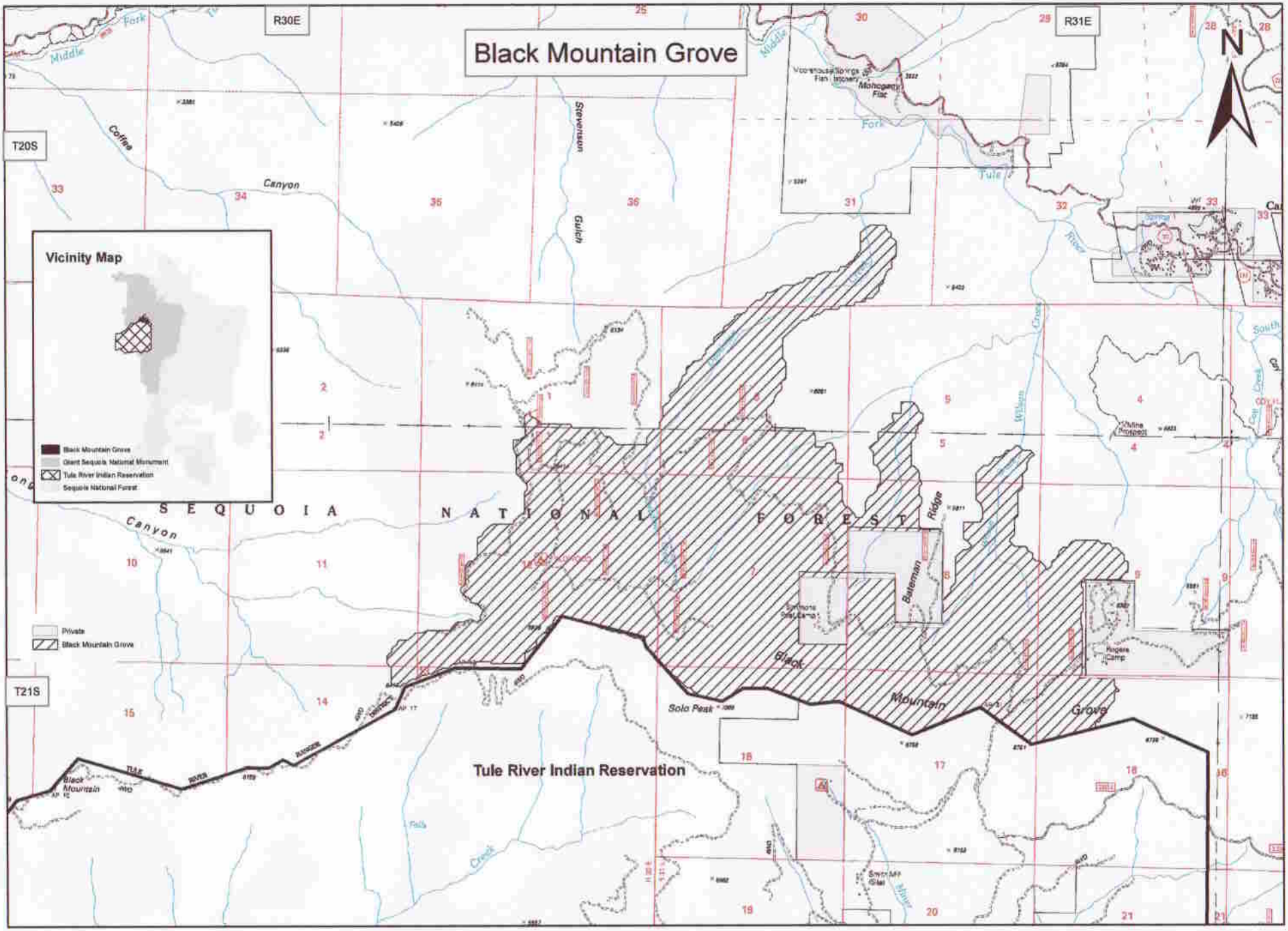
Fuel Load Reduction Evaluation
For the
Black Mountain Giant Sequoia Grove

Western Divide Ranger District
Giant Sequoia National Monument
Sequoia National Forest

July 2008

Prepared by: Robert Sanders Date: 8/11/08
ROBERT SANDERS
Fuels Specialist

Approved by: Priscilla R. Summers Date: 8/11/08
PRISCILLA R. SUMMERS
District Ranger


Black Mountain Grove
R30E
R31E
T20S
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Vicinity Map
Black Mountain Grove
Giant Sequoia National Monument
Tule River Indian Reservation
Sequoia National Forest
SEQUOIA NATIONAL FOREST
Private
Black Mountain Grove
Tule River Indian Reservation
Solo Peak
Black Mountain Grove
Stevenson Gulch
Coffee Canyon
Middle Fork
Tule River
Wilson Creek
Bateman Ridge
Falls Creek
Mahogany Flat
Warehouse Springs
Rogers Camp
Tule River & Hot Springs Ranger Districts
Sequoia National Forest
Giant Sequoia National Monument
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Map 1
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Introduction

The purpose of this fuel load reduction evaluation (Evaluation) is to meet the requirements in the Mediated Settlement Agreement (MSA 1990, Page 10.) The MSA requires that a "fuel load reduction plan" be conducted for logging or mechanical/mechanized treatments in giant sequoia groves. This Evaluation is fulfilling the requirement. As directed in the MSA, the objective of the Evaluation is to "preserve, protect, restore and regenerate" the Black Mountain Giant Sequoia Grove, "without any unnecessary damage to any old-growth trees in the Grove". The goal of administering the groves is to "protect, preserve, and restore the groves for the benefit and enjoyment of present and future generations" (MSA, page 6).

