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November 3, 2010

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Re: Sequoia ForestKeeper Comments (# 1) on Giant Sequoia National Monument Plan and Draft Environmental Impact Statement

Dear Ms. Thomas,

On behalf of Sequoia ForestKeeper, we are writing to provide you with comments on the draft environmental impact statement ("DEIS") that the United States Forest Service prepared for the proposed Giant Sequoia National Monument Management Plan ("management plan"). We appreciate the opportunity to participate in this process and request that you provide us with notice, sent to the undersigned, regarding all further action in this matter.

INTRODUCTION

Major Recommendations in this comment letter:

- **Lack of a fire plan to guide the Restoration of the Monument**
- **Lack of an Analysis of Current Conditions caused by Fire Suppression and Logging that must be Restored to Natural**
- **Lack of a stated Purpose to Restore Fire to the Ecosystem**
- **Lack of Science to Support Opening Grove Canopy for Sequoia Regeneration.**
- **DEIS Uses an inaccurate Metric to Assess or Evaluate Flammability to Justify Removal of Large Trees (20-inch Diameter and larger) for Fuel Reduction or any Trees outside of the 200 feet surrounding structures**
- **Lack of Science to: (A) Support Claimed Effectiveness of Fuel Treatments in Arbitrarily Defined Wildland Urban Interface (WUI) Zones to Protect**

Developed Areas or Any Other Areas from Wildfire and to (B) Show that proposed Fuel Treatments will not Impact Pacific Fisher and other Old Forest Dependent Species

- **Lack of Science to Justify some Conclusions Reached in GRT-220 (North et al. 2009) upon which the DEIS Relies**

The following recommendations will be discussed in great detail in subsequent comment letters.

- Cancel Ice, Saddle, White River, and Frog Timber Sales – state that we plan to ask the Chief to cancel theses sales to protect Monument resources and the Pacific fisher
- Fully Analyze the "Citizen's Park Alternative" as a reasonable alternative in the DEIS
- Resurrect the Science Advisory Board (SAB) to deal with major gaps in scientific knowledge
- Keep promise from Mediated Settlement Agreement (MSA) to recommend Wilderness for the Moses IRA in all alternatives
- Carefully craft detailed Tree Cutting and Removal Standards, Hazard Tree Felling Standards, and a clear prohibition on Salvage Logging to comply with Monument Proclamation's limitations on tree removal
- Do NOT incorporate standards & guidelines (S&Gs) from the 2001 Framework that are inconsistent with Monument values, or any S&Gs from the 2004 Framework, and remove reference to the 2007 MIS Amendment
- Climate Change and Carbon Sequestration – significant omissions and flaws
- Vegetation Management Direction for Fire and Fuel Reduction is unjustified
- Wildlife Analysis – completely inadequate
- Completely revise, update, and republish a new DEIS, incorporating suggested changes, for a new DEIS comment period

Unless the DEIS is significantly revised and another alternative is put forward that is more consistent with protection of Monument values and objects that results in a management plan protective of all the objects of interest in the Monument, Sequoia ForestKeeper will ask the Administration and Congress to transfer management of the Giant Sequoia National Monument to the National Park Service which is better able to manage the Monument for its protective purposes.

We believe that the following recommendations are critical science issues regarding the GSNM DEIS that should be reviewed in a new DEIS.

(1) Lack of a fire plan to guide the Restoration of the Monument

There is no fire plan provided in the DEIS! Supervisor Terrell said they were following the National Fire Plan. But the National Fire Plan has no EIS either. What document is guiding the fire management for the Monument?

The Draft Monument Plan is greatly focused on fire, suppressing fire, emulating fire, influencing fire behavior to prevent or lessen fire, the danger of fire, protection of communities from fire, and using fear of fire to justify removing a huge number of trees and biomass. The giant sequoias and its ecosystem have a unique relationship with fire and have evolved to thrive with frequent cool and occasional hot fires.

Almost every restoration goal in the Monument revolves around fire, the lack of it or the fear from forest flammability. YET there is no Fire and Fuels Management Plan for Sequoia National Forest or for the Sequoia National Monument: the myriad of issues and details about how, when, where to burn, suppress, how to coordination with other agencies are not included in the Draft EIS and Plan: Neither the public and likely not the agency knows the particulars of Fire Management for the Monument and certainly it has not gone through nor is it going through the NEPA process with full public input.

The Draft Monument Plan states the Monument will implement the 2009 "Guidance for Implementation of Federal Wildland Fire Management Policy." This Plan mandates, "Every area with burnable vegetation must have an approved Fire Management Plan."

When the Forest Service circulates a new Draft Plan and Draft EIS, those documents must include a Fire Management Plan.

(2) **Lack of an Analysis of Current Conditions caused by Fire Suppression and Logging that must be Restored to Natural**

See Monument Proclamation ("These forests need restoration to counteract the effects of a century of fire suppression and logging.").

The forest service has not provided any basis for the need to remove or change or burn because they have not described the affected environment to any degree of completeness or accuracy to determine the restoration needs of the Monument.

Logging roads ARE part of the century of logging damage that are to be restored. Logging is not just tree removal. Every logging project EA and DN acknowledges this - they approve roads, skid trails, landings, and also discuss watershed damages, soil movement, and other impacts. There also is edge effect and openings, drying, and other impacts. In addition, there are impacts of past logging in the use of poisons, used to protect the plantations, which killed various species including the now extirpated Porcupine – the primary food source for the Pacific fisher. All of these impacts were caused by logging and are damage that should be the focus of restoration.

Without first describing the forest the way it is now, managers cannot determine ANY course of action to restore the Monument following the logging and fire suppression. Failing to describe the current conditions is a NEPA violation.

When the Forest Service circulates a new Draft Plan and Draft EIS, those documents must include, as part of each alternative proposed, a plan to reintroduce the Porcupine.

(3) Lack Purpose to Restore Fire
See Monument Proclamation ("These forests need restoration to counteract the effects of a century of fire suppression and logging.").

The DEIS fails to provide a purpose for management of the Monument that would restore fire to the ecosystem. Instead the DEIS uses "fuel reduction" as the need for management.

Except for the 200 feet immediately surrounding structures for structure protection, we do not support reducing fuels by any means except by fire.

