Giant Sequoia National Monument
Grove Prioritization Methodology
As of 7/30/08

The 1990 Mediated Settlement Agreement (MSA, pages 9-10) gives the following direction for the management of groves: *Within this Plan period, the Sequoia National Forest shall begin to inventory and evaluate each Grove for its fuel load build-up. Based on this inventory and evaluation, Groves, or parts of Groves, with risks to catastrophic fire and/or exclusion of new giant sequoia regeneration because of natural fuel load build-up will be identified and prioritized for fuel load reduction treatment*.

The Sequoia National Forest utilized GIS based inventory and ArcInfo software to analyze and evaluate each grove for its fuel load build-up. This analysis also prioritized the groves for fuel load reduction treatment.

GIS "layers" of fire susceptibility, condition class, proximity to a wildland/urban intermix areas, forest health and planted stands were reviewed individually and combined. Fire susceptibility was the only "layer" used to prioritize the groves for fuel load reduction treatment. Rationale for this selection and a more detailed description of fire susceptibility is explained below.

Proximity to wildland/urban intermix areas and planted stands was dropped from further consideration because they are resources to be protected and/or improved. Protection of these resources (along with many others) is a Line Officer's decision to prioritize proposed actions in the groves or portions of groves to be analyzed in accordance with the National Environmental Policy Act (NEPA).

Condition Class and forest health were dropped from further consideration because all of the groves have similar condition class and similar forest health/mortality ratings. This gave no basis to differentiate the groves for priority.

The attached priority tables and maps will be utilized by Line Officers who make the final decision as to what groves, or portions of groves will be analyzed for fuel treatments in NEPA documents. Due to a variety of resource protection needs, potential condition changes, various concerns brought about by the interdisciplinary approach of NEPA, and public involvement, Line Officers may choose to propose to treat a grove or a portion of a grove, with a lower fuels treatment priority ranking.

Fire Susceptibility

Fire susceptibility is a combination of hazard (flame length), risk (fire occurrence) and severity (elevation).

ArcGIS and Flammap software were used to create and combine layers of various landscape values to represent hazard, risk, and severity which were then combined to represent fire susceptibility.

Hazard, Risk and Severity were given equal weight and the mapped polygons were assigned values of 1-3 points (high= 3 points, moderate=2 points, and low=1 point). The combined values were grouped to represent more-or-less equal area of each class of High, Moderate, and Low Fire Susceptibility.

Input	High	Moderate	Low
RISK	3	2	1
HAZARD	3	2	1
SEVERITY	3	2	1

Susceptibility	Combined Values
High	7-9 points
Moderate	5-6 points
Low	3-4 points

The groves sorted by High, Moderate, and Low Fire Susceptibility are shown in Appendix A. The highest priority groves are those with the highest percentage of its acres in the high fire susceptibility category. The groves that have the same priority number, have the same fire susceptibility.

Hazard

Hazard is represented here by flame length values obtained by utilizing Flammap version 3.0 software.

Hazard is broken into 3 levels based on the ability of hand crews (< 4 foot flames) or heavy equipment (< 8 foot flames) to successfully attack unwanted fires.

HAZARD	Flame Length
High	>8 feet
Moderate	4-8 feet
Low	0-4 feet

Flammap simulates fire activity using a landscape file comprised of rasterized data themes imported from GIS. Inputs to the landscape file included fuel model, percent canopy cover, slope and aspect measured in degrees, meters elevation, stand height and crown base height in feet, and crown bulk density in kg/m3x100.

Flammap also uses a fuel moisture file which was created using 90th percentile weather from the Sequoia's Uhl weather station. The weather data was run thru Fire Family Plus software to obtain 90th percentile 1, 10, and 100 hour, herbaceous and woody fuel moisture measurements.

Flammap simulated fire using fixed fuel moistures from the fuel moisture file and with a southwest wind (225 degrees) at 8 miles per hour at 20 feet above the ground.

Scott and Burgan fuel models were used and derived using a crosswalk from vegetation mapping. CalVeg vegetation mapping was done by the R5 USFS Remote Sensing Lab using 2001 satellite imagery and a 2003 update done for the McNally Fire area.

Modifications to fuel models and canopy cover were applied to account for changes in vegetation based on burn severity data for fires from 2001-2006.

Risk

Risk is defined here as the average number of fires per year for a given area called a Fire Occurrence Area.

Fire Occurrence Area values were grouped into 3 classes to show a more-or-less equal distribution of area within each class.

