FAA prior or during prescribed/fire use activities because this way when pilots call FAA will know if this is an activity that the park is already aware of.

Kanab Public Meeting

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Dear Superintendent Martin:

We are submitting these comments on the Grand Canyon National Park Fire Management Plan Draft Environmental Impact Statement (DEIS) on behalf of the Sierra Club's Grand Canyon Chapter. The Sierra Club is America's oldest, largest and most influential grassroots environmental organization. Inspired by nature, the Sierra Club's more than 750,000 membersincluding 13,000 plus in Arizona as part of the Grand Canyon Chapterwork together to protect our communities and the planet. The Sierra Club has been involved for many years in working to protect the Grand Canyon and its resources and has a significant interest in this fire plan. We provided scoping comments on the plan back in 2003. Many of our members enjoy hiking, backpacking, wildlife and scenery viewing, and educational opportunities throughout the Grand Canyon National Park.

Introduction

The Sierra Club-Grand Canyon Chapter appreciates the amount of work that has gone into to developing this fire management plan and appreciates the opportunity to provide comments. Based on the timing of the comment period as well as the large gap in time between when the plan was originally scoped and when the DEIS came out, we ask that you consider extending the comment deadline. This will allow us an opportunity to further discuss the proposal and seek some clarification on important issues.

The Sierra Club supports prescribed fire and wildland fire use as tools to restore forest systems and to reintroduce natural processes, especially the role of fire in fire-adapted ecosystems such as the ponderosa pine and mixed-conifer forests. As we stated in our scoping comments, we favor an approach with the goal of restoring natural processes, over a restoration approach that seeks to replicate specific forest structures. Focusing on restoration of natural processes allows the National Park Service (NPS) to use a range of historic conditions for reference without the burden of attempting to inappropriately replicate a specific forest structure, at a specific point in time.

We appreciate the leadership of the NPS in working to restore the role of fire in northern Arizona forest ecosystems. This approach is consistent with the mission of the NPS and with protecting the Canyon's resources. We do have a number of concerns about the DEIS and that while the goal to restore a natural fire regime is laudable, the DEIS itself is taking the Park in a direction that is inconsistent with that goal.

This draft fire management plan is deficient in several areas. First of all, it is drafted as an operational burn plan rather than a plan grounded in ecosystem processes and does not include a range of alternatives that focuses on protecting and restoring resource values, but rather analyzes

the effects of a range of fire management tools which all achieve similar objectives. For example, the Desired Conditions are not based on ecosystem needs but rather on fire behavior. The DEIS does not use models to create and compare various burn severity scenarios. The DEIS does not use adaptive management and fails to adequately review past mistakes what worked and what did not and then to incorporate it into this plan. For example, it does not address how canopy loss that is a frequent feature of previous burn activity on the North Rim can be reduced. Finally, we expected to see a new fire management plan, as promised in the 2001 scoping letter and the 2003 Notice of Intent, not just a revision of the old fire management plan.

It is the mission of the National Park Service to focus on protecting natural resources. The National Park Service Organic Act states:
The service thus established shall promote and regulate the use of the Federal areas known as national parks, monuments, and reservations hereinafter specified by such means and measures as conform to the fundamental purpose of the said parks, monuments, and reservations, which purpose is to conserve the scenery and the natural and historic objects and the wild life therein and to provide for the enjoyment of the same in such manner and by such means as will leave them unimpaired for the enjoyment of future generations.

In accordance with this, the NPS should place the highest priority on managing fire issues on Park lands to further the protection of Park resources, including landscapes and scenic quality, wildlife and plant species, and cultural objects and sites. The Fire Management Plan must more clearly reflect this central mission.

The development of new Fire Management Units (FMUs) is a step in the right direction as it works towards an ecosystem based approach. However, it would have been more useful if each of the eight new FMUs also had a fire treatment associated with them. If the development of the alternatives was based upon the FMUs, the management prescriptions would have been closer to an ecosystem based management plan.

The Fire Management Plan itself has been organized in a manner that makes it very difficult to read. Much of the modeling analysis, or admission of the lack thereof, is contained in the appendix rather than the main body of the DEIS. The environmental impacts of each alternative is also scattered throughout the document and is it difficult to clearly discern the differences and level of impact among the alternatives.

The Sierra Club has frequently expressed concerns about the lack of National Environmental Policy Act (NEPA) analysis related to on site specific burns. This planning process and resulting document should specify a NEPA process for site specific actions. Annual burn plans, maps, etc. could all be posted to the Park's website so that the agency only has to send a brief mailing or email message to alert the public to available documents for comment.

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While we strongly support the reintroduction of natural fire processes, we cannot support any of the alternatives listed in the document and request that the NPS develop new alternatives for the fire management plan, perhaps based upon the FMUs as discussed above. We ask that you reconsider this DEIS and develop a supplemental DEIS that includes additional alternatives. Furthermore, we ask that the NPS resolve the related issues outlined below.

Alternatives (DEIS Chapter 2):

Inadequate Development of the Alternatives

The FMP DEIS does not accomplish its objectives as stated in the May 2001 and September 2003 scoping documents nor does it adequately fulfill the National Environmental Policy Act (NEPA) requirements. The NPS has had nearly eight years from when this was first scoped to develop a fire management plan with a range of alternatives that focuses on protecting and restoring the Park's resources. The scoping letter dated May 31, 2001 (DEIS Appendix B, Attachment A), states, "The park welcomes your participation in understanding these management actions and developing alternative actions." We vwould have liked to have been more involved in the development of the alternatives as the 2001 scoping letter suggests, but there was little communication on the plan until the NPS came out with DEIS. Had we known sooner of the direction of the plan, we could have presented our concerns and worked with the NPS to develop an alternative that better achieves the goals and that is more consistent with the Park mission and more clearly connects ecological goals with the plan. It is unfortunate that the NPS did not offer additional opportunities for public comment before releasing the DEIS and chose such a busy time of the year (the holiday season) to release its DEIS.

In scoping comments, dated November 14, 2003, the Sierra Club encouraged the NPS to develop alternatives based on the absolute minimum intervention necessary to achieve reintroduction of natural process such as fire. This would mean the development of a fire policy that has a basis in ecosystem processes. We also noted that the fire management plan should recognize that ecosystem structures and processes have been altered to the point where fire might have to be used repeatedly in the same location before any historic fire behavior could be replicated. While the DEIS notes the idea of changed fire behavior and supports repeated burn cycles, the Desired Condition statements, the Alternatives and accompanying analysis still appear to hang on achieving a single historic condition.

The DEIS states that, "Action Alternatives (Alternatives 2, 3, 4 and 5) propose a variety of fire fuel, and vegetation treatments to accomplish objectives for ecosystem maintenance, ecosystem restoration, and hazardous fuel reduction for the GRCA wildland fire management program" (Page 2-1). The alternatives displayed may represent a range of wildland fire management

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strategies and tools but they do not represent a range of ecosystem restoration strategies. The alternatives all use the same tools, just in varying degrees of emphasis related to treatment locations.

NEPA requires government agencies to create a reasonable range of alternatives. However, Alternatives 3, 4 and 5 are all entirely unrealistic and would obviously not be the preferred choice of fire managers. The presentation of these single tool alternatives and comparison with a radically different multi-treatment alternative is an unfair basis for comparison. What is needed is a variety of multi-treatment, ecosystem based alternatives. Moreover, in the DEIS the selection of Alternative 2 is certain since fire managers prefer to maximize the "number of tools in the toolbox." It is just as certain that NPS fire managers would not chose an alternative that allowed the utilization of only one of those tools. Therefore, alternatives 3-5 are not truly viable alternatives.

The DEIS is also deficient and inconsistent in its description and analysis of the eight Fire Management Units (FMUs). It would be useful for the final EIS to include a more thorough and clear description of the type and intensity of fire management treatments that will be utilized with each FMU. The action alternatives expand the Fire Management Units (FMUs), but effectively result in little change in environmental impacts. This expansion appears to be more of an operational alteration not an environmental one and merely makes it easier for the NPS to organize its fire operations.

Minimal Difference between No Action and the Preferred Alternative and Failure to Justify Preferred Alternative

According to the 2003 scoping letter, the intent was to prepare a new fire management plan. Instead, Alternative 2, the "Preferred" alternative is a revision to the previous plan. Revisions already occurred in 1995 and 1998 without a full NEPA EIS process. If the intent was to do a minor revision, why use this process now? Again, the stated intent of the scoping letter was not another revision, but "preparation of a new fire management plan&." The NPS did not fulfill its own stated objectives with the document that has been produced and has created a fire management plan that differs greatly from what the public supported and called for during scoping nor does it reflect the public's concerns or its own stated objectives.

There are minimal differences between the current 1992-2005 Fire Plan (No Action Alternative) and the Preferred Alternative, although the impacts relative to fire intensity could be significant.

One example of the similarities is stated below:

"The No Action Alternative assumes a similar or slightly higher level of suppression would

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occur as occurred 19932005" (DEIS Ch.2-39).

"Alternative 2, Mixed Fire, assumes a similar or slightly higher level of suppression would occur through the life of the plan as occurred 19932005" (DEIS Ch.2-42).

Though a larger portion of the Wildland-Urban Interface (WUI) area will be mechanically treated, the WUI is a very small percentage of the park (1.22% WUI and 1.27% Secondary WUI, Pg. 2-33) and thus a very small part of the overall management plan.

While the changes are limited between the "No Action" and "Preferred" alternative, there are also several problems with the primary changes:

The critical difference between Alternative 1 and Alternative 2 is that the Preferred Alternative will widen the range of severity and allow for higher fire severity. The DEIS does not provide the necessary justification for the greater fire severities, however.

The current approach to mixed-conifer and spruce-fir has not been successful, yet there is little difference between current efforts and the proposed "Preferred" alternative. In fact, the "Preferred" alternative intensifies the same treatments in these habitat types and could mean that this plan exacerbates problems including high mortality in these ecosystems.

The "Preferred" alternative calls for increasing treatments in the piñon-juniper habitat, however, few fire or fuel studies had been conducted on piñon-juniper ecosystems at the time of the writing of this document. (Several new studies have been published in 2008 and perhaps can be considered with the FMP DEIS revision.) The NPS has not scientifically demonstrated its rationale for this decision not has it utilized the best available science in order to come to this decision. Environmental information "must be of high quality. Accurate scientific analysis, expert agency comments, and public scrutiny are essential&" (40 C.F.R § 1500.1 (b)). What is the basis for the burn plans for the piñon-juniper?

Lack of Data and Analysis to inform the Development of Alternatives

As admitted in this document, there is a lack of data with which to inform the development of the alternatives. In Appendix F, Fuel Modeling the DEIS states:

AMSET extensively investigated crown fuel layers provided by GRCA, but determined that layers were not comprehensive enough (areas missing), not updated for fires as was the surface fuel layer, had apparent inconsistencies, and were difficult to understand. AMSET tried to correct inconsistencies and update data for fires, but, in the end, a reasonable layer could not be constructed for the analysis area, thus testing and revision of LANDFIRE data for fires since

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2000 begun from scratch. (Appendix F-1)

Chapter 4, page 15 also discusses problems with the issue of lack of data and limitations of models used, in this instance on fuel accumulations in untreated areas:

Fire-effects monitoring data clearly show surface fuel accumulations after ten years; however, data were limited in number of plots and did not encompass all vegetation types and conditions. Data also did not include measures necessary to estimate crown fuels (canopy base height and canopy bulk density), since they were designed primarily to measure fire effects changes. Existing data were not considered adequate to accurately predict fuel condition changes. The Forest Vegetation Simulator model does provide predictions of surface and crown fuel accumulations over time, but this portion of the model is limited and results uncertain, particularly for surface and ladder fuels. Therefore, changes in fuel conditions in untreated areas were discussed qualitatively. They were not incorporated in FARSITE and FlamMap fire-behavior predictions. Expected changes in fire behavior due to qualitative predictions in fuels were described qualitatively.