We do not support the goal of preventing fire. Fire is a necessary part of this fire-adapted ecosystem. We what to prevent or slow fires in the 200 feet immediately surrounding structures – NOT throughout the forest which needs some level of fire.

Because there is no description of the affected environment, which is an essential component of any EIS, we do not know if the remaining habitat for old-growth dependent species is the last remaining viable habitat. If it were, then certain areas must be protected from all fire until replacement old-growth habitat is restored or has sufficient characteristics to support the population if fire does destroy the forest areas on which they are now depending.

We oppose the plan to uniformly make the forest less flammable because the forest needs to have ALL conditions... areas that have just been burned all the way to areas that are ready to ignite at the first lightning strike. Those areas that are extremely flammable are also habitat... and because of past logging there are way too few of those areas remaining.

The new DEIS must contain a complete description of the affected environment including a quantitative and qualitative description of all the logging damage that the Proclamation states needs restoration. The new DEIS must say what management will be used to restore each of those damaged areas.

Describing in detail the affected environment would inform the agency and the public what acreages are remaining that should not burn because the result would be NO fisher habitat remaining. A detailed affected environment description would also inform us of areas that should be kept in a high fuel load condition for the same reason for the fisher and marten which need that "messy" forest condition.

The fear of fire myth that the industry and Forest Service have used so long to justify a pseudo emergency reason to remove trees is false. Reducing or preventing fire is not the goal in a fire-adapted forest ecosystem. We want to protect structures in a reasonable way and we want fire allowed, indeed fostered on Monument lands.

Without describing the detailed description of the current conditions caused by past logging, there can be no real disclosure of impacts or a basis for restoration. The DEIS cannot be able to say what restoration is necessary without assessing the actual condition that need to be restored.

(1) Lack of Science to Support Opening Grove Canopy for Sequoia Regeneration
Professor O'Hara stated in the Science Consistency Review Report, "However, I did not see discussion of the urgency of this need given the longevity of the species. **How important is a 100-year age class gap in a species that lives for several thousand years? The uncertainty and urgency of sequoia regeneration may therefore be over-stated.** The regeneration of replacement trees is critical to the sustainability of any ecosystem. Given the longevity of giant sequoia, however, sequoia regeneration is probably less of an urgent need compared to sugar pine decline, fuel loadings, or encroachment of shade tolerant into existing groves."

The GSNM DEIS Vol. 1 page 25 Methods For Sequoia Regeneration says, "There are differences in opinion as to what balance of forest disturbances and what combination of fire and mechanical treatments would help promote and establish giant sequoia regeneration. **There is even some disagreement as to whether openings in the canopy are necessary.** Fires could be allowed to burn hot enough to create openings if relatively high mortality is acceptable. Regeneration plans should include planting and natural seeding.
A variety of scientifically based treatment methods is necessary to determine the most successful means of regenerating sequoias. Active on-site monitoring and research, in close cooperation with other agencies and the public, should be reflected in management of the Monument."

The Science Consistency Review pages II-4 and 5 says, "Other topics in the matrix: Giant sequoia grove and mixed-conifer ecology is briefly but accurately presented. Giant sequoia regeneration is accurately summarized and well grounded in field trials and personal observation. **The summary is appropriately careful to suggest that shady, mesic conditions are needed for establishment but than as sequoias move to the sapling and pole size height growth will become more dependent on the amount of direct light.** There are two nice studies suggesting optimal light environments and gap size for giant sequoia (York et al. 2003, 2008) that might be useful to discuss and cite. The summary also suggests what may be the only viable regeneration strategy for sequoia in warming, drying climate conditions—strategic planting in wet, cool years. A concern with planting versus using natural regeneration, which is not addressed, is spacing. Most studies (Bonnicksen and Stone 1982, Stephenson 1999) suggest large sequoias grow in groups with openings between which may be important for regenerating sequoias as well as providing habitat and microclimate variability. If planting is to be used in the groves, grouping planted seedlings may be more analogous to historic/natural regeneration patterns."

The GSNM DEIS Vol. 1 page 30 says, "**Alternative F** is the Preferred Alternative. It would protect the Objects of Interest and manage Monument resources to promote resiliency, adaptability to climate change, and heterogeneity across ecosystems. **This alternative responds to the issues of tree removal, fuels management/community**

protection, fire affecting adjacent Tribal lands, and methods for giant sequoia regeneration. It is similar to Alternative B, except in vegetation management. Alternative F contains no upper diameter limits for tree cutting and removal when clearly need for ecological restoration and maintenance or public safety, except for giant sequoias. This would allow more flexibility in treatment methods for forest health and ecological restoration."

The GSNM DEIS Vol. 1 page 132 says, "Many groves currently have small sequoia trees scattered in small openings or other disturbed areas that may be 35 to 100 years old. The lack of recent disturbances over the last decade or more which exposes mineral soils and allows light to reach the ground, has resulted in many groves lacking natural sequoia regeneration less than twenty years old." And "Giant sequoia seedlings and saplings may be abundant in occasional openings, but are rare under mature canopies."

It is our belief that the Forest Service has not surveyed (at the same location and time) for seedlings and saplings (up to 18-inch diameter) and for the actual conditions of canopy cover under which the seedlings and saplings are observed in sequoia groves.

However, SFK's eleven interns documenting the observed conditions in the groves (2007 through 2009) have consistently observed more or equal amounts of sequoia seedlings and pole-size saplings up to 18 inch diameter in closed canopy grove areas than in open canopy areas. See the attached (Exhibits A and B) two graphs from SFK's interns' reports.

These documented observations are of the actual conditions under which seedlings and sapling sequoias up to 18 inches in diameter are found in the groves, which leads us to believe that there is no urgency to open canopy cover in groves for sequoia regeneration, since there are more or an equal number of sequoia seedlings and saplings found under closed canopy than are found under open canopy.

(2) DEIS Uses an inaccurate Metric to Assess or Evaluate Flammability to Justify Removal of Large Trees (20-inch Diameter and larger) for Fuel Reduction or any Trees outside of the 200 feet surrounding structures

Except for the 200 feet immediately surrounding structures for structure protection, we do not support reducing fuels by any means except by fire.