As directed by Judge Breyer (Sierra Club v. Bosworth, October 11, 2006), management of the Monument, and therefore this evaluation, is consistent with the April 15, 2000 Giant Sequoia National Monument Proclamation (Proclamation), and is in accordance with direction from the 1988 Sequoia National Forest Land and Resource Management Plan (Forest Plan), as amended by the 1990 Mediated Settlement Agreement (MSA) and the 2001 Sierra Nevada Forest Plan Amendment (SNFPA). This evaluation has been developed to be compliant with these documents.

The Proclamation establishing the Giant Sequoia National Monument states the following regarding fuel build-up and giant sequoia reproduction:

> *A century of fire suppression has led to an unprecedented failure in sequoia reproduction in otherwise undisturbed groves. These forests need restoration to counteract the effects of a century of fire suppression and logging. Fire suppression has caused forests to become denser in many areas, with increased dominance of shade-tolerant species. Woody debris has accumulated, causing an unprecedented buildup of surface fuels. One of the most immediate consequences of these changes is an increased hazard of wildfires of a severity that was rarely encountered in pre-Euroamerican times.*

This evaluation displays these conditions and the need for treatments in context of the area surrounding the groves as well as within the groves. The comparison of the need for treatment in the Black Mountain Grove in relation to other groves on the Forest is not addressed in this document. All acres used in this document are approximate.

Existing Conditions

The Black Mountain Giant Sequoia Grove spans portions of the Tule River Indian Reservation and the Giant Sequoia National Monument (Monument) of the Sequoia National Forest. Approximately 2,545 acres are within the Monument. The remaining acres are on the Tule River Indian Reservation. There are 180 acres of private property that are islands within the Giant Sequoia National Monument. The portion of the grove on the Giant Sequoia National Monument is primarily on a north aspect. The

elevation ranges are 5,000 to 7,300 feet. The average annual precipitation in the grove is about 35 inches, mostly occurring as snow during the winter months.

The Black Mountain Giant Sequoia Grove lies within two watersheds, the Lower Upper Middle Fork and the South Fork Middle Fork of the Tule River. Both of these watersheds have a high fire susceptibility based on ArcGIS analysis using data from historical fire records. Sixth order watersheds were overlapped with risk/ignition density, fire susceptibility, and flame length data to list the priority for fuels treatments by watershed. This includes watersheds on non-forest land of which we have limited or no data. The analysis listed the priority of each watershed based on the percentage of acres falling into high, medium and low fire susceptibility. The analysis lists the Lower Upper Middle Fork and South Fork Middle Fork of the Tule River as high priority for fuels treatment.

Black Mountain Grove within the Monument is at the higher elevations of the Middle Fork Tule River watershed with the river tributaries on the north side of the river pointing toward the Reservation, particularly Long Canyon, Coffee Canyon, and the communities of Camp Nelson and Roger's Camp. In the last 15 years, the Tule River Canyon along the Middle Fork has been the location of many wildfires that have thus far traveled on the north side of the river rather than south toward the reservation. The risk of fires spreading up Long Canyon and Coffee Canyon is high. Risk of fire spreading from the private lands to Tribal lands is also a threat. In 2007, a home caught on fire and burned to the ground in the Roger's Camp area.

Planted stands within the grove have had no management activities since the last planting in 1989. The lack of management activities resulted in an overstocked stand. Trees planted in these stands are a mix of giant sequoia, ponderosa pine, sugar pine, and white fir. A significant number of incense cedar, black oak, dogwood, and willow reproduced naturally, and the ground between the trees is occupied by a mix of woody brush, fern, grasses, and forbs. The vegetative cover in the planted stands is greater than 80% and the multi-layered crown cover is continuous. Some of these stands have had insect outbreaks, but mortality has been restricted to small (one tenth to one quarter acre) openings.

Studies and records also show the majority of this stand has had no known fire occurrence since fire records have been maintained. This area has now missed many fire return intervals. The last fire ten acres or greater in size occurred 59 years ago. The combination of a lack of fires, lack of treatment to the planted stands and high fuel loading has created a high risk of unwanted fire spreading to Tribal lands, Black Mountain Giant Sequoia Grove, and the private lands.

Black Mountain Grove was inventoried in fall 2003, and was identified as having stands that "are now overstocked from decades of wildfire exclusion" (Jump 2004). The inventory was completed to measure and document the existing condition of the live and dead vegetation. The inventory revealed that the grove has an excessive number of snags and down logs which indicates an accumulation of stand density-related mortality over the last 30 to 40 years. Based on the Black Mountain Grove Inventory, there is an average of 459 conifers per acre of which 239 are seedlings. Hardwood tree species in the grove are at average of 105 trees per acre, 86 of which are seedlings. There is also an average of 35 standing dead trees per acre outside of planted stands. About three-fourths of these are less than 12 inches in diameter. Most of the intermediate understory trees are being killed by competition for light, water, and nutrients.