Qualitative discussions on an issue as important as fire effects and fire behavior are not acceptable.

Also absent is a discussion of past burns, lack of success with past burns, and how the NPS will attempt to avoid past mistakes. In particular, there is insufficient acknowledgement of difficulty and past lack of success in spruce-fir and mixed-conifer. The key issue that must be reviewed is the frequent occurrence of crown fire in non-crown fire landscapes, i.e., unnatural Outlet and Poplar Fires, as well as Warm Fire in the Kaibab National Forest.

The "No Action" alternative is based on fire management activities that occurred from 1993-2005, yet impacts from the previous 15 years of fire management at Grand Canyon are not fully analyzed. Data from these actions should be included and analyzed in order to inform the public as to the impacts of the proposed alternatives. Unfortunately, these data are not presented in this document. A thorough analysis of the "No Action" alternative should be what informs the proposed action alternatives, including the "Preferred" alternative. The lack of available data has led to an insufficient level of analysis of the "No Action" and all of the action alternatives.

See additional comments on this issue below, page 11. [In Environmental Consequences, Assumptions Made for Modeling and Incomplete Data]

DEIS Fails to Utilize the Best Available Science

As we discuss throughout our comments, we are concerned about the lack of appropriate data as

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well as the data limitations and how that has impacted the alternative development and analysis throughout the DEIS. There should be much more available data from the last thirteen years of implementation of the fire plan. If you are not utilizing that available data, how are you making appropriate decisions?

Desired Conditions (Chapter Two DEIS)

We support the NPS goal of using desired conditions, with a range of natural variability and achievement bench marks related to achieving ecological objectives to guide fire management. While the goals are positive, the analysis appears to favor hard targets that are poorly defined, over a range of variability. The difference between historic and existing forest structures and achieving that historic structure have become hard targets in assessing the impacts of the alternatives. In part, this may be the result of lack of data for certain habitat types and model limitations. This is of particular concern in spruce-fir and mixed-conifer habitats where there has been a long history of fire suppression. Even prescribed fires conducted under good weather conditions in these habits can result in an undesired level of severity.

Spruce-Fir

The DEIS states that spruce-fir forests likely burned as infrequent stand replacing events, as well as having more frequent, less severe ground fires. The DEIS also acknowledges the lack of data for spruce-fir habitats in the park. In an attempt to establish a range of historic conditions, the DEIS presents a diversity of studies with differing conclusions.

When considering how these diverse studies have been used to determine reference conditions it would be useful to know how the NPS is defining stand size and characteristics when discussing stand replacing events. The definition on page 6 of the glossary only refers to the total consumption of vegetation related to fire intensity. Typically both moderate and high severity fire in spruce-fir and mixed-conifer are considered stand replacing events because of the high percentage of canopy loss. Given the lack of structural stage data displayed in this section of the DEIS, it is difficult to determine how the stated desired conditions will affect on-the-ground conditions.

Given classification difficulties and the lack of evidence revealing "large" areas of fire-originated trees, it is hard to understand how Fulé's research on the North Rim can then be used to create a fire management plan that calls for a 30% rate of mortality from high severity fire. A high percentage of fire-initiated plots only indicates that the forest structure in those plots was created by a high intensity fire event. Alone, it does not indicate the size or percentage of mortality as it relates to the overall ecosystem component, of these "stand replacing" events. The analysis also needs to display the size and number of plots over a specific land area and how this relates to the

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spruce-fir habitat within the park boundary and on the Kaibab Plateau.

The increase in basal area and overall density for today's forests are primarily the result of fire suppression allowing for a proliferation of understory growth. The DEIS notes that fire behavior and post-fire effects are changed by the increase in fuel loads. This does not mean that the Park Service should increase the allowable level of mortality. It means that the Park Service should develop fire management scenarios that seek a significantly lower level of mortality and spatial variation to mimic infrequent stand replacing events.

When discussing the existing condition, the DEIS needs to clearly display:

" The acres of spruce-fir habitat within GCNP and the percentage of overall park habitat those acres represent. The data displayed should also include the percentage of coniferous habitat within the park that spruce-fire habitat acres represent.
" The acres of spruce-fir habitat outside of the GCNP boundaries on the Kaibab National Forest.
" Current spruce-fir forest structure in greater detail than displayed in paragraphs two and three, on page 2-4. An analysis of the cumulative effects of various fire management tools and fire intensity levels on canopy requires some information on canopy density in terms of distribution and spatial scale. A mean canopy cover of 50% does indicate a dense forest ecosystem. However, the individual stand ranges of 20% to 85% relate to past fire events, insect outbreaks, or topography. Individual stand data is very valuable when designing a specific project and assessing the potential outcomes.
" Tree densities by structural stage versus average densities. Averages of tree densities down to 2.5 cm (1") dbh, across large landscapes do not actually constitute usable stand structure information.
" Structural stage data should be displayed in inches by diameter range and tree densities should be translated into trees per acre. Research papers do use hectares instead of acres, centimeters instead of inches and meters instead of feet for tree height, the standard data displays used by land managers, such as the Forest Service are easier for the public to understand. The NPS has an obligation under NEPA to clearly and consistently display information on which the analysis is based, in a format that is generally understandable to the public.

Park Service Desired Condition for Spruce-Fir

The desired condition statement for spruce-fire forests in the DEIS seems to be defined more on how fire will behave given current forest conditions, as opposed to the forest structure and ecosystem functions that the NPS hopes to achieve. The desired condition statement does acknowledge that an increase in mortality is likely in certain forest structures because of an increase in fuel loads due to past fire suppression. We would be interested in a desired condition statement that is based on ecosystem objectives and alternatives that are designed to create fire

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management scenarios based on how past burns have behaved in the Park. While we support seeking a historic range of variability, it is important to acknowledge the loss of rare habitats within and outside of the Park and to develop management scenarios that include options based on the rarity of these habitats.

The objective of "Returning stand-replacing fire event characteristics to the range described in reference conditions" requires further definition. As previously stated, a high percentage of fire-initiated plots only indicates that the forest structure in those plots was created by a high intensity fire event. Alone, it does not indicate the size or percentage of mortality as it relates to the overall ecosystem component, of these "stand replacing" events. The analysis would also need to display the size and number of plots over a specific land area and how this relates to spruce-fir habitat within the park boundary, spruce-fir habitat within coniferous habitat in the park and on the Kaibab Plateau.

The DEIS states that the desired conditions include restoring topographic heterogeneity of vegetation types and maintaining a mixed fire regime. This represents a good ecosystem driven approach that should have generated an alternative with prescriptions that seek to mimic historic fire behavior related to changes in terrain and species composition. This type of management scenario should have driven the process, not just informed it. We acknowledge that this component of the desired condition statement will be harder to develop management scenarios for given the difficulty in identifying the gradient from mixed-conifer to spruce-fir and the cost of implementation. This however, is the type of ecosystem driven approach required to meet impairment standards for National Parks.

Park Service Desired Condition for Mixed-Conifer Forests

The Sierra Club is very supportive of NPS research and management efforts seeking to treat the mixed-conifer ecosystem as a mixed fire severity regime, with a history of frequent surface fires, rather than a stand replacing habitat. Restoring a natural fire regime in mixed-conifer will require a change from past burn designs, however.

The DEIS points to the difficulties in trying to reconstruct historic forest structure in mixed-conifer. Stating broad ranges of average tree densities indicates the overall increase in tree densities and potential fuel loads, but it needs to be displayed as a part of detailed structural stage data to determine what ecosystem components should be targeted in treatment design.

The desired condition statement for mixed-conifer forests in the DEIS starts out describing how fire will behave given current forest conditions, as opposed to the forest structure and ecosystem functions that the Park Service hopes to achieve. Then the desired condition evolves into a fairly specific description of stand structure, with a goal of reducing tree densities "by smaller size

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classes and tree species". As we stated in comments on spruce-fir, structural stage data needs to be displayed in a comprehensive and easy to use manner. When the data is scatter throughout the document, with multiple citations, the NPS needs to be very clear as to how these specific desired condition ranges were determined. The range of tree densities for the desired condition statement in the DEIS (shown below), does not relate to the densities discussed in the historic condition. At this point we cannot offer specific comments on contradictory and overlapping numbers. For Example:

Park Service Approximate Desired Condition for Mixed-Conifer:

" Maintain approximately 18.4 to 24 trees per acre (tpa) of 16+inch dbh size classes of ponderosa pine. (This was displayed as inches and acres in the DEIS)
" Tree densities greater than 31 cm (12.2 inches) dbh should range from 54 to 105 trees/ha (22 to 42 tpa). We assume that this number would also include the larger diameter trees stated for the first bullet point. How do these two desired conditions relate to each other?
" Trees greater than 24.4 inches dbh should be maintained at 6.4 to 12.8 tpa. How does this desired condition relate to the tree densities in the previous two bullet points?

We support the goal of reducing small diameter trees that have increased due to disruption of the natural fire regime, as well as seeking to restore topographic heterogeneity. The DEIS needs to use data from past and current burns to determine what specific fire tools can be used to achieve this goal and how successful past attempts have been.

When discussing the existing and desired conditions for mixed-conifer, the DEIS needs to clearly display:

" The acres of mixed-conifer habitat within GCNP and the percentage of overall park habitat those acres represent. The data displayed should also include the percentage of coniferous habitat within the park that mixed-conifer habitat acres represent.
" The acres of mixed-conifer habitat outside of the GCNP boundaries on the Kaibab National Forest.
" Current mixed-conifer forest structure in greater detail than displayed on page 2-5 and 2-6. The range of numbers in the desired condition is much more specific than for spruce-fir. We assume there is more research on which to base the stated desired condition and therefore more data to display.
" An analysis of the cumulative effects of various fire management tools and fire intensity levels on canopy requires some information on canopy density in terms of distribution and spatial scale. Individual stand data is very valuable when designing a specific project and assessing the potential outcomes.
" Tree densities by structural stage versus average densities. Averages of tree densities of a broad

nature, across large landscapes do not actually constitute usable stand structure information.
" Again, as stated relative to spruce-fir structural stage data should be displayed in inches by diameter range and tree densities should be translated into trees per acre. Research papers do use hectares instead of acres, centimeters instead of inches and meters instead of feet for tree height, however the standard data displays used by land managers, such as the Forest Service are easier for the public to understand.

Park Service Desired Condition for Ponderosa Pine

Structural stage data for the Reference, Existing and Desired Conditions sections needs to be displayed in a single table. This section of the DEIS contains contradictory and overlapping data that cannot be easily compared even when taking into account the upper and lower ranges described in the first paragraph on page 2-8. We have a similar information request for ponderosa pine that we have for spruce-fir and mixed-conifer. They are repeated below to avoid confusion.

When discussing the existing condition, the DEIS needs to clearly display:

" The acres of ponderosa pine habitat within GCNP and the percentage of overall park habitat those acres represent. The data displayed should also include the percentage of coniferous habitat within the park that ponderosa pine habitat acres represent.
" The acres of ponderosa pine habitat outside of the GCNP boundaries on the Kaibab National Forest.
" Current ponderosa pine forest structure in greater detail than displayed on page 2-7. An analysis of the cumulative effects of various fire management tools and fire intensity levels on canopy requires some information on canopy density in terms of distribution and spatial scale.
" Tree densities by structural stage versus average densities. Averages of tree densities across large landscapes do not actually constitute usable stand structure information.
" Structural stage data should be displayed in inches by diameter range and tree densities should be translated into trees per acre. The Park Service has an obligation under NEPA to clearly display information on which the analysis is based, in a format that is generally understandable to the public.