RISK	Fires/1,000 Acres/Year
High	0.2-6.0
Moderate	.05-0.2
Low	0.0-.05

Risk values are the result of an analysis of a reclassified 30-meter grid of Fire Occurrence Areas for the Southern Sierra Geographic Information Cooperative project area. The fire occurrence area is the assessment of the potential for wildland fire occurrences based on historic fire occurrences. These data are stratified into areas with uniform fire occurrence called Fire Occurrence Areas. These data are used to predict and assess the risk of wildland fire.

ArcGIS Spatial Analyst software and 21 years of ignition point location data were used to create an ignition point density grid with 2200 meters as the search radius and an output cell value of 30 meters. The density value represents the number of ignitions per square meter.

The final grid represents the probability of an acre igniting for each acre in any Fire Occurrence Area. This is calculated by dividing the actual number of ignitions in the Fire

Occurrence Area by the time frame for the ignition data expressed in fires per 1,000 acres per year.

The formula used for this calculation is: (IGNITIONS per sq. m. x sq. m. per Acre x 1000)/YEARS of analysis. This gave a result as number of fires per 1000 acres per year.

Severity

For this evaluation, fire severity is defined as a function of elevation. This is based on the historic length of fire season and observed past fire intensities.

Severity	Elevation
High	<6,500 feet
Moderate	6,500-8,000 feet
Low	>8,000 feet

Condition Class

Condition Class is determined by the number of times an area has "missed" fires burning it (calculated using historic data) due to fire suppression or other human actions. This is usually referred as the Fire Return Interval Departure (FRID). In order to the access the FRID for an area, the Historic Fire Return Interval layer was overlaid with Fire History layer for the forest. The forest was then broken into groups of Condition Class of 1, 2 or 3 depending on its FRID as identified below.

Condition Class	FRID	# of Missed Fires
3	Extreme	5-17
3	High	2-4.9
2	Moderate	0-1.9
1	Low	<0

Condition Class 1. For the most part, fire regimes in this Fire Condition Class are within historic ranges. Vegetation composition and structure are intact. Thus, the risk of losing key ecosystem components from the occurrence of fire remains relatively low.

Condition Class 2. Fire regimes on these lands have been moderately altered from their historic return interval. A moderate risk of losing key ecosystem components has been identified on these lands.

Condition Class 3. Fire regimes on these lands have been significantly altered from their historic return interval. The risk of losing key ecosystem components from a fire is high.

Forest Health

Forest Health is assessed on the risk of insect-caused tree mortality from data collected during the 2006 Forest Aerial Detection Survey. The survey collected tree mortality information from 2002-2005.

Tree mortality was grouped into 3 classes.

Mortality	Number of Dead Trees/Acre
High	40-90
Moderate	10-39
Low	1-9

Generally, areas with <1 tree per acre of mortality are considered to have "background" or "normal" levels of mortality and are not usually mapped during the flight.

An area is defined to be at risk if 25% or more tree mortality (beyond the normal level of approximately 0.6% annually) is expected over the next 15 years. This effort developed a statewide insect mortality risk layer based upon rules and statistics developed for the National Forests and expanded to cover all state and private forest land. Rule structures were based primarily upon stand density index and also included, precipitation, percent canopy cover of host species, and host type.

Results

Appendix A shows the result of these data analyzed for each grove using GIS layers. The groves are listed in priority based on the percentage of acres falling into high, medium and low fire susceptibility. Groves with the same percentage of high, medium and low are given the same priority ranking. Using the data for the areas within groves alone does not account for the influence of the surrounding areas, the following other analyses were conducted.

Appendix B is the result of these data analyzed for each sixth order watershed using GIS layers. The watersheds are listed in priority based on the percentage of acres falling into high, medium and low fire susceptibility. This includes areas on non-forest land of which we have limited or no data. Appendix C shows the result of these data calculations for National Forest System lands only in each sixth order watershed using GIS layers. The watersheds are listed in priority based on the percentage of acres falling into high, medium and low fire susceptibility. Appendix D shows the result of these data analyzed for each sixth order watershed listing the groves in each watershed using GIS layers in priority order.

These rankings should be updated as events (fires, treatments, or extensive mortality) result in a significant change to the data used.

