A - Alternatives Considered But Rejected

A preliminary analysis of alternatives resulted in the elimination of Alternative 5 – Wildland Fire Suppression Dominated, and Alternative 6 – Mechanical Fuel Reduction Dominated. These alternatives were described as follows:

Alternative 5 - Mechanical Fuel Reduction Dominated

This alternative would mechanically remove hazardous levels of fuels in non- wilderness areas and around developments. Up to 4% of the park (all non- wilderness) would be the primary focus of this alternative.

Legal and NPS policy restrictions prevent road construction and logging in designated and proposed wilderness, effectively restricting the application of this alternative to about 4% of the park. Mechanical work would occur primarily in the foothills zone and areas immediately adjacent to highway corridors and park developments, which constitutes the bulk of the parks non- wilderness acreage.

Prescribed fire would be used in conjunction with mechanical treatments to burn slash piles or similar fuels related activity. All unplanned ignitions would be suppressed consistent with firefighter safety.

Where mechanical treatments would be applied, they would be designed to reproduce natural plant community structure and function to the extent possible.

Alternative 6 – Wildland Fire Suppression Dominated

This alternative would return the park fire program to its function and purpose prior to 1968.

All unplanned ignitions would be suppressed. Prescribed burning would only occur in conjunction with mechanical treatments around developments. No prescribed fire projects would be implemented to restore or maintain natural systems, or to reduce hazardous levels of fuels outside developed areas.

The strategies and outcomes would be essentially the same as Alternative 5, except that mechanical fuel reduction would only be used immediately adjacent to developments to buffer these sites from unplanned fire events.

Factors in Eliminating Alternatives

The primary considerations that led to the elimination of these two alternatives were:

- An analysis of the maximum acres treatable under each of the two eliminated alternatives (Table A- 1) showed that optimum accomplishments under those alternatives still fall well short of achieving even modest natural resource and fire management goals. Ecologically

based desired future conditions for the resources have been developed, and the level of activity needed to move toward those conditions over time has been established through a comparison of existing conditions and desired conditions. See Chapter 4, Affected Environment, for additional details regarding that analysis.

- The designation of 96% of the park as proposed or designated wilderness is a primary constraint on mechanical fuel reduction, limiting its application to less than 4% of parklands (approximately 35,000 acres). Even within the 35,000 non- wilderness portion of the parks, many areas are in developed areas such as campgrounds or lodging, or are too steep or otherwise environmentally sensitive to apply mechanical treatments to any great degree (Figure A- 2 and Table A- 3). Many giant sequoia groves are located in wilderness areas. Selection of either of the alternatives would preclude proactive management of those groves, placing them at substantial risk.

- While some wildfires under the rejected alternatives would create local beneficial ecological effects at times, most areas of the park would be expected to suffer negative effects. Negative effects would come from areas accumulating unnaturally high fuel loads (which would eventually include much of the parklands under these alternatives) and making those acres subject to large- scale high- intensity catastrophic fire events that would be damaging to the natural resources including giant sequoia groves. These high intensity fire events would be hazardous and expensive to fight, compromise firefighter and public safety, and create long duration smoke events at random times. Aggressive suppression actions, including the creation of firelines, fire camps, and helispots, would have serious cumulative effects on park resources and wilderness conditions.

The interdisciplinary planning team forwarded the conclusions of the preliminary assessment to the parks' Environmental Management Committee for review and advice. The Committee ultimately recommended that Alternatives 5 and 6 be removed from further analysis since they could not be implemented in any fashion that would result in significant resolution of issues, nor would they fulfill fundamental fire management and natural resource objectives. The Superintendent concurred with this determination in a memo dated April 19, 2000.

Table A-1 – Summary of expected annual program achievement in acres by alternative at year 25.

Treatment Acres per year	Alt 1 No Action (Current Program)	Alt 2 Prescribed Fire	Alt 3 Wildland Fire Use	Alt 4 Multi-Strategy (Preferred Alternative)	Alt 5 Mechanical Fuel Reduction	Alt 6 Wildland Fire Suppression
Mechanical Fuel Reduction	10	16	30	16	467	30
Wildland Fire Suppression	886	726	2245	986	3055	3105
Prescribed Fire	1478	14490	164	2225	25	34
Wildland Fire Use	1293	0	11349	12055	0	0
Grand Totals	3667	15232	13788	15282	3547	3547

Notes:
This table represents the average program achievements projected at 25 years from implementation to assess the ability of each alternative to achieve resource management goals.
A conservative ecological analysis indicates that approximately 15,000 acres per year is the *minimum* average that would have burned under completely natural circumstances. Most years would have seen much higher numbers. (Caprio 1999). All alternatives were developed to attempt to meet minimum ecological needs.
Mechanical acres under Alternative 5 represent the maximum area that could be reasonably treated on a sustained basis given constraints of roadless and wilderness areas. Many development areas are currently treated by mechanical means under the parks tree hazard management program (e.g. campgrounds). Acres treated under this program are not included in these figures.
Mechanical acres increased slightly under Alternative 6 over most other alternatives as a tool to create larger reduced fuel buffers directly around developments to offset generally more intense fire events expected under this alternative.
Suppression acreage increased somewhat under Alternative 3 due to the random placement and timing of unplanned ignitions. Additional acres of suppression will be needed due to the lack of other preventative or proactive measures (e.g. prescribed fire) along boundaries and adjacent to developments that would otherwise buffer and allow freer management of unplanned ignitions.
Wildland fire use acres are slightly less under Alternative 3 than Alternative 4 due to the need to suppress or constrain more fire use projects due to the lack of proactive fuels management in adjacent areas. The number of acres for Alternative 4 represents a more liberal management of wildland fire use ignitions due to proactive fuels management in buffer areas, areas of special concerns (e.g. in giant sequoia groves), and around developments.

Figure A-2 – Non-wilderness areas in park minimally suitable for mechanical treatment.

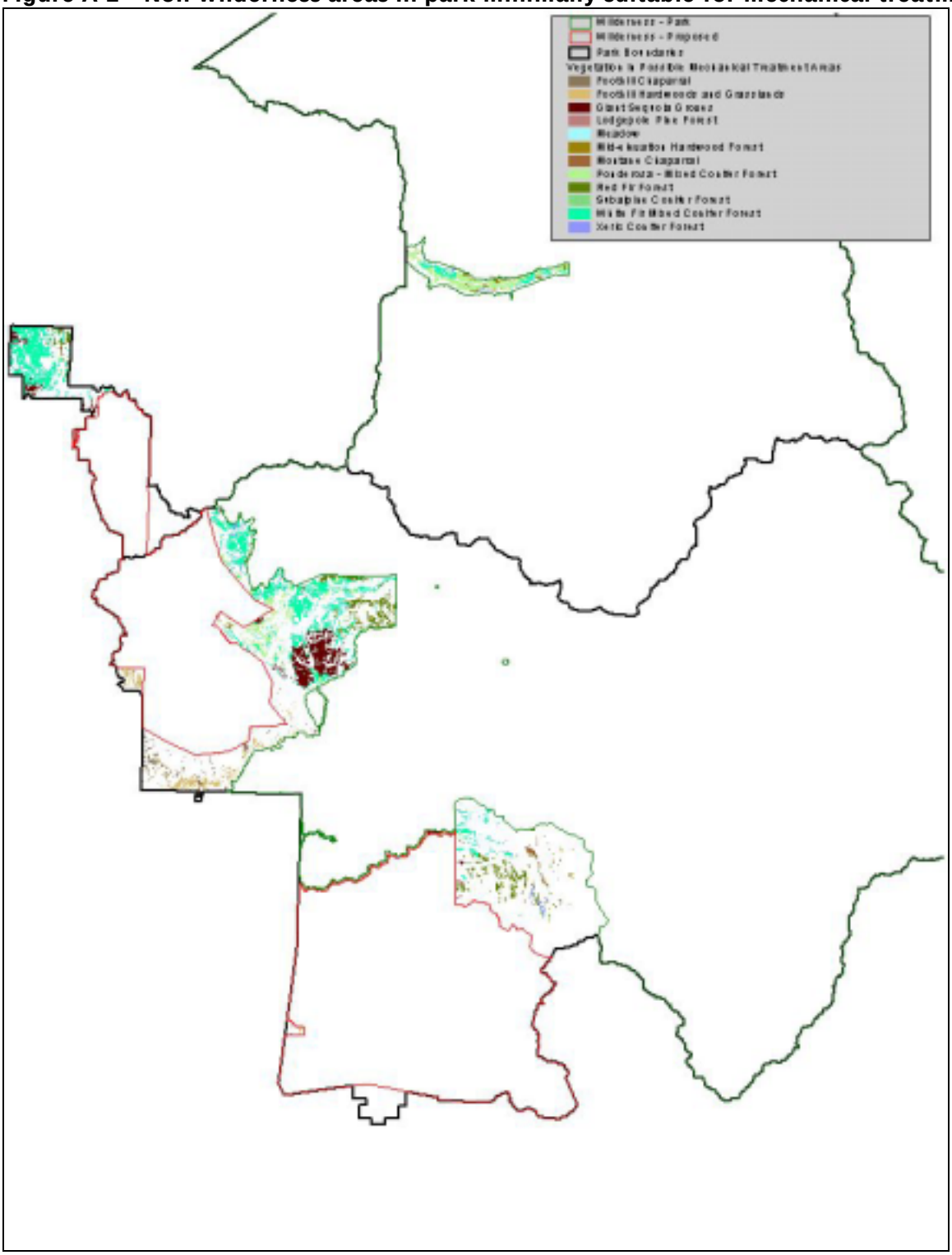

Table A-3 – Acres by vegetation type of non-wilderness areas in park minimally suitable for mechanical treatment.

Vegetation Type	Acres
Foothill Chaparral	388
Foothill Hardwoods and Grasslands	873
Giant Sequoia Groves	1,781
Lodgepole Pine Forest	46
Meadow	163
Mid-elevation Hardwood Forest	179
Montane Chaparral	166
Ponderosa - Mixed Conifer Forest	1,950
Red Fir Forest	1,495
Subalpine Conifer Forest	16
White Fir Mixed Conifer Forest	5,273
Xeric Conifer Forest	253
No (or missing) Data	311
TOTAL ACRES	**12,894**

Criteria for inclusion as minimally suitable were acres:
- Outside of designated or proposed wilderness, and
- Greater that 100' from streams, lakes or wetlands, and
- Less than 100 % slope, and
- Within 3 miles of a roadway to accommodate potential helicopter logging operations.

B - Plant and Wildlife Species Removed From Further Analysis

The U.S. Fish and Wildlife Service provided the parks with the list of "Endangered and Threatened Species that may occur or be Affected by Projects in the USFWS 7 1/2 Minute Quads, Reference File No. 03- SP- 1295." Table B- 1 identifies the plant species on this list that are not known to occur within the boundaries Sequoia and Kings Canyon National Parks, nor were they historically found in the parks. Table B- 2 identifies the wildlife species on this list that are not known to occur within the boundaries Sequoia and Kings Canyon National Parks, nor were they historically found in the parks. The National Park Service has determined, therefore, that the plants and wildlife included below would not be affected by the fire and fuels management program. Therefore, there is no effect on these species from any of the alternatives, nor are they potentially indirectly or cumulatively affected by any of the alternatives. These species will not be evaluated further in this environmental assessment. If any of these species are identified within SEKI boundaries in the future, the parks would initiate consultation with the U.S. Fish and Wildlife Service and determine assessment or analysis needs.

Table B-1 – Federal and State listed plant species in Fresno and Tulare counties not known to occur within Sequoia and Kings Canyon National Parks (endangered, threatened, candidate, state-listed, species of concern, and species of local concern).

Federal Endangered Species:

California jewelflower	*Caulanthus californicus*
palmate-bracted bird's beak	*Cordylanthus palmatus*
San Joaquin woolly-threads	*Monolopia congdonii (= Lembertia congdonii)*
Hartweg's golden sunburst	*Pseudobahia bahiifolia*
Keck's checker-mallow	*Sidalcea keckii*
Green's tuctoria	*Tuctoria greenei*

Federal Threatened Species:

Mariposa pussy-paws	*Calyptridium pulchellum*
San Benito evening-primrose	*Camissonia benitensis*
succulent owl's clover	*Castilleja campestris ssp. succulenta*
Hoover's spurge	*Chamaesyce hooveri*
Springville Clarkia	*Clarkia springvillensis*
Hoover's eriastrum	*Eriastrum hooveri*
Orcuttia inaequalis	*Orcuttia inaequalis*
San Joaquin adobe sunburst	*Pseudobahia peirsonii*

Candidate Species:

Ramshaw Meadows abronia	*Abronia alpina*
slender moonwort	*Botrychium lineare*

California State-Listed Species:

Kaweah brodiaea	*Brodiaea insignis*
carpenteria	*Carpenteria californica*

striped adobe-lily	*Fritillaria striata*
Boggs Lake hedge-hyssop	*Gratiola heterosepala*

Species of concern:

obovate-leaved thornmint	*Acanthomintha obovata ssp. obovata*
heartscale	*Atriplex cordulata*
brittlescale	*Atriplex depressa*
San Joaquin spearscale	*Atriplex joaquiniana*
lesser saltscale	*Atriplex minuscula*
vernal pool saltbush	*Atriplex persistens*
Lost Hills saltbush	*Atriplex vallicola*
Scalloped moonwort	*Botrychium crenulatum*
scalloped moonwort	*Botrychium crenulatum*
Inyo County star-tulip	*Calochortus excavatus*
alkali mariposa lily	*Calochortus striatus*
Shirley Meadows star-tulip	*Calochortus westonii*
Mono Hot Springs evening-primrose	*Camissonia sierrae ssp. alticola*
San Benito spineflower	*Chorizanthe biloba var. immemora*
Fresno County bird's-beak	*Cordylanthus tenuis ssp. barbatus*
Piute cypress	*Cupressus nevadensis*
Hall's tarplant	*Deinandra halliana*
Ewan's larkspur	*Delphinium hansenii ssp. ewanianum*
recurved larkspur	*Delphinium recurvatum*
Pierpoint Springs liveforever	*Dudleya cymosa ssp. costafolia*
Twisselmann's buckwheat	*Eriogonum twisselmannii*
spiny-sepaled coyote-thistle	*Eryngium spinosepalum*
delta tule-pea	*Lathyrus jepsonii var. jepsonii*
rayless layia	*Layia discoidea*
pale-yellow layia	*Layia heterotricha*
Munz's tidy-tips	*Layia munzii*
Panoche peppergrass	*Lepidium jaredii var. album*
Yosemite lewisia	*Lewisia disepala*
long-petaled lewisia	*Lewisia longipetala*
orange lupine	*Lupinus citrinus var. citrinus*
Father Crowley's lupine	*Lupinus padre-crowleyi (=L. dedeckerae)*
showy madia	*Madia radiata*
calico monkeyflower	*Mimulus pictus*
flax-like monardella	*Monardella linoides ssp. oblonga*
little mousetail	*Myosurus minimus ssp. apus*
Pine Mountains navarretia	*Navarretia setiloba*
Twisselmann's nemacladus	*Nemacladus twisselmannii*
Charlotte's phacelia	*Phacelia nashiana*
Nine Mile Canyon phacelia	*Phacelia novenmillensis*
valley sagittaria	*Sagittaria sanfordii*
Bolander's clover	*Trifolium bolanderi*

Species of Local Concern:

forked fiddleneck	*Amsinckia vernicosa var. furcata*
Kern Plateau milk-vetch	*Astragalus lentiginosus var. kernensis*
Earlimart orache	*Atriplex erecticaulis*
sublte orache	*Atriplex subtilis*
South Coast Range morning-glory	*Calystegia collina ssp. venusta*
Lemmon's jewelflower	*Caulanthus coulteri var. lemmonii*
cottony buckwheat	*Eriogonum gossypinum*
Kings river buckwheat	*Eriogonum nudum var. regirivum*
stinkbells	*Fritillaria agrestis*

serpentine bedstraw	*Galium andrewsii ssp. gatense*
Monarch gilia	*Gilia yorkii*
Tulare horkelia	*Horkelia tularensis*
Madera linanthus	*Linanthus serrulatus*
Indian Valley bush mallow	*Malacothamnus aboriginum*
slender-stalked monkeyflower	*Mimulus gracilipes*
no common name	*Schizymenium shevockii*

Table B-2 – Federal and State-listed wildlife species in Fresno and Tulare counties not known to occur within Sequoia and Kings Canyon National Parks (listed species and species of concern).

Listed Species:

San Joaquin kit fox	*Vulpes macrotis mutica*
riparian woodrat	*Neotoma fuscipes riparia*
giant kangaroo rat/critical habitat	*Dipodomys ingens*
Fresno kangaroo rat	*Dipodomys nitratoides exilis*
Tipton kangaroo rat	*Dipodomys nitratoides nitratoides*
San Joaquin antelope squirrel (CA only)	*Ammospermophilus nelsoni*
least Bell's vireo	*Vireo bellii pusillus*
greater sandhill crane (CA only)	*Grus canadensis tabida*
bank swallow (CA only)	*Riparia riparia*
California condor critical habitat	*Gymnogyps californianus*
western yellow-billed cuckoo (Candidate)	*Coccyzus americanus occidentalis*
mountain plover (Proposed)	*Charadrius montanus*
blunt-nosed leopard lizard	*Gambelia sila*
giant garter snake	*Thaamnophis gigas*
California red-legged frog	*Rana aurora draytonii*
California tiger salamander	*Ambystoma californiense*
Sacramento splittail	*Pogonichthys macrolepidotus*
delta smelt	*Hypomesus transpacificus*
Lahonton cutthroat trout	*Oncorhynchus clarki henshawi*
Paiute cutthroat trout	*Oncorhynchus clarki seleniris*
Central Valley steelhead	*Oncorhynchus mykiss*
Green sturgeon (Candidate)	*Acipenser medirostris*
vernal pool tadpole shrimp	*Lepidurus packardi*
vernal pool fairy shrimp	*Branchinecta lynchi*
vernal pool invertebrate critical habitat(Proposed)	NA

Species of concern:

Short-nosed kangaroo rat	*Dipodomys nitraatoides brevinasus*
Tulare grasshopper mouse	*Onychomys torridus tularensis*
southern grasshopper mouse	*Onychomys torridus ramona*
San Joaquin pocket mouse	*Perognathus inornatus*
Mt. Lyell shrew	*Sorex lyelli*
Pacific western big-eared bat	*Corynorhinus townsendii pallescens*
long-billed curlew	*Numenius americanus*
western burrowing owl	*Athene cunicularia hypugaea*
Costa's hummingbird	*Calypte costae*
Aleutian Canada goose	*Branta canadensis leucopareia*
American bittern	*Botaurus lentiginosus*
white-faced ibis	*Plegadis chihi*
San Joaquin LeConte's thrasher	*Toxostoma lecontei macmillanorum*

San Joaquin coachwhip	*Masticophis flagellum ruddocki*
western spadefoot	*Spea hammondii*
yellow-blotched ensatina	*Ensatina eschscholtzii croceator*
longfin smelt	*Spirinchus thaleichthys*
Kern brook lamprey	*Lampetra hubbsi*
Pacific lamprey	*Lampetra tridentata*
river lamprey	*Lampetra ayresi*
Cierro aegialian scarab beetle	*Aegialia concinna*
midvalley fairy shrimp	*Branchinecta mesovallensis*
San Joaquin dune beetle	*Coelus gracilis*
wooly hydroporus diving beetle	*Hydroporus hirsutus*
California linderiella fairy shrimp	*Linderiella occidentalis*
Hopping's blister beetle	*Lytta hoppingi*
molestan blister beetle	*Lytta molesta*
moestan blister beetle	*Lytta moesta*
Morrison's blister beetle	*Lytta morrisoni*
Dry Creek cliff strider bug	*Oravelia pege*
Bohart's blue butterfly	*Philotiella speciosa bohartorum*
San Emigdio blue butterfly	*Plebulina emigdionis*
Sierra pygmy grasshopper	*Tetrix sierrana*
San Joaquin tiger beetle	*Cicindella tranquebarica*
Kings Canyon cryptochian caddisfly	*Cryptochia excella*

C - Scoping Issues and Responses

The following table includes all comments received during the internal and public scoping period. The comments (and tables) are grouped by fifteen major themes. Similar comments have been edited or merged where thoughts were duplicated. Every effort was made to retain the original intent and tone of all comments. Park responses briefly address how those comments were considered or incorporated in the planning process. Responses often refer to more detailed information in the main text of this document (EA) or the companion *Fire and Fuels Management Plan* (FFMP).