Piñon-Juniper

As the DEIS acknowledges on page 2-8, "Southwestern piñon-juniper vegetation fire regime is poorly understood because there have been few fire-history studies." The DEIS suggests using adaptive management to refine treatment prescriptions, but without adequate monitoring including monitoring of the same plots, this type of management is likely to be unsuccessful. Furthermore, there are some relatively new studies that the NPS should consider relative to this

ecosystem type. See below:

" Huffman, D.W., P.Z. Fulé, K.M. Pearson, and J.E. Crouse. In press. A comparison of fire hazard mitigation alternatives in pinyon-juniper woodlands of Arizona. Forest Ecology and Management.
" Stoddard, M.T., D.W. Huffman, T. Alcoze, and P.Z. Fulé. 2008. Effects of slash on herbaceous communities in pinyon-juniper woodlands of northern Arizona. Rangeland Ecology and Management 61:485-495.
" Huffman, D.W., P.Z. Fulé, K.M. Pearson, and J.E. Crouse. 2008. Fire history of pinyon-juniper woodlands at upper ecotones with ponderosa pine forests in Arizona and New Mexico. Canadian Journal of Forest Research 38(8):2097-2108.

Adaptive Management and Monitoring (DEIS Chapter 2)

The Sierra Club is very supportive of using adaptive management to keep plans and decisions current and to utilize information gathered on the impacts of previous actions and activities. However, there is a tremendous gap between the concept of adaptive management and its practice as is evidenced by the failure to use adaptive management in developing this fire management plan. Lack of commitment and funding for adequate monitoring are the primary culprits. Since hard data are lacking from the last 20 years of fire activity at the GCNP we are very skeptical that the Park will be able to effectively implement an adaptive management to achieve fire management plan objectives. The DEIS discusses the basic tenants of adaptive management but it fails to detail how this management will be integrated into on the ground activities nor how it will inform future planning efforts. We would appreciate additional information on exactly how the NPS intends to monitor fire projects, how you will collect and utilize data, and what the budget implications of doing this will be.

Environmental Consequences (DEIS Chapter 4)

Management Objectives

The goals and objectives for the Fire Management Plan related to vegetation are to: "restore and maintain park ecosystems in a natural, resilient condition." This includes:

" Maintaining ecosystems within the natural range of variability described in Chapter Two.
" Restoring ecosystems to the natural range of variability and Desired Condition described in Chapter Two.
" The setting of treatment priorities based on site-specific information related to natural fire return intervals and the desired conditions described in Chapter Two.

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These goals and objectives point to the need to use the best available science to develop, display and analyze the desired conditions.

Departure from historic fire regimes is a key tool in the effects analysis. Given this situation, the research needs stated in the DEIS become critical. In theory, all of the alternatives in the DEIS would move the park closer to fire return intervals, based on any amount of prescriptive fire. The issue of data accuracy and reliability becomes critical in the effects analysis. Generally speaking, the DEIS goes to great length to determine and display how fire will behave, under different conditions in each vegetation type. Our concerns relate to how these data then informed the creation of alternatives.

Assumptions Made for Modeling and Incomplete Data

It is unfortunate that the Park Service limited fire behavior modeling to pre-monsoon weather conditions. Such a constraint does relate to fires that have more severe behavior and can inform NPS fire suppression decision-making processes. However, we were looking for an analysis of fire behavior that can inform the potential for success in achieving ecosystem restoration goals during more favorable burning seasons.

The DEIS acknowledges numerous data gaps related to fuel accumulations and canopy densities that could be significant in terms of analysis outcomes. Several discussion areas of Chapters Two and Three also express the need for research related to fire regimes, particularly in spruce-fir. If the data going into the fire behavior modeling is at a coarse scale, then will the effects of fire that burns in a theoretical high severity, or crown fire condition, show any ground mosaic pattern related to topography? Adaptive management can give the NPS flexibility in project design while seeking to fill data gaps. Unfortunately, research and monitoring are seldom funded to the levels necessary to inform a planning process. The DEIS should contain a comprehensive discussion of the levels of current research and monitoring, success in funding those efforts, and future research needs.

The Incomplete and/or Unavailable Information section on pages 4-16 and 4-17 is very confusing and is contradicted, at least in part, by the Effects Common to All Alternatives, Ponderosa Pine beginning at the bottom of page 4-17. After reading the DEIS it is unclear as to which years of data the park is using. Consistency of information present is a persistent problem. For example:

Page 4-16 of the DEIS states, "Data from the GRCA fire-effects monitoring program represent a programmatic sampling approach, i.e. they are not designed to sample an individual fire or other fire treatment, but rather overall effects of all projects." How does this description of data collection relate to the statement on page 4-9, under fire effects monitoring, that, "Fire effects

monitoring data includes pre and post-fire data collected since 1990. Data collected includes overstory and understory vegetation and surface fuels." Data were also collected at one, two, five, and ten year intervals. The second statement implies that data are collected on a fire-by-fire or project-by-project basis. The implication becomes stronger in the fire severity mapping section when the DEIS states that most fires receive extensive ground truthing at one year post-fire. Both quotes are talking about the GRCA fire-effects monitoring program.

If effects monitoring data for vegetation types are not stratified into different fire severities, then what data or information is the NPS using to determine effects of different fire severity scenarios on the vegetation type in each Fire Management Unit? Sampling is stratified by pre-fire vegetation types, which is expected to reflect differences in fire patterns and responses to fire. The DEIS goes on to state that different fire types would result in different fire severities. The NPS did start fire severity mapping in 2000, which makes the previous statements in the DEIS very confusing.

Effects Common to All Alternatives:

We agree with the NPS that spatial pattern is an important and often overlooked component of fire analysis. Understanding spatial pattern and possible management scenarios to achieve it are key if restoring topographic heterogeneity is a goal of ecosystem restoration. We had hoped the DEIS would display monitoring data from past prescribed fires that would indicate the success of different ignition patterns, in different vegetation types, forest structure and associated terrain changes.

Page 4-17 of the DEIS states, "Based on monitoring data collected at GRCA since 2000, conclusions were reached on potential effects to vegetation types from fire." The DEIS notes that not all vegetation types have been monitored due to a lack of prescribed fire in those habitats, such as spruce-fir. Given past data collection efforts, why was monitoring data limited to 2000 and later? In several places the DEIS discusses fire monitoring data collection efforts since 1993 being used to inform the decision making process.

Ponderosa Pine

The DEIS notes that severity mapping commenced in 2000. These data are broken down by vegetation type as displayed in this section of the effects analysis. Once again, we must ask how this section of the DEIS relates to the data limitations discussed on page 4-16. The statements made in the second paragraph of 4-16 seem to contradict the availability of the data displayed and conclusions drawn in pages 4-17 thru 4-24, at least for later years.

The DEIS states that severity mapping (since 2000) indicates that most fires in ponderosa pine

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result in less than 20% moderate/high or high severity impacts. This 20% number is stated to refer to the individual incidents in Table 4-4. While very informative, the DEIS needs to go on to display the cumulative percentage projected by habitat type for each alternative and what percentage of habitat in the park each action represents and impacts. This is especially important given that moderate/high or high severity categories can result in greater than 80% overstory tree mortality.

The percentages displayed in Table 4-5, Projected Fire Severity by Fire Category in Ponderosa Pine, appear to be general in terms of what level of severity can be expected with differing tools and given general burn histories. The effects analysis by alternative provides additional discussion, but does not put the projected fire behavior in the context of overall impacts to the ecosystem from cumulative actions.

Tree density information can be used to inform, however it cannot be the sole descriptor when discussing achieving habitat or ecosystem objectives. As we have previously stated, the structural stage data in the DEIS are fairly coarse. Several of the ponderosa pine study areas used in this analysis contain numerous Pre-settlement trees in the 12 to 16 inch diameter classes. If ecosystem restoration is the goal, then the prescriptions and the effects analysis need to be adjusted to reflect the fact that "old growth" is a function of age not size. While reducing the number of smaller trees present since disruption of the natural fire regime is a good goal, an assessment based solely on density disruption does not capture NPS stated objectives.

The DEIS states that wildland fire-use fires in ponderosa pine can generally be expected to support little crown fire, except where a "high departure" from historic fire conditions exists. On page 4-20, the DEIS goes on to define this condition as 24% of the vegetation type in the park. According to Figure 4-2, a high level of departure in ponderosa pine would be 14%. The inclusion of moderate/high at 8% and moderate at 2%, does bring the number to 24%. Based on stated natural range of variability and fire interval objectives this seems to be an error.

Mixed-Conifer and Spruce-Fir

The questions we have related to the cumulative nature of the projected fire severity percentages in ponderosa pine also apply to Tables 4-7 and 4-9. Once again, the percentages displayed in these tables appear to be general in terms of what level of severity can be expected with differing tools and given general burn histories. The additional Tables 4-13, 4-17, 4-20 and 4-23 referenced in the mixed-conifer analysis do not answer these questions. These tables provide fire behavior and severity information based on weather variations, but do not cover existing conditions.

Our comments relating to tree density in ponderosa pine as an analysis tool when discussing

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achieving habitat or ecosystem objectives apply to mixed-conifer and spruce-fir as well.

Alternative 1 - No Action

The "No Action" alternative would normally contain a detailed description of the existing conditions and provide an effects analysis of the existing conditions. In this case, the "No Action" alternative is a continuation of the existing Fire Management Plan, as amended. The effects analysis for Alternative 1 describes fire behavior and severity for future actions.

Under Alternative 1, 70% to 100% of the ponderosa pine vegetation is proposed for treatment during the planning period. We are in favor of restoring fire to the ponderosa pine ecosystem in GCNP. We have, however, expressed several concerns about the characterization of the desired condition for ponderosa pine elsewhere in the DEIS. Page 4-29 repeats the poorly stated goal of reducing tree densities for "medium and understory" trees without reference to stand structure and ages. The effects analysis relies on achieving the goals or ranges stated in the desired condition. As a result, we have the same concerns expressed elsewhere in our comments, regarding habitat objectives for all of the alternatives.

Alternative 1 plans to treat 57% of the mixed-conifer vegetation during the planning period. Under this alternative the Park Service plans to treat the 42% designated with a high level of departure from the natural fire regime with prescribed fire. In addition 20% of the wildland fire use acres are expected to occur in this habitat type. While we are very supportive of NPS efforts to develop new prescribed fire prescriptions for mixed-conifer, based on achieving variable spatial patterns, it is unclear if the current desired condition definition can be the basis for these actions. Our concerns and comments regarding mixed-conifer expressed elsewhere in this document, apply to all of the alternatives.

An inconsistency in numbers relating to fire severity in mixed-conifer prompts a question. The desired condition statement for mixed-conifer states that, "Research suggests lower elevation mixed-conifer forests on the North Rim experienced frequent surface fires. At higher elevations research shows a mix of about 20% fire initiated mixed-conifer stands (indicative of stand replacing events fire events), and about 80% non-fire-initiated stands." Page 4-34 states that the historic mixed-severity fire pattern for this habitat type would result in 30% of the area burning at high severity over the long term. It is unclear where the increase from 20% to 30% occurred in the analysis. Given the vegetation impact definitions of high severity, we have to assume that the 30% number also refers to stand replacing events.