However, we believe that even the metric of "flame length" selected by the Forest Service is invalid as a justification for the Forest Service's contrived and inappropriate fuel reduction purpose or need or goal to log.

The GSNM DEIS Vol. 1 says, "**Fire and Fuels**
Desired Conditions
Fire occurs in its characteristic pattern and resumes its ecological role. Frequent fire maintains lower, manageable levels of flammable materials, especially in the surface and understory layers. There is a low risk for uncharacteristic large,

catastrophic fires, and a highly diverse vegetation mosaic of age classes, tree sizes, and species composition. The objects of interest are protected; sustainable environmental, social, and economic benefits (such as those associated with tourism) are maintained, and the carbon sequestered in large trees is stabilized."

The GSNM DEIS Vol. 1 says, "Glossary of Terms
Hazard Reduction
Planned treatment or manipulation of naturally growing **vegetation or any other flammable material** for the purpose of reducing the rate of spread and the output of heat energy from any wildland fire occurring in the treated area."

"Mechanical Treatments
Includes those treatments conducted with heavy equipment such as piling or rearranging fuels for later burning, moving trees that have been thinned to a collection area, chopping or **masticating fuels to change their flammability**, or moving fuels away from trees or other special features to reduce the risk of damage from fire. **Mechanical fuel treatments are commonly followed by prescribed fire to burn the fuel that has been piled or rearranged. Use of a chainsaw, in and of itself is not considered mechanical treatment.**"

"Wildland Urban Interface (WUI)
An area where human habitation is mixed with areas of flammable wildland vegetation. It extends out from the edge of developed private land into federal, private, and state jurisdictions. The WUI is comprised of two zones: the defense zone and the threat zone. This layer is a land management allocation under the Sierra Nevada Forest Plan Amendment Record of Decision and receives a management prescription code (Sierra Nevada Forest Plan Amendment - Final SEIS, 2004)."

The GSNM DEIS Vol. 2 Current Management Guidance page 5 says, "**The Desired condition for fuels in the Monument is to establish and maintain lower, manageable levels of flammable materials, especially at the surface and understory layers using frequent fire return intervals**. Safer, manageable fuels are defined as those that pose low risk for large, catastrophic fires and include a highly diverse vegetation mosaic of age classes, tree sizes, and species composition. This Desired condition will also contribute to protecting the Objects of Interest and will help maintain sustainable environmental, social, and economic benefits (such as those associated with tourism)."

The GSNM DEIS Vol. 1 page 26 says, "Comments indicated that many scientific questions remain to be addressed, in particular regarding methods for giant sequoia regeneration. . . "

The GSNM DEIS Vol. 1 pages 413-414 say, "Some of the major differences between the November model run (#8) and the current estimates from this adjusted analysis are in biomass volume, cost, and value projections. The rule set for model run #8 was to estimate all woody biomass regardless of the probable excess per acre. This means that many acres of proposed treatments will not provide adequate wood products to support the fixed costs associated with performing the operations. This adjusted analysis requires a certain minimum biomass ranging from 1 to 9 CCF/acre depending on the prescription and restrictions for each alternative. There is also a major assumption for alternative F in this current analysis that the diameter limit of 30 inches applies to significantly more acres than the 8-inch diameter limit. In any event, the 8-inch limit should not be applied in Alternative F over more acres than it is in alternative B. Since fewer treatments would be limited to an 8-inch diameter, there would be more acres in a category that can be feasibly treated using a wood product sale offset. Treating stands for ecological restoration, including vegetation diversity and long term forest health, may require removing some trees that are larger than 20 inches in diameter. Removing similar biomass per acre for a 20-inch or 30-inch diameter limit may or may not affect the cost and value of the sale. Alternative F, however, may result in a larger volume of woody biomass removed in order to meet ecological objectives. This would likely increase the value of the offset resulting in a lower cost per acre to treat vegetation and fuels."

The GSNM DEIS Vol.1 page 467 says,
"**Alternatives A, B, C, and D-** Under these alternatives, trees large enough to be potential nest trees (>30 inches dbh) would not be removed for fuels reduction or ecological restoration. Trees this size would only be removed if they posed a safety hazard.
Alternative E- In this alternative there would be no diameter limits on trees removed for fuels reduction or ecological restoration except inside WUI defense zones. Although unlikely, potential nest trees could be removed. Inside the defense zones, the diameter limit for tree cutting would be 30 inches dbh, except for safety hazards.
Alternative F- In this alternative there would be no diameter limits on trees removed for fuels reduction, ecological restoration or safety hazards. Although unlikely, potential nest trees could be removed."

While we agree that logging has altered the structure of the public land forests, SFK doesn't unilaterally oppose some tree removal (see the discussion below).

Just because Martinson and Omi and Storm and Fuel found that "thinning of trees under 8 to 10 inches in diameter reduced potential for severe fire," doesn't mean that the Forest Service should remove all the trees up to 8 to 10 inches in diameter throughout the forest.

If you eliminate all the kindergartners, you will soon discover that there are no sixth graders.

Just drive between Mammoth and Lake Tahoe and look at the result of treatments that removed all the trees smaller than 16 inches in diameter. There are large trees and no medium or small trees available to replace the larger trees when the large trees die.

To be credible, the Forest Service must first 'research the impact on fire severity' of removing trees 3 to 4, 4 to 5, 5 to 6, 6 to 7, 7 to 8, and 8 to 9 inches in diameter in order to determine which has the least impact on the environment. Otherwise, it is another case of 'selective science' used to justify logging.

The Forest Service's chief fire specialist, Denny Truesdale, stated in an August 10, 2000 interview on the C-SPAN program, ‘Washington Journal,’ that the material that needs to be reduced to prevent severe fires is undergrowth less than 3 or 4 inches in diameter--not mature trees.