Table C-1 – Desired Future Conditions: Scoping Issues and Responses

Comment	Response
Goal is to get as much of park as possible to pre-Euroamerican fire regime… until then, have core "natural" fire areas and other "appropriate" fire areas. Designate core areas in every major vegetation type where, come hell or high water, we maintain pre-Euroamerican fire regime.	The park has established target resource conditions to fulfill resource stewardship requirements required by law and policy. The targets are based on the best available science and technology. Ongoing studies and research are conducted to continuously refine the ecological models used. The effects of current management actions on resources are monitored annually to provide feedback on program accomplishments. Program
The parks need a measurable 5-year long-term goal(s) for fire in the ecosystem that would be broken down to annual measurable goals.	
All natural starts, no matter location or burning conditions, should be allowed to burn unimpeded.	
I have always been a strong proponent of fire histories. They give us the best perspective of where we should be.	
Fire is an issue only because it is a natural force that was unfortunate to be weak enough for people to influence but strong enough to not be controlled. If fire was treated like rain, wind, and other natural forces, we would not have a problem.	
The parks have always done compliance on fires, but fire is the natural condition. It is for our failure to burn or our failure to allow natural fires to burn that we should be required to do compliance.	
Why is pre-Euroamerican desired? We can't go back. The climate is different, the air is different, the ecosystem is different, because it's limited.	

Table C-2 – Aesthetics: Scoping Issues and Responses

Comment	Response
Appearance near developed areas – use caution. Be careful of over-removal of "green space" – all vegetation types. "Green space" is important for a park landscape. By accelerating burning to "catch-up" we remove too much green space	Social science research shows most visitors accept fire effects (including fire scars on sequoia trees) as part of the natural environment (see EA Chapter 5, part I). However, some featured giant sequoia trees, logs, and snags would be protected from direct scorch or impact from fire if they are of particular individual significance (see FFMP Chapter 5, part C). In other parts of the park the rate and intensity of burning would be managed to create natural conditions based on the best available models of ecosystem process and structure.
The human idea of aesthetics is ever changing, and thus less important. Long-term aesthetics are truly served with fire. It's natural and healthy. Let it be! I think the way fire changes things is beautiful. Anything that is natural to this park is aesthetic.	
Blackened trees, more sunlight penetrating to the forest floor, and a carpet of wildflowers all sound aesthetically more pleasing than a dog-hair thicket of puny gray barked white fir trees.	
Aesthetics should be the lowest priority! The health of the ecosystem as a whole (not primarily human interest) should be most important.	

Table C-3 – Cost: Scoping Issues and Responses

Comment	Response
The parks can regulate the cost a lot easier if they use management burns.	A cost comparison of the different strategies is included in Chapter 5. Unwanted wildland fires are the most expensive to control, and bring a greater risk of loss than either prescribed fire or wildland fire use. Mechanical fuel removal is also an expensive strategy, but may be cost effective in focused areas adjacent to high value developments and along park boundaries.
As we learn more about all aspects of fire management, I hope we can be more aggressive in burning the forest. I don't know the numbers, but, in general, a proactive response is more economical than a reactionary one.	
Give us an example of how much it costs to do a prescribed burn vs. put out a wildfire.	
It seems to be most cost-effective to focus on managing prescribed fires as a preventive measure.	
The cheapest option is important, but it should also be the safest. Doesn't prescribed fire fit the bill for both?	
Prescribed burns cost approximately $40-$100 per acre. Wildfires cost approximately $400-$500 per acre.	
The parks need to continue to seek special funding for prescribed fire to reduce fuels and to reintroduce fire into the Sierran forests. The extreme buildup of fuels threatens the ecosystem, endangered and threatened species, the sequoia trees themselves, and remnants of prehistoric and historic human activities.	
Managing for fire/fuel load – once you've got structures endangered you've got to put your dollars there.	
Sure appears to be costly.	

Table C-4 – Air Quality: Scoping Issues and Responses

Comment	Response
Air Quality is a difficult issue. The park needs to continue to work with the state of California to assure that prescribed fires are carried out. The park needs to understand that prescribed fire is a better (air quality-related) alternative than wildfires, both from the standpoint of ignition pattern/timing and from the use of weather parameters to reduce emissions. They may not understand that most acreage WILL burn; it's just a matter of time.	Through a proactive fire management program and the adoption of a comprehensive *Smoke Management Plan* (Appendix J of the companion *Fire and Fuels Management Plan*) the parks will minimize the potential for air quality impacts from unwanted wildland fires, while accomplishing important public land management objectives. The *Smoke Management Plan* describes the best management practices that will be used for reducing emissions. These practices include mandatory training, smoke monitoring, public information, and strict adherence to permitting requirements of the San Joaquin Valley Unified Air Pollution Control District.
Know our airsheds – when and where we can burn. Can this be quantified? Timing is most important.	
BIG valley concern. Shouldn't stop or slow burning.	
I am confused as to why Air Quality Standards supercede all other resource-based objectives.	
A lot of smoke during a short period of time is more bearable than a lot of fire and loss of property.	
What about all the other air pollution sources which can be of greater health concern and are on-going as opposed to prescribed fires? It seems the major issue is the other pollution caused by human activities. Fire is just a larger, more visible source.	
If air quality is a major concern that would potentially deter us from encouraging natural fire cycles, maybe we should make a more serious commitment towards reducing emissions we are responsible for by car-pooling.	
Trying to choose the timing of smoke events seems difficult. When lightning strikes, the fire that may result should be allowed to follow its natural course if it is safe.	
Fire is a necessary agent and smoke is an unavoidable occurrence. By "scheduling" smoke events, people with health concerns or small children can make arrangements to temporarily relocate (rather than evacuate) if conditions are unhealthy.	
The inevitable smoke from this burning will have to be seen as both a natural part of the ecosystem and as an essential part of the visitor experience by all of us who recreate in or reside in or near the park. I regularly spend 3-4 weeks per year in Sequoia (at our family cabin in Silver City) and I am willing to put up with whatever smoke comes our way in order to assure that the ecosystem functions properly.	
Assess health effects/compared to everyday input.	

Table C-5 – Logging: Scoping Issues and Responses

Comment	Response
It may be necessary to physically remove some fuels by logging them out or by using burn piles in order to reduce these fuels. I have no problem with using logging trucks to remove some of the built-up fuels on a one-time basis in any given area. I would not want to see this logging continue in any given area. Fire should be used after the initial buildup has been removed by logging.	An assessment was conducted to determine acceptable portions of the park where mechanical removal of fuels could be used. Due to the steepness of terrain and other constraints such as wilderness designation, many areas of the parks are unsuitable for extensive mechanical removal. In other limited areas, primarily around developments, mechanical fuel removal is proposed as both an effective and acceptable means of reducing hazard fuels.

Table C-6 – Information / Education: Scoping Issues and Responses

Comment	Response
It would be great if somehow, a national education campaign could be started to coincide with the new fire management plans. Fire has been ingrained in the public's head as BAD for so long, that the public support is not there for the new policy.	As a result of public input gathered in the preparation of this document, the park has increased support for fire information efforts including the addition of a full time Fire Information Officer. These efforts have been formally incorporated into the fire management program.
Critical to success of the program.	
You're doing a great job! I appreciate the dialogue.	
Any thought of positioning a public information officer booth in Three Rivers during nearby burns? The parks could also staff booths in other locales, ie Lodgepole, Grant Grove, Cedar Grove, etc.	
Provide local media postings in area of park.	

Table C-7 – Fire Effects: Scoping Issues and Responses

Comment	Response
Set broad structural objectives in addition to process objs.	The park has, and will continue, an extensive program to monitor the outcomes of fire management actions on park resources, including cultural resources (FFMP Appendix C). If unexpected effects are detected, additional studies will be conducted on ways to mitigate or avoid undesired effects.
If fire is part of the natural process, harm to individual plants and animals would be negligible. Help restore processes… use prescribed fires!	
Without fire, individual plants and animals may undergo stress. When an ecosystem is impaired, every part of it can be impaired, keep things natural and let nature decide what lives and dies.	
As long as fires are set and monitored with safety in mind, I see nothing wrong with this also with the health effects to those living in the area.	
Fire is natural. Protect cultural resources, but don't limit burning.	
Sacrifices must be made.	
Burn! It's a natural process!	

Table C-8 – Hazard: Scoping Issues and Responses

Comment	Response
Careful prescribed burning should go along with studies on the effects to human health.	The Environmental Protection Agency, the state of California, and other agencies and public institutions conduct extensive research on the health effects of various pollutants. The park relies on the expertise of those agencies and the ongoing studies to assess health effects rather than conduct redundant research. The park, in conjunction with the San Joaquin Valley Air pollution control district, use the results of studies to design best management practices, smoke monitoring strategies, and to establish public health thresholds. The use of mechanical means to reduce hazard fuels in the parks is assessed under all alternatives and applied in some areas under the preferred alternative.
Include pros and cons for mechanical (cutting) or other fuel reduction options. Educate public about the pros and cons.	
It seems that the only way to stay within the limit of the laws that the park must obey is through burning fuel in as natural a way as possible.	
Firewood sales, salvage logging (in non-wilderness), biomass harvesting, cutting, piling, burning and prescribed burns should all be used.	
It would seem that trying to help keep nature in sync with its natural ongoing cycles would be the best policy, therefore – BURN BABY BURN!	
Prescribed burning seems less polluting or damaging to human health than the emissions that would result from making roads and using trucks to haul fuel away. Who wants the sound of chainsaws in the park?	
Can you do light burning?	
Trees that come down after the burn. Erosion problem? Responsibility? Response should be?	

Table C-9 – Human-Caused Fires: Scoping Issues and Responses

Comment	Response
If it is in a zone marked for prescribed burns, we may want to consider letting it burn.	By current national policy and direction fires begun by humans (other than management ignited prescribed burns) will be suppressed. Suppression strategies will consider firefighter safety and collateral damage to resources as a result of suppression actions when planning a response to a human caused ignition.
I think human-caused fires should be managed just like any other fires that start. Each fire should be analyzed for benefits and risks for the given area.	
I think if a human-caused fire occurs in an area that needs it, it can be safely monitored. It should not be suppressed.	
If a human-caused fire occurs in an area in need of burning why suppress it?	
Suppressing all human-caused fires is not always necessary and can be more costly than managing the anthropogenic ignition as a natural occurrence.	
Permit to burn if they achieve resource objectives.	
Human-caused fires should also be considered "most appropriate response". Backcountry campfire escapes or late-season fires that would be extinguished by snow anyway should at least have an opportunity to be looked at in a different management response.	
Some should be managed based on location, time of year.	
Humans are part of nature. Some human-caused fires should be left to burn. Thank goodness for the boys who burnt Point Reyes, or the community would never have done it. We should encourage it!	

Table C-10 – Lightning Fires: Scoping Issues and Responses

Comment	Response
Let them burn except where human safety is of concern.	Lightning ignited fires may be allowed to burn in some areas of the park if they provide resource benefit, do not threaten other resources or humans, and if the San Joaquin Unified Air Pollution District concurs with the management of those fires from an air quality standpoint. Other lightning fires that do no meet management objectives or that pose a significant risk to resources or air quality may be suppressed.
I think this is zone dependent.	
It seems that lightning fires are natural and should not be suppressed unless there's a risk to humans.	
Only fires that threaten life, irreplaceable resources, or property should be suppressed.	
The parks and lots of other land managing agencies, need to adjust their prescriptions for (what used to be called) prescribed natural fires to give lightning caused fires a chance to play their role in reducing fuels and modifying the vegetative cover. Particularly once fuels are reduced at the lower elevations and along boundaries, lightning should be the PRIMARY method of ignition that should burn the majority of the acreage each year.	

Table C-11 – Planning: Scoping Issues and Responses

Comment	Response
Must be well thought out. The parks need to accept political implications – place energies where there are no road blocks.	The park is applying planning models that incorporate both ecological need for fire along with areas at significant risk from unwanted fires. Significant constraints on the program will continue to be the need to balance other social and public health considerations with ecological and hazard reduction objectives. Each year specific prescribed burn projects will be proposed by the park and receive concurrence from the San Joaquin Valley Air Pollution Control District prior to implementation.
Bring burning back to natural levels.	
We wish to emphasize that although the NPS should be receptive to public input, the NPS should show leadership in upholding its mandate to protect the natural resources of Sequoia and Kings Canyon National Parks. The plan should employ clear, specific language to prevent ambiguity or misinterpretation of its proposals. We believe that appropriate reintroduction of fire to national park units will greatly improve resource health and reduce the threat of catastrophic fires to human safety and property.	

Table C-12 – Public Health: Scoping Issues and Responses

Comment	Response
Important, but let's not allow fire programs to be curtailed for exceeding standards over a short-term time table.	The park is compelled by both law and as a good steward to consider the effects of its actions on public health. Each prescribed fire and wildland fire use action will be evaluated by the San Joaquin Valley Air Pollution Control District to assure that they are conducted in ways that protect public health. Projects that do not meet the requirements of the District will not be implemented and will be suppressed (in the case of natural ignitions) or postponed to a more appropriate time (in the case of prescribed fire).
Although harsh, if you live next to a national park, you should expect to live with natural conditions/processes happening in the park – such as smoke.	
Particulate impacts – effects on residents in parks – effects on local communities.	

Table C-13 – Safety: Scoping Issues and Responses

Comment	Response
We have to have well trained managers along with accountability of supervisors for the training.	Public and firefighter safety will be foremost in implementing any fire management action. Safety is promoted through a proactive rather than reactive fire management program. Elements of a proactive program include safety training, physical fitness, presuppression planning, preparedness, and reduction of hazard fuels.
The Interpretation staff on fires need safety and survival training…to be on lines or in fire.	
Need to retain prescribed fire's "place" in dividing the smoke allowed pie.	
I think this is the most important premise with regards to fire management. Safe fire management practices are paramount for all decisions.	
Proactive management decreases the need for future suppression.	
Which is riskier, suppressing fire or managing it? Emphasis should be on the safest strategy. Need local education on fire safety, defensible space.	

Table C-14 – Prescribed Fire: Scoping Issues and Responses

Comment	Response
It took 130 years of suppression to mess up our fuels. We should plan on another 130 years to get back to something natural. We are not going to restore the system overnight, but we are not going to be successful until we overcome attitudes toward fire.	Current planning for exact prescribed fire locations is based on our best available knowledge of past fire regimes and current resource conditions. Initial prescribed burns tend to be smaller to both provide for control and to allow better management of smoke emissions. As fuel loads are reduced, larger areas may be burned at the same time with less risk, and with significantly less smoke. Due to the numerous variables of wind, weather, terrain, and human error, a small percentage of prescribed fires escape control. The risk of occasional escape from a prescribed fire must be balanced against the risks posed by ever increasing hazard fuel loads on parklands. These increasing loads, if not proactively treated, create increased risk to both park resources and human health and safety. Under procedures instituted by the NPS in 2001, contingency resources to manage potential escapes will be fully considered and available prior to implementing any prescribed burn. These procedures are intended to further reduce the risk of escape, and provide for timely and cost efficient response should one occur.
Increase the mean size of burns. The larger the burn, the lower the cost per acre. We should be thinking of doing entire drainages at a time, with provisions for assuring escape routes for mobile wildlife.	
The park should get more creative in using climatic and fuel moisture regimes as natural controls of prescribed fires and wildfires. Expected winter snows, major rain events, high moisture levels in 100 hr and 1000 hr fuels, cool temperatures during the occasional dry winters, night-time mass ignitions of large areas under cool temperatures and high humidities – these are all methods to increase the amount of acreage burned and to reduce costs per acre.	
Burns in developed areas – is it worth it? Burn where there are the least political implications.	
Somehow minimize the role of politics on our decision-making process. Decisions ideally should be resource based.	
Make strong distinction between restoration fires, (prescribed fire is often the tool of choice) and maintenance fires (both prescribed fire and lightning).	
With the increase in prescribed burning, I think information should be given to the public through TV and radio to explain the purpose, effects, and goals. Park neighbors and the public will have a better understanding of the situation. As a Three Rivers, resident I think more information as to what is going on to justify the smoke would settle some of the questions and grousing about the burning.	
I really dislike fire lines for several reasons. a) They look ugly and scar the park. b) They remove one more level of naturalness from the fire program – stochastic events controlling the fire perimeter. I realize that some areas must be tightly controlled. But sometimes it should be OK to plan a target burning and be able to allow consumption of whatever adjacent areas into which the fire moves.	
Park fire crews igniting prescribed fires have much less impact than bulldozers carving control lines around wildfires.	
Can be useful, but low intensity might not do what you want them to.	
Follow-up prescribed fires are questionable, especially when the end results of the initial fire burned with greater intensity then anticipated.	
I don't believe that humans automatically have an inherent right to "take" what we think we need at any cost and have no price to repay. I am referring to the question about local residents and others suffering the temporary discomfort of tolerating smoke. I believe that those who are so privileged as to be able to reside in proximity to such a national treasure have the duty to save it from exploitation, misuse, and neglect.	
Millions of dollars in salaries to manage fires. You have many more people on salary because of prescribed burns. They frequently go out of control and many of us have been adversely affected by smoke. Please stop burning!	
The Park Service's policy is designed to let nature take care of itself, because it has proved it can do better than humans. We expect other residents of Tulare County will agree. The best advice would be to let nature do its thing and stay out of the way.	

Table C-15 – Science: Scoping Issues and Responses

Comment	Response
Science is the only way to gain a platform of knowledge for deciding what to let burn or what to burn. Gives managers support for their decisions. It may help keep the lawyers at bay, when Mother Nature doesn't cooperate with management plans.	The Sequoia and Kings Canyon fire management program is based on over 30 years of research and monitoring. Both the monitoring and research plans (FFMP Appendices C and D) describe the continuing commitment of the park to assuring that the fire management program will operate using the best available information.
It would seem that science will lead us to err in the direction of long-term health goals instead of seemingly good short-sighted, short-term goals.	
Monitoring should be conducted on all wildfires and prescribed burns. The funding should be sought from fire funds to gather these data and a serious effort made to know what the role and function of fire truly is under the wide variety of conditions in the park. All fires are different.	
What else should fire management be based on? Science is the only impartial choice. You do need to take the human factor into consideration at the same time...	
GIS is an important element in monitoring. Actively use this system.	
Yes, we should be monitoring our environment and the impacts that cause changes.	
Do more science	

D - National Register Listing

Eighteen (18) of the recorded sites, structures, or features within the parks are formally listed in the National Register of Historic Places (NRHP). The Giant Forest Lodge and Giant Forest Village/Camp Kaweah historic districts are not included in this listing below, given their recent (1998- 99) removal on the ground. The impacts of this on- the- ground removal were mitigated as part of the Giant Forest Restoration Project.

The remaining sites/structures/features currently listed on the NRHP are:

1) Pear Lake Ski Hut
2) Barton- Lackey Cabin
3) Ash Mountain Entrance Sign
4) Cabin Creek Ranger Residence and Dormitory
5) Cattle Cabin
6) Knapp Cabin
7) Hocket Meadow Ranger Station
8) Moro Rock Stairway
9) Quinn Ranger Station
10) Redwood Meadow Ranger Station
11) Gamlin Cabin
12) Generals Highway Stone Bridges
13) Groenfeldt Site (Native American)
14) Tharp's Log
15) Shorty Lovelace Historic District (includes multiple structures)
16) Smithsonian Institution Shelter
17) Squatter's Cabin
18) Hospital Rock (Native American)

Additionally, a handful of sites or features have been formally determined "eligible" for listing in the NRHP. By regulation, they are to be managed as if they were formally listed on the register. These structures and features include:

1) Generals Highway
2) Atwell's Mill
3) Atwell Mill Ranger Station and Garage
4) Lost Grove Comfort Station
5) Redwood Mountain Residence
6) Warehouse at Grant Grove (Old Maintenance)
7) Mineral King Road Cultural Landscape District (listing pending)
8) General Grant National Park Historic District

E - Air Quality Analysis Methodology

Step 1. Determine quantity of fuels consumed under each alternative

Background

The alternatives in this environmental assessment were structured around primary fire management tools (wildland fire suppression, prescribed fire, wildland fire use, and mechanical fuel reduction). The acres proposed to be treated under each alternative were initially categorized under those headings. Those figures, however, do not automatically translate into volumes of fuel consumed each year by alternative – information critical to comparing the relative amount of particulate released into the air under each alternative.

To make the conversion from acres by tool to acres by fuel load, each vegetation type in the parks was assigned one or more standard fuel model to describe its current state. Fuel models describe the type and amounts of fuels, among other characteristics of interest to fire managers.