Appendix A – Groves in Priority Order of Fire Susceptibility

Priority	GROVE	DISTRICT	HIGH	MOD	LOW	Total	NF ACRES
1	Indian Basin	Hume Lake	99%	1%	0%	100%	448
2	Big Stump	Hume Lake	75%	25%	0%	100%	431
3	Converse	Hume Lake	37%	62%	1%	100%	4,666
4	Mountain Home	W. Divide	34%	66%	0%	100%	1,299
5	Bearskin	Hume Lake	28%	72%	0%	100%	187
6	Belknap	W. Divide	25%	74%	0%	100%	3,083
7	Grant	Hume Lake	22%	78%	0%	100%	292
8	Redwood Mountain	Hume Lake	7%	93%	0%	100%	989
8	Monarch	Hume Lake	7%	93%	0%	100%	54
8	Deer Meadow	Hume Lake	7%	93%	0%	100%	168
9	Dillonwood	W. Divide	7%	85%	9%	100%	366
10	Peyrone	W. Divide	5%	87%	7%	100%	741
11	Agnew	Hume Lake	4%	96%	0%	100%	43
12	Starvation	W. Divide	3%	97%	0%	100%	182
12	Alder Creek	W. Divide	3%	97%	0%	100%	408
12	Silver Creek	W. Divide	3%	97%	0%	100%	108
13	Evans	Hume Lake	3%	95%	2%	100%	4,255
14	Black Mountain	W. Divide	3%	89%	8%	100%	2,585
15	South Peyrone	W. Divide	2%	98%	0%	100%	115
16	Maggie Mountain	W. Divide	2%	89%	9%	100%	64
17	Long Meadow	W. Divide	1%	99%	0%	100%	568
18	Red Hill	W. Divide	1%	99%	0%	100%	602
18	Packsaddle	W. Divide	1%	91%	8%	100%	528
19	Middle Tule	W. Divide	1%	67%	33%	100%	301
20	Abbott Creek	Hume Lake	0%	100%	0%	100%	25
20	Cherry Gap	Hume Lake	0%	100%	0%	100%	170
20	Cunningham	W. Divide	0%	100%	0%	100%	32
20	Deer Creek	W. Divide	0%	100%	0%	100%	144
20	Wishon	W. Divide	0%	100%	0%	100%	171
21	Burro Creek	W. Divide	0%	98%	2%	100%	278
22	Freeman	W. Divide	0%	95%	4%	100%	4,182
23	Powderhorn Tree	W. Divide	0%	90%	10%	100%	5
24	Landslide	Hume Lake	0%	33%	67%	100%	226
25	Upper Tule (Moses)	W. Divide	0%	1%	99%	100%	22
	Total		**16%**	**80%**	**3%**	**100%**	**27,738**

Appendix B – Watersheds in Priority Order of Fire Susceptibility

Priority	Watershed	High	Moderate	Low	Outside Forest & GSNM	Total
1	Lower Middle Fork Tule River	27%	60%	0%	13%	100%
2	Tenmile Creek	26%	65%	7%	2%	100%
3	Dry Meadow Creek	25%	60%	16%	0%	100%
4	Headwaters Deer Creek	24%	62%	2%	12%	100%
5	No Name 2	23%	19%	0%	58%	100%
6	South Creek	20%	74%	5%	0%	100%
7	Kern River/Brush Creek	19%	62%	19%	0%	100%
8	South Fork Kings River/Lower Boulder Creek	16%	75%	9%	0%	100%
9	South Fork Middle Fork Tule River	16%	68%	17%	0%	100%
10	Bear Creek	16%	67%	0%	17%	100%
11	Kern River/Peppermint Creek	15%	67%	18%	0%	100%
12	Kern River/Freeman Creek	12%	85%	3%	0%	100%
13	Upper Dry Creek	12%	30%	0%	58%	100%
14	Mill Flat Creek	8%	82%	1%	9%	100%
15	North Fork Middle Fork Tule River	8%	63%	24%	5%	100%
16	Kings River/Rough Creek	8%	36%	0%	56%	100%
17	Upper Poso Creek	8%	33%	9%	49%	100%
18	Tyler Creek	6%	80%	0%	13%	100%
19	South Fork Kings River/Lightning Creek	5%	64%	29%	1%	100%
20	Upper North Fork Tule River	5%	52%	9%	35%	100%
21	Lower Little Kern River	4%	82%	14%	0%	100%
22	North Fork Kaweah River/Eshom Creek	4%	33%	1%	61%	100%
23	No Name 1	3%	4%	0%	92%	100%
24	Headwaters White River	2%	61%	5%	32%	100%
25	Kings River/Verplank Creek	2%	45%	0%	54%	100%
26	Upper South Fork Tule River	1%	28%	12%	59%	100%
27	Deer Creek/Gordon Creek	1%	25%	1%	73%	100%
28	Upper North Fork Kaweah River	1%	24%	18%	57%	100%
29	Lower North Fork Tule River	1%	4%	0%	96%	100%