The discussion for impacts to spruce-fir on page 4-37, would be significantly more informative if the total number of spruce-fir habitat acres in the park were a part of the discussion. In the case of Alternative 1, the only proposed project encompasses 19% of the spruce-fire vegetation type.

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The prescription for all alternatives predicts high to moderate/high severity levels at 40% for prescribed and wildland fire use fires. Under all of the alternatives, nearly 1/5th of the spruce-fir habitat in the park could have canopy mortality greater than 80%. To determine the significance of this action the public would need to know the total percentages of existing canopy loss due to fire, insects or other pathogens. The effects analysis on page 4-38 simply states that the , "Effect would be beneficial, minor and local since only a small portion of the type would be treated (19%)."

Taken alone the effect of any action may seem small. Whereas a comprehensive effects analysis might result in a different outcome and treatment design. Canopy impacts from the Outlet Fire are a good example. Page 4-39 notes that the Outlet Fire, which burned during "very high weather conditions in mixed-conifer and spruce-fir", resulted in "69% of spruce-fir burning at moderate/high to high severity levels. We assume this 69% number refers to spruce-fir acres within the fire boundary. How does the proposed action, in combination with canopy changes from the Outlet Fire and other past actions covered in the DEIS, affect spruce-fir canopy in GCNP? This is the question the effects analysis should answer.

The cumulative effects analysis does not contain any additional information regarding how the projected fire severity effects relate to existing conditions. This section simply categorizes the projected impacts. Appendix F, which covers Fire Behavior Modeling: Methods and Assumptions, does not provide any additional information. Table F-1 contains the same percentages of severity for prescribed fire by vegetation type shown elsewhere in the DEIS. Tables covering fire severity impacts to soils contain proposed treatment acres by habitat type. The data are not displayed, however, in a context that would address our concerns regarding cumulative effects.

Alternative 2- Preferred Alternative

All of our comments on Alternative 1 apply to Alternative 2. The major differences between these alternatives relate to the proposed increase in allowed fire severity percentages. The proposed increase changes the potential impacts primarily for mixed-conifer and spruce-fir habitats.

Comments related to all Alternatives

Data from historic fire intervals and fire data collected since 1993 have been used to inform the creation of alternatives. How impacts from recent past actions (1993 to 2000), in combination with current proposals is missing from the analysis, particularly as it relates to canopy structure and the Park's request for an increase in fire severity. The existing condition description for each habitat type is limited to general information regarding increases in tree densities and changes in

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the fire regime.

As we have stated elsewhere in our comments, data relating to historic, existing and desired conditions as displayed, are inconsistent and in many cases uninformative due to overlaps in tree sizes and spatial scales and contains prescriptions not supported by the text. Basic information necessary to determine cumulative effects is missing, inconsistent or fragmented throughout the DEIS so as to make comparisons between the cumulative effects of alternatives unachievable. For Example:

" There is no clear display of acres by habitat type in the park and what percentage of the park these ecosystems represent.
" Table 2-3 on Page 2-21 displays FMU Characteristics for Alternative 1. It does contain acreage numbers for ponderosa pine and mixed-conifer and the percentage of the park these acres represent. There is no corresponding number and percentage for spruce-fir in this table. These acres shown are not the same numbers stated elsewhere in the DEIS. (see next point)
" Pages 3-14 & 3-15, related to special status plant species contain habitat acreage numbers that vary significantly from other displays. Ponderosa pine forest habitat comprises almost 60,000 GRCA acres at a low level of departure from its natural fire regime." According to other tables this should represent about 75% of the ponderosa pine acres.
" Table 2-3 shows 42,899 acres of ponderosa pine in FMUs for 3.60% of the park.
" The existing soundscape discussion on page 3-75 states 7.9% of the park is in the ponderosa pine vegetation type.
" Pages 3-14 & 3-15 state that mixed-conifer occupies approximately 38,000 GRCA acres.
" Table 2-3 on Page 2-21, (FMU Characteristics for Alternative 1) shows mixed-conifer covering 92,150 acres or 7.73 percent of the park.
" Fire management unit characteristics displayed in Table 2-5 on pages 2-33 & 2-34 contain acres for each FMU and the percentage of the park they represent. While habitat types play a role in FMU design, topography and other management designations (WUI) are also featured in FMU acres. As a result, the ponderosa pine habitat might exist in 5 of the 8 FMUs.

Affected Environment (DEIS Chapter 4)

Air Quality

Grand Canyon National Park is a Federal Class I area for air quality pursuant to the Clean Air Act. As such, the NPS must take actions to protect that air quality as outlined in this plan. The main impacts of the smoke will be on visibility and on public health, both to park visitors and park employees. The NPS should use best management practices as outlined in the DEIS to ensure that smoke is dispersed and that any prescribed burns are timed to limit visitor impacts and impacts on park employees. All visitors and park employees should be warned of any fires

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both for public safety reasons and to ensure that those with respiratory ailments can limit their exposure.

Wildlife and Special Status Species General Comments

The NPS did an insufficient job of analyzing canopy and structure and lacked structural data in sections of this DEIS dealing with habitat. As stated earlier, averages of tree densities across large landscapes do not actually constitute usable stand structure information. There is also apparently no real population data for most of the species within the Park. Because of this, it is clear that the analysis of the impacts on most species is insufficient.

Mexican Spotted Owl and Mexican Spotted Owl Critical Habitat Mitigation Measures (Pg 4-189)

It is inappropriate for the NPS to seek relief from the U.S. Fish and Wildlife Service regarding survey requirements and mitigation measures for Mexican Spotted Owl. The NPS should uphold the highest of standards when it comes to protection of endangered species and other special status species. All alternatives should include survey requirements and the associated mitigation measures. The list of measures as outlined on page 4-189 ensuring that fire related activities such as dip sites are an adequate distance from PACs, that biologists are notified when a MSO is discovered, survey PACs, etc. is critical to ensuring adequate protection of the owls. Moreover, in reference to critical habitat, the DEIS incorrectly states that, "not all mapped habitat qualifies, as one or more constituent elements (tree density or steeper slopes) may be lacking" (pg 4-185). It is our understanding that all mixed-conifer qualifies as critical MSO habitat when it occurs in a critical habitat unit. There must be significant coordination between the NPS and U.S. Fish and Wildlife Service on these issues to ensure that this and other special status species are able to thrive in the Park.

Alternative 2, the Preferred Alternative, proposes to treat more than 57% of the mixed-conifer vegetation type with prescribed fire. This is on top of the additional acres that will burn under wildland fire use (30%). The alternative also includes prescribed fire treatment of 19% of the spruce-fir habitat and 36% is assumed to burn from suppression fire. It is also difficult to discern why the NPS is proposing to remove the low intensity fire requirement in the Spruce-Fir habitat type when Figure 4-2 on page 4-9 indicates that only 1% of the Spruce-Fir habitat departs from the Historic Fire Regime in the high intensity area. We did not see a justification for this in the DEIS. The DEIS also presents four different numbers for total amount of mixed conifer acreage in the park: 37,083; 37,272; 37,647; and 37,777 acres. Because the amount of mixed conifer habitat type is unclear, the number of acres of potential habitat that will be impacted by higher severity fire is not readily apparent. Considering the lack of data and the past failures in these habitat types, we are concerned that this alternative will significantly reduce habitat for Mexican

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Spotted Owl and other species dependent on these ecosystems. Though the DEIS claims that none of the alternatives will result in impairment of Park resources, we do not find justification for that claim, particularly in the MSO analysis. We urge the Park to clearly demonstrate the expected level and acreage of impairment of MSO habitat and designated critical habitat. If the level of impairement is as high as expected, we recommend that the alternatives be modified to significantly reduce the effects.

Wilderness Character

We are supportive of the goals of the FMP to:

" Conduct fire management activities in proposed wilderness in a manner that will not diminish suitability for designation or result in changes to the current wilderness proposal.
" Use minimum impact management techniques to reduce impacts to wilderness values, cultural and soil resources, and limit spread of invasive plant species.

This is consistent with requirement that the NPS manage proposed wilderness as wilderness. While the plan goals are appropriate and consistent with wilderness, it is unclear to us the level of use for roads that are closed to the public but open for fire management. The plan states:

"Approximately 58 miles of primitive roads in 300-foot-wide, non-wilderness corridors are open to mechanized travel and provide access to trailheads and scenic overlooks (NPS 1998b). All other unpaved roads or trails are not open to motorized vehicles or bicycles. Exceptions (e.g., for fire management) are governed by the minimum requirement decision process (see Appendix A)."

What will this mean on the ground and how will those activities affect the wilderness character? Are there additional roads that should be considered for total closure? Are there roads that are unnecessary altogether? Was this considered?

The Park's "fire road" closures need to be effectively enforced. The GRCA Draft Wilderness Plan (USDI 1998:76-77), reiterating provisions of the 1980 Wilderness Recommendation, points out that the six so-called "fire roads" within the proposed wilderness of Grand Canyon National Park (Tiyo Point, Komo Point, Walhalla Glades, Francois Matthes Point, Widforss and W-1 from the landfill to its junction with the Point Sublime Road) are (or should be) closed to public and administrative mechanized transport. These routes constitute nonconforming intrusions within the proposed wilderness and administrative use of mechanized transport or tools, if any, should be evaluated in the context of the minimum requirement concept. Non-emergency administrative use should not continue to be permitted on these routes.

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The plan goes on to say that:

Administrative use of motorized/ mechanical equipment or transport will be authorized only
o If determined by the Superintendent to be the minimum requirement needed by management to achieve the purposes of the area as wilderness, including preservation of wilderness character and values; or
o In emergency situations (search and rescue) involving health or safety of persons actually in the area. Such management activities will be conducted in accordance with all applicable regulations, policies, and guidelines, including minimum requirement protocols as practicable
o For analysis purposes, some level of aircraft use is assumed.

Policy stresses that use of mechanized equipment constitutes "an exception to be exercised very sparingly and only when it meets the test of being the minimum necessary for wilderness purposes" (USDI 2000). In addition, "[m]anagers contemplating the use of aircraft or other motorized equipment within wilderness must consider impacts to the aesthetics and traditions of wilderness, as well as the costs and efficiency of the equipment" (USDI 2001, §6.3.4.3; emphasis added).

Also, Policy advises that "[m]anagement intervention should only be undertaken to the extent necessary to correct past mistakes, the impacts of human use, and influences originating outside of wilderness boundaries" (§6.3.9).

We are supportive of keeping all mechanical and manual treatment outside the proposed wilderness as the plan states as that is consistent with protecting the wilderness character and with wilderness management.

Summary

In order to ensure success and properly restore ecosystems, plus protect and restore the Park resource values and to reintroduce fire on a landscape level, it is critical that the NPS coordinate with the surrounding land management agencies. We appreciate the steps taken to attempt to coordinate fire management activities and ask that the NPS continue this effort so coordination is also on a planning level.

Again we appreciate the opportunity to comment on the DEIS, but ask that the NPS consider extending the comment deadline to allow for additional discussions. Furthermore, we ask that the NPS evaluate developing additional alternatives including one that is more grounded in ecosystem processes and that focuses on protecting and restoring resource values.

We would appreciate meeting with you to discuss the plan and our concerns.

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Thank you.

Sincerely,

Sandy Bahr
Chapter Director
Sierra Club Grand Canyon Chapter

Stacey Hamburg
Conservation Program Manager
Sierra Club Grand Canyon Chapter

9505 W Hashknife Trail
Flagstaff, AZ 86001-8061
January 21, 2009

Mr. Steve Martin, Superintendent
Grand Canyon National Park
P.O. Box 129
Grand Canyon, AZ 86023-0129
Attn.: Office of Planning and Compliance

Dear Superintendent Martin,

This letter expresses my major comments on the Draft Environmental Impact Statement (DEIS) for the Fire Management Plan for Grand Canyon National Park (GRCA).