The fuel models do not remain static over time. As the forests change with time, so do the related fuel models. For example, changes in forest conditions may occur as a result of fire suppression and subsequent buildup of dead fuels and increases in live fuel density. Fuel complexes may also change as a result of a fire event. Since fuels are reduced and the forest canopy becomes more open. Areas within a particular vegetation type that have been prescribed burned or otherwise received fire in recent years generally have less fuel load and are consequently assigned a fuel model that represents that load. Areas of the park that have not been treated with fire generally have higher fuel loads and are assigned fuel models that represent those loads. The estimates that follow were generated at two time steps, 10 and 25 years, to evaluate long term changes that occur as fuels are altered by the management actions proposed under the alternatives.

The parks used the following process to convert acres proposed for annual treatment by primary tool under each alternative into fuels information usable by the software package that produced the emissions estimates. The software package is called First Order Fire Effects Model version 4.0 (FOFEM). The resulting emissions estimates were then used to compare air quality effects between alternatives.

Process to determine fuels consumed each year by each alternative

1 - Establish the number of current acres in good ecological/low hazard fuel condition (maintenance mode) for each vegetation type using the Fire Return Interval Departure (FRID) analysis.

- 1a - assign a representative fuel model for each vegetation type in maintenance mode (FRID class 0- 1)

2 - Establish the number of acres needing restoration/fuel reduction for each vegetation type using the FRID analysis.

- 2a - assign a representative fuel model for each vegetation type needing restoration (FRID class 2+)

Model Assumption: The FRID analysis adequately represents differences in forest structure and fuel loads. Areas that have missed a significant number of fire return intervals as a result of past fire suppression will have a significantly different fuel load, and need to be represented by a different fuel model than those areas that have been previously restored or maintained, or that have naturally long return intervals.

3 - Establish a maximum natural return interval for each vegetation type that, if achieved, would maintain fuels within a safe range and keep ecosystem function intact.

Model Assumption: Maintaining vegetation within the natural fire return interval will reduce hazard while maintaining adequate ecosystem function. While the natural fire return interval for each vegetation type is more accurately expressed as a range of years (e.g. "between 5 and 15 years"), the model assumes that acceptable conditions will be sustained by using a reasonable maximum interval (e.g. "15 years"). This is, however, an untested ecological assumption.

4 - For each alternative, model the number of acres treated per year that could be restored in each vegetation type given the strategies to be applied under the alternative.

Model Assumption: The backlog of acres needing restoration should restored slowly over time and not all at once to minimize smoke events. Different alternatives allow more or less management control over where and when acres burn. To restore the backlog of fuels over time, the following rules were applied:

- In short fire return interval vegetation types (less than 25 years), attempt to eliminate the backlog over 25 years

- In long fire return interval vegetation types (over 25 years), attempt to eliminate the backlog within one fire return interval.

5 - For each alternative, model the number of acres that would be maintained for each vegetation type given the strategies to be applied under the alternative.

Model Assumption: To the extent possible, prevent acres in good condition (FRID class 0- 1) from reverting to unacceptable condition (FRID class 2+).

- Include in the model, acres already in acceptable condition, plus those restored each year

- *Acres in maintenance are divided by the maximum return interval to arrive at annual targets*

6 - Total the modeled acres burned per year (maintenance + restoration) by fuel type for each alternative.

7 - Run steps 4- 6 using 10- year average accomplishments and conditions and repeat the analysis at 25 years to reflect changes in the fuel load as backlogs of heavy fuels are reduced (or increased) and areas are converted to fuel models with more (or less) fuel load.

Assumptions used to determine the categorization of vegetation types into fuel models include:

<u>Alternative 1</u>

- Acres for each vegetation type were based on estimates from initial analysis spreadsheets used to develop environmental assessment alternatives.
- Acres determined to be suppression are considered restoration fuel model.
- Acres for wildland fire use are considered maintenance fuel model.
- Prescribed fire acres include some restoration and some maintenance fuel models proportional to the amount of acres in those classes as determined through the FRID analysis.

Alternative 2

- Acres for each vegetation type were based on estimates from initial analysis spreadsheets used to develop environmental assessment alternatives.
- The proportion of acres within each vegetation type assigned restoration or maintenance fuel model was accomplished by using proportion derived from the FRID analysis.
- An assumption was that a program constrained to prescribed fire would mimic prescribed fire and wildland fire use accomplishments to extent possible.

Alternative 3

- Additional suppression acres would occur as a result of less proactive fuels management.
- Suppression acres were all considered restoration fuel model since there would be little proactive fuels management.
- Many acres managed with wildland fire use would not have been previously restored under this alternative, so those acres are split between restoration and maintenance fuel model proportional to the acres indicated by the FRID model. The exceptions are the lodgepole and subalpine types which have naturally long fire return intervals and have been little affected by fire suppression to date.
- Foothills Chaparral and Foothills Hardwood vegetation acres were split proportionally between restoration and maintenance fuel model based on Alternative 4's GIS/FRID analysis of their current condition.

Alternative 4

- All wildland fire use acres are considered maintenance fuel model.
- Prescribed fire acres were split between restoration and maintenance fuel models per proportions from the GIS/FRID extended analysis.
- All suppression acres in this alternative were considered restoration fuel model.
- Lodgepole and subalpine wildland fire use and prescribed fire acres were all considered as maintenance fuel model due to long fire return intervals and little disturbance to date.

Alternative 5

- All acres were considered restoration fuel model to account for the effects of fuel removal, pile burning, and follow- up underburn. The exceptions were lodgepole and subalpine acres which were all considered as maintenance fuel model due to long fire return intervals and little disturbance to date.

Alternative 6

- All acres were considered restoration fuel model. The exceptions were lodgepole and subalpine acres which were all considered as maintenance fuel model due to long fire return intervals and little disturbance to date.

Different assumptions between alternatives lead to different amounts of fuel being consumed. An example of how the basic assumptions affect fuel loads by alternative is shown below.

EXAMPLE: White Fir/Mixed Conifer Vegetation Type

Assumptions common to both alternatives in the example:

- Total treatment acres were derived from alternative development sessions and are similar between Alternatives 2 and 4.
- Suppression acres (not included below) were also derived from alternative development sessions and are considered restoration fuel model, but are the similar for both Alternative 1 & 2 at both time steps.
- The change in percent between the two time steps came from analysis conducted within each vegetation type, and represents conversion from restoration (fuel model 10) to maintenance (fuel model 8) over time.
- The example calculations are based on 100 acres for simplicity.

Alternative 2 – Prescribed Fire - Assumptions:

- Percentages from FRID analysis based on vegetation type acres needing restoration (FRID Class 2+) and acres needing maintenance (FRID class 0- 1).
- Change in percent between 10 and 25 years represents change from FM- 10 to FM- 8.

		10yr	25yr
Prescribed fire acres 100 acres	Maintenance	27% (27ac)	48% (48ac)
	Restoration	73% (73ac)	52% (52ac)
	Total Acres =	100	100

Alternative 4 – Multi- Strategy - Assumptions:

- Prescribed fire acres assume some maintenance and some restoration, the percent of each based on the FRID assessment and subsequent conversion of FM- 10 to FM- 8 between year 10 and 25.
- Wildland fire use acres assumed to be all maintenance fuel model (FM- 8).

		10yr	25yr
Prescribed fire acres (yr 10=50 acres) (yr 25=7 acres)	Maintenance	27% (13.5ac)	48% (3.4ac)
	Restoration	73% (36.5ac)	52% (3.6ac)
Wildland Fire Use acres (yr 10=50 acres) (yr 25=93 acres)	Maintenance	100% (50ac)	100% (93ac)
	Maintenance Acres =	63.5	96.4
	Restoration Acres =	36.5	3.6
	Total Acres =	100	100

Step 2. Update fuel model information and run emissions analysis for each alternative

To best represent fuel loads, information used in the model was based on park wide fire effects plots and fuels inventory plots data, where such information was available. Fuel consumption estimates were made based on data from park fire effects plots collected on prescribed burn projects over the past 18 years. Where no local data was available, standard fuel model descriptors were applied.

In order to produce smoke emission estimates based on fuel loading and consumption data the First Order Fire Effects Model version 4.0 (FOFEM) was used. In its present configuration FOFEM does not exactly duplicate the consumption measured in the field by fire effects plots. However, the model does have the benefit of using algorithms that approximate the relationship between fuels that are burned in the flaming and smoldering phases. Modeling consumption using the two phases is important because significantly more smoke is produced in the smoldering phase than in the flaming phase given the same quantity of fuel burned.

Estimated smoke emission outputs for each fuel model from FOFEM were then used as a multiplier for the acres of fuel model that are estimated to be burned each year under the various environmental alternatives. The results show estimated emissions of PM- 10 for each alternative per year.

Example of the methodology used:

- Park wide heavy timber litter forest stands (fuel model 10) have an average total fuel loading of 101 tons- per- acre of burnable, dead and down vegetation.
- The park wide average overall fuels reduction that occurs in fuel model 10 is 76%.
- Using the data based on the above examples, the FOFEM runs show that for each acre of fuel model 10 that is burned in the parks an average of 1,650 pounds of PM- 10 is produced.

Under Alternative 4 - 3,421 acres comprised of fuel model 10 would burn each year at 10 years which would produce about (1,650 pounds/acre x 3,421 acres) = 5,644,650 pounds of PM- 10 per year parkwide.

F - Data From First Order Fire Effects Model

TITLE: ANNUAL GRASS (1) - model execution on date: 1/30/01

*** FIRE EFFECTS CALCULATOR ***
SMOKE SUMMARY TABLE - FUEL CONSUMPTION CALCULATIONS

REGION: Pacific West
COVER TYPE: Mountain Grasslands (FRES 36)
FUEL TYPE: Natural
FUEL ADJ FACTOR: Typical
DUFF MOISTURE (%): 20.0 - Lower
WOOD (3+ IN) MOISTURE (%): 20.0 - Adjusted NFDR
WOOD (10 HR) MOISTURE (%): .0

FUEL CONSUMPTION TABLE

Fuel Component Name	Preburn Load (t/acre)	Consumed Load (t/acre)	Postburn Load (t/acre)	Percent Reduced (%)	Equation Reference Number
Litter	.0	.0	.0	.0	39
Wood (0-1 inch)	.0	.0	.0	.0	21
Wood (1-3 inch)	.0	.0	.0	.0	25
Wood (3+ inch)	.0	.0	.0	.0	32
Duff	.0	.0	.0	.0	1
Herbaceous	.7	.7	.0	100.0	22
Shrubs	.0	.0	.0	.0	23
Tree regeneration	.0	.0	.0	.0	24
Crown branchwood	.0	.0	.0	.0	38
Crown foliage	.0	.0	.0	.0	37
Total Fuels	.7	.7	.0	100.0	

TITLE: Results of FOFEM model execution on date: 1/30/01

*** FIRE EFFECTS CALCULATOR ***

REGION: Pacific West
COVER TYPE: Mountain Grasslands (FRES 36)
FUEL TYPE: Natural
FUEL ADJ FACTOR: Typical
DUFF MOISTURE (%): 20.0 - Lower
WOOD (3+ IN) MOISTURE (%): 20.0 - Adjusted NFDR

SMOKE SUMMARY TABLE - SMOKE EMISSIONS CALCULATIONS

Forest Floor Emission Component	Ave Combust Efficiency	PM10 Emission (lbs/acre)	PM2.5 Emission (lbs/acre)	CO (lbs/acre)
Litter	.00	.0	.0	.0
Wood (0-1 inch)	.00	.0	.0	.0
Wood (1-3 inch)	.00	.0	.0	.0

Wood (3+ inch)	.00	.0	.0	.0
Duff	.00	.0	.0	.0
Herbaceous	.85	18.6	15.8	184.4
Shrubs	.00	.0	.0	.0
Tree regeneration	.00	.0	.0	.0
Crown branchwood	.00	.0	.0	.0
Crown foliage	.00	.0	.0	.0
Total Fuels	.85	18.6	15.8	184.4

TITLE: Results of FOFEM model execution on date: 1/30/01

*** FIRE EFFECTS CALCULATOR ***

REGION: Pacific West
COVER TYPE: Mountain Grasslands (FRES 36)
FUEL TYPE: Natural
FUEL ADJ FACTOR: Typical
DUFF MOISTURE (%): 20.0 - Lower
WOOD (3+ IN) MOISTURE (%): 20.0 - Adjusted NFDR

SMOKE SUMMARY -- FLAMING AND SMOLDERING SUMMARY

Fuel Component Name	Prefire loading ton/acre	Moist Content (%)	------- Consumption ------- Flaming (t/ac)	Smoldering (t/ac)	Total (t/ac)	PM2.5 Emissions (%)
Litter	.0	--	.0	.0	.0	.0
Wood (0-1 inch)	.0	--	.0	.0	.0	.0
Wood (1-3 inch)	.0	--	.0	.0	.0	.0
Wood (3+ inch)	.0	20.0	.0	.0	.0	.0
Duff	.0	20.0	.0	.0	.0	.0
Herbaceous	.7	--	.7	.0	.7	100.0
Shrubs	.0	--	.0	.0	.0	.0
Tree regeneration	.0	--	.0	.0	.0	.0
Crown branchwood	.0	--	.0	.0	.0	.0
Crown foliage	.0	--	.0	.0	.0	.0
Total Fuels	.7	--	.7	.0	.7	100.0

TITLE:High Elev Shrt Ndle, Vry Slw Sprd (18) model execution on date: 1/31/01

*** FIRE EFFECTS CALCULATOR ***

SMOKE SUMMARY TABLE - FUEL CONSUMPTION CALCULATIONS

REGION: Pacific West
COVER TYPE: Red Fir (SAF 207)
FUEL TYPE: Natural
FUEL ADJ FACTOR: Typical
DUFF MOISTURE (%): 24.0 - Entire
WOOD (3+ IN) MOISTURE (%): 1.0 - Actual
WOOD (10 HR) MOISTURE (%): 15.0

FUEL CONSUMPTION TABLE

Fuel Component Name	Preburn Load (t/acre)	Consumed Load (t/acre)	Postburn Load (t/acre)	Percent Reduced (%)	Equation Reference Number
Litter	4.8	4.8	.0	100.0	39
Wood (0-1 inch)	2.7	2.4	.3	90.0	21
Wood (1-3 inch)	2.6	1.7	.9	65.0	25
Wood (3+ inch)	31.6	28.0	3.6	88.5	31
Duff	28.0	20.6	7.4	73.5	2
Herbaceous	.0	.0	.0	.0	22
Shrubs	.0	.0	.0	.0	23
Tree regeneration	.0	.0	.0	.0	24
Crown branchwood	.0	.0	.0	.0	38
Crown foliage	.0	.0	.0	.0	37
Total Fuels	69.7	57.5	12.2	82.5	

TITLE: Results of FOFEM model execution on date: 1/31/01

*** FIRE EFFECTS CALCULATOR ***

REGION: Pacific West
COVER TYPE: Red Fir (SAF 207)
FUEL TYPE: Natural
FUEL ADJ FACTOR: Typical
DUFF MOISTURE (%): 24.0 - Entire
WOOD (3+ IN) MOISTURE (%): 1.0 - Actual

SMOKE SUMMARY TABLE - SMOKE EMISSIONS CALCULATIONS

Forest Floor Emission Component	Ave Combust Efficiency	PM10 Emission (lbs/acre)	PM2.5 Emission (lbs/acre)	CO Emission (lbs/acre)
Litter	.95	44.6	37.9	251.5
Wood (0-1 inch)	.95	22.6	19.2	127.3
Wood (1-3 inch)	.92	23.7	20.1	188.3

Wood (3+ inch)	.89	534.4	453.3	4879.8
Duff	.82	625.4	530.8	6503.2
Herbaceous	.00	.0	.0	.0
Shrubs	.00	.0	.0	.0
Tree regeneration	.00	.0	.0	.0
Crown branchwood	.00	.0	.0	.0
Crown foliage	.00	.0	.0	.0
Total Fuels	.87	1250.8	1061.3	11950.1

TITLE: Results of FOFEM model execution on date: 1/31/01

*** FIRE EFFECTS CALCULATOR ***

REGION: Pacific West
COVER TYPE: Red Fir (SAF 207)
FUEL TYPE: Natural
FUEL ADJ FACTOR: Typical
DUFF MOISTURE (%): 24.0 - Entire
WOOD (3+ IN) MOISTURE (%): 1.0 - Actual

SMOKE SUMMARY -- FLAMING AND SMOLDERING SUMMARY

Fuel Component Name	Prefire loading ton/acre	Moist Content (%)	------- Consumption ------- Flaming (t/ac)	Smoldering (t/ac)	Total (t/ac)	PM2.5 Emissions (%)
Litter	4.8	--	4.8	.0	4.8	3.6
Wood (0-1 inch)	2.7	--	2.4	.0	2.4	1.8
Wood (1-3 inch)	2.6	--	1.7	.0	1.7	1.9
Wood (3+ inch)	31.6	1.0	22.4	5.6	28.0	42.7
Duff	28.0	24.0	8.2	12.3	20.6	50.0
Herbaceous	.0	--	.0	.0	.0	.0
Shrubs	.0	--	.0	.0	.0	.0
Tree regeneration	.0	--	.0	.0	.0	.0
Crown branchwood	.0	--	.0	.0	.0	.0
Crown foliage	.0	--	.0	.0	.0	.0
Total Fuels	69.7	--	39.5	17.9	57.5	100.0

TITLE: Clsed Tmbr, Shrt Ndl, Slw Sprd (8) - model execution on date: 1/31/01

*** FIRE EFFECTS CALCULATOR ***

SMOKE SUMMARY TABLE - FUEL CONSUMPTION CALCULATIONS

REGION: Pacific West
COVER TYPE: White Fir (SAF 211)
FUEL TYPE: Natural
FUEL ADJ FACTOR: Typical
DUFF MOISTURE (%): 27.4 - Entire
WOOD (3+ IN) MOISTURE (%): 42.0 - Actual
WOOD (10 HR) MOISTURE (%): 15.0

FUEL CONSUMPTION TABLE

Fuel Component Name	Preburn Load (t/acre)	Consumed Load (t/acre)	Postburn Load (t/acre)	Percent Reduced (%)	Equation Reference Number
Litter	1.6	1.6	.0	100.0	39
Wood (0-1 inch)	2.5	2.3	.3	90.0	21
Wood (1-3 inch)	2.5	1.6	.9	65.0	25
Wood (3+ inch)	7.0	5.0	2.0	72.0	31
Duff	4.7	3.4	1.3	72.0	2
Herbaceous	.0	.0	.0	.0	22
Shrubs	.0	.0	.0	.0	23
Tree regeneration	.0	.0	.0	.0	24
Crown branchwood	.0	.0	.0	.0	38
Crown foliage	.0	.0	.0	.0	37
Total Fuels	18.3	13.9	4.4	76.0	

TITLE: Results of FOFEM model execution on date: 1/31/01

*** FIRE EFFECTS CALCULATOR ***

REGION: Pacific West
COVER TYPE: White Fir (SAF 211)
FUEL TYPE: Natural
FUEL ADJ FACTOR: Typical
DUFF MOISTURE (%): 27.4 - Entire
WOOD (3+ IN) MOISTURE (%): 42.0 - Actual

SMOKE SUMMARY TABLE - SMOKE EMISSIONS CALCULATIONS

Forest Floor Component	Ave Combust Efficiency	PM10 Emission (lbs/acre)	PM2.5 Emission (lbs/acre)	CO Emission (lbs/acre)
Litter	.95	14.9	12.6	83.8
Wood (0-1 inch)	.95	20.9	17.8	117.9
Wood (1-3 inch)	.92	22.8	19.3	181.0
Wood (3+ inch)	.89	96.2	81.6	878.7

Duff	.82	102.9	87.3	1070.1
Herbaceous	.00	.0	.0	.0
Shrubs	.00	.0	.0	.0
Tree regeneration	.00	.0	.0	.0
Crown branchwood	.00	.0	.0	.0
Crown foliage	.00	.0	.0	.0
Total Fuels	.89	257.7	218.7	2331.6

TITLE: Results of FOFEM model execution on date: 1/31/01

*** FIRE EFFECTS CALCULATOR ***

REGION: Pacific West
COVER TYPE: White Fir (SAF 211)
FUEL TYPE: Natural
FUEL ADJ FACTOR: Typical
DUFF MOISTURE (%): 27.4 - Entire
WOOD (3+ IN) MOISTURE (%): 42.0 - Actual