Ornithologist, Jared (Jerry) Verner Ph.D. and author of the SNEP technical report on the California Spotted owl, stated, at the University of California, Davis campus, "Old-Forests" Workshop on "Sierra Nevada Framework for Conservation and Collaboration", August 24, 1999, *“Songbirds require relatively large, dense stands. As foliage volume increases, the number of (bird) species increases. As tree crown volume increases, the number of (bird) species increases.”*

Also, when asked what size ladder fuel trees the habitat could afford to have removed by a logging fuels treatment, Ornithologist, Jared (Jerry) Verner, Ph.D., said, “Only take 6 inch diameter (dbh) trees or less.” (Personal conversation)

Perhaps 80 percent of the nesting Southwest Willow Flycatchers in the Kern River Preserve nest in trees larger than 6 inch diameter. (Personal conversation with Southwest Willow Flycatcher expert, Mary Whitfield, December 8, 2009)

The joint U. S. Department of Commerce and U. S. Department of Agriculture document, <u>FIRE WEATHER</u>, is a 229 page detailed, scientific explanation, which describes **the closed canopy forest** as one which **provides a variety of benefits that decrease the risk of forest fires** and states that **all features of the environment that affect heating and cooling are <u>significant</u>.**

The forest canopy of dense timber stands **shades the ground and the forest fuels from elevated temperatures from solar radiation**. The forest canopy **radiates out the heat** accumulated from solar radiation. The forest canopy **provides moisture by transpiration through the leaves** to the air and forest fuels, which decreases the possibility of forest fires. **Transpiration from an area of dense vegetation can contribute up to eight times as much moisture to the atmosphere as can an equal area of bare ground**. The forest canopy **slows down wind** movement and fire progress, due to its large friction area. A forest with a dense understory **is an effective barrier to downslope winds**.

The two most important weather, or weather-related, elements affecting wildland fire behavior are wind and fuel moisture. Wind affects wildfire in many ways. It carries away moisture-laden air and hastens the drying of forest fuels. **Logs under a forest canopy remain more moist (approximately 25% more moist) through the season than those exposed to the sun and wind.** The flow beneath a dense canopy is affected only slightly by thermal turbulence, except where holes let the sun strike bare ground or litter on the forest floor, causing local heating. Convective winds have their origin in local temperature differences. The nature and strength of convective winds vary with many other factors. Since they are temperature-dependent**, all features of the environment**

that affect heating and cooling are significant. Even small openings in a moderate to dense timber stand may become warm air pockets during the day. These openings often act as natural chimneys and may accelerate the rate of burning of surface fires. Temperature of forest fuels, and of the air around and above them, is one of the key factors in determining how wildland fires start and spread.

Logging and logging roads open the forest canopy and **increase the temperature** of the air, the ground and the forest fuels, which accelerate the rate of burning of surface fires. **Logging and logging roads** open the forest canopy and **lower humidity** of forest fuels, which **increases the flammability of forest fuels** and critically influences the behavior of wildland fires. **Logging and logging roads open the forest canopy and may cause rapid and intense fire spread**.

(FIRE WEATHER . . . A Guide For Application Of Meteorological Information To Forest Fire Control Operations, by Mark J. Schroeder, Weather Bureau, Environmental Sciences Administration, U.S. Commerce Department and Charles C. Buck, Forest Service, U.S. Department of Agriculture
U.S. Government Printing Office : 0-244 :923, first published in May 1970. Reviewed and approved for reprinting August 1977, Stock No. 001-000-0193-0 / Catalog No. A 1.76:360)
(http://firemodels.fire.org/downloads/behaveplus/publications/FireWeather/pms_425_Fire_Wx_all.pdf) (16.28 MB) (or by the chapter at http://firemodels.fire.org/content/view/34/34/#Fire%20weather)

In summary **logging and logging roads** change the fire prevention characteristics of the multi-layered closed canopy forest and **increase the chance of wildland fire**.

The standing trees provide a variety of ecological and natural fire-suppression benefits, including cooling shade, wind block, and habitat.

Logging removes trees and their canopy cover, causes brush to grow where the trees once stood, and causes the surface winds to increase in the forest, which increase the fire hazard and the fire danger.

Physics tells us that a flame requires three things – oxygen, heat, and surface area of the fuel.

"Different kinds of fires burn at different rates—one fire may slowly smolder, while another may quickly use up its fuel. The rate at which a fire burns depends on the composition of the fuel, the surface area of the fuel, and the amount of oxygen that is available. The burning rate of the same fuel, however, can also vary depending on how much of the fuel's surface is exposed to the air. **As the exposed surface of a fuel increases in comparison to its volume, the burning rate of the fuel increases as well**. **When the fuel's gases have more surface area from which to escape, they can come into contact with more air. The increased exposure to air increases the amount of oxygen available for combustion**. **For example, people often use small twigs and**

pieces of wood called kindling to start a campfire. Kindling has a large amount of surface area compared to its volume. Its relatively large surface area to volume ratio also means that kindling heats and ignites more easily than thicker pieces of wood. Once ignited, kindling burns very quickly." (See ENCARTA – Fire http://encarta.msn.com/text_761563809___13/Fire.html)

It is hard to ignite a large tree trunk, which is why we start a camp fire with kindling before we add the large pieces of wood to the fire.

The standing trees TRUNKS present the least amount of available fuel surface area for a flame, while bushes and small diameter trees up to 3 and 4 inches in diameter provide the greatest surface area for fire ignition.

Removing the bushes and small diameter trees would decrease the surface area that is exposed to heat and air, which decreases the chance of ignition.

SFK promotes fuel treatments within 200-300 feet surrounding structures to reduce fire severity and protect communities. Removing any trees beyond 200-300 feet from structures would produce more landscape disturbance than would fire. Because trees up to 3 and 4 inch diameter have most of their branches near the ground, there is justification for removing these trees in the 200-300 feet immediately surrounding structures, and possibly in a minority of selected places in the general forest. A sufficient number of small diameter trees need to remain in the general forest for habitat and replacements.

Removing trees larger than 6 inch dbh would impact many species, including songbirds, and would be more harmful to the ecosystem than removing bushes and smaller trees. Judiciously placed fire in the general forest is the most protective and least costly way to restore forests. Fire, judiciously placed, rather than biomass removal should be the method for managing conifer forests.

The following three citations to science and the attached research on "The importance of Active Surface Area in the Carbon-Oxygen Reaction" (http://www.ems.psu.edu/~radovic/PLW/1963_67_2030_Laine_JPhysChem.pdf) support the contention that "surface area" rather than flame length is a proper metric for fuel reduction/flammability.