The Black Mountain Giant Sequoia Grove Inventory also states the grove is at high risk of loss from unwanted wildfire. A wildfire is deemed unwanted because the potential tree mortality from a fire under extreme conditions would likely be high. The existing conditions are dense mixed conifer stands, high fuel loading, significant ladder fuels, and severe departure from fire return intervals which puts the Black Mountain Grove is at high risk of loss to an unwanted wildfire. The data sets collected in 2003 for inventory of the grove are considered sufficient for this Evaluation because no wildfires have occurred and no treatments have been implemented to reduce fuels.

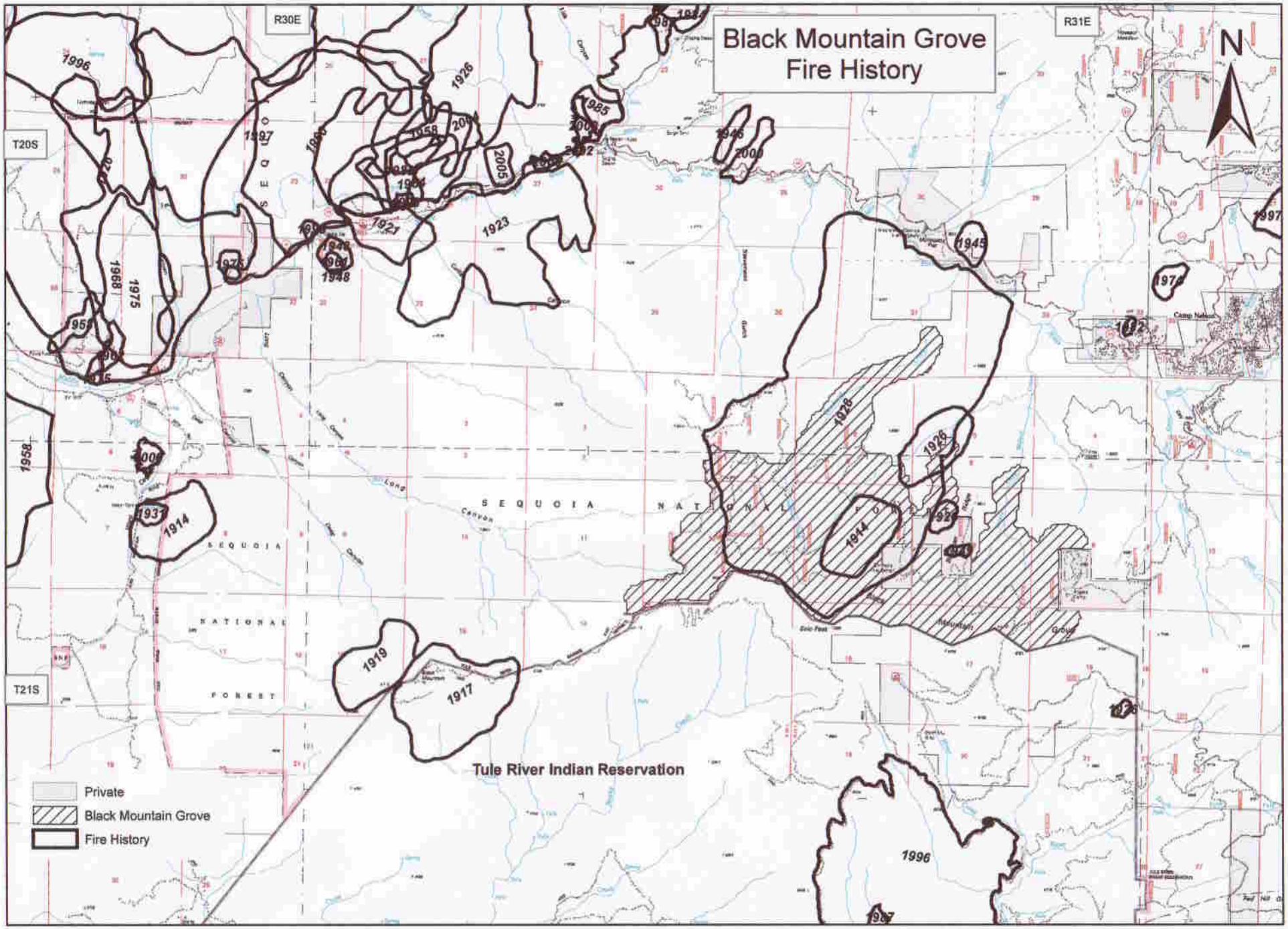
The combination of topography, vegetation, and fuel loading in and around the grove are such that a wildfire could not be safely suppressed under extreme conditions. Once a fire is established, a crown fire would likely initiate and spread. Such a fire would be a threat to life, property, and resources in the area. The primary resource concern is mortality of giant sequoia trees, especially the large specimen trees. Other threatened resources are water quality, cultural sites, wildlife habitat, dispersed recreation sites, adjacent private property and the Tule River Indian Reservation. The life and property threats from fire exist for the Tule River Indian Reservation (Reservation) and the community of Rogers Camp. The Tule River Tribal Council has identified the Reservation as a community at risk through the California Fire Alliance.

Fire History and Potential

The historic fire return interval for Giant Sequoia Groves is as low as 3-8 years with a mean average of 15-18 years depending on the aspect of the slope (Kilgore and Taylor 1979). The last fire 10 acres or larger was 58 years ago. The forest has maintained fire records since the early 1900's and there are areas within the grove have no record of fire occurrence. The accumulation of woody debris has led to an unnaturally high level of surface fuels on the majority of this grove. In addition, natural reproduction of shade tolerant species such as white fir and incense cedar has created a fuel ladder that would connect fire to the over-story trees.

