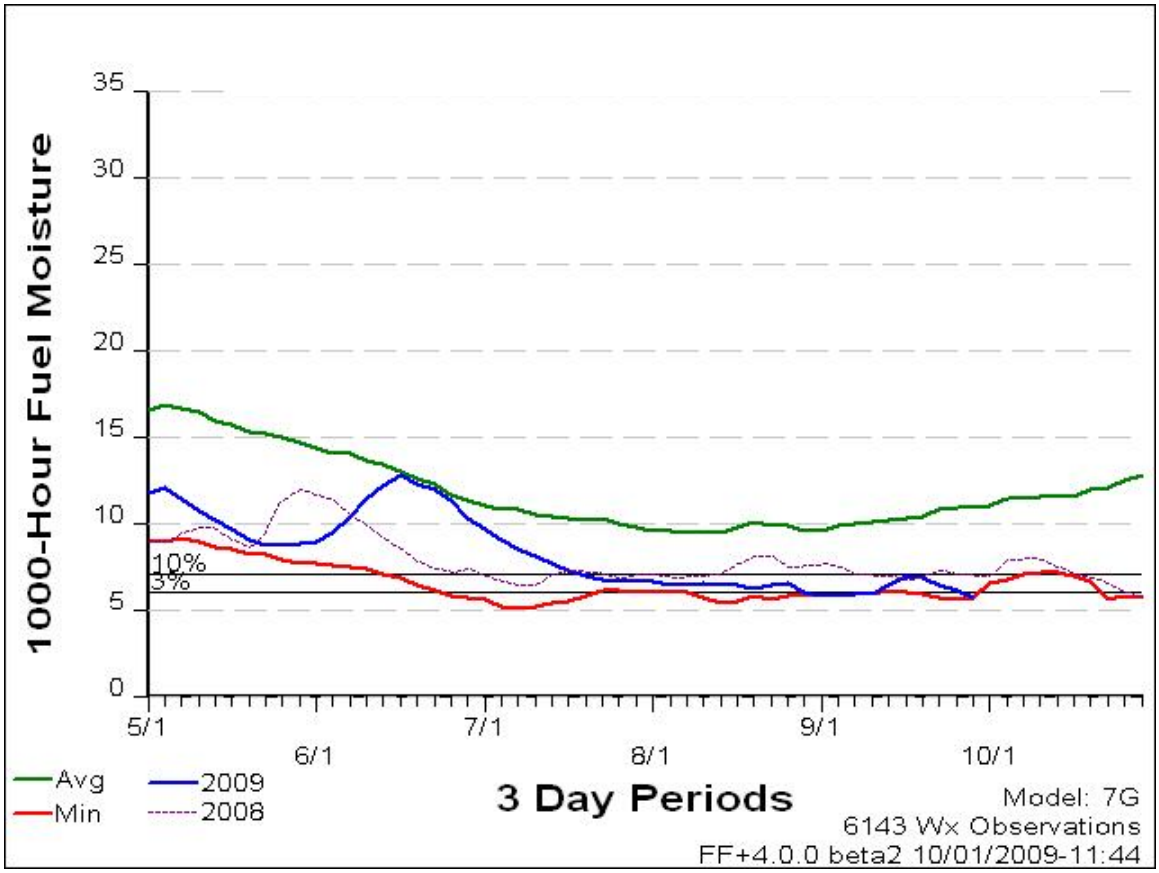
Long term drought in Southern California has resulted in near record lows for the 1000 hr fuels. This has led to a very high dead to live ratio, which lessons the chance for rebound through out the Unit.



SAN BERNARDINO MOUNTAINS

Wildland fuels or vegetation are the basic catalyst that supports the combustion process of wildfires. The various fuels found in California have specific characteristics, which allow fire behavior analysts to categorize them based on how they burn. The Fire Behavior Prediction System (FBPS) was the method chosen for categorizing fuels for the fire plan process. This method classifies fuels in 13 basic fuel models, each of which has specific physical and burning characteristics. FBPS are mathematical formulas that require mathematical descriptions of **fuel models** and their respective fuel properties as input. This input combined with meteorological and topographic parameters is used for calculations of fire danger and/or fire behavior.