SMOKE SUMMARY -- FLAMING AND SMOLDERING SUMMARY

Fuel Component Name	Prefire loading ton/acre	Moist Content (%)	------- Consumption ------- Flaming (t/ac)	Smoldering (t/ac)	Total (t/ac)	PM2.5 Emissions (%)
Litter	1.6	--	1.6	.0	1.6	5.8
Wood (0-1 inch)	2.5	--	2.3	.0	2.3	8.1
Wood (1-3 inch)	2.5	--	1.6	.0	1.6	8.8
Wood (3+ inch)	7.0	42.0	4.0	1.0	5.0	37.3
Duff	4.7	27.4	1.4	2.0	3.4	39.9
Herbaceous	.0	--	.0	.0	.0	.0
Shrubs	.0	--	.0	.0	.0	.0
Tree regeneration	.0	--	.0	.0	.0	.0
Crown branchwood	.0	--	.0	.0	.0	.0
Crown foliage	.0	--	.0	.0	.0	.0
Total Fuels	18.3	--	10.9	3.0	13.9	100.0

TITLE: Grass w/overstory (2) FOFEM model execution on date: 2/ 1/01

*** FIRE EFFECTS CALCULATOR ***
SMOKE SUMMARY TABLE - FUEL CONSUMPTION CALCULATIONS

REGION: Pacific West
COVER TYPE: Mountain Grasslands (FRES 36)
FUEL TYPE: Natural
FUEL ADJ FACTOR: Typical
DUFF MOISTURE (%): 20.0 - Lower
WOOD (3+ IN) MOISTURE (%): 20.0 - Adjusted NFDR
WOOD (10 HR) MOISTURE (%): .0

FUEL CONSUMPTION TABLE

Fuel Component Name	Preburn Load (t/acre)	Consumed Load (t/acre)	Postburn Load (t/acre)	Percent Reduced (%)	Equation Reference Number
Litter	.0	.0	.0	.0	39
Wood (0-1 inch)	3.0	2.7	.3	90.0	21
Wood (1-3 inch)	.5	.3	.2	65.0	25
Wood (3+ inch)	.0	.0	.0	.0	32
Duff	.0	.0	.0	.0	1
Herbaceous	.5	.5	.0	100.0	22
Shrubs	.0	.0	.0	.0	23
Tree regeneration	.0	.0	.0	.0	24
Crown branchwood	.0	.0	.0	.0	38
Crown foliage	.0	.0	.0	.0	37
Total Fuels	4.0	3.5	.5	88.1	

TITLE: Results of FOFEM model execution on date: 2/ 1/01

*** FIRE EFFECTS CALCULATOR ***

REGION: Pacific West
COVER TYPE: Mountain Grasslands (FRES 36)
FUEL TYPE: Natural
FUEL ADJ FACTOR: Typical
DUFF MOISTURE (%): 20.0 - Lower
WOOD (3+ IN) MOISTURE (%): 20.0 - Adjusted NFDR

SMOKE SUMMARY TABLE - SMOKE EMISSIONS CALCULATIONS

Forest Floor Component	Ave Combust Efficiency	PM10 Emission (lbs/acre)	PM2.5 Emission (lbs/acre)	CO Emission (lbs/acre)
Litter	.00	.0	.0	.0
Wood (0-1 inch)	.95	25.1	21.3	141.5
Wood (1-3 inch)	.92	4.5	3.9	36.2
Wood (3+ inch)	.00	.0	.0	.0

Duff	.00	.0	.0	.0
Herbaceous	.85	12.6	10.6	124.6
Shrubs	.00	.0	.0	.0
Tree regeneration	.00	.0	.0	.0
Crown branchwood	.00	.0	.0	.0
Crown foliage	.00	.0	.0	.0
Total Fuels	.93	42.2	35.8	302.3

TITLE: Results of FOFEM model execution on date: 2/ 1/01

*** FIRE EFFECTS CALCULATOR ***

REGION: Pacific West
COVER TYPE: Mountain Grasslands (FRES 36)
FUEL TYPE: Natural
FUEL ADJ FACTOR: Typical
DUFF MOISTURE (%): 20.0 - Lower
WOOD (3+ IN) MOISTURE (%): 20.0 - Adjusted NFDR

SMOKE SUMMARY -- FLAMING AND SMOLDERING SUMMARY

Fuel Component Name	Prefire loading ton/acre	Moist Content (%)	------- Consumption ------- Flaming (t/ac)	Smoldering (t/ac)	Total (t/ac)	PM2.5 Emissions (%)
Litter	.0	--	.0	.0	.0	.0
Wood (0-1 inch)	3.0	--	2.7	.0	2.7	59.5
Wood (1-3 inch)	.5	--	.3	.0	.3	10.8
Wood (3+ inch)	.0	20.0	.0	.0	.0	.0
Duff	.0	20.0	.0	.0	.0	.0
Herbaceous	.5	--	.5	.0	.5	29.7
Shrubs	.0	--	.0	.0	.0	.0
Tree regeneration	.0	--	.0	.0	.0	.0
Crown branchwood	.0	--	.0	.0	.0	.0
Crown foliage	.0	--	.0	.0	.0	.0
Total Fuels	4.0	--	3.5	.0	3.5	100.0

TITLE: TALL GRASS (3) - model execution on date: 1/30/01

*** FIRE EFFECTS CALCULATOR ***

SMOKE SUMMARY TABLE - FUEL CONSUMPTION CALCULATIONS

REGION: Pacific West
COVER TYPE: Mountain Grasslands (FRES 36)
FUEL TYPE: Natural
FUEL ADJ FACTOR: Typical
DUFF MOISTURE (%): 20.0 - Lower
WOOD (3+ IN) MOISTURE (%): 20.0 - Adjusted NFDR
WOOD (10 HR) MOISTURE (%): .0

FUEL CONSUMPTION TABLE

Fuel Component Name	Preburn Load (t/acre)	Consumed Load (t/acre)	Postburn Load (t/acre)	Percent Reduced (%)	Equation Reference Number
Litter	.0	.0	.0	.0	39
Wood (0-1 inch)	.0	.0	.0	.0	21
Wood (1-3 inch)	.0	.0	.0	.0	25
Wood (3+ inch)	.0	.0	.0	.0	32
Duff	.0	.0	.0	.0	1
Herbaceous	3.0	3.0	.0	100.0	22
Shrubs	.0	.0	.0	.0	23
Tree regeneration	.0	.0	.0	.0	24
Crown branchwood	.0	.0	.0	.0	38
Crown foliage	.0	.0	.0	.0	37
Total Fuels	3.0	3.0	.0	100.0	

TITLE: Results of FOFEM model execution on date: 1/30/01

*** FIRE EFFECTS CALCULATOR ***

REGION: Pacific West
COVER TYPE: Mountain Grasslands (FRES 36)
FUEL TYPE: Natural
FUEL ADJ FACTOR: Typical
DUFF MOISTURE (%): 20.0 - Lower
WOOD (3+ IN) MOISTURE (%): 20.0 - Adjusted NFDR

SMOKE SUMMARY TABLE - SMOKE EMISSIONS CALCULATIONS

Forest Floor Component	Ave Combust Efficiency	PM10 Emission (lbs/acre)	PM2.5 Emission (lbs/acre)	CO Emission (lbs/acre)
Litter	.00	.0	.0	.0
Wood (0-1 inch)	.00	.0	.0	.0
Wood (1-3 inch)	.00	.0	.0	.0
Wood (3+ inch)	.00	.0	.0	.0

Duff	.00	.0	.0	.0
Herbaceous	.85	75.6	64.1	750.1
Shrubs	.00	.0	.0	.0
Tree regeneration	.00	.0	.0	.0
Crown branchwood	.00	.0	.0	.0
Crown foliage	.00	.0	.0	.0
Total Fuels	.85	75.6	64.1	750.1

TITLE: Results of FOFEM model execution on date: 1/30/01

*** FIRE EFFECTS CALCULATOR ***

REGION: Pacific West
COVER TYPE: Mountain Grasslands (FRES 36)
FUEL TYPE: Natural
FUEL ADJ FACTOR: Typical
DUFF MOISTURE (%): 20.0 - Lower
WOOD (3+ IN) MOISTURE (%): 20.0 - Adjusted NFDR

SMOKE SUMMARY -- FLAMING AND SMOLDERING SUMMARY

Fuel Component Name	Prefire loading ton/acre	Moist Content (%)	------- Consumption ------- Flaming (t/ac)	Smoldering (t/ac)	Total (t/ac)	PM2.5 Emissions (%)
Litter	.0	--	.0	.0	.0	.0
Wood (0-1 inch)	.0	--	.0	.0	.0	.0
Wood (1-3 inch)	.0	--	.0	.0	.0	.0
Wood (3+ inch)	.0	20.0	.0	.0	.0	.0
Duff	.0	20.0	.0	.0	.0	.0
Herbaceous	3.0	--	3.0	.0	3.0	100.0
Shrubs	.0	--	.0	.0	.0	.0
Tree regeneration	.0	--	.0	.0	.0	.0
Crown branchwood	.0	--	.0	.0	.0	.0
Crown foliage	.0	--	.0	.0	.0	.0
Total Fuels	3.0	--	6.6	.0	3.0	100.0

TITLE: TALL BRUSH (4) - model execution on date: 1/30/01

*** FIRE EFFECTS CALCULATOR ***

SMOKE SUMMARY TABLE - FUEL CONSUMPTION CALCULATIONS

REGION: Pacific West
COVER TYPE: Chaparral - high shrub cover (FRES 34)
FUEL TYPE: Natural
FUEL ADJ FACTOR: Typical
DUFF MOISTURE (%): 20.0 - Lower
WOOD (3+ IN) MOISTURE (%): 20.0 - Adjusted NFDR
WOOD (10 HR) MOISTURE (%): .0

FUEL CONSUMPTION TABLE

Fuel Component Name	Preburn Load (t/acre)	Consumed Load (t/acre)	Postburn Load (t/acre)	Percent Reduced (%)	Equation Reference Number
Litter	.0	.0	.0	.0	39
Wood (0-1 inch)	.0	.0	.0	.0	21
Wood (1-3 inch)	.0	.0	.0	.0	25
Wood (3+ inch)	.0	.0	.0	.0	32
Duff	.0	.0	.0	.0	1
Herbaceous	.0	.0	.0	.0	22
Shrubs	16.0	12.8	3.2	80.0	231
Tree regeneration	.0	.0	.0	.0	24
Crown branchwood	.0	.0	.0	.0	38
Crown foliage	.0	.0	.0	.0	37
Total Fuels	16.0	12.8	3.2	80.0	

TITLE: Results of FOFEM model execution on date: 1/30/01

*** FIRE EFFECTS CALCULATOR ***

REGION: Pacific West
COVER TYPE: Chaparral - high shrub cover (FRES 34)
FUEL TYPE: Natural
FUEL ADJ FACTOR: Typical
DUFF MOISTURE (%): 20.0 - Lower
WOOD (3+ IN) MOISTURE (%): 20.0 - Adjusted NFDR

SMOKE SUMMARY TABLE - SMOKE EMISSIONS CALCULATIONS

Forest Floor Emission Component (lbs/acre)	Ave Combust Efficiency	PM10 Emission (lbs/acre)	PM2.5 Emission (lbs/acre)	CO
Litter	.00	.0	.0	.0
Wood (0-1 inch)	.00	.0	.0	.0
Wood (1-3 inch)	.00	.0	.0	.0
Wood (3+ inch)	.00	.0	.0	.0

Duff	.00	.0	.0	.0
Herbaceous	.00	.0	.0	.0
Shrubs	.85	321.9	273.2	3195.7
Tree regeneration	.00	.0	.0	.0
Crown branchwood	.00	.0	.0	.0
Crown foliage	.00	.0	.0	.0
Total Fuels	.85	321.9	273.2	3195.7

TITLE: Results of FOFEM model execution on date: 1/30/01

*** FIRE EFFECTS CALCULATOR ***

REGION: Pacific West
COVER TYPE: Chaparral - high shrub cover (FRES 34)
FUEL TYPE: Natural
FUEL ADJ FACTOR: Typical
DUFF MOISTURE (%): 20.0 - Lower
WOOD (3+ IN) MOISTURE (%): 20.0 - Adjusted NFDR

SMOKE SUMMARY -- FLAMING AND SMOLDERING SUMMARY

Fuel Component Name	Prefire loading ton/acre	Moist Content (%)	------- Consumption ------- Flaming (t/ac)	Smoldering (t/ac)	Total (t/ac)	PM2.5 Emissions (%)
Litter	.0	--	.0	.0	.0	.0
Wood (0-1 inch)	.0	--	.0	.0	.0	.0
Wood (1-3 inch)	.0	--	.0	.0	.0	.0
Wood (3+ inch)	.0	20.0	.0	.0	.0	.0
Duff	.0	20.0	.0	.0	.0	.0
Herbaceous	.0	--	.0	.0	.0	.0
Shrubs	16.0	--	12.8	.0	12.8	100.0
Tree regeneration	.0	--	.0	.0	.0	.0
Crown branchwood	.0	--	.0	.0	.0	.0
Crown foliage	.0	--	.0	.0	.0	.0
Total Fuels	16.0	--	12.8	.0	12.8	100.0

TITLE: MEDIUM BRUSH (6) - Results of FOFEM model execution on date: 1/30/01

*** FIRE EFFECTS CALCULATOR ***
SMOKE SUMMARY TABLE - FUEL CONSUMPTION CALCULATIONS

REGION: Pacific West
COVER TYPE: Chaparral - moderate shrub cover (FRES 34)
FUEL TYPE: Natural
FUEL ADJ FACTOR: Typical
DUFF MOISTURE (%): 20.0 - Lower
WOOD (3+ IN) MOISTURE (%): 20.0 - Adjusted NFDR
WOOD (10 HR) MOISTURE (%): .0

FUEL CONSUMPTION TABLE

Fuel Component Name	Preburn Load (t/acre)	Consumed Load (t/acre)	Postburn Load (t/acre)	Percent Reduced (%)	Equation Reference Number
Litter	.0	.0	.0	.0	39
Wood (0-1 inch)	.0	.0	.0	.0	21
Wood (1-3 inch)	.0	.0	.0	.0	25
Wood (3+ inch)	.0	.0	.0	.0	32
Duff	.0	.0	.0	.0	1
Herbaceous	.0	.0	.0	.0	22
Shrubs	6.0	4.8	1.2	80.0	231
Tree regeneration	.0	.0	.0	.0	24
Crown branchwood	.0	.0	.0	.0	38
Crown foliage	.0	.0	.0	.0	37
Total Fuels	6.0	4.8	1.2	80.0	

TITLE: Results of FOFEM model execution on date: 1/30/01

*** FIRE EFFECTS CALCULATOR ***

REGION: Pacific West
COVER TYPE: Chaparral - moderate shrub cover (FRES 34)
FUEL TYPE: Natural
FUEL ADJ FACTOR: Typical
DUFF MOISTURE (%): 20.0 - Lower
WOOD (3+ IN) MOISTURE (%): 20.0 - Adjusted NFDR

SMOKE SUMMARY TABLE - SMOKE EMISSIONS CALCULATIONS

Forest Floor Component	Ave Combust Efficiency	PM10 Emission (lbs/acre)	PM2.5 Emission (lbs/acre)	CO Emission (lbs/acre)
Litter	.00	.0	.0	.0
Wood (0-1 inch)	.00	.0	.0	.0
Wood (1-3 inch)	.00	.0	.0	.0
Wood (3+ inch)	.00	.0	.0	.0

Duff	.00	.0	.0	.0
Herbaceous	.00	.0	.0	.0
Shrubs	.85	120.5	102.2	1196.2
Tree regeneration	.00	.0	.0	.0
Crown branchwood	.00	.0	.0	.0
Crown foliage	.00	.0	.0	.0
Total Fuels	.85	120.5	102.2	1196.2

TITLE: Results of FOFEM model execution on date: 1/30/01

*** FIRE EFFECTS CALCULATOR ***

REGION: Pacific West
COVER TYPE: Chaparral - moderate shrub cover (FRES 34)
FUEL TYPE: Natural
FUEL ADJ FACTOR: Typical
DUFF MOISTURE (%): 20.0 - Lower
WOOD (3+ IN) MOISTURE (%): 20.0 - Adjusted NFDR

SMOKE SUMMARY -- FLAMING AND SMOLDERING SUMMARY

Fuel Component Name	Prefire loading ton/acre	Moist Content (%)	------- Consumption ------- Flaming (t/ac)	Smoldering (t/ac)	Total (t/ac)	PM2.5 Emissions (%)
Litter	.0	--	.0	.0	.0	.0
Wood (0-1 inch)	.0	--	.0	.0	.0	.0
Wood (1-3 inch)	.0	--	.0	.0	.0	.0
Wood (3+ inch)	.0	20.0	.0	.0	.0	.0
Duff	.0	20.0	.0	.0	.0	.0
Herbaceous	.0	--	.0	.0	.0	.0
Shrubs	6.0	--	4.8	.0	4.8	100.0
Tree regeneration	.0	--	.0	.0	.0	.0
Crown branchwood	.0	--	.0	.0	.0	.0
Crown foliage	.0	--	.0	.0	.0	.0
Total Fuels	6.0	--	7.6	.0	4.8	100.0

TITLE: HEAVY TIMBER LITTER (10) - model execution on date: 1/30/01

*** FIRE EFFECTS CALCULATOR ***
SMOKE SUMMARY TABLE - FUEL CONSUMPTION CALCULATIONS

REGION: Pacific West
COVER TYPE: White Fir (SAF 211)
FUEL TYPE: Natural
FUEL ADJ FACTOR: Typical
DUFF MOISTURE (%): 1.0 - Entire
WOOD (3+ IN) MOISTURE (%): 70.0 - Actual
WOOD (10 HR) MOISTURE (%): 80.0

FUEL CONSUMPTION TABLE

Fuel Component Name	Preburn Load (t/acre)	Consumed Load (t/acre)	Postburn Load (t/acre)	Percent Reduced (%)	Equation Reference Number
Litter	13.6	13.6	.0	100.0	39
Wood (0-1 inch)	5.0	4.5	.5	90.0	21
Wood (1-3 inch)	5.0	3.3	1.8	65.0	25
Wood (3+ inch)	32.4	18.3	14.1	56.5	31
Duff	42.7	35.7	7.0	83.7	2
Herbaceous	.0	.0	.0	.0	22
Shrubs	.0	.0	.0	.0	23
Tree regeneration	.0	.0	.0	.0	24
Crown branchwood	.0	.0	.0	.0	38
Crown foliage	.0	.0	.0	.0	37
Total Fuels	98.7	75.4	23.3	76.4	

TITLE: Results of FOFEM model execution on date: 1/30/01

*** FIRE EFFECTS CALCULATOR ***

REGION: Pacific West
COVER TYPE: White Fir (SAF 211)
FUEL TYPE: Natural
FUEL ADJ FACTOR: Typical
DUFF MOISTURE (%): 1.0 - Entire
WOOD (3+ IN) MOISTURE (%): 70.0 - Actual

SMOKE SUMMARY TABLE - SMOKE EMISSIONS CALCULATIONS

Forest Floor Emission Component (lbs/acre)	Ave Combust Efficiency	PM10 Emission (lbs/acre)	PM2.5 Emission (lbs/acre)	CO
Litter	.95	126.5	107.4	712.6
Wood (0-1 inch)	.95	41.9	35.6	236.3
Wood (1-3 inch)	.92	45.6	38.8	362.8
Wood (3+ inch)	.89	349.5	296.4	3191.4

Duff	.82	1086.5	922.1	11297.4
Herbaceous	.00	.0	.0	.0
Shrubs	.00	.0	.0	.0
Tree regeneration	.00	.0	.0	.0
Crown branchwood	.00	.0	.0	.0
Crown foliage	.00	.0	.0	.0
Total Fuels	.87	1650.0	1400.3	15800.4

TITLE: Results of FOFEM model execution on date: 1/30/01

*** FIRE EFFECTS CALCULATOR ***

REGION: Pacific West
COVER TYPE: White Fir (SAF 211)
FUEL TYPE: Natural
FUEL ADJ FACTOR: Typical
DUFF MOISTURE (%): 1.0 - Entire
WOOD (3+ IN) MOISTURE (%): 70.0 - Actual

SMOKE SUMMARY -- FLAMING AND SMOLDERING SUMMARY

Fuel Component Name	Prefire loading ton/acre	Moist Content (%)	------- Consumption ------- Flaming (t/ac)	Smoldering (t/ac)	Total (t/ac)	PM2.5 Emissions (%)
Litter	13.6	--	13.6	.0	13.6	7.7
Wood (0-1 inch)	5.0	--	4.5	.0	4.5	2.5
Wood (1-3 inch)	5.0	--	3.3	.0	3.3	2.8
Wood (3+ inch)	32.4	70.0	14.6	3.7	18.3	21.2
Duff	42.7	1.0	14.3	21.4	35.7	65.8
Herbaceous	.0	--	.0	.0	.0	.0
Shrubs	.0	--	.0	.0	.0	.0
Tree regeneration	.0	--	.0	.0	.0	.0
Crown branchwood	.0	--	.0	.0	.0	.0
Crown foliage	.0	--	.0	.0	.0	.0
Total Fuels	98.7	--	50.3	25.1	75.4	100.0