Ratios of Surface Area to Volume For Common Fine Fuels

Author: Brown, James K.[1]
Source: Forest Science, Volume 16, Number 1, 1 March 1970 , pp. 101-105(5)
Publisher: Society of American Foresters
http://www.ingentaconnect.com/content/saf/fs/1970/00000016/00000001/art00020

Abstract:

The ratio of surface area to volume (σ), an indicator of fuel flammability, was determined for needles of eight conifer species, five grasses, leaves of two hardwood species, and a beard lichen. Surface area and volume of needles, grasses, and lichens were estimated, using measurements of perimeter, cross-sectional area, and length; similar estimates for hardwood leaves were made, using blueprint outlines and thickness. Calculations of σ from these estimates gave values ranging from 45 cm^2/cm^3 to 632 cm^2/cm^3. Shape factors, relating measured cross-sectional perimeters to circumferences calculated from measured cross-sectional areas as circles, ranged from 1.1 to 4.3. Minor errors in σ are traceable to several sources in the method, but accuracy is hard to assess because true surface is difficult to define. Forest Sci. 16:101-105.

Keywords: Fuel flammability; fuel size

Document Type: Journal article

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Properties of wood for combustion analysis
http://www.sciencedirect.com/science?_ob=ArticleURL&_udi=B6V24-48XKN8B-9&_user=10&_coverDate=12%2F31%2F1991&_rdoc=1&_fmt=high&_orig=search&_origin=search&_sort=d&_docanchor=&view=c&_searchStrId=1548031724&_rerunOrigin=scholar.google&_acct=C000050221&_version=1&_urlVersion=0&_userid=10&md5=a65876e80ddf11f943f92326c9fcdbb0&searchtype=a

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Abstract

A systematic compilation of 21 different property values of wood and bark fuel was made to facilitate the engineering analysis and **modeling of combustion systems**. Physical property values vary greatly and properties such as density, porosity, and internal surface area are related to wood species whereas bulk density, particle size, and shape distribution are related to fuel preparation methods. Density of dry wood and bark varies from 300 to 550 kg m^{-3}; bulk density of prepared wood fuel varies from about 160 to 230 kg m^{-3}. Thermal property values such as specific heat, thermal conductivity, and emissivity vary with moisture content, temperature, and degree of thermal degradation by one order of magnitude. The carbon content of wood varies from about 47 to 53% due to varying lignin and extractives content. Mineral content of wood is less than 1%, but it can

be over 10 times that value in bark. The composition of mineral matter can vary between and within each tree. Properties that need further investigation are the temperature dependency of thermal conductivity and the thermal emissivity of char-ash. How mineral matter is transformed into various sizes of particulates is not well understood. **Physical properties for analysis of combustion systems include density, bulk density, particle size, internal and external surface area per unit volume, porosity, and color.**

Author Keywords: Wood; combustion; fuel properties; modeling

Combustion of wood particles—a particle model for eulerian calculations
http://www.sciencedirect.com/science?_ob=ArticleURL&_udi=B6V2B-45JP9NH-3&_user=10&_coverDate=04%2F30%2F2002&_rdoc=1&_fmt=high&_orig=search&_origin=search&_sort=d&_docanchor=&view=c&_searchStrId=1548077103&_rerunOrigin=scholar.google&_acct=C000050221&_version=1&_urlVersion=0&_userid=10&md5=2ec71c51274ee649eb7b7a8c94a92256&searchtype=a

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Abstract

A simplified model for the combustion of solid fuel particles is derived, relevant for particle sizes and shapes used in fluidized and fixed-bed combustors and gasifiers. The model operates with a small number of variables and treats the most essential features of the conversion of solid fuel particles, such as temperature gradients inside the particle, the release of volatiles, shrinkage, and swelling. Typical shapes (spheres, finite cylinders, and parallelepipeds) are also considered. The model treats the particle in one dimension, and to describe the conversion inside a fuel particle the model only needs the transfer of heat and mass to an element of its external surface. **When modeling a large combustion system, it is a great advantage that the conversion is related to the external surface, because the model does not have to be limited to just a single particle. In fact, it can handle the conversion of a solid phase in a computational cell, where the conversion is related to surface area per unit volume, instead of the surface area of a single particle.** The model divides the particle into four layers: moist (virgin) wood, dry wood, char residue, and ash. The development of these layers is computed as function of time. The model shows satisfactory agreement with measurements performed on more than 60 samples of particles of different sizes, wood species, and moisture contents. Comparison with the experiments shows that the simplifications made do not significantly influence the overall accuracy of the model. The model also demonstrates the great influence of shrinkage on the times of devolatilization and char combustion.

"The Standard and Guidelines anticipate the removal of dominant and co-dominant trees through mechanical treatment to supposedly meet fuel objectives. *See* Management Plan at pg. 133 ("Canopy cover reductions may be needed to meet fuels objectives, but do not exceed a 20 percent reduction in the dominant and co-dominate trees."). However, the linkage in the standards and guidelines between large trees and fire hazard reduction is not based on science. If Forested Stands of Large Trees with Moderate to Dense Canopy Cover can achieve the same outcome (6-ft flame length) by thinning trees up to 12 inches in diameter, why must the agency log larger trees in The General Monument and WUI. Without information on the spatially specific assessment of fuels, the reader must question why this treatment is justified. This is especially true because flame lengths are predicted using surface fuels models, but no surface fuel model includes in its inventory material larger than three inches in diameter. *See* Rice Decl. at 8

The Forest Service should focus treatment on surface fuel rather than crown fuels. Agee and Skinner (2005) present the priorities of fuel treatments:

> First, surface fire behavior must be controlled, so that treatments should either reduce such potential behavior or at least not contribute to increased fire behavior. Because such treatments often open the understory so that midflame windspeed will increase and fine fuel moisture will decline (van Wagtendonk 1996, Weatherspoon 1996), maintaining no change in surface fire behavior generally requires a reduction in surface fuels or significant greenup of grasses and low shrubs (Agee et al., 2002). Second, a reduction in torching potential requires a comparison of potential surface fire flame length with a critical flame length, which is a function of canopy base height. At best, a reduction in potential surface fire behavior plus an increase in canopy base height will minimize torching potential. Third, reduction in potential active crown fire spread can be accomplished by a reduction in canopy bulk density. Where thinning is followed by sufficient treatment of surface fuels, the overall reduction in expected fire behavior and fire severity usually outweigh the changes in fire weather factors such as wind speed and fuel moisture (Weatherspoon, 1996).