A **fuel model** is a mathematical representation of various fuel types used in mathematical fire spread models. **Fuel models** are expressed numerically 1-13 that describe fuels in terms that spread models understand (surface area to volume ratio, fuel load, size, shape, compactness, horizontal and vertical continuity, moisture of extinction, etc.). Simply put, ***fuel models are*** *tools that help land management agencies and fire planners realistically estimate fire behavior or fire danger.*

The models include 3 grass, 4 brush, 3 timber, and 3 slash fuel types. The fire plan has labeled fuel model #2, a grass model, as a woodland fuel. This modeling system also allows the creation of custom fuel models when none of the 13 models adequately represent the fuels that are found in an area. Custom fuel model #14 was developed for plantation/burned areas, water and rock/barren areas. Custom fuel models #15 and #28 refer to desert and urban fuels respectively.

Table 1.— Description of fuel models used in fire behavior as documented by Albini (1976)

Fuel model	Typical fuel complex	Fuel loading 1 hour	10 hours	100 hours	Live	Fuel bed depth	Moisture of extinction dead fuels
		Tons/acre				Feet	Percent
	Grass and grass-dominated						
1	Short grass (1 foot)	0.74	0.00	0.00	0.00	1.0	12
2	Timber (grass and understory)	2.00	1.00	.50	.50	1.0	15
3	Tall grass (2.5 feet)	3.01	.00	.00	.00	2.5	25
	Chaparral and shrub fields						
4	Chaparral (6 feet)	5.01	4.01	2.00	5.01	6.0	20
5	Brush (2 feet)	1.00	.50	.00	2.00	2.0	20
6	Dormant brush, hardwood slash	1.50	2.50	2.00	.00	2.5	25
7	Southern rough	1.13	1.87	1.50	.37	2.5	40
	Timber litter						
8	Closed timber litter	1.50	1.00	2.50	0.00	0.2	30
9	Hardwood litter	2.92	.41	.15	.00	.2	25
10	Timber (litter and understory)	3.01	2.00	5.01	2.00	1.0	25
	Slash						
11	Light logging slash	1.50	4.51	5.51	0.00	1.0	15
12	Medium logging slash	4.01	14.03	16.53	.00	2.3	20
13	Heavy logging slash	7.01	23.04	28.05	.00	3.0	25

The fuel models are used to label the current and historic fuels in the unit. The current fuels are those that exist now. The historic fuels are the climax fuel models or those that existed prior to recent fire occurrence in the area. Past wildfires and Vegetation Management Program (VMP) burns have modified these fuels to their current condition. We must assess these areas to determine the historic fuels prior to the fires or what fuels the land will be converted to. The historic fuel models will be used to label the four CAL FIRE planning belts found in the San Bernardino Unit as grass, brush, and desert or conifer types.

In Southern California only, criteria to issue RED FLAG WARNINGS depend upon Burning Index values for the predominant fuel model that will support and carry fire - a value that changes seasonally. In spring finer fuels such as grass are used. From June until January chemise and chaparral fuel models are used for elevations below 4000 ft - and timber above 4000 ft. If BI's are low and critical weather conditions exist, NO RED FLAG is issued.

Fire behavior differences among the four groups are basically related to the FUEL LOAD and its DISTRIBUTION among the fuel particle size classes. Each fuel model is described by the fuel load and the ratio of surface area to volume for each size class; the depth of the fuel bed involved in the fire front; and fuel moisture and/or moisture of extinction. Additionally, fuel loading varies with fuel depth - and the horizontal or vertical orientation of the fuel bed.