TITLE: Low Elev. Shrt Ndle Conifer (14) - model execution on date: 1/31/01

*** FIRE EFFECTS CALCULATOR ***

SMOKE SUMMARY TABLE - FUEL CONSUMPTION CALCULATIONS

REGION: Pacific West
COVER TYPE: White Fir (SAF 211)
FUEL TYPE: Natural
FUEL ADJ FACTOR: Typical
DUFF MOISTURE (%): 1.0 - Entire
WOOD (3+ IN) MOISTURE (%): 55.0 - Actual
WOOD (10 HR) MOISTURE (%): 35.0

FUEL CONSUMPTION TABLE

Fuel Component Name	Preburn Load (t/acre)	Consumed Load (t/acre)	Postburn Load (t/acre)	Percent Reduced (%)	Equation Reference Number
Litter	6.7	6.7	.0	100.0	39
Wood (0-1 inch)	2.9	2.6	.3	90.0	21
Wood (1-3 inch)	2.9	1.9	1.0	65.0	25
Wood (3+ inch)	40.3	26.3	14.0	65.2	31
Duff	27.9	23.2	4.7	83.3	2
Herbaceous	.0	.0	.0	.0	22
Shrubs	.0	.0	.0	.0	23
Tree regeneration	.0	.0	.0	.0	24
Crown branchwood	.0	.0	.0	.0	38
Crown foliage	.0	.0	.0	.0	37
Total Fuels	80.7	60.7	20.0	75.2	

TITLE: Results of FOFEM model execution on date: 1/31/01

*** FIRE EFFECTS CALCULATOR ***

REGION: Pacific West
COVER TYPE: White Fir (SAF 211)
FUEL TYPE: Natural
FUEL ADJ FACTOR: Typical
DUFF MOISTURE (%): 1.0 - Entire
WOOD (3+ IN) MOISTURE (%): 55.0 - Actual

SMOKE SUMMARY TABLE - SMOKE EMISSIONS CALCULATIONS

Forest Floor Emission Component (lbs/acre)	Ave Combust Efficiency	PM10 Emission (lbs/acre)	PM2.5 Emission (lbs/acre)	CO
Litter	.95	62.3	52.9	351.1
Wood (0-1 inch)	.95	24.3	20.6	136.8
Wood (1-3 inch)	.92	26.4	22.4	210.0
Wood (3+ inch)	.89	501.9	425.7	4582.9

Duff	.82	706.3	599.4	7344.1
Herbaceous	.00	.0	.0	.0
Shrubs	.00	.0	.0	.0
Tree regeneration	.00	.0	.0	.0
Crown branchwood	.00	.0	.0	.0
Crown foliage	.00	.0	.0	.0
Total Fuels	.87	1321.2	1121.1	12624.8

TITLE: Results of FOFEM model execution on date: 1/31/01

*** FIRE EFFECTS CALCULATOR ***

REGION: Pacific West
COVER TYPE: White Fir (SAF 211)
FUEL TYPE: Natural
FUEL ADJ FACTOR: Typical
DUFF MOISTURE (%): 1.0 - Entire
WOOD (3+ IN) MOISTURE (%): 55.0 - Actual

SMOKE SUMMARY -- FLAMING AND SMOLDERING SUMMARY

Fuel Component Name	Prefire loading ton/acre	Moist Content (%)	------- Consumption ------- Flaming (t/ac)	Smoldering (t/ac)	Total (t/ac)	PM2.5 Emissions (%)
Litter	6.7	--	6.7	.0	6.7	4.7
Wood (0-1 inch)	2.9	--	2.6	.0	2.6	1.8
Wood (1-3 inch)	2.9	--	1.9	.0	1.9	2.0
Wood (3+ inch)	40.3	55.0	21.0	5.3	26.3	38.0
Duff	27.9	1.0	9.3	13.9	23.2	53.5
Herbaceous	.0	--	.0	.0	.0	.0
Shrubs	.0	--	.0	.0	.0	.0
Tree regeneration	.0	--	.0	.0	.0	.0
Crown branchwood	.0	--	.0	.0	.0	.0
Crown foliage	.0	--	.0	.0	.0	.0
Total Fuels	80.7	--	41.5	19.2	60.7	100.0

G - Fire Management Zones and Units

The parks are divided into three **Fire Management Zones** - the Kings, Kern, and Kaweah. The Zones represent, for the most part, major park watersheds resulting in an ecologically based planning framework for fire management activities. Each Zone has characteristics that allow unified fire and fuels management concepts to be applied within the Zone.

Zones may be subdivided into smaller **Fire Management Units (FMUs)**. FMUs are generally sub- watersheds having locally unique values, hazards, and/or risks that affect the specific mix of fuels treatments and fire management activities to be used. Because the FMUs are based on sub-watersheds, ecological integrity and landscape level goals and achievements can be evaluated with some confidence. (Maps of the Zones and FMUs are found in the companion *Fire and Fuels Management Plan*.)

FMUs may be further subdivided into **Segments**. Segments are comprised of a portion of a FMU that will receive uniform treatment. Segments are usually defined by natural or human created boundaries that allow for ease of management. Each segment will have a separate action plan developed (burn plan and/or fuels treatment plan). In some cases, segments may be further divided into **Sub- segments** under the same burn plan or fuels treatment plan to allow greater control and flexibility in managing the duration of the project, smoke impacts, or for other purposes.

Table G-1 – Fire Management Zones, Units, Segments, and Sub-Segments

Planning Unit	Subset of:	Geographic Extent	Designation	
Fire Management Zone	Parks	Major watershed(s)	Kings Kern	Kaweah
Fire Management Unit (FMU)	Fire Management Zone	Sub-watershed	Kings Zone Sierra Crest Cedar Grove Kern Zone Kern	Kaweah Zone Grant Grove North Fork Marble Fork Middle Fork East Fork South Fork
Segment	FMU	Manageable portion of a sub-watershed receiving common treatment under a single burn plan or fuels treatment plan.	Boundaries determined through annual planning process.	
Sub-Segment	Segment	Portion of a segment. Individual project to be treated along with other segments (though perhaps at different times) under a single burn plan or fuels treatment plan.	Boundaries determined through annual planning process and on-the-ground reconnaissance.	

H - Minimum Requirement/Tool Definitions

NATIONAL PARK SERVICE
SEQUOIA AND KINGS CANYON NATIONAL PARKS

RECORD OF DECISION
MINIMUM REQUIREMENT/MINIMUM TOOL DEFINITIONS
FOR MANAGEMENT OF THE
SEQUOIA- KINGS CANYON WILDERNESS
AND SPECIFIED ASSOCIATED AREAS

APRIL 2003

INTRODUCTION

In order to establish and maintain wilderness character in designated wilderness areas, the Wilderness Act of 1964 establishes the following standard:

> *…except as necessary to meet the minimum requirements for the administration of the area for the purpose of this Act (including measures required in emergencies involving the health and safety of persons within the area) there shall be no temporary road, no use of motor vehicles, motorized equipment or motorboats, no landing of aircraft, no other form of mechanical transport, and no structure or installation within any such area.*
> *- The Wilderness Act: Section 4 (c)*

The Service's Management Policies further define this process:

> *All management decisions affecting wilderness must be consistent with a minimum requirement concept…. When determining minimum requirement, the potential disruption of wilderness character and resources will be considered before, and given significantly more weight than, economic efficiency and convenience. If a compromise of wilderness resource or character is unavoidable, only those actions that preserve wilderness character and/or have localized short- term adverse impacts will be acceptable.*
> *- NPS Management Policies: 6.3.5 Minimum Requirement*

Director's Order 41, *Wilderness Preservation and Management,* provides additional guidance on this concept:

> Wilderness managers may authorize (using a documented process) the generally prohibited activities or uses listed in Section 4(c) of the Wilderness Act if they are deemed necessary to meet the minimum requirements for the administration of the area as wilderness and where those methods are determined to be the 'minimum tool' for the project. The use of motorized equipment and the establishment of management facilities are specifically prohibited when other reasonable alternatives are available.

The purpose of this document is to define, as specified above, the Minimum Requirement for managing the Sequoia- Kings Canyon Wilderness in Sequoia and Kings Canyon National Parks, California, and to identify and analyze those specific actions that represent the "minimum tool" approach to implementing the programs so defined. The Minimum Requirement herein defined also applies to certain additional areas, termed here "associated areas" and specifically defined as other portions of Sequoia and Kings Canyon National Parks that are proposed or recommended for wilderness designation or are being studied for wilderness suitability.

Proposed actions that fall completely within the definitions contained herein therefore fall within the scope of Minimum Requirements for the Management of the Sequoia- Kings Canyon Wilderness. Proposed actions not conforming to the following must be the subject of additional specific minimum requirement analysis before they can be implemented.

MANAGEMENT GOALS

Section 2 of the Wilderness Act states that a designated wilderness is an area that:

(c)(2) has outstanding opportunities for solitude or a primitive and unconfined type of recreation.

This statement makes it clear that recreation is one of the purposes of designated wilderness.

Section 2(a) of the Wilderness Act states that wilderness areas:

> *shall be administered for the use and enjoyment of the American people in such manner as will leave them unimpaired for future use and enjoyment as wilderness, and so as to provide for the protection of these areas, the preservation of their wilderness character, and for the gathering and dissemination of information regarding their use and enjoyment as wilderness.*

This section clearly identifies the responsibility of agencies to manage wilderness areas. As implied by the legislation, this management should provide for:

- The safety of visitors, which enhances enjoyment;
- The protection of the wilderness resource through educational efforts and repair of impacted areas; and
- "Gathering and dissemination" of information on wilderness use patterns and activities, which is utilized in planning processes for long and short term wilderness preservation.

These outcomes are achieved through trail patrols, public contact activities, rehabilitation of damaged areas, emergency medical actions, search and rescue actions and the preparation of reports detailing wilderness conditions and public use patterns.

Section 4(a) of the Wilderness Act stipulates that wilderness areas in national parks remain subject to national park legislation:

> *(3) Nothing in this Act shall modify the statutory authority under which units of the national park system are created. Further, the designation of any area of any park, monument, or other unit of the national park system as a wilderness area pursuant to this Act shall in no manner lower the standards evolved for the use and preservation of such park, monument, or other unit of the national park system in accordance with the Act of August 25, 1916, the statutory authority under which the area was created, or any other Act of Congress which might pertain to or affect such area….*

Section 4(b) of the Wilderness Act reinforces this concept by stating:

> *Except as otherwise provided in this Act, wilderness areas shall be devoted to the public purposes of recreational, scenic, scientific, educational, conservation, and historical use.*

Together, these statements confirm that the Sequoia- Kings Canyon Wilderness should continue to be managed under the Acts of 1890, 1926, and 1940 that created and enlarged Sequoia and Kings Canyon National Parks and the Act of 1916 that created the National Park Service. These acts address the responsibility of national parks to protect and understand natural and cultural resources.

The Management Goals of the Sequoia- Kings Canyon Wilderness follow from the above:

1. To provide opportunities for primitive and unconfined wilderness recreation and visitor enjoyment in a manner that is compatible with the Wilderness Act and the legislation creating Sequoia and Kings Canyon National Parks;
2. To provide for visitor management and resource protection in such a way and by such means as to enhance enjoyment of the wilderness resource while preserving wilderness character; and
3. To protect, restore, and understand natural and cultural resources in wilderness.

These three goals generate a suite of management programs, which, taken together, constitute the Minimum Requirement for Management of the Sequoia- Kings Canyon Wilderness.

MINIMUM REQUIREMENT FOR MANAGEMENT

1. Program for Visitor Recreation and Enjoyment

Goal: To provide opportunities for primitive and unconfined wilderness recreation and visitor enjoyment in a manner which is compatible with the Wilderness Act and the legislation creating Sequoia and Kings Canyon National Parks.

To provide for visitor enjoyment in the Sequoia- Kings Canyon Wilderness (723,000 acres) and associated areas, the National Park Service maintains a trail system of approximately 800 miles of foot and horse routes. Trails in the Sequoia- Kings Canyon Wilderness are constructed of materials available on site including earth, rock, gravel, and logs. No trails are hard surfaced. Causeways of timber or rock and earth may be constructed in wet areas. Trails generally are 2- 3 feet wide, but may be wider in areas of heavy use or rugged terrain, where additional space is required for safety.

To support recreational use of this trail system and to manage human impacts associated with use, the Service also maintains the following trail- associated items of human manufacture:

- Signing (directional, safety, and regulatory)
- Bridges and Footlogs
- Drift Fences
- Trailside Camps

Analysis and Justification

The use of a system of defined trails to facilitate recreation in the high Sierra of California is a long recognized attribute of Sierra Nevada wilderness recreation. All of the major trail routes in the Sequoia- Kings Canyon Wilderness predate the establishment of the wilderness in 1984. Many of the routes date back to the 19th century, and a number follow Native American routes that predate documented history.

The Sequoia- Kings Canyon Wilderness is one of the most rugged in the 48 contiguous states. Altitudes vary from barely 3,000 feet to over 14,000 feet above sea level. Huge canyons (several rivaling the Grand Canyon of Arizona) cut through the range. High ridges separate the various watersheds, with a dozen passes exceeding 12,000 feet and two more than 13,000 feet above the sea. Thick vegetation clothes the middle altitude country and thickets can impede travel up to 10,000 feet. Above about 9,000 feet, where Pleistocene glaciers scoured the ground across the landscape as recently as 12,000 years ago, the terrain is rocky and sometimes unstable. No roads cross the southern Sierra, and much of the Sequoia- Kings Canyon Wilderness is accessible only by several days of foot or stock travel.

For all these reasons, trail construction began early in the Sierra, and the existing system was essentially complete by 1940. Little has changed over the years, and trails remain the primary means of access. Almost all Sequoia- Kings Canyon Wilderness users rely on them for access. Even experienced hikers who enjoy cross- country (off- trail) travel in the high country usually approach their destinations on maintained trail routes.

Associated with the parks' trail system are a number of supporting improvements, all of which are necessary to meet the goal of wilderness recreation.

Trailside signing is limited to that necessary to provide visitors with required orientation (trail junctions, for example), that required to help visitors avoid the most serious safety hazards (such as lightning on the summit of Mt. Whitney) and that required to enforce necessary resource protection regulations (e.g. no fires, campsite closed, closed to grazing).

Several major rivers are born in the Sequoia- Kings Canyon Wilderness, and crossing them can be dangerous, particularly during the first half of the summer when the snowmelt is still underway. To facilitate access, a small number of bridges and footlogs are maintained over major streams where crossings are particularly dangerous or difficult. The great majority of stream crossings remain without bridges.

Stock use (mainly horses and mules) remains significant in the Sequoia- Kings Canyon Wilderness, and stock is traditionally turned out to graze in many areas within the Wilderness.

In some of these areas, drift fences are maintained where free- grazing is an appropriate use and to protect sensitive resources near camps from which stock tends by historical experience to drift away. Drift fences thus facilitate stock camping and travel, which is recognized as a traditional wilderness use in the Sierra and protect resources.

In pursuit of the goal of "a primitive and unconfined type of recreation," camping is allowed over nearly the entire extent of the Sequoia- Kings Canyon Wilderness. Nature, however, in the form of providing level terrain near water and adjacent the trails, has the effect of concentrating camping in desirable locations. Many of these sites have been in use since the trails themselves came into being long ago. As a result, these desirable locations tend to be heavily used.

To mitigate these impacts while preserving opportunities for primitive and unconfined recreation, the Service has found it necessary over the years to provide, selectively, limited camp improvements including constructed fire pits (where fires are legal), food storage boxes (where bears are common and raid camps, hitching posts (where tethered stock would otherwise damage vegetation), and toilets (where the natural systems are too fragile to handle waste without them).

Without this trail system and associated trailside improvements, it would be impossible to sustain wilderness recreation in the Sequoia- Kings Canyon Wilderness in the manner that has developed over more than a century in the High Sierra of California. Since this form of recreation is, quite literally, one of the forms of wilderness use that helped inspire the Wilderness Act, it is clear that the wilderness should be managed to sustain these uses in a manner that, as the Act of 1916 requires, "provides for their enjoyment by future generations…."

The Minimum Requirement for recreation in the Sequoia- Kings Canyon Wilderness thus consists of a trail system supported by trailside signs, bridges and footlogs, drift fences, and campsites with (when necessary) fire pits, food storage boxes or toilets.

2. Program for Visitor Management and Resource Protection

Goal: To provide for visitor management and resource protection in such a way and by such means as to enhance enjoyment of the wilderness resource while preserving wilderness character.

In order to assure the safety and well being of wilderness users and to protect the wilderness resource from unacceptable impacts, Sequoia and Kings Canyon National Parks maintains a system of backcountry rangers. In order to provide adequate support for the actions of the rangers, certain facilities are permitted to exist and to be maintained. These include:

- The existence and maintenance of backcountry ranger stations
- The existence and maintenance of toilet facilities
- The existence and maintenance of small- scale utility systems
- The existence and maintenance of communication systems

Analysis and Justification

It has been determined that, due to the size of the Sequoia- Kings Canyon Wilderness, and owing also to the large numbers of wilderness users, rangers must reside temporarily within the wilderness. This means that backcountry ranger stations are necessary. Options that do not provide for stations do not allow adequate patrol coverage of the vast area. In order to enhance enjoyment and protect the wilderness resource, the presence of rangers deep within the wilderness is required.

Owing to the requirement of stationed rangers, certain facilities and actions are necessary for proper and efficient conduct of wilderness ranger duties. Largest of the facilities are ranger stations. These provide a point from which rangers can work. They are utilized for shelter, storage of supplies and normal day to day living activities. They also serve as a place for visitors in need to seek out and obtain assistance.

The ranger stations and some high use camping areas have toilet facilities. Most of these are of the "privy" type, that is, pit toilets. These are required in areas of concentrated ranger and visitor use and assure that human waste is not scattered throughout an area thereby preventing unsanitary and unhealthy conditions. At Emerald and Pear Lakes there are two larger scale composting toilets. These structures are necessary due to the solid bedrock of this high use area. The digging of pit toilets is not feasible.

Ranger stations also contain some small- scale utilities, primarily solar generated electricity. This is necessary in order to provide power to recharge radio batteries as a part of communication systems.

The system of wilderness rangers requires effective radio communication systems to provide support responses for emergency services and to provide updated information to the frontcountry about trail and other wilderness conditions. In order to adequately cover the large size of the SEKI wilderness, radio repeaters exist in strategic locations and need to be maintained.

In order for the rangers to sustain themselves and to provide visitor management and assistance, it is necessary to supply the rangers and their stations. Food, clothing, tools, communication devices, and emergency medical and search and rescue supplies must be maintained at the stations. There are times when it is necessary to bring these supplies and occasionally insert or remove rangers from their stations via helicopters. This is generally when stock access is precluded, such as when passes are snowed in, supplies are too heavy or large, when time-sensitive materials are being transported, or there are no stock available.

Without the actions of the backcountry rangers and the support these stations provide, enjoyment of the wilderness by the visiting public and protection of the wilderness resource would be compromised. The quality of the wilderness experience and the quality of the wilderness resource would be impaired.

The Minimum Requirement for managing visitor use and enhancing wilderness enjoyment and resource protection in the Sequoia- Kings Canyon Wilderness and associated areas thus consists

of a system of backcountry rangers and stations supported by specific facilities and actions as defined above.

3. Program for Resource Management and Research

Goal: Protect, restore, and understand natural and cultural resources in wilderness

To provide for scientific, educational, conservation, and historical use of the Sequoia- Kings Canyon Wilderness and associated areas, the National Park Service conducts a broad resource management and research program designed to:

- Sustain cultural resources in wilderness through understanding, inventory, monitoring, protection, restoration, and maintenance;
- Sustain natural resources in wilderness through understanding, inventory, monitoring, protection, restoration, and maintenance. Such actions include establishing plots, monitoring devices, and collection of biologic and other samples, removal of trash and other manmade materials, removal of non- native plants and animals, removal or relocation of hazardous plants and animals;
- Sustain natural fire regimes in wilderness through understanding, monitoring, restoration, and maintenance. Such actions include prescribed fires, management of natural fire, hazard fuel removal, fire suppression and control. In order to foster natural fire regimes in wilderness, it is necessary to protect certain structures, installations, and natural and cultural resources from fire;
- Provide barriers to protect natural and cultural resources from incompatible uses. Such barriers include cave exclusion gates, boundary fences, fences to protect structures and installations from wildlife depredation, food storage lockers, fireline construction and rehabilitation, containment and diversions to protect resources from hazardous wastes and other unnatural flows, stock confinement structures such as hitching rails and drift fences, and signs for resource protection and visitor safety.