Rice Decl. at 9.

Once a large tree is felled, it has several components with different levels of flammability. Just like fine fuels, limbs and tops of trees are more flammable than the larger tree trunk. This has to do with the physics of burning. Dr. Hanson explains:

> The Forest Service's own science clearly concludes that large logs are essentially irrelevant to fire behavior. Due to the extremely low mass (or surface area) to volume ratio in logs over about 8 inches in diameter, such logs make no significant contribution to fire intensity, according to the Forest Service's own research (Brown et al. 2003 [Fig. 3]). Specifically, these Forest Service scientists concluded that the curves representing fire hazard "flatten" at a diameter of about 5 inches or 8 inches, depending

> upon how it is measured (Brown et al. (2003), p. 8 and Figure 3). In other words, the relevance to fire hazard becomes insignificant when pieces of coarse woody debris are over 5-8 inches in diameter. This is consistent with another seminal Forest Service study, Rothermel (1991), which found that pieces of coarse woody debris over 6 inches in diameter did not contribute to a significant increase in fire intensity even where a large amount (30 tons per acre) of such material was added.
>
> The reason that large logs do not significantly affect fire hazard is that they have an extremely low ratio of surface area to mass, while small woody material (0-3 inches, and 3-6 inches, in diameter) has a very high ratio of surface area to mass (Brown et al. 2003, Fig. 3). A low ratio of surface area to mass means that there is relatively little fuel available for combustion, while a high ratio means the opposite. To illustrate this point, consider a solid block of wood one cubic foot in size. This cubic foot of wood has a surface area of 6 square feet and, for fir and pine species, it would weigh approximately 21 pounds—equating to a surface area to mass ratio of 0.29 square feet per pound. Now imagine that that same cubic foot of wood is an equal mass (21 pounds, or, conservatively, 2000 sheets of 8.5" x 11" paper) of writing paper, and that each page has been crumpled into loose balls and made into a pile. Each of the 2000 sheets of paper has a surface area of 1.3 square feet (front and back side included), for a total of about 2600 square feet of surface area. Thus, the surface area to mass ratio of the 21 pounds of crumpled paper is 124 square feet per pound—more than 400 times the surface area to mass ratio of the 21-pound block of wood. Anyone who has ever built a fire in a woodstove, or in a campground fire pit, will understand intuitively the significance of this. If you put a match to the solid 21-pound block of wood, the match will likely burn out long before you achieve ignition, as will the next match, and the next; whereas the 21 pounds of crumpled paper will become a very intense fire within seconds of coming in contact with the match flame.

Dr. Hanson Declaration, ¶¶ 17-18 (Exhibit C). For these reasons, the Forest Service can easily remove any parts of the tree that would potentially cause a fire hazard and still keep the large tree in the forest near high public use areas and in areas where they may want to do managed fire by treating the smaller diameter material. We have no problem with removing this smaller diameter material to avert hazards.

For these reasons, tree boles over 10-12 inches in diameter that the agency needs to fell for ecological restoration (or to avert a public safety hazard) would not create any significant fire hazard. But they would clearly benefit wildlife, soils, and ecosystem processes.

Moreover, operability for prescribed fire management should not be an issue when leaving these large tree boles as down logs. In fact, the 2001 Framework standards take large down logs into consideration if managed fire is considered. It states: "design prescribed burn prescriptions and techniques to minimize the loss of . . . large down material." 2001 Framework ROD, Appendix A, p. 28.

Finally, if other areas of the Monument should need these tree boles to increase large down woody material, they should be moved to those areas to enhance ecological functions as part of ecological restoration. In such a case, their removal from the Monument cannot be justified because it would not be "clearly needed for ecological restoration and maintenance or public safety." "

(3) Lack of Science to (A) support Claimed Effectiveness of Fuel Treatments in Arbitrarily Defined Wildland Urban Interface (WUI) Zones to Protect Developed Areas or Any Other Areas from Wildfire

The GSNM DEIS uses 'selective science' when it ignores USDA Forest Service research, the recommendations of the California Department of Forestry and Fire Protection (CDF), and the United States Government Accountability Office (GAO).

The GSNM DEIS Vol. 1 says, "Glossary of Terms
"Wildland Urban Interface (WUI)
An area where human habitation is mixed with areas of flammable wildland vegetation. **It extends out from the edge of developed private land into federal, private, and state jurisdictions. The WUI is comprised of two zones: the defense zone and the threat zone.** This layer is a land management allocation under the Sierra Nevada Forest Plan Amendment Record of Decision and receives a management prescription code (Sierra Nevada Forest Plan Amendment - Final SEIS, 2004)."

GSNM DEIS Vol.1 page 56 says "**Alternative C proposes a WUI defense zone that extends approximately 300 feet from the boundary of the private land within the Monument.** Developed recreation sites and administrative sites would also be managed with a 300 foot boundary for fuels treatment."

GSNM DEIS Vol.1 page 57 regarding Alternative D says "This alternative proposes a WUI defense zone that extends approximately 200 feet from structures **on National Forest System land or from the boundary with private land**, unless topographic circumstances dictate otherwise."

GSNM DEIS Vol.1 page 79 says "**The first priority for fuel reduction treatments in the TFETA would be those areas within 1/4 mile of the reservation boundary or in the Long Canyon area**."

GSNM DEIS Vol.1 pages 431-432 say "The alternatives can be contrasted based on the amount of area included in the WUI zones. **All alternatives provide a buffer between developed areas and wildlands**. **Alternative B provides generally a 1 1/2 mile WUI defense** (45,342 acres) **and threat zone** (145,522 acres) **reducing the threat of severe**

wildfire to human communities as compared to only a 300 ft (8,304 acres) **defense zone in Alternative C and a 200 ft** (4,603 acres) **defense zone in Alternative D.** The size of the WUI in Alternatives A, B, E and F is represented by approximately 58 percent of the Monument as compared to 3 percent in Alternative C and 1 percent in Alternative D.
Fuel reduction activities in the WUI zone are designed to protect human communities from wildland fires, as well as minimize the spread of fires that might originate in urban areas. The management objective in the WUI zone is to enhance fire suppression capabilities by modifying fire behavior inside the zone and providing a safe and effective area for possible future fire suppression activities (2001 SNFPA).
The addition of the Tribal Fuels Emphasis Treatment Area (TFETA) would reduce the threat of severe wildfire to the Tule River Reservation in this alternative more than in Alternatives A, D, and E.
Alternative B proposes more areas for potential fuel reduction activities in the Monument and in areas of moderate and high fire susceptibility than Alternatives A, C, D, and E. Fire susceptibility is an indicator of the possibility of large severe fires. Areas of high and moderate fire susceptibility have higher potential to result in a large, severe fire under high fire danger weather conditions than areas of low susceptibility."