Potential large fire threats to the Black Mountain Grove exist from fires coming upslope from Long Canyon or the South Fork or Middle Fork drainages of the Tule River (see Figure 1). Due to the large fuel load and the amount of time that has past since the last known fires, it is believed that if a fire is established and spread up the steep slopes and into the grove it would be a stand replacing fire. Such a fire would threaten specimen-size giant sequoias, degrade water quality, and impair other resource values.

In the last 20 years on the Western Divide Ranger District in which the Black Mountain Giant Sequoia Grove is located, 35 of 146 (or 24%) of the fires have started down slope of the grove from the north or north-west with the majority of these fires starting near Upper and Lower Coffee Camp Day Use Areas and along Highway 190 (see Figure 2 and Map 2). A fire starting in lower Long Canyon is also a concern for the Tule River Tribe. This canyon, located between the lower Tule River and Black Mountain Grove is a path that fire could follow from the lower slopes south of Coffee Camp, through the grove and onto Tribal lands (see Figure 1). From the years 1910 to 1999, the Tule River Reservation had 103 of 146 (70.5%) fires start down slope of the grove from the south to the west in the South Fork of the Tule River. One notable fire, the Chololllo fire, came within less than ½ mile of the Black Mountain Grove in 1996.



Tule River & Hot Springs Ranger Districts
Sequoia National Forest
Giant Sequoia National Monument

0 0.25 0.5 1 1.5 2 Miles

Map 2

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Since formal fire records have been kept, only five fires larger than ten acres have burned within the grove boundary on the Forest and Monument. (See Table 1 and Map 2)

Table 1. Fire History GIS Layer Giant Sequoia National Monument - Sequoia National Forest.			
Fire Year	**Cause**	**Total fire size in acres**	**Acres of the fire in Grove**
1914	Camp fire	362	181
1926	Lightning	158	34
1926	Lightning	27	27
1928	Camp fire	3181	1277
1949	Camp fire	10	10