Analysis and Justification

Managing for scientific, educational, conservation, and historical use is a long recognized attribute of the Sequoia- Kings Canyon Wilderness. Such management long predates the establishment of the wilderness in 1984, and is based on the legislation which established both the National Park Service and Sequoia and Kings Canyon National Parks. These acts give the Park Service a clear mandate to manage cultural and natural resources.

Implementation of the resource management and research program involves crews entering the Sequoia- Kings Canyon Wilderness to conduct field activities. Associated with this field work are a number of supporting improvements, all of which are necessary to meet the goal of scientific, educational, conservation, and historical use. Infrastructure is limited to that necessary to support field crews, mitigate safety hazards, and minimize impacts in the wilderness.

To mitigate the impacts of field crew camps, the parks have found it necessary over the years to selectively provide constructed fire pits (where fires are legal), food storage boxes (where bears are common and raid camps) and pit toilets (where the natural systems are too fragile to handle

waste without them). Field- crew camp infrastructure is provided to the minimum extent necessary and is rehabilitated as appropriate when no longer required.

Stock (mainly horses and mules) are sometimes used to support field crews in the Sequoia-Kings Canyon Wilderness. Stock is traditionally turned out to graze in many areas within the wilderness. In some of these areas, drift fences are maintained near camps to prevent animals from drifting into sensitive habitats. Stock- related infrastructure is provided to the minimum extent necessary and is rehabilitated as appropriate when no longer required.

Stock are generally the preferred method of supporting field crews in the Sequoia- Kings Canyon Wilderness. Helicopter support is used to (1) transport equipment that is too fragile for other methods, (2) to transport samples and other cargo which are time- dependent, require stable conditions, or are of large volume or weight, or (3) where stock are not allowed or would be unduly damaging to the resource.

Without the parks' resource management and research program and associated improvements, it would not be possible to manage for scientific, educational, conservation, and historical use in the Sequoia- Kings Canyon Wilderness in the manner necessary to sustain the quality and integrity of the wilderness resource.

The actions, activities, and services of the resource management and research program ensure that the Sequoia- Kings Canyon Wilderness will allow for appropriate resource protection and visitor management. These actions, activities, and services are thus categorically defined as minimum requirement on the basis of past management experience and are carried out with the purpose of appropriate and necessary administration of the area as wilderness and do not pose a significant impact to wilderness resources and character.

The minimum requirement for scientific, educational, conservation, and historical use in the Sequoia- Kings Canyon Wilderness thus consists of the above described resource management and research program.

MINIMUM TOOL

In order to carry out those actions that are defined above as the Minimum Requirement for Management of the Sequoia- Kings Canyon Wilderness and associated areas, it is required that managers "identify the management method (tool) that causes the least amount of impact to the physical resources and experiential qualities (character) of wilderness." This is defined as the "Minimum Tool."

According to Director's Order 41, "Minimum Tool means a use or activity, determined to be necessary to accomplish an essential task, which makes use of the least intrusive tool, equipment, device, force, regulation, or practice that will achieve the wilderness management objective. This is not necessarily the same as the term "primitive tool," which refers to the actual equipment or methods that make use of the simplest available technology (i.e., hand tools)."

Attachment "A" defines Minimum Tool as practiced within the Sequoia- Kings Canyon Wilderness. For the purposes of analysis, three alternative approaches to Minimum Tool application are presented for each major element of the three management program elements that constitute the Minimum Requirement. In all cases, Alternative "B" is the approved Minimum Tool approach. This Record of Decision incorporates Alternative "B" as the approved Minimum Tool program for the Sequoia- Kings Canyon Wilderness and associated areas.

The Minimum Tool Analysis does not address roads or motorized ground transport since these activities are prohibited entirely within the Sequoia- Kings Canyon Wilderness.

PROHIBITED ACTIVITIES

The following management actions are prohibited within the Sequoia- Kings Canyon Wilderness:

- THE CONSTRUCTION, MAINTENANCE, OR USE OF ANY TEMPORARY ROAD IN WILDERNESS.
- The use of any motor vehicle in wilderness, other than approved helicopter use as described above.
- The use of any motorized equipment or motorboats in wilderness, other than described above.
- The landing of any aircraft in wilderness, other than described above.
- The use of any mechanical transport in wilderness.
- The maintenance, placement, or construction of any structure or installation or related facility in wilderness, other than described above.
- Any management action or activity not described above.

SCOPE AND DURATION

The Minimum Requirement defined by this Record of Decision and attached Minimum Tool Analysis applies specifically to the Sequoia- Kings Canyon Wilderness and also to other portions of Sequoia and Kings Canyon National Parks that are proposed or recommended for wilderness designation or are being studied for wilderness suitability. These additional areas that are not current designated wilderness are referred to above as "associated areas."

The decisions herein documented are valid for one year from the date of approval of this document unless revoked sooner by the Superintendent of Sequoia and Kings Canyon National Parks.

IMPLEMENTATION

In order to insure that the decisions documented herein are implemented in a consistent and compliant fashion, each of the operating divisions of Sequoia and Kings Canyon National Parks

that intends to carry out management activities in the Sequoia/Kings Canyon Wilderness under the authority of this decision will develop and maintain a "Minimum Requirement/Minimum Tool Compliance Agreement." These agreements, which will be reviewed by the parks' Environmental Management Committee and approved by the Superintendent, will provide detailed examples and guidance to supervisors and employees to assure that the parks' Minimum Requirement/Minimum Tool policies and standards are consistently followed. Enforcement of the parks' Minimum Requirement/Minimum Tool policies will be the responsibility of the parks' Environmental Management Committee.

/S/
Richard H. Martin
Superintendent

Attachment: Minimum Tool Analysis

Table H-1 – Minimum Tool Analysis

Table: Maintain a wilderness trail system
Requirement: Tasks involved include trail tread maintenance, clearing of logs and debris, drainage improvements, retaining wall construction or reconstruction, causeway construction or reconstruction, trail relocation for resource protection reasons, and abandoned trail restoration to natural conditions. Trail crew camps are occupied for significant periods at sites that are often returned to annually. Crew campsites require limited improvements to function effectively. Storage containers are needed to protect food from bears and other wildlife. Hitching posts and portable, temporary electric fences facilitate stock use and protect resources at selected, regularly used camps. Fenced pastures are constructed at a few of these camps to facilitate stock support of the crews.

	Alternative A: Primitive Tools	**Alternative B: Selective Mix of Tools**	**Alternative C: Modern Tools**
Use of Motorized Equipment	**Allowable Motorized Equipment**		
	No motorized equipment used. All work done by hand.	Motorized equipment used limited to chainsaws, rock drills, generators, and power hand tools. Use of motorized tools limited to between 8:30 am and 4:30 pm. Most work done by hand.	Motorized equipment used includes, but not limited to, bobcats, cement mixers, motorized wheelbarrows, chainsaws, rock drills, generators, and power hand tools. Little work is done by hand.
	Analysis		
	Work required to sustain trails is not fully accomplished unless substantial increases are made to trail crew budgets, which would result in the presence of larger crews and crew camps in the wilderness. Wilderness travelers do not encounter motorized equipment. Trail system likely to deteriorate. Wilderness character preserved, but minimum requirement not fully met.	Work required to sustain trails is done with moderate efficiency. Presence of motorized tools is limited to certain machines and to specified working hours only. Most work is done by hand. Wilderness travelers encounter only very limited motorized equipment. Trail system sustained. Wilderness character essentially preserved. Minimum requirement met.	Work required to sustain trails is done efficiently, but conflicts significantly with wilderness character. Wilderness travelers frequently encounter motorized equipment. Minimum requirement met, but wilderness character impaired.
Landing of Aircraft	**Allowable Landing of Aircraft**		

	No supply of trail work by helicopter. Trail crews access work sites by ground travel only. Trail crews receive construction supplies by non-motorized ground transport only.	Limited supply of trail work by helicopter. Trail crews access work sites by air only when ground travel is not feasible due to trail conditions, weather conditions, or non-availability of stock. Crews receive camp supplies under same limitations. Supplies delivered by air to work sites when above conditions apply or when required items are too large or too fragile for ground transport.	Unlimited supply of trail crews by helicopter. Trail crews routinely access work sites by helicopter. Crews routinely receive construction and camp supplies by helicopter.
	Analysis		
	Crew access and supply is accomplished only with difficulty. Large or fragile items cannot be delivered to sites. Travelers never encounter helicopters supporting trail crews. Stock impacts increase. Wilderness character preserved, but minimum requirement not fully met.	Crew access and supply is done with moderate efficiency but in a manner that essentially preserves wilderness character. Helicopters have a limited presence. Travelers seldom encounter helicopters supporting trail crews. Wilderness character essentially preserved and minimum requirement met.	Crew access and supply is efficient, but conflict with wilderness character is significant. Travelers encounter helicopters supporting trail crews with some regularity. Wilderness character significantly impaired, but minimum requirement met.
Structures and Installations	**Allowable Structures and Installations**		
	Only fully portable (by stock or person) food storage or equipment storage containers present at camp and work sites. Hitching racks and portable, temporary electric fences are not erected at trail crew campsites. Fenced pastures are not constructed or maintained at trail crew campsites.	Larger, temporary (not attached to ground) food storage and equipment storage containers present at camp and work sites. Hitching racks and portable, temporary electric fences are erected at some trail crew campsites. Fenced pastures are developed at a tightly limited number of regularly used camps where stock is based.	Large, semi-permanent (attached to ground) food storage and equipment storage containers present at camp and work sites. Hitching racks and electric fences are constructed at most sites where crews camp. Fenced pastures are developed at numerous locations to control stock and facilitate trail crew operations.
	Analysis		

	Small containers make it difficult to insure that all food is kept securely out of reach of wildlife. Tools and valuable private property in trail crew camps are generally not kept secure when crews are not in camp. Containers are portable and can be easily removed when no longer needed at site. Problems with wildlife and security may result. Not having hitching posts or electric fences makes stock use difficult, and natural resources suffer. Lack of fenced pastures make stock control difficult. Crew efficiency suffers. Wilderness travelers see no structures, but overall productivity of trail crews is low and trail system deteriorates. Wilderness character preserved but minimum requirement not fully met.	Larger containers insure that all food is kept securely out of reach of wildlife and that tools and valuable private property in trail crew camps are kept secure when crews are not present. Containers are temporary and are removed when no longer needed at site. Problems with wildlife and security area essentially prevented. Hitching posts and portable, temporary electric fences are uncommon but present. Fenced pastures at a few carefully selected locations increase crew efficiency but are seldom detected by visitors. Wilderness travelers encounter a limited number of structures. Wilderness character essentially preserved and minimum requirement met.	Larger containers insure that all food is kept securely out of reach of wildlife and that tools and valuable private property in trail crew camps are kept secure when crews are not in camp. Containers are semi-permanent and remain onsite for indefinite periods. Problems with wildlife and security essentially prevented. Hitching posts and electric fences are commonly present, and fenced pastures are encountered. Wilderness travelers encounter a significant number of structures. Wilderness character impaired but minimum requirement met.

Table: Provide necessary signs.
Requirement: Trailside signing is limited to that necessary to provide visitors with required orientation (trail junctions, for example), that required to help visitors avoid the most serious safety hazards (such as lightning on the summit of Mt. Whitney) and that required to enforce necessary resource protection regulations (no fires, campsite closed, closed to grazing, etc.). Signing work within the wilderness is related to delivery and installation of the signs. Signs are manufactured outside the designated wilderness. Also required to support this requirement, but addressed elsewhere, is maintaining a wilderness trail system.

	Alternative A: Primitive Tools	Alternative B: Selective Mix of Tools	Alternative C: Modern Tools
Use of Motorized Equipment	**Allowable Motorized Equipment**		
	No motorized equipment used to install signs. Installation by hand tools only.	Selective and limited used of motorized equipment is made. Signs posts are placed in ground by hand unless soil conditions (bedrock) require drilling of a hole for the post.	Regular use of motorized equipment is made to install signs. Power tools are used to excavate post holes where signs are erected.
	Analysis		
	All work is done by hand. No impacts on wilderness character. Work is accomplished except that signs could not be erected securely in those few sites where bedrock is only surface medium. Minimum requirement not fully met.	Almost all work is done by hand. Impacts on wilderness character are negligible. Work is accomplished and Minimum requirement met.	Significant presence of motorized equipment. Wilderness character impaired. Work accomplished and minimum requirement met.
Landing of Aircraft	**Allowable Landing of Aircraft**		
	No motorized equipment used to deliver signs. Delivery is accomplished by pack stock only.	Signs are delivered to work sites under provisions identified in "Trails" table for delivery of supplies to trail crews.	Signs are brought into wilderness primarily by helicopter.
	Analysis		
	Supply is accomplished only with difficulty. Crew efficiency is low and sustaining of sign systems may not be possible. Sign system may deteriorate. Wilderness character not impaired, but minimum requirement not fully met.	Supply is accomplished with moderate efficiency but in a manner that essentially preserves wilderness character. Helicopters have a limited presence. Work sites supplied with some difficulty but minimum requirement met.	Work sites supplied without difficulty. Supply is efficient, but conflict with wilderness character is significant. Helicopters have a strong presence. Minimum requirement met, but wilderness character significantly impaired.
Structures and	**Allowable Structures and Installations**		

Installations	Signs are largely not present in the backcountry. Directional information not usually found at trail junctions. Hazards such as lightning risk on Mt. Whitney not identified to travelers on site. Regulatory signs not present.	Signs are placed in wilderness as called for in SEKI Backcountry Management Plan. Signs are limited to directional signs at junctions, safety warning signs where there is a clear and present danger, and regulatory signs where ranger patrol staff recommend their presence.	In addition to signs called for in Alternative B, additional signing is installed to identify creeks, geographic features, points, of interest, etc.
	Analysis		
	Travelers do not encounter signs that may intrude in their wilderness experience. Signs are not present to provide critical information to wilderness users. Directional information at trail junctions not present. Highest level safety messages not made available to all travelers on the site. Information necessary to protect resources where problems occur not present. Additional management problems occur resulting from lost visitors, safety incidents, and resource damage. Wilderness character preserved. Minimum requirement not met.	Travelers encounter a limited number of signs that may intrude on their wilderness experience. Signs are present to provide critical information to wilderness users. Directional signs at trail junctions define routes for travelers. Highest level safety messages are made available to all travelers on the site. Regulatory signs provide information necessary to protect resources where problems occur. Critical information communicated to wilderness travelers. Wilderness character is not impaired, and the minimum requirement met.	Travelers encounter numerous signs that may intrude on their wilderness experience. Signs are present to provide critical information to wilderness users. Directional signs at trail junctions define routes for travelers. Highest level safety messages are made available to all travelers on the site. Regulatory signs provide information necessary to protect resources where problems occur. Basic and supplemental messages are communicated. Wilderness character impaired, but minimum requirement met.

Table: Trail bridges and footlogs
Requirement: Trail bridges or placed footlogs are provided at selected critical locations where crossings are particularly dangerous or difficult. The great majority of stream crossings remain without bridges. Bridge and footlog work is related to constructing, maintaining, and reconstructing bridge structures and their footings. These actions require imported supplies and materials that must be worked on site. Native materials are also sometimes used. Also required to support this requirement, but addressed elsewhere, is maintaining a wilderness trail system.

	Alternative A: Primitive Tools	Alternative B: Selective Mix of Tools	Alternative C: Modern Tools
Use of Motorized Equipment	**Allowable Motorized Equipment**		
	No motorized equipment used to construct, maintain, or reconstruct bridges and footlogs. All work done by hand tools only	Selective and limited used of motorized equipment is made. Motorized equipment used limited to chainsaws, rock drills, generators, welders and power hand tools. Use of motorized tools limited to between 8:30 am and 4:30 pm. Much work is still done by hand.	Full use of motorized equipment is made to do bridge and footlog work. Motorized equipment used includes, but not limited to, bobcats, cement mixers, motorized wheelbarrows, chainsaws, rock drills, generators, and power hand tools. Little work is done by hand.
	Analysis		
	Crew efficiency is low. Work required to sustain bridges and footlogs is not fully accomplished unless substantial increases are made to trail crew budgets. Systems of bridges and footlogs may deteriorate. Wilderness character preserved but minimum requirement not met.	Work required to sustain bridges and footlogs is done with moderate efficiency. Presence of motorized tools is limited to certain machines and to specified working hours only. Wilderness character essentially preserved. Minimum requirement met.	Work required to sustain bridges and footlogs is done efficiently, but conflict with wilderness character is significant. Motorized tools have a strong presence. Minimum requirement met.
Landing of Aircraft	**Allowable Landing of Aircraft**		
	No supply of bridge projects by helicopter. Bridge projects receive construction supplies by non-motorized ground transport only.	Limited supply of bridge projects by helicopter. Trail crews access work sites by air only when ground travel is not feasible due to trail conditions, weather conditions, or non-availability of stock. Supplies delivered by air to work sites when above conditions apply or when required items are too large or too fragile for ground transport.	Unlimited supply of bridge projects by helicopter. Projects routinely receive construction supplies by helicopter.
	Analysis		

	Project supply is accomplished only with difficulty. Large or fragile items cannot be delivered to sites. Bridges and footlogs deteriorate, and stock impacts increase. Travelers never encounter helicopters supporting bridge work. Wilderness character preserved, but minimum requirement not fully met.	Project supply is done with moderate efficiency but in a manner that essentially preserves wilderness character. Travelers seldom encounter helicopters supporting bridge work. Wilderness character essentially preserved, and minimum requirement met.	Project supply is efficient, but conflict with wilderness character is significant. Travelers may encounter helicopters supporting bridge work with some frequency during project periods. Minimum requirement met, but wilderness character significantly impaired.
Structures and Installations	**Allowable Structures and Installations**		
	Bridges and footlogs are not constructed or maintained along any park trails. Existing structures are removed.	Bridges are constructed or maintained or footlogs placed at selected sites on primary through routes where major safety problems exist for a significant part of the summer use season. The great majority of water crossings remain without bridges.	Bridges are constructed or maintained at numerous locations on both primary and less important routes where the public faces a challenge in crossing streams. Significant portions of the trail system's stream crossings have bridges or placed footlogs.
	Analysis		
	No stream crossing by visitors is assisted, even in the most dangerous situations. This presents hazards to public safety. Wilderness character preserved but minimum requirement not met.	Safe passage is provided across a small number of the most dangerous selected stream crossings. Wilderness character is preserved essentially intact and the minimum requirement met.	Safe and easy passage is provided across many park streams. Increased presence of work crews reduces opportunities for solitude. Wilderness character impaired, but minimum requirement met.

Table: Provide drift fences
Requirement: Provide drift fences at selected locations along major wilderness trails. Drift fences limit wandering by free-grazing stock in areas appropriate for stock camping, protecting sensitive resources from pack stock impacts. Drift fence work involves constructing, reconstructing, or maintaining trail gates and fences. These actions require imported supplies and materials, for on-site construction. Materials native to the site may also be used. Also required to support this requirement, but addressed elsewhere, is maintaining a wilderness trail system.