Priority	Watershed	High	Moderate	Low	Outside Forest & GSNM	Total
30	Upper Boulder Creek	0%	44%	55%	0%	100%
31	Alpine Creek	0%	40%	60%	0%	100%
32	South Fork Kaweah River/Grouse Creek	0%	16%	0%	84%	100%
33	South Fork Tule River/Bond Creek	0%	0%	0%	100%	100%
	Grand Total	9%	47%	10%	34%	100%

Appendix C – Watersheds (National Forest System land only) in Priority Order of Fire Susceptibility

	SUSCEPTIBILITY			
WATERSHED	**High**	**Moderate**	**Low**	**Grand Total**
No Name 2	54%	46%	0%	100%
No Name 1	46%	54%	0%	100%
Lower Middle Fork Tule River	31%	68%	0%	100%
Upper Dry Creek	29%	71%	0%	100%
Headwaters Deer Creek	27%	71%	2%	100%
Tenmile Creek	27%	66%	7%	100%
Dry Meadow Creek	25%	60%	16%	100%
South Creek	20%	75%	5%	100%
Bear Creek	19%	81%	0%	100%
Kings River/Rough Creek	19%	81%	0%	100%
Kern River/Brush Creek	19%	62%	19%	100%
Lower North Fork Tule River	17%	83%	0%	100%
South Fork Kings River/Lower Boulder Creek	16%	75%	9%	100%
South Fork Middle Fork Tule River	16%	68%	17%	100%
Upper Poso Creek	16%	65%	18%	100%
Kern River/Peppermint Creek	15%	67%	18%	100%
Kern River/Freeman Creek	12%	85%	3%	100%
North Fork Kaweah River/Eshom Creek	11%	86%	3%	100%
Mill Flat Creek	9%	90%	1%	100%
North Fork Middle Fork Tule River	9%	66%	25%	100%
Tyler Creek	7%	93%	0%	100%
Upper North Fork Tule River	7%	79%	13%	100%
South Fork Kings River/Lightning Creek	5%	65%	30%	100%
Deer Creek/Gordon Creek	4%	92%	4%	100%
Lower Little Kern River	4%	82%	14%	100%
Kings River/Verplank Creek	3%	97%	0%	100%
South Fork Kaweah River/Grouse Creek	2%	98%	0%	100%
Headwaters White River	2%	89%	8%	100%
Upper South Fork Tule River	2%	68%	30%	100%
Upper North Fork Kaweah River	2%	57%	41%	100%
South Fork Tule River/Bond Creek	0%	84%	16%	100%
Upper Boulder Creek	0%	44%	55%	100%
Alpine Creek	0%	40%	60%	100%
Grand Total	14%	71%	15%	100%

Appendix D – Watersheds in Priority Order of Fire Susceptibility with Groves

PRIORITY	WATERSHED	GROVE	Sum of ACRES
1	Lower Middle Fork Tule River	Black Mountain	301
		Not in Grove	13,054
		Off-Forest	1,996
	Lower Middle Fork Tule River Total		15,351
			15,351
2	Tenmile Creek	Bearskin	187
		Converse Basin	10
		Evans	281
		Indian Basin	449
		Landslide	226
		Not in Grove	23,147
		Off-Forest	551
	Tenmile Creek Total		24,850
			24,850
3	Dry Meadow Creek	Cunningham	32
		Long Meadow	516
		Not in Grove	22,593
	Dry Meadow Creek Total		23,141
			23,141
4	Headwaters Deer Creek	Deer Creek	144
		Not in Grove	10,747
		Off-Forest	1,544
	Headwaters Deer Creek Total		12,435
5	No Name 2	BigStump	267
		Not in Grove	7,314
		Off-Forest	11,014
	No Name 2 Total		18,595
6	South Creek	Cunningham	0
		Long Meadow	52
		Not in Grove	14,013
		Off-Forest	27
		Packsaddle	527
		Powderhorn Tree	5
	South Creek Total		14,623
7	Kern River/Brush Creek	Not in Grove	642
		Off-Forest	28,039
	Kern River/Brush Creek Total		28,681