The GSNM DEIS Management Plan under "Fire and Fuels" page 27 says, "**Fuel reduction treatments in the wildland urban interface (WUI) zones are focused on developed areas within these zones.** The need to maintain fuel conditions that support fires characteristic of the ecosystems is emphasized, and allows for a natural range of fire **to lower fire intensity and protect human life and property on lands in and adjacent to the Monument.**"

A visual example of how the GSNM DEIS proposes to implement the so-called "Defense Zone" fuel treatments around communities was provided by the Forest Service and presented to the public in a slide presentation for the first Draft Management Plan, which was subsequently found to be illegal. Exhibit D is a map graphic from the presentation to the public (prior to the Management Plan being ruled illegal) showing how the so-called "Defense Zone" would be placed around the boundary of the community of Hume Lake rather than immediately adjacent to and surrounding the structures in the community.

The GSNM DEIS ignores the fire science of Jack Cohen (Jack D. Cohen, Research Physical Scientist, U.S. Forest Service Fire Sciences Laboratory, PO Box 8089, Missoula, MT 59807 406-329-4821 (fax) 406-329-4825 jcohen@fs.fed.us), which has not even been mentioned, even though the agency has been repeatedly asked by the public to consider the science of Jack Cohen.

In a personal communication dated March 17, 2003, Jack Cohen said,

"You are correct in stating that my research indicates that modifying the home ignition zone (the home and its immediate surroundings within 200 ft) can perform the necessary and sufficient changes that effectively reduce home ignitability during extreme wildfire conditions. My research does address firebrands and spot ignitions. Putting a fuel break around communities without modifying the community will not be sufficient to significantly reduce the home ignition potential during extreme conditions. **We know that fuel breaks don't stop spotting--that is why I suggest making the community the fuel break. This produces far less landscape disturbance for the purpose of community protection and reduces the community threat from any kind of wildland fire**. That should provide increased opportunities for prescribed burning." (Exhibit E 100316-8.COHEN)

The Map Graphic shows that "Defense Zone" fuel treatments would be placed hundreds of feet beyond the structures except in the cases of two structures where the fuels treatment begins within close proximity to the structures, but only extends for 25 percent of the radial area around these two structures. The Map Graphic indicates that most of the "Defense Zone" fuels reduction would be beyond 200 feet immediately surrounding the structures and the Threat Zone fuel reduction would be 1-1/4-miles or more beyond that.

The proposed treatments also fail to comply with the latest science on community protection endorsed by The California Department of Forestry & Fire Protection (CDF) and the United States Government Accountability Office (GAO). The CDF and GAO reports are cited below.

The California Department of Forestry & Fire Protection (CDF) agrees with the fire science of Jack Cohen when it recommends fuel treatments within 200 feet of structures. The CDF report, "Forestland Steward," Spring 2002, page 5 "FAQs about defensible space" by the available from Forest Stewardship Program P.O. Box 944246 Sacramento, CA 94244-2460, states the following:

"*Defensible space is the area between a house and an oncoming wildfire where the vegetation has been modified to reduce the wildfire threat and to provide an opportunity for firefighters to effectively defend the house. Sometimes a defensible space is simply the homeowner¹s maintained backyard.*" The CDF states the following about where and how much defensible space is located to protect structures in the community adjacent to wildlands.

Recommended defensible space by slope/vegetation type

0–20% slope 21–40% slope 40%+ slope

flat to gently sloping moderately steep very steep

grass 30ft 100ft 100ft

shrubs 100ft 200ft 200ft

trees 30ft 100ft 200ft

(California Dept. of Forestry & Fire Protection, Forestland Steward, Spring 2002, page 5 "FAQs about defensible space" by the available from Forest Stewardship Program P.O. Box 944246 Sacramento, CA 94244-2460 and found at http://ceres.ca.gov/foreststeward/pdf/newslettr22.pdf).

The United States Government Accountability Office report GAO-05-627T, a testimony before the Subcommittee on Public Lands and Forests, Committee on Energy and Natural Resources, U.S. Senate, titled, "WILDLAND FIRE MANAGEMENT **- Progress and Future Challenges, Protecting Structures, and Improving Communications"** states, "*The two most effective measures for protecting structures from wildland fires are (1) creating and maintaining a buffer **around a structure** by eliminating or reducing trees, shrubs, and other flammable objects **within an area from 30 to 100 feet around the structure** and (2) **using fire-resistant roofs and vents**. Other technologies—such as **fire-resistant building materials**, chemical agents, and geographic information system mapping tools—can help in protecting structures and communities, but they play a secondary role.*" (Highlights of the GAO report GAO-05-627T). The report can be found at http://www.gao.gov/new.items/d05627t.pdf).

The GSNM DEIS and the Sierra Nevada Forest Plan Amendment failed to provide independent, peer-reviewed scientific research to prove that reducing the continuity and density of fuels on National Forest managed lands would protect houses located on private property and failed to show how killing and removing trees beyond the 200 feet immediately surrounding structures would protect the forest (one of the objects in the Monument) and the habitat it provides to the species in the forest (including the Pacific Fisher, American Marten, California Spotted Owl, and Northern Goshawk to name a few).

The GSNM DEIS fails to discuss or rely on the latest science when it fails to specify treating the structures in the community with fire-resistant roofing, vents, and siding and to treat only the 200 feet immediately surrounding the structures. The GSNM DEIS, instead, proposes in the case of most structures to treat beyond the 200 feet immediately adjacent to and surrounding structures; which can cause far more landscape disturbance.

We know of no science to support treating beyond 200 feet from structures for community protection without treating the immediate surroundings of the structures and the structures themselves.