The DEIS represents a massive, challenging effort, and participants in its preparation are to be congratulated for their dedication to the project. My comments are intended to help produce the best possible fire management program for Grand Canyon forests that will protect these forests for future generations to enjoy and study as I have. Unfortunately, serious shortcomings in the DEIS indicate the proposed management will fall far short of this objective and lead to impairment of Park resources.

Notes:

1. All references appearing herein can be found in the Bibliography of the DEIS.
2. I use the terms "crown fire" and "stand-replacing fire" interchangeably.
3. Many of the problems noted below appear repeatedly in the DEIS. I did not attempt a complete numeration.

Background

My comments on the DEIS focus on the sections that pertain to vegetation, my area of expertise. As context for my comments, I have a long history with the study of vegetation, including the forests of GRCA. My research on fire and fire exclusion on coniferous forests in western national parks began in Sequoia National Park in 1967 and expanded to GRCA in 1984. I have published four research papers on GRCA forests and authored the lengthy report "Montane and Subalpine Terrestrial Ecosystems of the Southern Colorado Plateau – Literature Review and Conceptual Models" for the Southern Colorado Plateau unit of the National Park Service (NPS). My career in vegetation ecology has included 31 years as a university professor, a 4-year term (i.e., temporary) position as "Special Projects Ecologist" for GRCA (concluding November 2007),

service in the elected positions of Chair of the Vegetation Section of the Ecological Society of America and Chair of the North American Section of the International Association for Vegetation Science, authorship of the book "The Natural Vegetation of North America", and, currently, on-going research on Grand Canyon forests as a private consultant with funding from the NPS. In addition, I wrote the first draft of Section 3.1.1 of the Fire Management Plan DEIS, i.e., the vegetation portion of Chapter 3, Affected Environment (portions of my work were also used elsewhere in the DEIS).

Major Substantive Issues

A. Portions of the DEIS are fundamentally flawed because they do not rely "on current and best-available information".

Section 1.4 of the DEIS states several Goals and Objectives of GRCA's Fire Management Program, including Goal 4: "Promote a science-based program that relies on current and best-available information." The DEIS should have been conceived and written to this standard, but it is not. In fact, some of the following examples indicate preparation of the DEIS included avoidance of "current and best-available information".

1. The interdisciplinary team guiding preparation of the DEIS (see Table 5-1) did not include anyone with expertise in GRCA forest vegetation, despite the availability of two employees of the Park's Science Center (now Division of Science and Resource Management), both of whom had multiple scientific publications on that topic. The fire ecologists on the team are not unbiased, because they represent the Fire Management Program. In addition, they lacked the scientific background and knowledge of a GRCA forest vegetation specialist (one fire ecologist lacked experience with Southwestern forests prior to appointment to the team; the other is from the Regional Office and is not a GRCA vegetation specialist). The Adaptive Management Service Enterprise Team similarly could not replace a GRCA forest vegetation specialist on the team, because of lack of experience with GRCA forests. This apparent purposeful lack of "best-available information" is glaringly apparent in many sections of the DEIS, and led to key assumptions, statements, and conclusions that are incorrect, as described herein.

2. Although I, as one of the two forest vegetation specialists from GRCA's Science Center, was asked to provide a draft of the vegetation portion of Chapter 3 of the DEIS, misleading revision of my statements is another example of avoidance of "current and best-available information". Below, I highlight in bold some of key differences in the original that was submitted vs. the misleading revisions that appear in the DEIS:

a. Original version: **Little research** has been done on fire regimes of

Southwestern Spruce-Fir forests (Moir 1993, Swetnam and Baisan 1996, Allen 2002).

Misleading revision: **Existing research** for Southwestern fire regimes in spruce-fir forests includes work from Moir 1993, Swetnam and Baisan 1996, Allen 2002 and others. (Section 2.4.1.1, paragraph 1)

b. Original version: **However, there is little, if any, evidence** of a similar crown fire regime in the Southwest.

Misleading revision: **There is some evidence** suggesting a stand-replacement fire regime occurred in the Southwest. (Section 2.4.1.1, paragraph 2)

c. Original version: A crown fire regime has also been proposed **(but not documented)** for GRCA (Merkle 1954, White and Vankat 1993).

Misleading revision: The critical parenthetical statement was eliminated (Section 2.4.1.1, paragraph 2)

d. Original version: In addition, some historical accounts can be interpreted as suggestive of past crown fire. For example, Lang and Stewart (1910) stated that the Kaibab Plateau in general contained "vast denuded areas, charred stubs and fallen trunks and the general prevalence of blackened poles" and that "old fires extended over large areas at high altitudes, amounting to several square miles." **However, like many early descriptions, the comments of Lang and Stewart (1910) are open to interpretation. For example, "vast denuded areas" may have referred to extensive meadows (parks) that early observers could have assumed were originally formed by fires. In addition, charred stubs, fallen trunks, blackened poles, and large burned areas are evidence of fire, but not necessarily crown fire. Indeed, Lang and Stewart (1910) also reported, "Evidence indicates light ground fires over practically the whole forest".**

Misleading revision: All sentences (those in bold) describing a plausible alternative to crown fire were eliminated, misleadingly leaving only one interpretation where two were expressed. (Section 2.4.1.1, second paragraph)

Taken individually, each of these misleading revisions may appear relatively minor, but collectively they led to a key, incorrect conclusion about the historic fire regime of spruce-fir forest (see below).

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3. The interdisciplinary team did not follow up with questions about the draft of the vegetation portion of Chapter 3 of the DEIS, nor did the team ask about implications for fire management issues. This shortcoming is especially important because the information provided to the team was also used (and sometimes misused) in descriptions of Reference, Existing, and Desired Conditions in Section 2.4, which sets the stage for much of the rest of the DEIS, particularly the critically important Chapter 4 Environmental Consequences.

4. Despite almost three years between when the draft was submitted and the DEIS was finished, the interdisciplinary team did not ask for an updated version to include "current…information" (including new research on GRCA forest vegetation funded by the NPS!). No one else appears to have provided "current…information", because the DEIS includes only one journal article on vegetation published after 2006.

5. The DEIS does not follow basic conventions for professional documents with regard to reporting numbers, and this makes it possible to judge the validity of many conclusions.

a. The DEIS makes substantial use of information collected from Fire Effects Monitoring Plots and in several places acknowledges the importance of sample size (number of plots), but frequently does not state the sample sizes upon which conclusions are based.

b. In many places the DEIS presents arithmetic means without indicating the range of variation of values around the means (this is especially ironic when associated with statements regarding "Historic [Natural] **Range of Variation**"; emphasis mine).

These omissions are basic flaws that prevent evaluation of many conclusions reached in the DEIS, particularly in the critically important Chapter 4 Environmental Consequences.

6. The Fire Effects Monitoring Program is not yet a statistically valid program, and, at least a few years ago, was making such slow progress that it will take decades for validity to be reached. This also prevents evaluation of many conclusions reached in the DEIS, particularly in the critically important Chapter 4 Environmental Consequences. Simply because it is available does not make it suitable.

7. Without use of "current and best-available information", particularly from science, some key assumptions, statement, and conclusions are incorrect, as shown below. Some of the flawed conclusions, if implemented, will lead to impairment of Park resources.

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B. Incorrect description of key aspects of Reference, Existing, and Desired Conditions of GRCA's spruce-fir forest led to incorrect conclusions that, if implemented, make impairment likely.

Portions of the DEIS incorrectly describe what current science shows about the historical fire regime of GRCA's spruce-fir forest. This appears to be a conscious change of emphasis from the description provided in the original draft of the vegetation portions of Chapter 3 Affected Environment (which was also used in portions of Chapter 2 (evidence of conscious change is in A.2 above). GRCA's spruce-fir forest differs in several ways from that of the Rocky Mountains where a crown fire regime is well-documented. The "current and best-available information" produced by science and documented in my draft of the vegetation portions of Chapter 3 Affected Environment is that GRCA spruce-fir forests had a mixed-severity fire regime with frequent surface fires. This problem would not have arisen if vegetation specialists had been placed on the interdisciplinary team (see A.1 above).

1. Problems initially show up in Section 1.3.2 Wildland Fire Conditions at Grand Canyon National Park. As indicated in Table 1-2, the fire regime of GRCA's spruce-fir forest is classified as Type III Regime Class with a fire frequency of 35-100+ years. Placement in this class is faulty because research findings (given in this table!) indicate a mean fire return interval of 8 to 31 years (actually 9-31 years). Given that this frequency does not fit the Type III Regime Class, the fire regime of Grand Canyon's spruce-fir forest is Type I-III. This designation would deservedly add greater emphasis on surface fires and result in less emphasis on the crown fire component of mixed-severity fires. The DEIS discrepancy between scientific data and assumption has ramifications for conclusions drawn later in the DEIS because it overemphasizes the role of stand-replacing fire in GRCA's spruce-fir forest.

2. The misinterpretation of the fire regime of spruce-fir forest appears again in Section 2.4.1.1 Reference Conditions, which focuses on the fire regime and, after the first sentence, incorrectly emphasizes stand-replacing fire, leading to the error that such fires had an important role in GRCA's spruce-fir forest. In part this was achieved by misleading revisions noted above in A.2. The other part was achieved by incorrect interpretations of Fulé et al. (2003a). The critical misinterpretation is that this section of the DEIS divides the landscape into different forest types "…from ponderosa pine to spruce-fir forests." In contrast, Fulé et al. (2003a) focused on the landscape as a whole. Indeed, the title of publication is "Mixed-severity fire regime in **a high-elevation forest**…" [emphasis mine]. While Fulé et al. (2003a) did discuss variation within this forest, the clear emphasis is on mixed-severity fire across the largely spruce-fir landscape, not necessarily within individual forest types; again, see the title of the publication. In contrast, the DEIS divides the landscape and focuses on "truer spruce-fir stands", thereby overemphasizing the role of stand-replacement fire.

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In short, incorrect interpretation on Fulé et al. (2003a) led in part to misinterpretation of fire regime reference conditions in GRCA's spruce-fir forest.

3. Here and elsewhere, the DEIS uncritically incorporates results of Fulé et al. (2003a) without examining the methods and assumptions by which they achieved those results. With regard to "Fire-initiated forest stands [being] indicative of stand-replacing fire events..." (Section 2.4.1.1, paragraph 3), it is important to more carefully consider what Fulé et al. (2003a) wrote. For example, Fulé et al. (2003a) stated that their "...fire-initiated groups or patches...may have contained many fire survivors." Therefore, it must be questioned whether these stands-groups-patches truly originated by stand-replacing fires on the order of the moderate/high and high severity fires described elsewhere in the DEIS. Indeed, documentation of these stands-groups-patches by Fulé et al. (2003a) was based solely on the assumption that "When the oldest trees were the fire-susceptible species POTR, PIEN, or ABLA [i.e., quaking aspen, spruce, and subalpine fir], the plot was classified as fire-initiated". This assumption needs verification (for example, spruce and subalpine fir can regenerate below a canopy of quaking aspen). In short, uncritical reliance on Fulé et al. (2003a) led in part to misinterpretation of fire regime reference conditions in GRCA's spruce-fir forest.