PRIORITY	WATERSHED	GROVE	Sum of ACRES
8	South Fork Kings River/Lower Boulder Creek	Agnew	43
		Deer Meadow	168
		Evans	3,975
		Monarch	54
		Not in Grove	13,822
		Off-Forest	6,543
	South Fork Kings River/Lower Boulder Creek Total		24,604
9	South Fork Middle Fork Tule River	Belknap	3,157
		Black Mountain	2,476
		Not in Grove	22,759
		Off-Forest	8
	South Fork Middle Fork Tule River Total		28,401
10	Bear Creek	Mountain Home	3,336
		Not in Grove	10,180
		Off-Forest	2,796
	Bear Creek Total		16,312
11	Kern River/Peppermint Creek	Not in Grove	16,159
		Off-Forest	17,373
	Kern River/Peppermint Creek Total		33,533
12	Kern River/Freeman Creek	Freeman Creek	4,189
		Not in Grove	10,100
		Off-Forest	4,348
	Kern River/Freeman Creek Total		18,636
13	Upper Dry Creek	BigStump	6
		Not in Grove	5,157
		Off-Forest	7,181
		Redwood Mountain	1
	Upper Dry Creek Total		12,345
14	Mill Flat Creek	Abbott	25
		BigStump	158
		Cherry Gap	170
		Converse Basin	706
		Grant	292
		Not in Grove	21,028
		Off-Forest	8,785
	Mill Flat Creek Total		31,164
15	North Fork Middle Fork Tule River	Alder Creek	929
		Burro Creek	299

PRIORITY	WATERSHED	GROVE	Sum of ACRES
		Maggie Mountain	65
		Middle Tule	623
		Mountain Home	1,085
		Not in Grove	21,103
		Off-Forest	2,081
		Silver Creek	192
		Upper Tule	22
		Wishon	171
	North Fork Middle Fork Tule River Total		26,569
16	Kings River/Rough Creek	Converse Basin	3,543
		Not in Grove	8,963
		Off-Forest	15,668
	Kings River/Rough Creek Total		28,174
17	Upper Poso Creek	Not in Grove	7,874
		Off-Forest	11,141
	Upper Poso Creek Total		19,015
18	Tyler Creek	Not in Grove	8,986
		Off-Forest	1,419
		Packsaddle	1
		Starvation	182
	Tyler Creek Total		10,589
19	South Fork Kings River/Lightning Creek	Not in Grove	5,870
		Off-Forest	8,469
	South Fork Kings River/Lightning Creek Total		14,339
20	Upper North Fork Tule River	Dillonwood	372
		Not in Grove	14,015
		Off-Forest	7,625
	Upper North Fork Tule River Total		22,012
21	Lower Little Kern River	Freeman Creek	4
		Not in Grove	4,499
		Off-Forest	26,316
	Lower Little Kern River Total		30,819
22	North Fork Kaweah River/Eshom Creek	Not in Grove	8,278
		Off-Forest	15,339
		Redwood Mountain	1,371

PRIORITY	WATERSHED	GROVE	Sum of ACRES
	North Fork Kaweah River/Eshom Creek Total		24,987
23	No Name 1	Not in Grove	684
		Off-Forest	33,058
	No Name 1 Total		33,742
24	Headwaters White River	Not in Grove	6,532
		Off-Forest	3,036
	Headwaters White River Total		9,568
25	Kings River/Verplank Creek	Converse Basin	408
		Not in Grove	5,252
		Off-Forest	11,429
	Kings River/Verplank Creek Total		17,089
26	Upper South Fork Tule River	Black Mountain	9
		Not in Grove	7,345
		Off-Forest	16,335
		Peyrone	741
		Redhill	728
		South Peyrone	115
	Upper South Fork Tule River Total		25,273
27	Deer Creek/Gordon Creek	Not in Grove	5,886
		Off-Forest	15,922
	Deer Creek/Gordon Creek Total		21,809
28	Upper North Fork Kaweah River	Not in Grove	6,481
		Off-Forest	15,866
	Upper North Fork Kaweah River Total		22,347
29	Lower North Fork Tule River	Not in Grove	1,038
		Off-Forest	23,355
	Lower North Fork Tule River Total		24,393
30	Upper Boulder Creek	Not in Grove	11,329
		Off-Forest	7,401
	Upper Boulder Creek Total		18,730
31	Alpine Creek	Not in Grove	184
		Off-Forest	17,297
	Alpine Creek Total		17,481
32	South Fork Kaweah River/Grouse Creek	Not in Grove	3,106
		Off-Forest	15,922
	South Fork Kaweah River/Grouse Creek Total		19,028
33	South Fork Tule River/Bond Creek	Black Mountain	8
		Not in Grove	102

PRIORITY	WATERSHED	GROVE	Sum of ACRES
		Off-Forest	39,193
	South Fork Tule River/Bond Creek Total		39,303
Grand Total			727,936