(3) Lack of Science to (B) to show that proposed Fuel Treatments will not Impact Pacific Fisher and other Old Forest Dependent Species

The GSNM DEIS says, "**Fire and Fuels** Desired Conditions **-** Fuel reduction treatments in the wildland urban interface (WUI) zones are focused on developed areas within these zones. The need to maintain fuel conditions that support fires characteristic of the ecosystems is emphasized, and allows for a natural range of fire to lower fire intensity and protect human life and property on lands in and adjacent to the Monument."

The GSNM DEIS Vol. 1 pages 413-414 say, "There is also a major assumption for alternative F in this current analysis that the diameter limit of 30 inches applies to significantly more acres than the 8-inch diameter limit. In any event, the 8-inch limit should not be applied in Alternative F over more acres than it is in alternative B. Treating stands for ecological restoration, including vegetation diversity and long term forest health, may require removing some trees that are larger than 20 inches in diameter. Removing similar biomass per acre for a 20-inch or 30-inch diameter limit may or may not affect the cost and value of the sale. Alternative F, however, may result in a larger volume of woody biomass removed in order to meet ecological objectives. This would likely increase the value of the offset resulting in a lower cost per acre to treat vegetation and fuels."

The GSNM DEIS Vol.1 page 462 says, "**Alternatives A, B, F-** These alternatives would maintain the nine current goshawk PACs and restrict management activities on 2,390 acres of high quality habitat. A limited operating period from February 15 to September 15 for activities within ¼ mile of the nest site would be required for most management activities. Habitat characteristics important to northern goshawks would also be protected in spotted owl PACs (22,651 acres), fisher den site buffers (2,965 acres), marten den site buffers (109 acres), riparian conservation areas, critical aquatic refuges (27,147 acres), old forest emphasis areas (160,607 acres) and the Southern Sierra Fisher Conservation Area (333,542 acres)."

The GSNM DEIS Vol.1 page 467 says,
"**Alternatives A, B, C, and D-** Under these alternatives, trees large enough to be potential nest trees (>30 inches dbh) would not be removed for fuels reduction or ecological restoration. Trees this size would only be removed if they posed a safety hazard.
Alternative F- In this alternative there would be no diameter limits on trees removed for fuels reduction, ecological restoration or safety hazards. Although unlikely, potential nest trees could be removed."

The GSNM DEIS Vol.2 page 146 Proposed Management Direction "Vegetation and Fuel Treatments in General Forests" says, "Design mechanical treatments to remove surface and ladder fuels **up to 20 inches dbh**. Focus treatments on removing suppressed and intermediate conifer trees. Apply treatments to enhance stand heterogeneity. When conducting treatments in dense stands with uniform tree size and spacing, introduce heterogeneity into such stands by creating small (typically less than one acre), irregularly-spaced openings. (Modified 2001 SNFPA ROD Appendix A, p. A-49) (Changed 20% absolute to 30% proportion to be consistent with other guides and to reflect a more realistic and dynamic approach. **If the preexisting cover were 50% an absolute amount of 20% would mean we would retain 30%, but a proportional amount of 30% would mean we would retain 35% cover**.)"

Based on the statements about fuel treatments in Pacific Fisher habitat by Dr. Chad Hanson (see the attached Exhibit F), if Alternative B or F were implemented with tree removal being balanced with offset value (sale value) of the removed trees instead of managing strictly to protect the Fisher and its habitat, the Pacific Fisher habitat would be degraded and management could impact the viability of the Pacific Fisher and other species

(4) Lack of Science to Justify some Conclusions Reached in GRT-220 (North et al. 2009) upon which the DEIS Relies

The GSNM DEIS Vol.1 page 721 cites to "North, M.; Stine, P.; O'Hara, K.; Zielinski, W.; Stephens, S. 2009. An ecosystem management strategy for Sierran mixed-conifer forests. PSW-GTR-220. Albany, CA: U.S. Department of Agriculture, Forest Service, Pacific Southwest Research Station. 49 p."

The GSNM DEIS Vol.1 page 430 says, "**Alternative B includes a 20" diameter tree cutting limit in the WUI defense zone for fuels reduction and fire protection.** This is compared to a 30" diameter tree cutting limit in the WUI defense zone in Alternative A and no diameter limit in Alternative F. Research suggests that for managing fuels, most of the reduction in fire severity is achieved by reducing surface fuels and thinning smaller ladder fuel trees (Agee et al. 2000, Agee and Skinner 2005, Stephens et al. 2009). What is considered a ladder fuel differs from stand to stand, but typically these are trees in the 10 to 16 inch dbh classes (North, 2009). If trees larger than this are thinned, it is important to provide reasons other than for ladder-fuel treatment (North, 2009). In most cases, thinning 20 to 30 inch dbh trees will not affect fire severity (North, 2009). Retaining the largest trees within stands also increased fire resistance (Keeley, 2009). This research indicates that by reducing surface fuels and thinning smaller diameter trees, less than 16 inches, fire severity is reduced and fuels management objectives can be achieved."

PSW-GTR-220 presents many good concepts. However, PSW-GTR-220 fails to consider all the available fire science, makes some un-cited claims, and fails to discuss the gaps in science that remain, which if filled could clarify some remaining questions. Please see the attached file (Exhibit G) of concerns regarding GTR-220.

Thank you for considering these issues of great concern which are discussed in this comment letter. Please keep me and the following organizations and persons, by and for whom this comment letter is written, listed below, on the contact list for all stages of this planning process. Each of the following organizations and persons listed below would also like a copy of all further documents on this planning process. Thank you for your time in this regard.

Respectfully Submitted,

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Attachments:

Exhibit A – Graphic from SFK interns' 2007 report – "What we found sequoia distribution."
Exhibit B – Graphic from SFK interns' 2008 seedling sapling distribution (with statement of 2009 report results).
Exhibit C – Dr. Hanson Declaration
Exhibit D – A map graphic "Defense Zone" around the boundary of Hume Lake rather than immediately adjacent to and surrounding the structures in the community.

Exhibit E – 100316-8.COHEN Personal Communication
Exhibit F – 100927-5.Hanson quotes on Fisher and fuel reduction.
Exhibit G – 100316-5.Comments and Concerns North et al GTR-220