	Alternative A: Primitive Tools	Alternative B: Selective Mix of Tools	Alternative C: Modern Tools
Use of Motorized Equipment	**Allowable Motorized Equipment**		
	All work is done by hand. Drift fences and gates are constructed, reconstructed, or maintained entirely by crews using non-motorized hand tools.	Most work is done by hand. Selective and limited use of motorized equipment is made. Fences are placed in ground by hand unless soil conditions (bedrock) require drilling of a hole. Use of motorized tools limited to between 8:30 am and 4:30 pm. Gates are constructed mostly by hand with limited use of power saws.	Much work is done with motorized equipment. Regular use of motorized equipment is made to install fences. Power tools are used to excavate post holes where fences are erected. Power tools are used to facilitate construction of gates.
	Analysis		
	Work is accomplished with some loss in efficiency. Ability to maintain fence system is reduced, and fence system may deteriorate. Travelers never encounter motorized equipment in use to support fence work. Wilderness character preserved but minimum requirement not fully met.	Work is accomplished. Travelers seldom encounter motorized equipment being used to support fence work. Wilderness character is preserved and minimum requirement met.	Significant presence of motorized equipment facilitates efficient work. During periods of fence work, travelers are likely to encounter motorized tools being used. Minimum requirement met, but wilderness character significantly impaired.
Landing of Aircraft	**Allowable Landing of Aircraft**		
	No supply of fence projects by helicopter. Projects receive construction supplies by non-motorized ground transport only.	Limited supply of fence projects by helicopter. Trail crews access work sites by air only when ground travel is not feasible due to trail conditions, weather conditions, or non-availability of stock. Supplies delivered by air to work sites when above conditions apply or when required items are too large or too fragile for ground transport.	Unlimited supply of fence projects by helicopter. Projects routinely receive construction supplies by helicopter.
	Analysis		

	Project supply is accomplished only with some difficulty. System of fences may deteriorate, and stock impacts increase. Travelers do not encounter helicopters supporting fence work. Wilderness character preserved, but minimum requirement not fully met.	Project supply is done with moderate efficiency but in a manner that essentially preserves wilderness character. Travelers seldom encounter helicopters supporting fence work. Wilderness character preserved and minimum requirement met.	Project supply is efficient, but conflict with wilderness character is significant. Travelers are likely to encounter helicopters supporting fence work during project periods. Wilderness character significantly impaired, but minimum requirement met.
Structures and Installations	**Allowable Structures and Installations**		
	Drift fences are not constructed or maintained along any park trails. Existing structures are removed.	Drift fences are constructed or maintained at selected sites only on primary through-routes where free-grazing is an appropriate use, stock camping is a regular activity, and to protect sensitive resources where stock historically wander from camp. The great majority of camp areas do not have drift fences.	Drift fences are constructed or maintained at numerous locations on both primary and less important routes where the public faces a challenge in maintaining easy control over free grazing stock. A significant portion of the parks' wilderness campsites have drift fences nearby.
	Analysis		
	There is no control of free-grazing stock. No fences intrude. Sensitive resources are impacted by free-grazing stock. Stock camping is significantly more difficult. Wilderness character preserved, but minimum requirement not fully met.	Control of free-grazing stock is achieved in the vicinity of a limited number of regularly used stock camps. Meadow and streams are protected from impairment. Fences are a rare wilderness feature. Wilderness character is preserved essentially intact and the minimum requirement met.	Control of free-grazing stock is achieved at numerous locations on both primary and less important routes. Fences are a common wilderness feature. Minimum requirement met, but wilderness character impaired significantly.

Table: Trailside camps
Requirement: Provide opportunities for camping in a "primitive and unconfined" manner along wilderness trails by constructing the following improvements:

- Construct fire pits to limit size and impact of user-constructed fire rings in areas were fires are allowed and use is heavy
- Install food storage boxes at sites where bears are common and raid camps
- Construct toilets structures where natural systems are not sufficiently robust to handle the volume of human waste being generated
- Construct hitching posts at campsites that are commonly used by stock parties and where resource damage can be thus reduced

Tasks involved focus on the installation and maintenance of these improvements. Also required to support this requirement, but addressed elsewhere, is maintaining a wilderness trail system.

	Alternative A: Primitive Tools	**Alternative B: Selective Mix of Tools**	**Alternative C: Modern Tools**
Use of Motorized Equipment	**Allowable Motorized Equipment**		
	All work done by hand. No motorized equipment used.	Most work done by hand. Motorized equipment used limited to chainsaws, rock drills, generators, and power hand tools. Use of motorized tools limited to between 8:30 am and 4:30 pm.	Little work is done by hand. Motorized equipment used includes, but not limited to, bobcats, cement mixers, motorized wheelbarrows, chainsaws, rock drills, generators, and power hand tools.
	Analysis		
	Travelers will not encounter motorized equipment being used to support campsite work. Tasks required to sustain camp improvements will not be fully accomplished unless substantial increases are made to park trail crew budgets. Camp improvements likely to deteriorate. Wilderness character preserved but minimum requirement not met.	Travelers will seldom encounter motorized equipment being used to support campsite work. Tasks required to sustain camp improvements will be done with moderate efficiency. Presence of motorized tools is limited to certain machines and to specified working hours only. Camp improvements sustained. Wilderness character essentially preserved and minimum requirement met.	Travelers likely to encounter motorized equipment being used to support campsite work during project periods. Tasks required to sustain campsite improvements done efficiently. Motorized tools have a strong presence. Minimum requirement met, but wilderness character impaired.
Landing of Aircraft	**Allowable Landing of Aircraft**		

	No supply of camp improvement work by helicopter. Trail crews access work sites by ground travel only. Trail crews receive construction supplies by non-motorized ground transport only.	Limited supply of camp improvement work by helicopter. Crews access work sites by air only when ground travel is not feasible due to trail conditions, weather conditions, or non-availability of stock. Supplies delivered by air to work sites when above conditions apply or when required items are too large or too fragile for ground transport.	Unlimited supply of crews by helicopter. Trail crews routinely access work sites by helicopter. Crews routinely receive construction and supplies by helicopter.
	Analysis		
	Travelers do not encounter helicopters being used to support campsite work. Crew access and supply is accomplished only with difficulty. Large or fragile items cannot be delivered to sites. Stock impacts increase with increased use. Wilderness character preserved, but minimum requirement not fully met.	Travelers seldom encounter helicopters being used to support campsite work. Crew access and supply is done with moderate efficiency but in a manner that essentially preserves wilderness character. Helicopters have a limited presence. Wilderness character essentially preserved and minimum requirement met.	Travelers likely to encounter helicopters being used to support campsite work during project periods. Crew access and supply is efficient, but conflict with wilderness character is significant. Helicopters have a strong presence. Wilderness character significantly impaired, but minimum requirement met.
Structures and Installations	**Allowable Structures and Installations**		
	No camp improvements constructed.	Limited camp improvements constructed as follows: Fire pits where fires are allowed and use is heavy Food storage boxes at sites where bears are common and raid camps Toilets structures where natural systems are not sufficiently robust to handle the volume of human waste being generated Hitching posts at campsites that are commonly used by stock parties and where resource damage can be thus reduced	Camp improvements constructed as follows: Fire pits wherever fires are allowed and fires are built regularly Food storage boxes at sites where wilderness travelers desire them Toilets structures where travelers request them for convenience Hitching posts at campsites that are commonly used by stock parties
	Analysis		

	Wilderness travelers do not encounter structures and installations associated with trailside campsites. At popular sites, the following issues intensify: problems with unmanaged fire pits; camp raiding by bears and other wildlife; human waste; damage to trees and other natural resources from the tethering of stock; and trampling and overgrazing of adjacent meadows. Wilderness character preserved, but minimum requirement not fully met.	Wilderness travelers encounter a limited number of structures and installations associated with trailside campsites. Campsites with specific problems receive improvements that limit impacts but most sites are left undeveloped. Wilderness character essentially preserved and minimum requirement met.	Wilderness travelers frequently encounter structures and installations associated with trailside campsites. Many campsites, including some with no resource problems, receive improvements. Wilderness character significantly impaired, but minimum requirement met.

Table: The existence and maintenance of backcountry ranger stations
Requirement: Maintain a system, or network, of backcountry rangers and appropriate support mechanisms in order to provide for public safety, enhanced wilderness enjoyment, and protection of the wilderness resource. Rangers also provide for education and the gathering and dissemination of information which leads to wilderness preservation through informed planning and operational decisions.

	Alternative A: Primitive Tools	Alternative B: Selective Mix of Tools	Alternative C: Modern Tools
Use of Motorized Equipment	**Allowable Motorized Equipment**		
	Prohibit all use of motorized equipment to maintain or support wilderness Ranger Stations.	Motorized equipment used limited to drills, saws and power hand tools. Use of motorized tools limited to between 8:30 am and 4:30 pm.	Regular and frequent use of motorized equipment.
	Analysis		
	Ability to maintain stations with only hand tools leads to deterioration over time. Aesthetic condition of stations compromised. Structures are more primitive and require more frequent replacement. Wilderness character preserved, but minimum requirement not fully met.	Structures are maintained in good condition leading to a positive aesthetic. Structures are kept in condition to maximize efficient operation. Wilderness character essentially preserved and minimum requirement met.	Structures are kept in condition to maximize efficient operation. Minimum requirement met, but wilderness character impaired.
Landing of Aircraft	**Allowable Landing of Aircraft**		
	Aircraft is never used to maintain or support wilderness Ranger Stations.	Limited use of aircraft to maintain and support.	Regular and frequent use of aircraft.
	Analysis		
	All material to maintain and support stations brought in by stock or on foot, limiting types of materials and support equipment, and impacting associated functions (e.g. EMS/SAR). Additional stock use would lead to more trail and meadow impacts. Wilderness character preserved, but minimum requirement not fully met.	Material to adequately support structure and associated functions would be available. Impacts of stock use is kept at manageable levels. Wilderness character essentially preserved and minimum requirement met.	All supplies are readily available. Impacts of stock use are significantly reduced or eliminated. Minimum requirement met, but wilderness character impaired.
Structures and Installations	**Allowable Structures and Installations**		
	No ranger stations would be maintained; existing structures would be removed.	Maintain and/or improve existing ranger stations.	Improve existing ranger stations and construct stations in new locations.
	Analysis		

	No structures would severely limit the time rangers can spend in wilderness which would reduce visitor enjoyment by not having available associated functions (e.g. EMS/SAR and educational opportunities). Also, resource damage in remote wilderness areas would not be mitigated in most cases. If no structures, wilderness character (i.e. aesthetic) would be improved. Removal of existing structures requires large numbers of stock, and or aircraft use for removal and cleanup efforts. Wilderness character preserved, but minimum requirement not fully met.	System of stations provides support for wilderness administration activities (e.g. EMS/SAR, education, resource protection) enhancing visitor enjoyment and preservation. Wilderness character essentially preserved and minimum requirement met.	System of support for administration of wilderness would increase, providing more services to the public and more resource protection. Construction of new facilities would lead to more materials being transported (via stock or helicopter). Minimum requirement met, but wilderness character impaired.

Table: The existence and maintenance of toilet facilities
Requirement: Maintain primitive toilet facilities at ranger stations and in wilderness areas of high use. Tasks involve maintenance of above ground structures, removal of waste in some cases, and relocation of pits. Also required to support this requirement, but addressed elsewhere, is maintaining trailside camps.

	Alternative A: Primitive Tools	Alternative B: Selective Mix of Tools	Alternative C: Modern Tools
Use of Motorized Equipment	**Allowable Motorized Equipment**		
	Prohibit all use of motorized equipment to maintain or support wilderness toilets.	Limited utilization of motorized equipment to maintain and support. Use of motorized tools limited to between 8:30 am and 4:30 pm.	Regular and frequent use of motorized equipment.
	Analysis		
	Ability to maintain with only hand tools leads to deterioration over time. Aesthetic condition of toilets less than optimal. Structures more primitive and require more frequent replacement. Sanitation is compromised. Wilderness character preserved, but minimum requirement not fully met.	Structures maintained in good condition leading to good aesthetics. Structures kept in condition to maximize efficient operation. Sanitation would be maintained. Wilderness character essentially preserved and minimum requirement met.	Structures kept in condition to maximize efficient and sanitary operation. Minimum requirement met, but wilderness character impaired.
Landing of Aircraft	**Allowable Landing of Aircraft**		
	Aircraft is never used to maintain or support wilderness toilets.	Limited use of aircraft to maintain and support.	Regular and frequent use of aircraft.
	Analysis		
	All material to maintain would be brought in or removed by stock or on foot. Waste would need to be dealt with on site or hauled out by stock or on foot, creating problems of safe handling. Additional stock use would lead to more trail and meadow impacts. Wilderness character preserved, but minimum requirement not fully met.	Material to adequately support structure is available. Waste is removed for disposal outside wilderness and handled in safe manner. Impacts of stock use is kept at manageable levels. Wilderness character essentially preserved and minimum requirement met.	All supplies are readily available. Waste is removed and handled safely. Impacts of stock use are significantly reduced or eliminated. Minimum requirement met, but wilderness character impaired.
Structures and Installations	**Allowable Structures and Installations**		
	No toilets would be maintained; existing structures would be removed.	Maintain existing toilets.	Maintain or modernize existing toilets and construct new toilets in more locations.
	Analysis		

	No toilets severely impacts resource protection and visitor enjoyment. High use areas have high potential of encountering human waste on the landscape. Water quality also impacted. Higher probability of visitors contracting illnesses. Removal of existing structures requires increased stock use, and or aircraft use for removal and cleanup efforts. Wilderness character preserved, but minimum requirement not fully met.	Toilets provide a safe way to concentrate human waste, enhancing visitor enjoyment, preservation, and health and safety. Wilderness character essentially preserved and minimum requirement met.	Number of structures increases, providing more sanitary conditions for the public and more resource protection. Improvement of old and construction of new facilities leads to more materials being transported (via stock or helicopter). Minimum requirement met, but wilderness character impaired.

Table: Existence and maintenance of small-scale utility systems.
Requirement: Maintain small-scale utility systems, both electrical (consisting of solar panels, inverters, and batteries), and in some cases water, at ranger stations in wilderness. Tasks involve installation and maintenance of systems to support rangers through enabling the recharging of radio batteries and production of indoor water. Ranger presence and ability to provide visitor services leads to wilderness enjoyment, protection of the wilderness resource and public safety. Also required to support this requirement, but addressed elsewhere, is maintaining a system of backcountry rangers and adequate support for them to accomplish their duties of enhancing visitor enjoyment, public safety, and resource protection.

	Alternative A: Primitive Tools	Alternative B: Selective Mix of Tools	Alternative C: Modern Tools
Use of Motorized Equipment	**Allowable Motorized Equipment**		
	Prohibit all use of motorized equipment to maintain or support wilderness utility systems.	Limited utilization of motorized equipment to maintain and support. Use of motorized tools limited to between 8:30 am and 4:30 pm. Most work done by hand.	Regular and frequent use of motorized equipment to maintain and support.
	Analysis		
	Ability to maintain with only hand tools leads to deterioration over time. Aesthetic condition of systems less than optimal. Systems require more frequent replacement. Wilderness character preserved, but minimum requirement not met.	Systems are maintained in good condition leading to good aesthetics. Systems are kept in condition to maximize efficient operation. Sanitation of structures is maintained. Wilderness character essentially preserved. Minimum requirement met.	Systems are kept in condition to maximize efficient operation. Minimum requirement met, but wilderness character impaired.
Landing of Aircraft	**Allowable Landing of Aircraft**		
	Aircraft is never used to maintain or support wilderness utility systems.	Limited use of aircraft to maintain and support. Supplies delivered by air to stations when ground travel is not feasible due to trail conditions, items are too large or fragile for stock, or stock is not available.	Regular and frequent use of aircraft.
	Analysis		
	All material to maintain is brought in or removed by stock or on foot. Broken/obsolete equipment is dealt with on site or hauled out by stock or on foot, creating problems of safe handling. Additional stock use leads to more trail and meadow impacts. Wilderness character preserved, but minimum requirement not met.	Material to adequately support systems is available. Broken/obsolete equipment is removed for disposal outside wilderness and handled in a safe manner. Impacts of stock use are kept at manageable levels. Wilderness character essentially preserved. Minimum requirement met.	All supplies are readily available. Failed equipment is removed and handled safely. Impacts of stock use are significantly reduced or eliminated. Minimum requirement met, but wilderness character impaired.

Structures and Installations	**Allowable Structures and Installations**		
	No utility systems would be maintained; existing systems would be removed.	Maintain existing small-scale systems consisting of solar panels, inverters, and batteries. In limited instances, waterheads with pipes to stations are permitted.	Maintain or modernize existing systems.
	Analysis		
	No utility systems impairs rangers' ability to carry out the full scope of their duties leading to compromised resource protection and visitor enjoyment. No systems regularly leads to lack of communication that compromises visitor safety and enjoyment. Removal of existing structures requires increased stock use, and or aircraft use for removal efforts. Wilderness character preserved, but minimum requirement not met.	Systems provide efficient, low-impact way to support communication of rangers, enhancing visitor enjoyment, preservation, and health and safety. Wilderness character essentially preserved. Minimum requirement met.	Size and obtrusiveness of systems increases, providing increased public safety and resource protection. Improvement of old and construction of new facilities leads to more materials being transported (via stock or helicopter) further compromising wilderness character. Minimum requirement met, but wilderness character impaired.

Table: Existence and maintenance of a communications network
Requirement: Tasks involved include installing and maintaining a network of radio relays sites in order to provide emergency and operations communications capacity for government personnel working within the wilderness. Radio relay sites are mostly located on peaks and ridges well away from trails or areas of general use. Also required to support this requirement, but addressed elsewhere, are the trail system, trail bridges, trailside camps, backcountry ranger stations, toilet facilities, and small scale utility systems.

	Alternative A: Primitive Tools	Alternative B: Selective Mix of Tools	Alternative C: Modern Tools
Use of Motorized Equipment	**Allowable Motorized Equipment**		
	All work done by hand. No motorized equipment used.	Site work involving rock or vegetation done mostly by hand. Motorized equipment used for site work limited to chainsaws, welders and rock drills. Generators and motorized hand tools used on structures. Use of motorized tools limited to between 8:30 am and 4:30 pm. Work on electronic components done with battery- or generator-powered equipment.	Little work is done by hand. Motorized equipment used without limitations on site work, structures, and electronic components.
	Analysis		
	Travelers will not encounter motorized equipment being used to support the communications network. Crew efficiency is very low and work on electronic components may be impossible in some cases. Communications systems will not be fully sustained. Wilderness character preserved but minimum requirement not met.	Travelers almost never encounter motorized equipment being used to support communications network because sites are remote. Crew efficiency will be moderate, but work can be accomplished. Wilderness character essentially preserved and minimum requirement met.	Travelers may occasionally encounter motorized equipment being used to support communications network. Crew efficiency will be high but with increased potential for negative impact on wilderness character. Minimum requirement met, but wilderness character impaired.
Landing of Aircraft	**Allowable Landing of Aircraft**		

	No supply of communications network improvement work by helicopter. Crews access work sites by ground travel only. Communications crews receive construction and maintenance supplies by non-motorized ground transport only.	Limited supply of work sites by helicopter. Crews access work sites by air when ground travel is not feasible due to remoteness (lack of trail access), poor trail conditions, weather conditions, or non-availability of stock. Supplies delivered by air to work sites when above conditions apply or when required items are too large or too fragile for ground transport. Repair work at sites will continue as required to maintain operations but major construction or reconstruction is scheduled in the shoulder season whenever possible.	Unlimited supply of crews by helicopter. Crews always access work sites by helicopter. Crews always receive construction and maintenance supplies by helicopter. Work at sites occurs throughout the summer season as required.
	Analysis		
	Travelers do not encounter helicopters being used to support communications network. Crew access and supply is accomplished only with difficulty. Large or fragile items cannot be delivered to sites. Maintenance of installations is difficult and expensive. Installation of new facilities is almost impossible. Network cannot be maintained and deteriorates. Wilderness character preserved, but minimum requirement not met.	Because most communication sites are located on sites that are remote from the trail system, helicopters will commonly be used to support work at these sites. When the conditions listed above can be met, ground access will be used but this will not happen frequently. Travelers encounter helicopters being used to support communications network, but most trips occur in spring or fall when use is light. Crew access and supply is done with moderate efficiency. Wilderness character essentially preserved and minimum requirement met.	Travelers likely to encounter helicopters being used to support communications work during project periods. Crew access and supply is efficient, but conflict with wilderness character is significant. Helicopters have a strong presence. Wilderness character impaired, but minimum requirement met.
Structures and Installations	**Allowable Structures and Installations**		
	Existing communications system is removed; no new improvements constructed.	Electronic equipment shelters and antennas installed as required to sustain network. Structures are designed to blend in whenever possible.	Electronic equipment shelters and antennas installed as required to sustain network.
	Analysis		

	Wilderness travelers never encounter structures and installations associated with communications network because network does not exist. Removal and clean up of existing system requires extensive use of helicopter and/or stock with resultant impacts. Wilderness character preserved, but minimum requirement not fully met.	Wilderness travelers encounter a limited number of structures and installations associated with the communications network. Sites are remote and seldom visited. Installations are designed to minimize visibility from a distance. Wilderness character essentially preserved and minimum requirement met.	Wilderness travelers encounter a limited number of structures and installations associated with the communications network. Sites are remote and seldom visited. Installations are often visible from some distance. Wilderness character impaired but minimum requirement met.

Table: Sustain cultural resources in wilderness through understanding, inventory, monitoring, protection, restoration, and maintenance. **Requirement:** Conduct cultural resource management and research actions including inventory, monitoring, evaluating resource impacts or conditions, restoration and maintenance of resources (historic cabins, etc.), collection of samples, removal of debris and intrusive materials, establishing and marking plots. Some of the above actions involve transporting items (e.g., quick response required by law) that are time-critical. Some of the above actions involve transporting equipment (e.g., artifacts) that is too fragile or hazardous for ground transport. Some of the above actions involve transporting material (e.g., secure storage lockers) that is too large for ground transport. Also required to support this requirement, but addressed elsewhere, are minimum necessary signs for resource protection, visitor safety, and trail orientation, stock confinement facilities including hitching rails and regular and electric drift fences, communication systems, and temporary field crew camps and work sites which may include toilets and temporary food storage lockers and other secure storage.