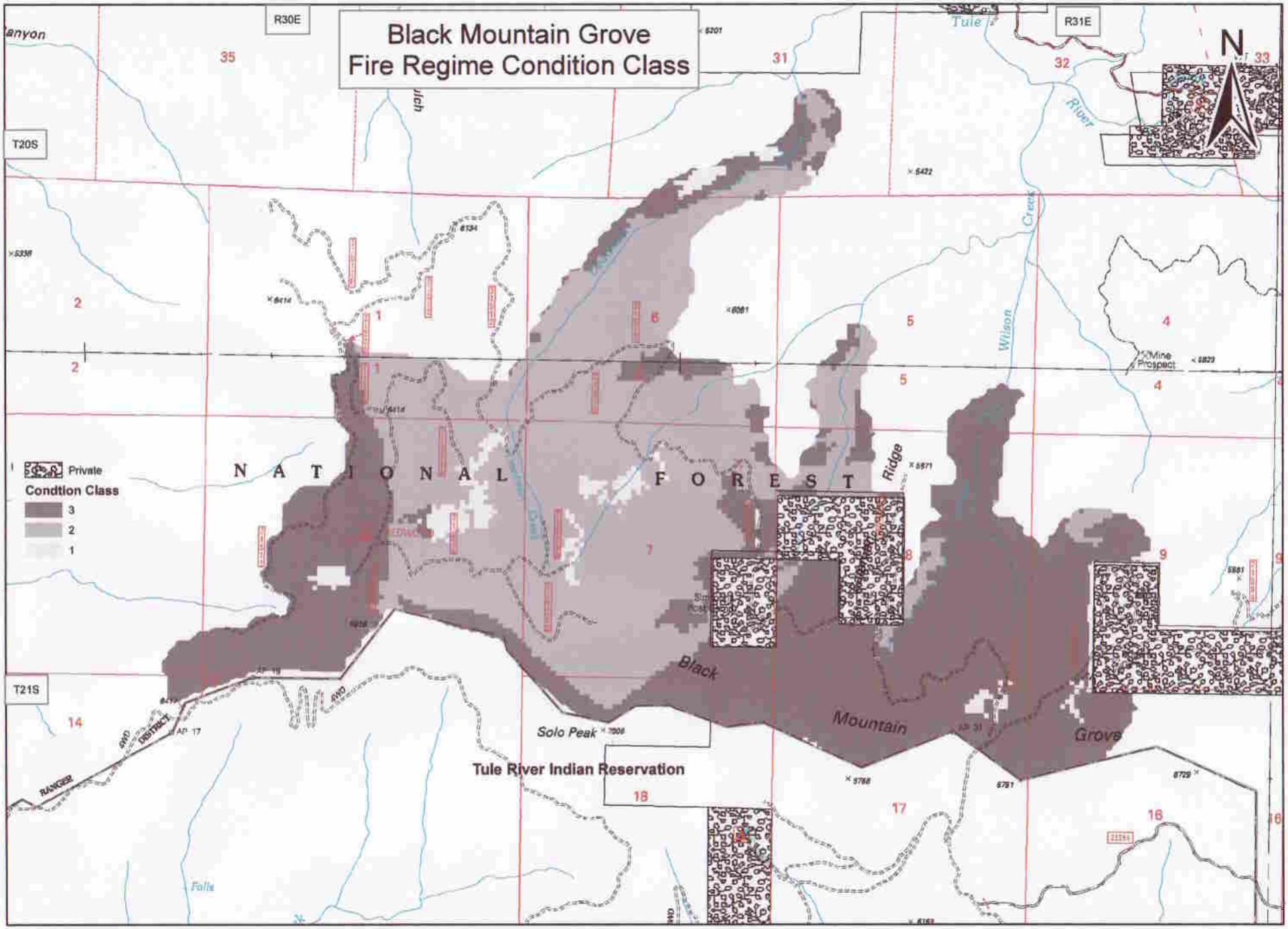
Fire Return Interval

Fire return interval is defined as the interval between two successive fire occurrences. Sequoia National Forest fire history maps (GIS layers) show the earliest fire within the grove boundary occurring in 1914 with the last fire ten acres or larger occurring in 1928, over 58 years ago. Based on the mean historic fire return interval of 15-18 years for giant sequoia groves (Kilgore and Taylor 1979), the fire return interval for this grove has missed more than three times on the majority of the acres within the grove boundary.

These areas that have missed one to two fire return intervals are considered in Fire Regime Condition Class (FRCC) 1; those missing two to five fire return intervals are considered FRCC 2, and those with more than five fire return intervals missed are considered FRCC 3. The departure from the fire return intervals is interpreted as moderate, high, and extreme for FRCC 1, 2, and 3, respectively. Approximately 97% of the Black Mountain Grove is in FRCC 2 or 3 with approximately 49% in FRCC 3 (see Figure 1, Figure 2, Figure 3 and Map 3). These acres are derived for the Sequoia National Forest's Fire Return Interval Departure (FRID) GIS layer and cross walked to the FRCC (see Table 2 and Map 3).

Table 2. Departure from Fire Return Interval in Black Mountain Grove		
Intervals missed	**Acres**	**Fire Regime Condition Class (FRCC)**
Extreme 5+	1249	3
High 2-5	1220	2
Moderate 1-2	76	1
Total Acres	**2545**	

A mean fire return interval frequency as low as 3-8 years has been recorded in giant sequoia groves in the Sierra Nevada Mountains (Swetnam et al.1992, Swetnam 1993). Tree ring scars along Highway 190 near the community of Cedar Slope indicate a mean fire return interval of approximately 5 years. This interval ended in the late 1800's. This information is based on preliminary research on trees with fire scars conducted by Pennsylvania State University in 2005; a published scientific report is expected on


Black Mountain Grove
Fire Regime Condition Class
R30E
R31E
T20S
T21S
N
Private
Condtion Class
3
2
1
NATIONAL FOREST
Black Mountain Grove
Solo Peak
Tule River Indian Reservation
Ridge
Wilson Creek
Tule River
Mine Prospect
Falls
RANGER DISTRICT
Tule River & Hot Springs Ranger Districts
Sequoia National Forest
Giant Sequoia National Monument
0 0.125 0.25 0.5 0.75 1 Miles
Map 3
1:30,000

this research. The Community of Cedar Slope is located approximately three air miles northwest of the grove on a south-facing slope.

Of the is 2545 acres within the grove boundary on the Monument, only 1691 acres have burned over the last 94 years. Some of these acres have burned more than once with over lapping fire perimeters (see Map 2). This is an average of 18 acres per year burning from fire for this period of time.