4. Uncritical consideration of other methods of Fulé et al. (2003a) also led the DEIS to incorrect conclusions in Section 2.4.1.2 Existing Conditions. The DEIS cites Fulé et al. (2003a) for the statement that "...past forests were significantly less dense with significantly lower basal area than contemporary forests." Fulé et al. (2003a) used forest reconstruction techniques to attempt to determine tree densities and basal areas present in 1880; however, reconstruction of these values in spruce-fir forest is inherently inaccurate. Fulé et al. (2003a) stated that "...reconstructions are reliable..." only if dead tree evidence is present on the site. The problem is that not all 1880 trees >1 inch diameter are present, alive or dead, 123 years later. The original text provided the DEIS interdisciplinary team included the following precaution regarding forest reconstruction: "...the accuracy of reconstructed values is uncertain in Spruce-Fir Forest, where evidence of 1880 trees may be lost because of decomposition with moist conditions"; however, this was eliminated from the DEIS and values reported by Fulé et al. (2003a) were accepted uncritically. (Inaccuracy of the density values reported by Fulé et al. (2003a) is apparent when they are converted to an average area occupied per tree of 27 X 27 feet – and it applies to trees as small as 1-inch diameter, in a forest with no evidence of landscape-scale crown fire in the years shortly before 1880.)

5. The above erroneous interpretations led to incorrect conclusions:

a. Section 2.4.1.3 Desired Conditions includes the statement: "Return stand-replacing fire event characteristics to the range described in reference conditions." As indicated in B.2 and 3 above, the role of stand-replacing fire is incorrectly described in the section on Reference

Conditions. Adoption of the DEIS would lead to excessive stand-replacing fire, which would result in impairment of GRCA's spruce-fir forest.

b. Page 4-24, paragraph 2, lines 2-3 state: "Medium (5.9-15.8 inch dbh) and larger (greater than 15.8-inch dbh) tree densities did not change significantly [following prescribed and suppression fires] and remain above desired condition levels." Section 2.4.1.3 Desired Conditions lacks a quantitative statement of desired densities, so it is impossible to judge this conclusion. Also, use of values based on Fulé et al. (2003a) is unwise, given the concerns about forest reconstruction applied to GRCA's spruce-fir forest (see B.4 above).

c. Page 4-24, paragraph 6, lines 7-8 refer to: "...larger patches of high severity fire during very high weather conditions, similar to what researchers (Fulé et al. 2003a) surmised from park fire history and vegetation reconstructions." Again, see B.2 and 3 above. Also, although Fulé et al. (2003a) did not quantify patch sizes, their findings indicated that individual patches were relatively small: "...fire-initiated groups were intermixed with non-fire-initiated groups..." At least the patches were much smaller than produced by recent fires such as the 2000 Outlet Fire (in which one patch of stand-replacing fire in spruce-fir and mixed conifer forests had an area of 13 km^2). Evidence that this was a conscious misconstruction is that the DEIS left out the following statement provided to the interdisciplinary team: "Neither remote sensing nor ground reconnaissance on the North Rim revealed large areas of fire-originated trees, such as would be produced by crown fires (Fulé et al. 2003a)."

d. The following statement is on page 4-39, paragraph 3, line 11: "Fulé et al. (2004) reported increases in crown fire potential since the 1880s..." While the statement is accurate, the findings of Fulé et al. (2004) were based on forest reconstructions such as those by Fulé et al. (2003a) and, as indicated in B.4 above, are inaccurate for spruce-fir forests.

6. The DEIS, especially in Chapter 4, generally fails to describe the current risk of landscape-scale crown fires in GRCA's spruce-fir forest. The DEIS should explicitly acknowledge that remnants of the topographic diversity that was an important aspect of reference conditions are still evident in the unburned parts of the landscape. It should also state that these remnant conditions are at risk (as stated in the draft provided the interdisciplinary team, that "...conditions for the crowning component of the mixed-severity fire regime have increased across landscapes, and fires in Spruce-Fir Forest now have greater potential to become landscape-scale crown fires dissimilar to the formerly patchy mixed-severity fires (White and Vankat 1993, Fulé et al. 2003a)"). Therefore, while future fires will result in a range of severities on the landscape, it will be in a pattern far different from the Historic (Natural) Range of Variation. In contrast to what is concluded in Chapter 4 Environmental Consequences, loss of these remnant reference

conditions through landscape-scale crown fires, all of which began as either prescribed or wildland fire-use fires, is impairment of GRCA resources (see G below).

7. Given past failures of management fires in GRCA's spruce-fir forest (both suppression fires began as either prescribed or wildland fire-use fires), the DEIS should limit future management fires to less risky weather percentiles and attempt innovative burning methods to avoid large patches of landscape-scale crown fire.

C. Incorrect description of key aspects of Reference, Existing, and Desired Conditions of GRCA's mixed conifer forest led to incorrect conclusions that, if implemented, make impairment a near-certainty.

1. Problems initially show up in Section 1.3.2 Wildland Fire Conditions at Grand Canyon National Park. As indicated in Table 1-2, the fire regime of GRCA's mixed conifer forest is classified as Type III Regime Class with a fire frequency of 35-100+ years. Placement in this class is faulty because research findings (given in this table!) indicate a mean fire return interval of only 5 to 19 years. Given that this frequency does not fit the Type III Regime Class, the fire regime of Grand Canyon's mixed conifer forest is Type I-III. This designation would deservedly add greater emphasis on surface fires and result in less emphasis on the crown fire component of mixed-severity fires. The DEIS discrepancy between scientific data and assumption has ramifications for conclusions drawn later in the DEIS because it overemphasizes what the "current and best-available information" says about the role of stand-replacing fire in GRCA's mixed conifer forest.

2. The misinterpretation of the fire regime of mixed conifer forest appears again in Section 2.4.2.1 Reference Conditions. The statement "At higher elevations research shows a mix of about 20% fire-initiated mixed-conifer stands (indicative of stand-replacing fire events) and about 80% non-fire-initiated stands" apparently is based on Fulé et al. (2003a). With regard to the contention imbedded within this sentence, that "…fire-initiated mixed-conifer stands [are] indicative of stand-replacing fire events…", it is important to more carefully consider what Fulé et al. (2003a) wrote. For example, Fulé et al. (2003a) stated that their "…fire-initiated groups or patches…may have contained many fire survivors." Therefore, it must be questioned whether these stands-groups-patches truly originated by stand-replacing fires on the order of the moderate/high and high severity fires described elsewhere in the DEIS. Indeed, documentation of these stands-groups-patches by Fulé et al. (2003a) was based solely on the assumption that "When the oldest trees were the fire-susceptible species POTR, PIEN, or ABLA [i.e., quaking aspen, spruce, and subalpine fir], the plot was classified as fire-initiated". This assumption needs verification (for example, spruce and subalpine fir can regenerate below a canopy of quaking

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aspen). It also should be recognized that the percentage of fire-initiated mixed conifer stands in the landscape (20% or something less) was not the product of individual fires, but was the cumulative effect of many pre-1880 fires that molded the landscape. In short, uncritical reliance on and misunderstanding of Fulé et al. (2003a) led in part to misinterpretation of fire regime reference conditions in GRCA's mixed conifer forest.

3. Uncritical consideration of other methods of Fulé et al. (2003a) also led the DEIS to incorrect conclusions in Section 2.4.2.1 Reference Conditions. The DEIS cites Fulé et al. (2003a) for the statement that "Research also indicated that past forests were less dense and had lower basal area than contemporary forests" and that "[t]otal tree densities ranged from 150 to 337 trees/ha." However, as described in B.4 above, Fulé et al. (2003a) used forest reconstruction techniques to attempt to determine tree densities and basal areas present in 1880; however, reconstruction of these values in mixed conifer forest is likely inaccurate. Fulé et al. (2003a) stated that "...reconstructions are reliable..." only if dead tree evidence is present on the site..." The problem is that not all 1880 trees >1 inch diameter are present, alive or dead, 123 years later. The original text provided the DEIS interdisciplinary team included the following precaution regarding forest reconstruction: "...the accuracy of reconstructed values is uncertain in Mixed Conifer Forest, where evidence of 19th century trees may be lacking because of decomposition with moist conditions"; however, this was eliminated from the DEIS and values reported by Fulé et al. (2003a) were accepted uncritically. (Inaccuracy of the density values reported by Fulé et al. (2003a) is apparent when they are converted to the average area occupied per tree of 18 X 18 feet to 27 X 27 feet – and it applies to trees as small as 1-inch diameter, in a forest with no evidence of landscape-scale crown fire in the years shortly before 1880.)

4. Section 2.4.2.1 Reference Conditions contains additional misleading statements, errors, and misinterpretations:

a. The statement that "Fire sizes prior to European settlement reached a least hundreds of hectares for fires scarring 25% or more of samples distributed across study areas, and probably reached many thousands to tens of thousands of hectares." is misleading because Fulé et al. (2003b) did not direct this statement toward mixed conifer forest, the subject of this section. In fact, only one of their five study sites had mixed conifer vegetation; the others had ponderosa pine/Gambel oak vegetation.

b. In the next paragraph, the DEIS states "Various Grand Canyon reconstruction studies..." This misleadingly suggests that there are several such studies; however, there is only one study focused on mixed conifer forest: Fulé et al. (2002a). One other included mixed conifer as part of a highly varied landscape dominated by spruce-fir forest: Fulé et al. (2003b).

c. In the same paragraph, the DEIS attributes large differences in tree densities reconstructed for 1879 and sampled in 1935 to "...indicate GRCA landscape pattern heterogeneity." This explanation is highly unlikely and ignores the more plausible explanation provided in the original draft of the vegetation portion of Section 3 that the difference is likely due to inaccurate forest reconstruction values (see C.3 above).

d. The statement: "...reconstructed by Fulé et al. (2003, 2004)" is erroneous. Fulé et al. (2004) contained no data on forest reconstruction.

5. The description of reference conditions also lacks important, "current and best-available information:

a. Perhaps most critically, Section 2.4.2.1 Reference Conditions lacks description of the small-scale vegetation mosaic that evidence indicates characterized reference conditions of GRCA's mixed conifer landscape. While this is described at the beginning of Section 2.4.2.2 Existing Conditions, it is a critical part of reference conditions and should have been included in Section 2.4.2.1 to have been recognized as such. Any description of the fire regime of reference conditions should note that nearly all fires were only surface fires and likely only in the driest years did individual fires have both a surface and crown fire component. Therefore, fires were likely of mixed severity primarily in a temporal sense, not always in a spatial sense. In contrast to reference conditions, the DEIS attempts to justify all fires being of mixed severity in a spatial sense.

b. An essential aspect of the fire regime of reference conditions that is not addressed anywhere in these sections on mixed conifer forest is information on the size of patches of stand-replacing fire. As indicated in the draft provided the interdisciplinary team, Fulé et al. (2003b) wrote that "no large patches (>1-2 ha) that might have originated from stand-replacing fires" were observed in their study area of GRCA mixed conifer forest.