	Alternative A: Primitive Tools	Alternative B: Selective Mix of Tools	Alternative C: Modern Tools
Use of Motorized Equipment	**Allowable Motorized Equipment**		
	No motorized equipment used.	Motorized equipment limited to chainsaws, generators, computers, and other hand-held motorized tools such as drills. Use of motorized tools limited to between 8:30 am and 4:30 pm. When operating motorized equipment, reasonable efforts will be made to limit disturbance of nearby wilderness users.	Work is accomplished with motorized equipment whenever that method is deemed most efficient. Motorized equipment includes, but is not limited to, motorized wheelbarrows, chainsaws, generators, computers, and other hand-held motorized tools such as drills.
	Analysis		
	No motorized equipment used. Wilderness character preserved, but minimum requirement not fully met.	Motorized equipment limited to chainsaws, generators, and hand-held motorized tools. Use of motorized tools limited to between 8:30 am and 4:30 pm. When operating motorized equipment, reasonable efforts will be made to limit disturbance of nearby wilderness users. Wilderness character essentially preserved and minimum requirement met.	Work is accomplished with motorized equipment whenever that method is deemed most efficient. Motorized equipment includes, but is not limited to, bobcats, motorized wheelbarrows, chainsaws, generators, and hand-held motorized tools. Minimum requirement met, but wilderness character impaired.
Landing of Aircraft	**Allowable Landing of Aircraft**		

	No support of cultural resource work by helicopter. Field crews, supplies, and materials that cannot be transported by ground will not be transported.	Limited support of cultural resource work by helicopter. Field crews, supplies, and materials transported by ground except when infeasible due to trail conditions, weather conditions, or unavailability of stock or when moving large, fragile, or time-sensitive items that cannot be practically transported otherwise.	Substantial support of cultural resource work by helicopter. Field crews, supplies, and materials frequently transported by helicopter whenever convenient.
	Analysis		
	Crew access and supply is accomplished only with severely impaired efficiency but in a manner that preserves wilderness character. Large, fragile, and time-sensitive items cannot be delivered or removed from sites. No helicopters touch down except in emergencies. Number of stock required on trails to support field crew camps significantly increases over Alternative C with resultant impacts. Field crew camps adequately supplied. Cultural resources remain uninventoried or deteriorate and minimum requirements are not met.	Helicopters have a limited presence, limited to transporting large, fragile, or time-sensitive items that cannot be practically transported otherwise. Much transport that could most efficiently be accomplished by helicopter is instead done with stock or backpack. Number of stock required on trails to support field crew camps slightly increases over Alternative C with resultant impacts. Field crew camps adequately supplied. Crew access and supply is accomplished with moderate efficiency. Cultural resources are inventoried and sustained, wilderness character essentially preserved and minimum requirements are met.	Helicopters are commonly employed for efficiency. Number of stock required on trails to support field crew camps is similar to present conditions. Field crew camps well supplied. Crew access and supply is accomplished with maximum efficiency. Cultural resources are inventoried and sustained and minimum requirements are met, but wilderness character is significantly impaired.
Structures and Installations	**Allowable Structures and Installations**		
	Cultural resource structures are not actively removed, but they are treated with benign neglect. No installations are permitted in support of cultural resources.	Significant cultural resource sites and structures are maintained consistent with NPS policies, but the rest are treated with benign neglect. Limited installations are used in support of cultural resources. Installations are limited to survey markers (e.g. pin flags) and monitoring devices.	Cultural resource structures are maintained and protected consistent with NPS policies. Installations are used in support of cultural resources whenever that method is deemed most efficient. Installations include, but are not limited to, survey markers and monitoring devices.
	Analysis		
	Due to benign neglect, NPS policies are not met, cultural resources deteriorate, and minimum requirements are not met. Wilderness character is preserved.	Cultural resources are sustained at an acceptable level and minimum requirements are met. Wilderness character is preserved.	Cultural resources are sustained at an acceptable level and minimum requirements are met. Wilderness character is impaired.

Table: Sustain natural resources in wilderness through understanding, inventory, monitoring, protection, restoration, and maintenance. Such actions include establishing plots, placing monitoring devices, and collection of biologic and other samples, removal of trash and other manmade materials intruding on the wilderness, removal of non-native plants and animals, and removal or relocation of hazardous plants and animals.
Requirement: Conduct natural resource management and research actions including inventory, monitoring (including but not limited to meteorological stations, air quality sampling stations, water quality gauging and sampling stations, sound recording equipment, remote cameras, data loggers, and wildlife traps), evaluating resource impacts or conditions, restoration and maintenance of resources, control and removal of non-native plants and animals, tree hazard mitigation, collection of samples, removal of debris and intrusive materials, establishing and marking plots. Some of the above actions involve transporting items that are time-critical. Some of the above actions involve transporting equipment that is too fragile, hazardous, or too large for ground transport. Also required to support this requirement, but addressed elsewhere, are minimum necessary signs for resource protection, visitor safety, and trail orientation, stock confinement facilities including hitching rails and drift fences, communication systems, and temporary field crew camps and work sites which may include toilets and temporary food storage lockers and other secure storage.

	Alternative A: Primitive Tools	**Alternative B: Selective Mix of Tools**	**Alternative C: Modern Tools**
Use of Motorized Equipment	**Allowable Motorized Equipment**		
	No motorized equipment used.	Motorized equipment limited to chainsaws, rock drills, generators, computers, electroshocking devices, and other hand-held motorized tools such as drills. Use of motorized tools limited to between 8:30 am and 4:30 pm. When operating motorized equipment, reasonable efforts will be made to limit disturbance of nearby wilderness users.	Work is accomplished with motorized equipment whenever that method is deemed most efficient. Motorized equipment includes, but is not limited to, bobcats, motorized wheelbarrows, chainsaws, rock drills, generators, computers, electroshocking devices, and other hand-held motorized tools such as drills.
	Analysis		
	Work required to sustain natural resources is accomplished with severely impaired efficiency. No motorized tools are used except in emergencies. Wilderness character is preserved, but natural resources deteriorate and minimum requirements are not met.	Work required to sustain natural resources is accomplished with moderate efficiency. Presence of motorized tools is limited to smaller machines and to working hours only. Much work that could most efficiently be accomplished by modern tools is instead done with nonmotorized tools. Wilderness character is essentially preserved, natural resources are sustained and minimum requirements are met.	Work required to sustain natural resources is accomplished with maximum efficiency. Motorized tools are commonly employed for efficiency without restriction to working hours. Natural resources are sustained and minimum requirements are met, but wilderness character is significantly impaired.
Landing of Aircraft	**Allowable Landing of Aircraft**		

	No support of natural resource work by helicopter. Field crews, supplies, and materials that cannot be transported by ground will not be transported.	Limited support of natural resource work by helicopter. Field crews, supplies, and materials transported by ground except when infeasible due to trail conditions, weather conditions, or unavailability of stock or when moving large, fragile, or time-sensitive items that cannot be practically transported otherwise.	Substantial support of natural resource work by helicopter. Field crews, supplies, and materials transported by helicopter whenever that mode is deemed most efficient.
	Analysis		
	Crew access and supply is accomplished only with severely impaired efficiency. Large, fragile, and time-sensitive items cannot be delivered or removed from sites. No helicopters touch down except in emergencies. Number of stock required on trails to support field crew camps significantly increases over Alternative C with resultant impacts. Field crews are not adequately supplied. Wilderness character is preserved, but natural resources deteriorate and minimum requirements are not met.	Crew access and supply is accomplished with moderate efficiency. Helicopters have a limited presence, limited to transporting large, fragile, or and time-sensitive items that cannot be practically transported otherwise. Much transport that could most efficiently be accomplished by helicopter is instead done with stock or backpack. Number of stock required on trails to support field crew camps slightly increases over Alternative C with resultant impacts. Field crew camps adequately supplied. Wilderness character is essentially preserved, natural resources are sustained and minimum requirements are met.	Crew access and supply is accomplished with maximum efficiency and convenience. Helicopters are commonly employed for efficiency. Number of stock required on trails to support field crew camps is similar to present conditions. Field crew camps well supplied. Natural resources are sustained and minimum requirements are met, but wilderness character is significantly impaired.
Structures and	**Allowable Structures and Installations**		

Installations	No structures or installations used in support of natural resources.	Limited temporary structures and installations are used in support of natural resource protection and are removed when no longer required. Structures and installations are limited to survey and plot markers, monitoring devices (meteorological stations and monitoring devices, air quality sampling stations, water quality gauging and sampling stations, cave monitoring stations, sound recording equipment, remote cameras, data loggers and similar recording devices, wildlife traps, snares, track plates, gill nets, mist nets etc.).	Temporary structures and installations are used in support of natural resources whenever that method is deemed most efficient or convenient and remain onsite for indefinite periods. Structures and installations include, but are not limited to, survey and plot markers, monitoring devices (meteorological stations and monitoring devices, air quality sampling stations, water quality gauging and sampling stations, cave monitoring stations, sound recording equipment, remote cameras, data loggers and similar recording devices, wildlife traps, snares, track plates, gill nets, mist nets etc.).
	Analysis		
	Work required to sustain natural resources is accomplished with severely impaired efficiency. No structures or installations are used except in emergencies. Much work that could most efficiently be accomplished with the support of structures and installations is instead left undone, accomplished with reduced accuracy, or done with labor intensive methods. Wilderness character is preserved, but natural resources deteriorate and minimum requirements are not met.	Work required to sustain natural resources is accomplished with moderate efficiency. Presence of structures and installations is limited. Some work that could most efficiently be accomplished with the support of structures and installations is instead left undone, accomplished with reduced accuracy, or done with labor intensive methods. Wilderness character is essentially preserved, natural resources are sustained and minimum requirements are met.	Work required to sustain natural resources is accomplished with maximum efficiency and convenience. Structures and installations are commonly employed for efficiency. Natural resources are sustained and minimum requirements are met, but wilderness character is significantly impaired.

Table: Sustain natural fire regimes in wilderness through understanding, inventory, monitoring, restoration, and maintenance. Such actions include prescribed fires, management of natural fire, hazard fuel removal, fire suppression and control. In order to foster natural fire regimes in wilderness, it is necessary to protect certain structures, installations, and natural and cultural resources from fire.
Requirement: Conduct fire management actions including inventory, monitoring, evaluating resource impacts or conditions, restoration and maintenance of natural fire regimes, collection of samples, removal of debris and intrusive materials, establishing and marking plots, hazard fuel removal, fire suppression and control, and actions to protect structures and installations from fire. Some of the above actions involve transporting items (e.g., fire pumps) that are time-critical. Some of the above actions involve transporting material (e.g., secure storage lockers) that is too large for ground transport. Also required to support this requirement, but addressed elsewhere, are minimum necessary signs for resource protection, visitor safety, trail orientation, communication systems, and temporary field crew camps and work sites which may include toilets and temporary food storage lockers and other secure storage.

	Alternative A: Primitive Tools	**Alternative B: Selective Mix of Tools**	**Alternative C: Modern Tools**
Use of Motorized Equipment	**Allowable Motorized Equipment**		
	No motorized equipment used.	Motorized equipment limited to chainsaws, fire pumps, generators, and other hand-held motorized tools such as drills. When operating motorized equipment, reasonable efforts will be made to limit disturbance of nearby wilderness users.	Work is accomplished with motorized equipment whenever that method is deemed most efficient or convenient. Motorized equipment includes, but is not limited to, motorized wheelbarrows, chainsaws, fire pumps, generators, and other hand-held motorized tools such as drills.
	Analysis		
	Work required to sustain natural fire regimes is accomplished with severely impaired efficiency but in a manner that preserves wilderness character. No motorized tools are used except in emergencies such as fire suppression. Wilderness character is preserved, but natural fire regimes deteriorate and minimum requirements are not met.	Work required to sustain natural fire regimes is accomplished with moderate efficiency. Presence of motorized tools is limited to smaller machines. Much work that could most efficiently be accomplished by modern tools is instead done with nonmotorized tools. Wilderness character is largely preserved, natural fire regimes are sustained and minimum requirements are met.	Work required to sustain natural fire regimes is accomplished with maximum efficiency. Motorized tools are commonly employed for efficiency and convenience. Natural fire regimes are sustained and minimum requirements are met, but wilderness character is significantly impaired.
Landing of Aircraft	**Allowable Landing of Aircraft**		

	No support of natural fire regime work by helicopter. Field crews, supplies, and materials that cannot be transported by ground will not be transported.	Limited support of natural fire regime work by helicopter. Field crews, supplies, and materials transported by ground except when infeasible due to trail conditions, weather conditions, or unavailability of stock or when moving large, fragile, or time-sensitive items that cannot be practically transported otherwise.	Substantial support of natural fire regime work by helicopter. Field crews, supplies, and materials transported by helicopter whenever that mode is deemed most efficient and or convenient.
	Analysis		
	Crew access and supply is accomplished only with severely impaired efficiency. Large, fragile, and time-sensitive items cannot be delivered or removed from sites. No helicopters touch down except in emergencies. Number of stock required on trails to support field crew camps significantly increases over Alternative C with resultant impacts. Field crew camps are not adequately supplied. Wilderness character is preserved, natural fire regimes deteriorate and minimum requirements are not met.	Crew access and supply is accomplished with moderate efficiency. Helicopters have a limited presence, limited to transporting large, fragile, or and time-sensitive items that cannot be practically transported otherwise. Much transport that could most efficiently be accomplished by helicopter is instead done with stock or backpack. Number of stock required on trails to support field crew camps slightly increases over Alternative C with resultant impacts. Field crew camps are adequately supplied. Wilderness character is essentially preserved, natural fire regimes are sustained and minimum requirements are met.	Crew access and supply is accomplished with maximum efficiency and convenience. Helicopters are commonly employed for efficiency. Number of stock required on trails to support field crew camps is similar to present conditions. Field crew camps are well supplied. Natural fire regimes are sustained and minimum requirements are met, but wilderness character is significantly impaired.
Structures and Installations	**Allowable Structures and Installations**		
	No structures or installations used in support of natural fire regimes.	Limited temporary structures and installations are used or erected in support of natural fire regimes and are removed when no longer required. Structures and installations are limited to such things as survey markers and monitoring devices.	Temporary structures and installations are used and erected in support of natural fire regimes whenever that method is deemed most efficient or convenient and remain onsite for indefinite periods. Structures and installations include, but are not limited to, survey markers and monitoring devices.
	Analysis		

	Work required to sustain natural fire regimes is accomplished with severely impaired efficiency. No structures or installations are used or erected except in emergencies. Much work that could most efficiently be accomplished with the support of structures and installations is instead left undone, accomplished with reduced accuracy, or done with labor intensive methods. Wilderness character is preserved, but natural fire regimes deteriorate and minimum requirements are not met.	Work required to sustain natural fire regimes is accomplished with moderate efficiency. Presence of structures and installations is limited. Some work that could most efficiently be accomplished with the support of structures and installations is instead left undone, accomplished with reduced accuracy, or done with labor intensive methods. Wilderness character is essentially preserved, natural fire regimes are sustained and minimum requirements are met.	Work required to sustain natural fire regimes is accomplished with maximum efficiency. Structures and installations are commonly employed for efficiency and convenience. Natural fire regimes are sustained and minimum requirements are met, but wilderness character is significantly impaired.

Table: Provide barriers to protect natural and cultural resources. Such barriers include cave exclusion gates, boundary fences, fences to protect structures and installations from wildlife depredation, food storage lockers, fireline construction and rehabilitation, containment and diversions in response to hazardous wastes and other unnatural flows, stock confinement structures such as hitching rails and drift fences, and signs for resource protection and visitor safety.
Requirement: Fences (boundary fences, cave exclusion gates, research exclosures, regular and electric fences for protecting structures and installations from wildlife depredation), fireline, and dams and diversions for resource protection. Also required to support this requirement, but addressed elsewhere, are minimum necessary signs for resource protection, visitor safety, and trail orientation, stock confinement facilities including hitching rails and regular and electric drift fences, communication systems, and temporary field crew camps and work sites which may include toilets and temporary food storage lockers and other secure storage.

	Alternative A: Primitive Tools	**Alternative B: Selective Mix of Tools**	**Alternative C: Modern Tools**
Use of Motorized Equipment	**Allowable Motorized Equipment**		
	No motorized equipment used.	Motorized equipment limited to chainsaws, rock drills, generators, computers, and other hand-held motorized tools such as drills. Use of motorized tools limited to between 8:30 am and 4:30 pm. When operating motorized equipment, reasonable efforts will be made to limit disturbance of nearby wilderness users.	Work is accomplished with motorized equipment whenever that method is deemed most efficient and convenient. Motorized equipment includes, but is not limited to, bobcats, motorized wheelbarrows, chainsaws, rock drills, generators, computers, and other hand-held motorized tools such as drills.
	Analysis		
	Work required to provide barriers is accomplished with severely impaired efficiency. No motorized tools are used except in emergencies. Wilderness character is preserved, but barriers deteriorate or are foregone and minimum requirements are not met.	Work required to provide barriers is accomplished with moderate efficiency. Presence of motorized tools is limited to smaller machines and to working hours only. Much work that could most efficiently be accomplished by modern tools is instead done with nonmotorized tools. Wilderness character is essentially preserved, necessary barriers are provided and minimum requirements are met.	Work required to provide barriers is accomplished with maximum efficiency. Motorized tools are commonly employed for efficiency and convenience without restriction to working hours. Necessary barriers are provided and minimum requirements are met, but wilderness character is significantly impaired.
Landing of Aircraft	**Allowable Landing of Aircraft**		

	No support of barrier work by helicopter. Field crews, supplies, and materials that cannot be transported by ground will not be transported.	Limited support of barrier work by helicopter. Field crews, supplies, and materials transported by ground except when infeasible due to trail conditions, weather conditions, or unavailability of stock or when moving large, fragile, or time-sensitive items that cannot be practically transported otherwise.	Substantial support of barrier work by helicopter. Field crews, supplies, and materials transported by helicopter whenever that mode is deemed most efficient or convenient.
	Analysis		
	Crew access and supply is accomplished only with severely impaired efficiency. Large, fragile, and time-sensitive items cannot be delivered or removed from sites. No helicopters touch down except in emergencies. Number of stock required on trails to support field crew camps significantly increases over Alternative C with resultant impacts. Field crew camps are not adequately supplied. Wilderness character is preserved, but barriers deteriorate and minimum requirements are not met.	Crew access and supply is accomplished with moderate efficiency. Helicopters have a limited presence, limited to transporting large, fragile, and or time-sensitive items that cannot be practically transported otherwise. Much transport that could most efficiently be accomplished by helicopter is instead done with stock or backpack. Number of stock required on trails to support field crew camps slightly increases over Alternative C with resultant impacts. Field crew camps are adequately supplied. Wilderness character is essentially preserved, necessary barriers are provided and minimum requirements are met.	Crew access and supply is accomplished with maximum efficiency. Helicopters are commonly employed for efficiency and convenience. Number of stock required on trails to support field crew camps is similar to present conditions. Field crew camps are well supplied. Necessary barriers are provided and minimum requirements are met, but wilderness character is significantly impaired.
Structures and Installations	**Allowable Structures and Installations**		
	No barriers or other structures or installations used in support of natural or cultural resources.	Limited temporary structures and installations are used in support of natural and cultural resources and are removed when no longer required. Structures and installations are limited to barriers (electric and regular fences, gates, fireline, dams and diversions for resource protection, etc.) and such support items as survey markers and monitoring devices.	Temporary structures and installations are erected and used in support of natural and cultural resources and are removed when no longer required. Structures and installations include, but are not limited to barriers (electric and regular fences, gates, fireline, dams and diversions for resource protection, etc.) and such things as survey markers and monitoring devices.
	Analysis		

	Barriers are not provided except in emergencies. Existing structures and installations are removed via stock with resultant impacts. Wilderness character is preserved, but barriers deteriorate or are foregone and minimum requirements are not met.	Work required to provide and maintain barriers is accomplished with moderate efficiency. Presence of structures and installations is limited. Wilderness character is essentially preserved, necessary barriers are provided and minimum requirements are met.	Work required to provide barriers is accomplished with maximum efficiency. Structures and installations are commonly employed for efficiency or convenience. Necessary barriers are provided and minimum requirements are met, but wilderness character is significantly impaired.

I - Addendum

Fire and Aviation Management Operations Guide (FAMOG), Sequoia and Kings Canyon National Parks, 2002.