Fire Behavior

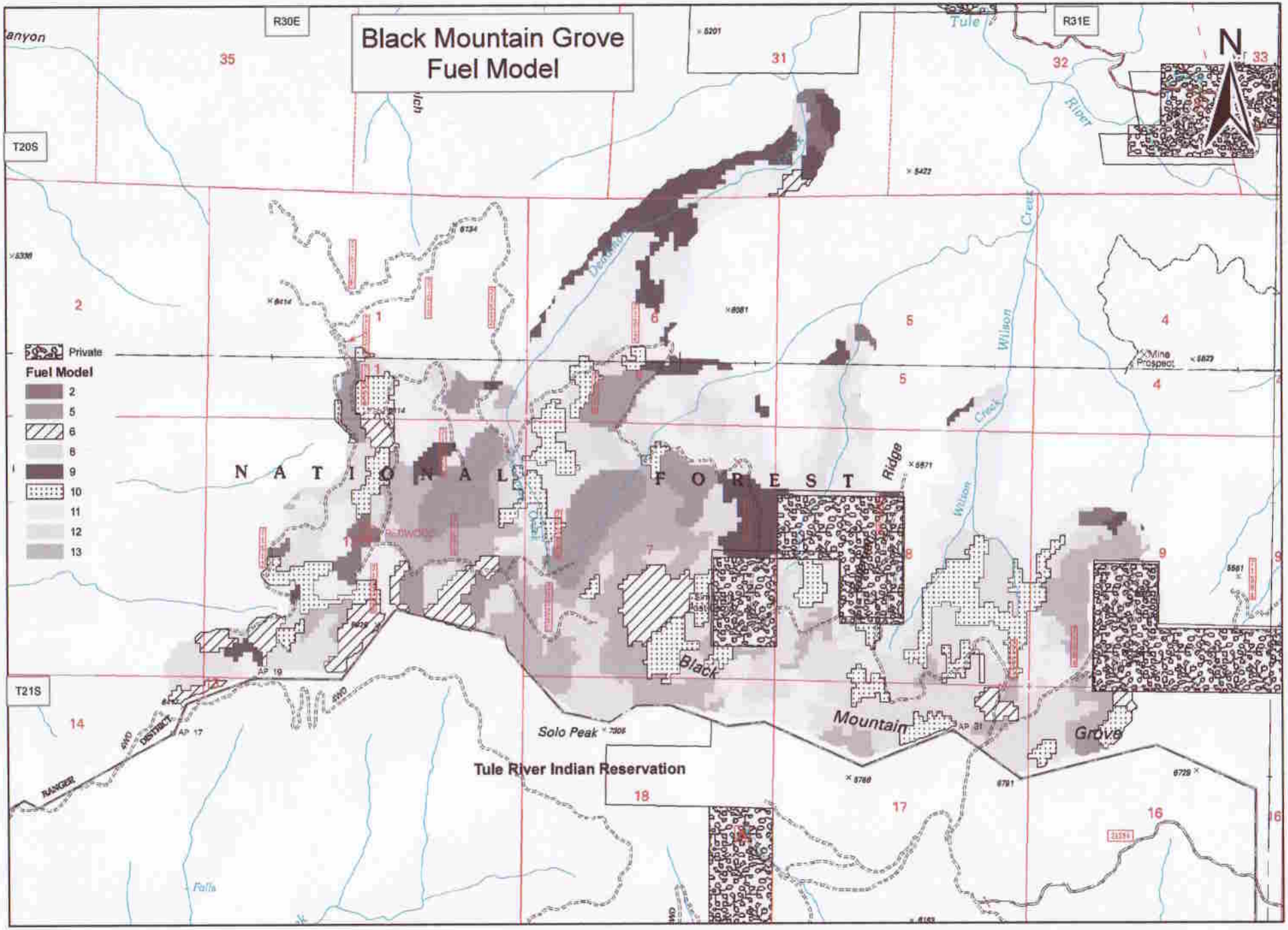
Methods used to determine fuel models included: the Forest / Monument GIS layer, Satellite images, plots from the Black Mountain Giant Sequoia Grove Inventory, personal observations and the use of photo series (PSW-GTR-163). BEHAVE fire behavior prediction computer program runs were completed using 90th percentile weather from 20 years of data from RAWS (radio activated weather stations) to predict flame lengths and rates of spread of a fire. Fireline production rates for crews are found in the Fireline Handbook, 2004, Appendix A, page A-30. A four-foot flame length is considered the maximum height that can be attacked by hand crews to create fire lines near the fire. The amount of heat is measured in BTU's (British Thermal Units). The amount of BTU's created by fires limit the distance firefighters can be near a fire. In addition, the greater the amount of fuel, the greater effort and time required for fireline production. As shown on **Table 3**, the production rates are less than 10 chains per hour for more than half of the grove.

Table 3. Fuel Models, expected flame lengths, and Type 1 Crew sustained fire line production rates. All acres are approximate.

Fuel Model	Acres	Expected flame lengths	Fire Line Production rates (in chains per hour)
Fuel model 2 Open Pine w/ grass	36	5.4 feet	24
Fuel model 5 Shrubs	214	6.3 feet	6
Fuel model 6 Chaparral	133	4.9 feet	6
Fuel model 8 Short needle conifer	7	.9 feet	7-40
Fuel model 9 Pine and Hardwood	165	2.3 feet	28-40
Fuel model 10 Mixed Conifer	276	5.2 feet	6
Fuel model 11 Mixed Conifer With Light Surface Fuels	723	3.1 feet	15
Fuel model 12 Mixed Conifer With Medium Surface Fuels	636	7.3 feet	7
Fuel model 13 Mixed Conifer With Heavy Surface Fuels	355	9.5 feet	5
TOTAL	**2545**		

Fuel Loading of Surface Fuels

Based on sample plot data collected in Black Mountain Grove Inventory in 2003 the surface fuel loading is approximately 92 (Table 4). These data are less than what exists today because no fires or fuel reduction activities have occurred since 2003, allowing an increase in fuel from plant growth and natural tree mortality.



Tule River & Hot Springs Ranger Districts
Sequoia National Forest
Giant Sequoia National Monument

0 0.125 0.25 0.5 0.75 1 Miles

Map 4

1:30,000

Table 4. Desired and Current tons per acre of fuels in size classes in Black Mountain Grove.		
Fuel Size Class (in.)	**Current tons per acre**	**Desired tons per acre**
Duff	30.1	5-15
0-1	3.1	1-2
1-3	4.4	1-3
3-9	5.0	1-3
Greater than 9	49.2	10-20
Total	**91.8**	**18-43**

Tree Density

Jump (2004) states that the Black Mountain Grove Inventory indicates the grove is in a generally declining condition due to high tree density causing mortality in white fir and sugar pine (see Table 5). Excessive numbers of snags and down logs in the grove indicate an accumulation of stand density-related mortality over the past 30 to 40 years. Giant sequoia trees average only 4% of the trees per acre and are significantly below the desired numbers (10% of trees per acre) in order to sustain the stand. High canopy cover of shrubs, white fir, and hardwoods indicate that fuel loading is in excess of desired levels, and that the grove is at risk from destructive wildfire (Jump, 2004, page 2).