6. Section 2.4.2.2. Current Conditions clearly indicates how misleading statements, errors, misinterpretations, and omissions in the previous section on reference conditions led to misconceptions regarding current conditions. Here are examples:

a. The second paragraph of this section utilizes erroneous reconstructed values for density and basal area as a touchstone for comparison of current conditions.

b. A relatively minor error, but one that is indicative of problems with the section on mixed conifer forest is that Fulé et al. (2004) is again mis-cited

as a source of data on tree densities.

c. Paragraphs 3 and 4 misrepresent the situation regarding fire impacts on Grand Canyon mixed conifer forest by (1) ignoring fire effects on the vegetation mosaic described at the beginning of this section and (2) under-reporting the effects of landscape-scale crown fires such as the Outlet Fire. The DEIS states, "In some mixed-conifer stands, resulting fire effects will mimic historic fire effects through fire-initiated stands." Evidence indicates that this is incorrect, as recent fires have produced patches of stand-replacing fire that far exceed the <1-2 ha patch size documented by Fulé et al. (2003b). The original draft provided for the DEIS indicated that 85% of the patches of stand-replacing fire in the Outlet Fire were >2 ha and that "A single patch covering 13 km^2 accounted for 69% of the area burned by crown fire" in the Outlet Fire." This "current and best-available" science is ignored by the statement in the DEIS that "The 2000 North Rim Outlet Fire has a range of effects..." The key point is that overall percentages of different fire severities do not reflect the fact that recent fires (also including the Poplar Fire in GRCA and the Warm Fire in adjacent Kaibab National Forest) homogenize what once had been complex small-scale mosaic landscapes (White and Vankat 1993, Fulé et al. 2003b).

7. Two parts of Section 2.4.2.3 Desired Conditions need further elaboration:

a. The DEIS states "Desired conditions include...[r]estore topographic heterogeneity of vegetation types", but it is essential to state the small-scale of this topographic heterogeneity.

b. The DEIS should state how the quantitative values for tree densities stated as "Specific desired stand structure conditions" were determined. Otherwise, it cannot be determined if "current and best-available information" was used.

8. Section 3.1.1.3 concludes with the correct statement that "In general, areas of management fires involving small-scale patches of different fire severities are likely closer to the natural range of variability, although research is needed to test this hypothesis." However, "current and best-available information" and a balanced perspective on recent fires in mixed conifer forest should have included another statement from the original draft provided to the interdisciplinary team: "In contrast, areas of large-scale crown fires are outside the natural range of variability."

9. The statement on page 4-20, paragraph 2, lines 2 and 3 that "Presently, an estimated 40% of mixed-conifer type is at low departure from historic fire return interval" would seem to be correct only if the large areas of recent landscape-scale crown fires are included as "low departure". However, these areas do not

mimic historic fire patterns that had patchy mixed-severity affects correlated with topography and limiting patches of crown fire to <2 hectares (as described in C.5.d above).

10. The statement on page 4-20, last three lines that levels of stand-replacing fire of 12 to 48% are "...within the range of variability of estimated historic distribution for fire severities in this vegetation type" is a untrue according to "current and best-available" science. Even the DEIS, in Section 2.4.2.1 Reference Conditions, implies that stand-replacing fire was about 20%, and the critique in C.2 above indicates that 20% is an over-estimate. This same error is repeated later in this paragraph. Because this major error occurs in a section on Effects Common to All Alternatives, it is a fatal flaw in the analysis of Environmental Consequences of the DEIS, because errors such as this can lead to major errors in evaluating alternatives, especially Alternatives 2-5 that permit high percentages of stand-replacing fire in GRCA's mixed conifer forest. Acceptance of this incorrect view of reference conditions will lead to impairment of Park resources (see G below).

11. The conclusion on page 4-21, next to last paragraph, last three lines that future mixed-severity fires will "trend toward natural range of variability" is unfounded, because it ignores the history that prescribed and wildland fire-use fires in Grand Canyon's mixed conifer forest have led to suppression fires with patch sizes much greater than the 2 hectare historic limit. How can a patch size of 13 km^2, such as occurred in the Outlet Fire, be considered a "trend toward natural range of variability" in a landscape formerly characterized by a topographically determined, small-scale vegetation mosaic? Again, because this major error occurs in a section on Effects Common to All Alternatives, it is a fatal flaw in the analysis of Environmental Consequences of the DEIS, because errors such as this can lead to major errors in evaluating alternatives, especially Alternatives 2-5 that permit high percentages of stand-replacing fire in GRCA's mixed conifer forest. Acceptance of this incorrect view of the natural range of variability in mixed conifer forest will lead to impairment of Park resources (see G below).

12. In the same paragraph, the DEIS states "...the majority of fires in mixed-conifer vegetation type are thought to be mixed..." This is incorrect, because the majority of fires are thought to have been surface fires (see C.5.a above).

13. Page 4-22, paragraph 3 contains several statements that are erroneous, at least by the standard of "current and best-available information":

a. The statement that landscape-scale stand-replacement fires will occur only "[o]n rare occasions..." is incorrect, because such fires have occurred in mixed-conifer forest of Grand Canyon in 2000 (Outlet) and 2003 (Poplar) and in adjacent Kaibab National Forest in 2006 (Warm Fire). Two such fires in seven years do not support the contention of "rare

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occasions".

b. Statements that these landscape-scale fires and future similar fires are "at the high end of natural range of for mixed-conifer vegetation" is contradicted by data, as indicated above.

c. The statement that "...recent wildland fire-use fires in this vegetation show they are either within or at the high end of the natural range of variability for a mixed severity regime in proportion of area burned at different severity levels" appears to be based on the sentence that follows and cites sources for the Pacific Northwest and California. While these areas have mixed conifer forests, they are different in species, climate, landforms, etc. from GRCA mixed conifer forests and should not be used as models for a GRCA Fire Management Plan – DEIS. In the case of different ecosystems, one size of fire severity does NOT fit all, and this critical aspect of the DEIS is yet another clear case where "current and best-available information" was not used. This misconstruing of the natural range of variability for fire, particularly stand-replacing fire, in GRCA's mixed conifer forest is repeated elsewhere (e.g., page 4-33, paragraph 2, lines 1-2; page 4-34, paragraph 1, lines 1-2) and, if accepted, will lead to impairment of Park resources (see G below).

14. Gross misinterpretation of the historic role of fire in mixed conifer forest is exemplified by the statement on 4-34, paragraph 2, lines 2-3: "There would be some beneficial impact from any fire in this [mixed conifer] type in moving toward a reduced likelihood of uniformly high severity fire." This would justify additional ecologically disastrous fires such as the Outlet Fire (with a 13 km^2 patch of stand-replacing fire) and Poplar Fires, as well as the Warm Fire in adjacent Kaibab National Forest.

15. Even more grievous than the statement described in the previous paragraph is what can only be described as a fabrication that "There is some evidence that extensive high severity fire may have occurred in some of the mixed-conifer type historically..." Note that no source for this is cited – for good reason, because there is no such scientific evidence from GRCA! In fact, all scientific evidence from across the Southwest is to the contrary, as stated in the DEIS itself on page 3-4, last paragraph, lines 1-2: "All studies in the Southwest indicate that crown fires were uncommon and patchy before Euro-American influence." And again on page 3-5, first paragraph, lines 2-3: "In summary, all Southwest research has indicated that "extensive crown fires were rare to non-existent" prior to fire exclusion (Brown et al. 2001)." So while the DEIS may at times report the "current and best-available information" it doesn't always use it and puts GRCA resources at high risk of impairment (see G below).

16. The same paragraph includes yet another scientifically invalid statement on lines 14-15: "Historically, mixed conifer is thought to have had a mixed severity

pattern, which means that over the long term, typically 30% or more of the area would burn at high severity." If this statement was true, why isn't it included in the description of historic conditions for mixed conifer? If this statement was true, why isn't is supported by data in Fulé et al. (2003a) that suggest a value of 20% (which might be an overestimate, as explained in C.2 above).

17. Page 4-34, last paragraph. Methods such as igniting ridgetops were used in Grand Canyon in 2007 in the Southwest Roost Fire; therefore, one-year results should be available and should be included in the DEIS. Such innovative methods need to be a major focus of returning fire to mixed conifer forest. As failures of past management fires have shown (the Outlet and Poplar Fires in GRCA and the Warm Fire in adjacent Kaibab National Forest all started as management fires before being converted to suppression fires), traditional methods often do not work and something new must be tried rather than repeat the same mistakes – indeed make worse mistakes in Alternatives 2-5 which would allow for higher levels of fire intensity/severity. Only innovative methods appear to possibly mimic the historic fire regime of mixed-severity fire coincident with small-scale topographic heterogeneity.

18. Page 4-35, paragraph 3 states "There would be a potential minor, adverse effect from suppression fires." This statement absurdly ignores impairment of Park resources. And if its effects were minor, why were great costs expended to suppress these fires? Suppression fires such as the Outlet and Poplar Fires in GRCA and the Warm Fire in adjacent Kaibab National Forest have dramatically changed enormous acreages from complex vegetation mosaics to homogeneous expanses that will not return to complex mosaics for more than a century, if at all. It is an insult to characterize this loss of American's natural heritage as "minor". As an important ecological resource of the Southwest, such change in the mixed conifer forest is the ecological equivalent of flattening the multicolored cliffs, walls, spires, and depths of the Grand Canyon and characterizing the effect as "minor".

19. The descriptions of Alternatives 2-5 contain many similar distortions of "current and best-available information", but are even worse than Alternative 1, because of higher fire severities allowable (e.g., pages 4-47 through 4-48). Any Alternative that would allow greater amounts of stand-replacing fire would cause even greater departure from the historic range of variation for mixed conifer landscapes and as described above, assure impairment of Park resources (see G below).

D. Ponderosa pine forest.

1. Section 2.4.3.1 Reference Conditions inappropriately includes information from Fulé et al. (2002b). This source is inappropriate because it considered only small ponderosa pine patches in a high-elevation landscape dominated by

spruce-fir vegetation, not the landscapes of ponderosa pine forest at lower elevation that is the subject of Section 2.4.3.

2. This section on reference conditions should include the critically important point that the historic fire regime produced only very small patches of stand-replacing fire, limited to <2 hectares, according to Fulé et al. (2003b).

3. Section 2.4.3.2 Existing Conditions inappropriately includes information from Swamp Ridge, which is an area of mixed conifer forest.

4. Page 4-28, last paragraph suggests that fires should not be set above the 90th percentile weather conditions. If this weather limit has been used in the past, it has frequently led to prescribed, fire-use, and suppression fires that exceeded 4% crown fire, an amount highly likely above reference conditions, and this calls into question the accuracy of the modeling. If 90th percentile limits were not used in the past and if alternatives allow continuation of this policy, the alternatives – and policy – should be changed.

E. Pinyon-Juniper vegetation.

1. The third sentence in Section 2.4.1.1 Reference Conditions is an incorrect, misleading revision of what was provided in the first draft of the vegetation portions of Chapter 3. The accurate statement as submitted was "Another review hypothesized that different fire regimes occurred in the three Piñon-Juniper subtypes: frequent surface fire carried by grasses in grass savanna, moderately frequent crown fires carried by shrubs and trees in shrub woodland, and very infrequent crown fires carried by trees in forest (Romme et al. 2003)."

F. Modeling

The modeling portions of the DEIS are difficult to evaluate by persons unfamiliar with the approaches used. They are particularly difficult to evaluate in terms of how the simplifying assumptions have influenced the results. Nevertheless, several problems or shortcomings of the modeling are evident:

1. The modeling appears to be descriptive rather than prescriptive or diagnostic. One could summarize the modeling as having shown (1) fire is not overly risky (in terms of stand-replacing fire) in ponderosa pine forest, (2) fire is very risky in mixed conifer and spruce-fir forests, (3) fires burning in extreme weather are exceedingly risky, and (4) wildland fire-use fires are riskier than prescribed fires. While I recognize that these findings are demonstrated quantitatively, this would seem more useful to fire managers when developing fire prescriptions for than for a DEIS.