Table 5. Trees and Seedlings per Acre in Black Mountain Grove[1]		
Tree Species	**Percent of Trees per Acre**	**Seedlings per Acre**
Giant Sequoia	4	0
Ponderosa Pine	4	10
Sugar pine	12	20
White fir	52	151
Incense cedar	17	55
Black Oak	Not shown	31
Nutmeg	Not shown	6
Pacific dogwood	Not shown	55
TOTAL	**89**	**328**

[1] From Table 1. Species Composition, and Table 3. Seedlings per acre (Jump, 2004).

Table 6. Trees per acre and Basal Area per acre by Diameter Class[2]		
Diameter Class (Inches DBH)	**Basal Area per Acre (SQ. FT)**	**Trees per Acre**
1-4	6	133
5-10	39	90
11-14	31	31
15-20	52	38
21-28	64	30
29-38	58	20
39+	142	14
AVERAGE	**56**	**51**

Based on Table 5 and Table 6, the regeneration of giant sequoia is lacking overall and shade tolerant species (white fir) have increased. As stated above from Jump 2004, trees less than 12 inches dbh per acre are dominating much of the grove and make up the ladder fuels that lower the canopy base height. This makes up a large portion of the fuel putting the area at risk for high mortality should a wildfire burn in the area.

Treatment Goals

The objective of this Evaluation is to preserve, protect, restore, and regenerate the Black Mountain Giant Sequoia Grove (MSA direction). According to Jump (2004), based on the Recommended Management Variability (RMV) (as described in Piirto and Rogers 1999) no elements of existing grove structure in the Black Mountain Grove are within RMV ranges, indicating that this grove should have a high priority for structural restoration. The immediate need for restructuring and treatment is to decrease the trees 12 inches or less. The long term goal is vegetative structure allowing fire to play a more natural role without excessive mortality.

Four of the factors that affect fire behavior are topography, weather, vegetation, and surface fuels. Two of these factors can be managed; vegetation and surface fuels. The amount and distribution of surface fuels and vegetation can be treated to reduce the potential flame lengths and behavior of the fire. The lower vegetation can be removed to break the fuel ladder and lower the resistance to control efforts. The trees per acre can be reduced to lower the risk of fire spread in the tree crowns. Treatments to achieve these goals would make the stands in the grove more resilient to natural disturbances (particularly fire) and minimize potential loss of large (or old growth) trees, including large giant sequoia trees.

Although use of fire alone as a treatment method to attain conditions where fire can play a more natural role and move nearer to historic fire return intervals is desirable and a long term goal, it is currently limited due to large amounts of existing surface, ladder, and crown fuel. In areas where appropriate, using prescribed fire alone is a viable option. Due to the high fuel load in the grove using burning as an initial treatment could cause undesirable high tree mortality. Therefore, a series of treatments would

2 Table 2 from Jump, 2004. Grove Density and Tree Stocking by Diameter Class.

best preserve, protect, restore and regenerate giant sequoias in the Black Mountain Grove without unnecessary damage to any old growth trees in the grove.

The goals for vegetative treatments in the short term (within about five to ten years) and long term (beyond about 10 years) are shown below. These were identified based on the resource values identified and fire suppression or management strategies. Specific treatments are not mapped or shown here because they will incorporate public involvement, analysis and documentation in accordance with the National Environmental Policy Act, as amended.

Road side fuels treatments have been successful in stopping spread of a fire. For example, during the 2004 Deep Fire the advancement of fire near the Giant Sequoia Groves and Mountain Home State Forest was stopped by a road side fuel break with action by ground crews. A similar situation occurred south of the Black Mountain Grove on Tule River Indian Reservation lands in 1996 where treatments along a road allowed firefighters to access the road and use back-burning techniques to stop the fire at the road (Brian Rueger, pers. com.).

The current restrictive smoke management policies that are in effect due to air quality of the San Joaquin Valley are a consideration for planning fuel projects for the grove. The burn window at this location is short with limited access in the fall and winter due to snow. Rains are needed during the fall to increase the fuel moisture levels required to control a prescribed fire and meet prescriptions in burn plans.

These following short term and long term goals will be used to propose projects to move the area with conditions to meet the long term conditions to allow fire to play a more natural role in the grove and/or be able to use fire as the principle tool to manage the vegetation in the grove.

Short Term Goals

Short term goals for fuel reduction in the Black Mountain Grove is to reduce the risk of unwanted fire spreading into in Black Mountain Grove, private land, and the Tule River Indian Reservation. The principle fuel to reduce in the short term is trees and brush 12 inches dbh and less, based on Jump (2004) and the existing conditions of the planted areas

- Reduce fuel along access roads resulting in areas to burn from or hold a fire during prescribed fires or wildfires. The intent is to improve access and egress during fire situations and create safer escape routes from a wildfire to be used by local residents, visitors, and firefighters.

- Reduce fuel to double the fire line production rate of a Type 1 crew, which will increase the ability to manage a fire (either to suppress, use wildland fire use, or prescribed fire).

- Reduce fuel loading and continuity along the Reservation boundary to reduce risk of fire spread across boundaries.

- Reduce the fuel along private property boundaries (defense zones) to reduce risk of fire spread from private land and/or into private land.

- Use fire to reduce fuel loading as conditions allow.