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2. The modeling results appear to be used to say what is acceptable with regard to stand-replacing fire, but it appears that an underlying assumption is that the past determines the future. While this may be appropriate for Alternative 1, it is problematic for the other alternatives because (1) the past included a range of effects and means alone do not express this range, (2) the sample size of past fires is small, exceedingly so in some ecosystems, and therefore likely will not determine the future, (3) adaptive management should have resulted in improvements in management fires and limit the likelihood of suppression fires, and (4) innovative approaches have the potential to invalidate this assumption.

3. Modeling that is diagnostic needs to be included.

a. Modeling needs to explore how recent increases in tree mortality (see pages 3-3 and 3-5) affect fire patterns and needs. How much mortality is needed to change forest structure and reduce (a) the probability of suppression fires and (b) the necessity of higher-risk management fires?

b. Modeling needs to explore the effects of innovative patterns of prescribed fire (see C.17 above). How does igniting fires on ridgetops in a mixed conifer landscape, as done with the 2007 Southwest Roost Fire, affect predicted burn patterns? Should ridgetop ignitions be followed by ignitions on drier slopes, moister slopes, or valley bottoms to mimic the topographically driven historic fire patterns in spruce-fire and mixed conifer landscapes?

In short, modeling needs to be used to develop new approaches to achieving the Historic (Natural) Range of Variation.

4. Current modeling suggests that past fires that had amounts and patterns of stand-replacing fire outside the Historic (Natural) Range of Variation burned at high weather percentiles (Chapter 4, Tables 4-12, etc.). This strongly suggests that prescriptions for management fires need to be more cautionary, yet Alternatives 2-5 involve burning at higher levels of intensity/severity. This is key aspect of these alternatives, and it leads to the conclusion is that these alternatives, if implemented, would led to impairment of Park resources.

5. Page 4-6, next to last paragraph states: "It was infeasible to model spatial effects of wildland fire-use fires or suppression wildland fires..." Given the major influence of both types of fires, this would seem to prevent modeling from addressing the question of whether proposed management actions would lead toward or away from the Historic (Natural) Range of Variation, particularly in spruce-fir and mixed conifer forests. More explanation of the statement cited above is needed.

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G. Fire management will produce rotation periods for stand-replacing fire that will lead to impairment of at least mixed-conifer forest.

The areas burned by stand-replacing fire were used to calculate "rotation period", which is an established descriptor of disturbance regimes (the NPS Fire and Aviation Management website uses the term "fire rotation"). Rotation period is defined as the time required for disturbance to affect an area equal in size to a specified area (such as the area of mixed conifer forest in GRCA).

Theoretically, the entire area is not necessarily disturbed, because some sites within the area could have repeated disturbance. However, repeated stand-replacing fire is impossible when the rotation period is shorter than the number of years required for burned stands to regrow and again become susceptible to stand-replacing fire. In these circumstances, which apply to most of the following results, the rotation period is the time required for stand-replacing fire to burn the entire area.

I calculated rotation periods for stand-replacing fire for ponderosa pine, mixed conifer, and spruce-fir forests, as well as pinyon-juniper vegetation using data from the DEIS. Because the DEIS does not include data on estimated annual area of stand-replacing fire by vegetation type, I made the assumption that past history of stand-replacing fires (as shown in Table 4-4 for ponderosa pine forest, for example) will continue in the future. This assumption is identical to that made by the DEIS modelers, except that I assumed that the occurrence of stand-replacing fire due to prescribed fire in ponderosa pine and mixed-conifer forest would be switched due to fire management's shift in emphasis from ponderosa pine forest to mixed conifer forest. In my final calculation for each vegetation type, I took the area of that vegetation type that hasn't been burned in recent stand-replacing fires and divided it by the estimated annual area of stand-replacing fire in that vegetation type.

I calculated rotation periods for two scenarios. In the basic scenario, I used the percentage figures in the projected fire severity table for each vegetation type (e.g., Table 4-5 for the ponderosa pine forest). I also calculated a "worst-case" scenario, using the highest recorded percentages for stand-replacing fire in the one-year post-fire severity tables (e.g. Table 4-4). For each of these vegetation types, I divided its total area by its estimated annual area of stand-replacing fire. Here are the results (rotation periods are expressed in years):

Scenario	Ponderosa Pine	Mixed Conifer	Spruce-Fir	Pinyon-Juniper
Basic	213	13	24	1007
"Worst-Case"	61	11	24	184

Recall that these rotation periods express the number of years required for stand-replacing fires **to burn the entire area of the vegetation type**. Therefore,

because only 11-13 years would be required under this DEIS for the compete loss of GRCA's mixed conifer forest to stand-replacing fires, it is clear that the alternatives in this DEIS are likely to lead to impairment of this Park resource. Similarly, the risk of impairment of spruce-fir forest is very high and the risk of impairment of ponderosa pine forest under the "worst-case" scenario should be of grave concern to the National Park Service.

But there is also the issue of maintaining old-growth, legacy trees. With regard to this, stand-replacing fire rotation periods should be interpreted in comparison to the age of current canopy trees (assuming that the ages of current canopy trees are similar to ages of canopy trees with under desired conditions). For example, ponderosa pine is a canopy dominant of stands in both ponderosa pine and mixed conifer forests. Many of these trees are older than 200 years; some are older than 400 years (except, of course, in areas of recent stand-replacing fire). Rotation periods shorter than the age of current canopy trees would result in both a loss of old-growth trees and a decrease in stand ages (the greater the difference between the rotation period and the age of current canopy trees, the more rapid the loss of old-growth trees and the greater the decrease in stand ages). Even rotation periods equal to the age of current canopy trees will result in decreases of old-growth trees and stand ages. Stand-replacing fire rotation periods would need to be twice the age of current canopy trees in order to retain today's array of tree and stand ages in even approximately 50% of the area, four times the age of current canopy trees to retain it in approximately 75%, etc.

Long fire rotation periods have many advantages in addition to maintaining legacy trees and forest age structure. For example, long fire rotation periods maintain more extensive refugia or reinvasion sources than short rotation periods. Refugia are essential for maintaining biodiversity in landscapes subject to major disturbance such as stand-replacing fire, and reinvasion sources are essential for succession following stand-replacing fire.

The obvious conclusion of this analysis is one that is supported by the "current and best-available information", as stated many times above: large-scale crown fires of the past (and future ones allowable under the alternatives of this DEIS) are far outside the Historic (Natural) Range of Variability and must be replaced by management fires, including ones with innovative designs for mixed conifer and spruce-fir forest, that result in surface fires with small, <2 hectare patches of stand-replacing fire.

H. Other

1. Page 2-14, Figure 2-2 is more of a flow chart of how adaptive management is to be used rather than an actual example of how it has been used. The DEIS should include several concrete examples of GRCA's use of adaptive management, particularly with regard to reducing the adverse ecological impacts of management fires.

2. In Chapter 2, adaptive management is mentioned as a "desired condition" only for spruce-fir forest and pinyon-juniper vegetation (see Sections 2.4.1.3 and 2.4.4.3). The DEIS should explain why adaptive management isn't equally important for mixed-conifer and ponderosa pine forests (Sections 2.4.2.3 and 2.4.3.3).

3. Portions of Chapters 2 and 4 that suggest that Alternative 1 (no change) and aspects of other Alternatives that assume that future management will be similar to past management seem to be counter to use of adaptive management. The DEIS should account for this apparent discrepancy.

4. Recent decreases in tree densities in unburned spruce-fir and mixed conifer forests (see pages 3-3 and 3-5) would seem to have gotten stands closer to historic conditions. This should be discussed in the DEIS, particularly as it might reduce the need for higher severity management fires. Also, this mortality would seem to have decreased departure from the Historic (or Natural) Range of Variation, which in the DEIS appears to be measured only by time, not by structural and compositional information. The DEIS should have developed an index of departure that accounts for this potentially important phenomenon.

5. The DEIS appears to judge movement toward the Historic (Natural) Range of Variation by reduction of departure in terms of time since last fire. Therefore, any fire, regardless of levels of severity and patch patterns different from historic conditions appears to be viewed as beneficial. The DEIS should not include such self-serving, tautological arguments.

6. Page 4-28, paragraph 2: Here and elsewhere, these values need to be expressed on an annual basis. Otherwise, they are meaningless without knowing the time frame of this document, and this time frame is not specified. This is a fatal flaw, because it is impossible to fully judge the different alternatives without annual figures.

I. The DEIS is fundamentally lacking because alternatives are procedurally or tool-based and do not address the key environment issue.

THE key issue regarding fire management in GRCA is the amount of stand-replacing fire to allow in forests that had little such fire in reference conditions. This was true when DEIS deliberations began several years ago, when internal deliberations over a previous DEIS led to its demise before being made available for public comment, and continues to be true today. Instead of this key issue, the alternatives of the current DEIS focus on (1) two different classifications of Fire Management Units (a management issue seemingly unnecessary to include in a DEIS) and (2) differing blends of prescribed fire vs. wildland fire-use fires vs. hand and mechanical thinning (a tools issue that only indirectly – and often in

fatally flawed and sometimes obscure ways – deals with the core issue of fire severity levels.

The current DEIS is analogous to Kaibab National Forest submitting a DEIS for future timber harvest and basing the alternatives on different blends of (1) chain sawing, (2) hand sawing, and (3) mechanical harvesting, along with (4) a no action alternative that permits future harvests on the basis of past harvests. While there are differences in environmental impact among these three approaches or tools, most are minor and the DEIS likely would be unacceptable for failure to treat issues such as selective cutting vs. clear cutting, landscape patterns of cutting such as riparian buffers vs. no riparian buffers, other aspects of the resultant landscape mosaic, inclusion vs. exclusion of old-growth legacy trees, etc.

GRCA's DEIS is as equally conceptually lacking as this analogy. For example alternatives 3-5 are essentially straw men, because no fire manager would truly consider reducing the number of tools in his/her toolbox. Also, because no DEIS would be necessary if fire management was satisfied with the current situation, Alternative 1 is a straw man (albeit one that is required for a DEIS). That leaves Alternative 2 as the obvious, only choice. However, Alternative 2 is fundamentally flawed ecologically because of the high level of stand-replacing fires permitted that will lead to impairment of Grand Canyon resources. As documented above, this fundamentally flawed alternative is supported by fundamentally flawed statements unsupported by "current and best-available information".

1. On page 2-2, paragraph 3, the statement: "These proposed alternatives represent a full range of wildland fire management strategies" is incorrect, because they do not consider a full range of limits on stand-replacing fire in individual forest types, i.e., low, medium, and high levels of moderate/high plus high severity fire.

2. The alternatives presented in Section 2.7 Alternatives Under Consideration should be replaced by alternatives similar to the following: (1) no action, (2) management actions designed to limit the amount of moderate/high plus high severity fire to a low level, (3) management actions designed to limit the amount of moderate/high plus high severity fire to a medium level, and (4) management actions designed to limit the amount of moderate/high plus high severity fire to a high level. This will usefully confront the key issue, allowing clear analysis of alternatives that have large differences in environmental consequences and avoid alternatives that are essentially straw men.

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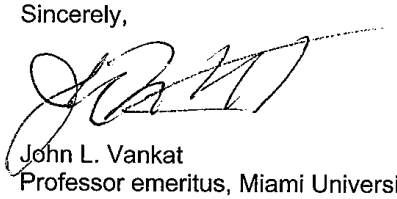
Concluding Remarks:

I thank you for the opportunity to comment on the DEIS of the Fire Management Plan. I hope that my comments are useful in the development of the best-possible fire management program for Grand Canyon National Park. I am available at your convenience to discuss my concerns with you or other members of your staff.

Sincerely,



John L. Vankat
Professor emeritus, Miami University, Oxford Ohio
Former Special Projects Ecologist, Grand Canyon National Park, Arizona