- In planted stands and in areas that have a high risk of fire escape, mechanical treatments are recommended before prescribed fire is used.

Long Term Goals

Maintain conditions attained by short term goal treatments, and improve the conditions to allow use of fire as the primary vegetation management tool.

- Continue to reduce fuel along property boundaries, roads, and ridgelines to continue to restore the fire rotation cycle.

- Use fire as a primary treatment as conditions allow, including joint fire treatments with the Tule River Indian Reservation.

- Restore stand structure to promote growth of giant sequoia and pine seedlings, reduce shade-tolerant trees (principally fir and cedar), and decrease trees per acre overall.

Figure 1. Long Canyon from looking down slope from Forest Road 21S94.

Figure 2. Stevenson's Gulch below the Black Mountain Grove (photo taken from Highway 190). The steep slopes are covered with heavy fuels and limited opportunities to safely suppress a fire. A fire starting at the river would likely go up to the ridge top and into the Black Mountain Grove.

Figure 3. Looking southwest from highway 190 toward the Black Mountain Grove. This area falls within the perimeter of a fire in 1928 shown on the fire history map. The fire burned up hill from the river to the top of the ridge. The terrain and fuels of this area are currently similar to fuels down the canyon to the west where there is no recorded fire history. This area has missed numerous fire return intervals.

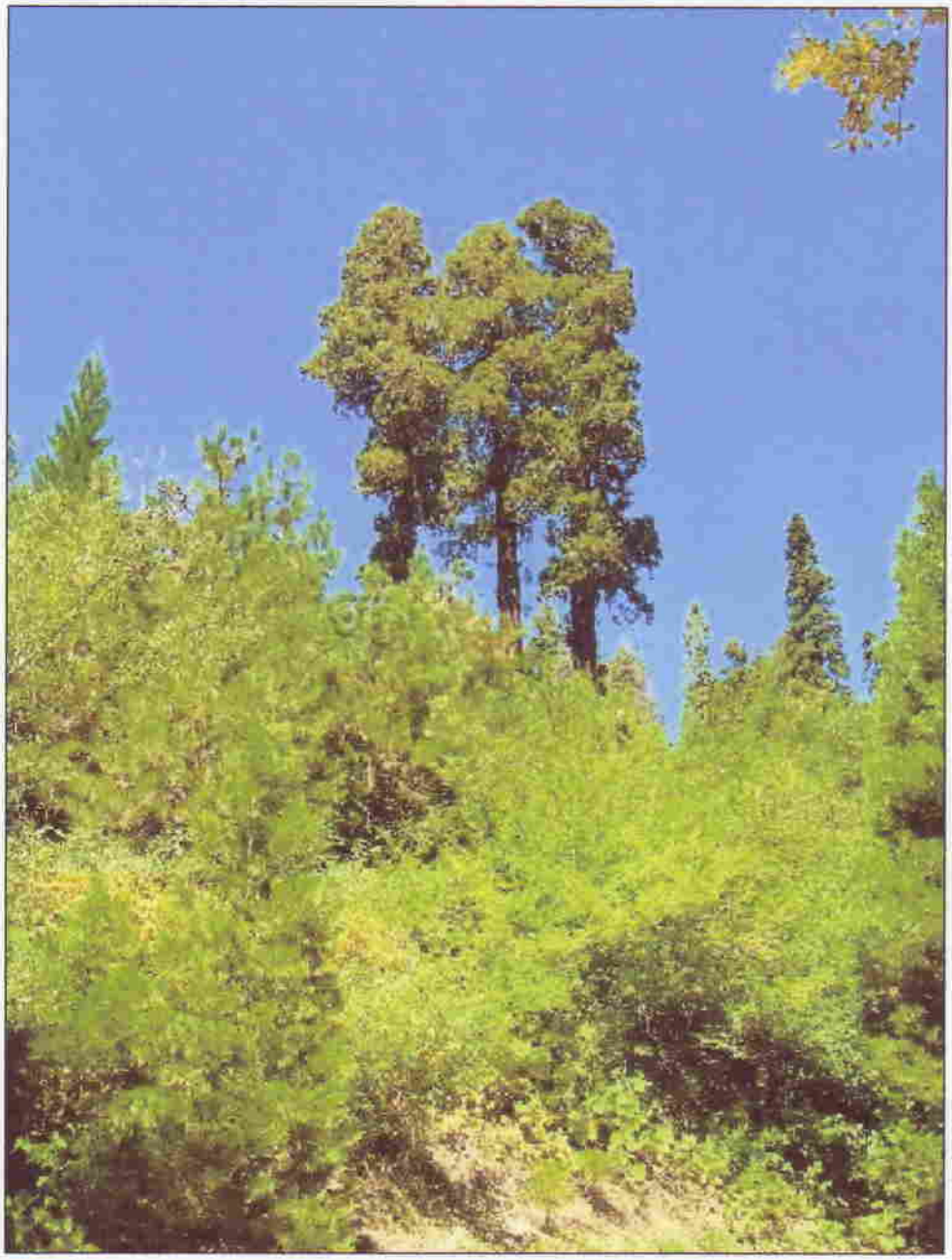


Figure 4. Plantation within the Black Mountain Grove. Plantations such as this one in the Black Mountain Grove were created in the 1980's have since become thick with brush, young giant sequoia trees, ponderosa pine, Jeffrey pine, and incense cedar trees.

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