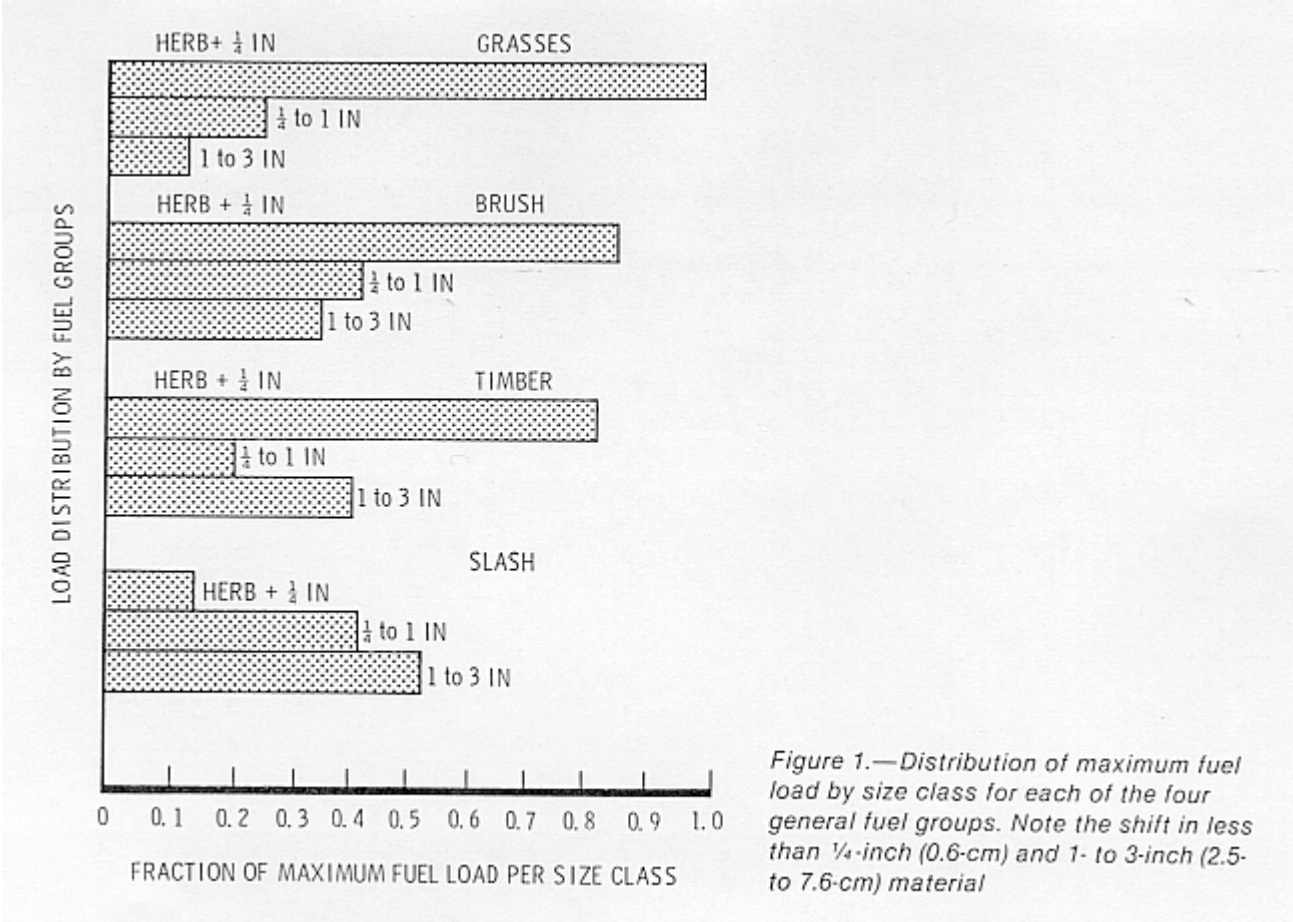


Figure 1.—Distribution of maximum fuel load by size class for each of the four general fuel groups. Note the shift in less than ¼-inch (0.6-cm) and 1- to 3-inch (2.5- to 7.6-cm) material

A second term associated with fuels is **Ladder Fuels**. These are a continuous arrangement of fuels from the surface to the canopy that carry a fire from the surface up into the canopy. When the fire is carried from one fuel group into another, the fire likely will behave differently as changes occur in fuel models, fuel moistures and meteorological conditions. Often new fire behavior calculations are required if the initial calculations did not account for this change.

The current fuel model, slope class, ladder fuel, crown closure component, and difficulty of control rating are used to derive the fuel hazard rank for each quad 81st. CAL FIRE staff in Sacramento determined that there are realistically no low hazard fuels in California, thus the fuels are ranked medium, high, or very high.

San Bernardino fuels models have recently been upgraded from FRAP after significant effort with Unit personnel and preliminary vegetation imagery has been reviewed and validated. Fuels validation, will continue and is constantly being reevaluated to consider the effects of fire history in the Unit.

Structure Fuels

Research on home ignitability implies that homeowners have the ultimate responsibility for reducing home fire loss potential because they alone have the authority to make the necessary changes on their privately owned property.

Home ignitability ultimately may require a change in thinking between the relationship of homeowners and the fire services. Instead of pre-suppression and fire protection responsibilities residing with fire agencies, homeowners (Stakeholders) take the principal responsibility for assuring adequately low home ignitability.

In the San Bernardino Unit federal, state and local fire services have become a community partner providing homeowners with technical assistance, fuels project assistance as well as fire response in a strategy of assisted and managed community stakeholder self-sufficiency.

To this end, San Bernardino Unit Pre Fire and Resource personnel and The San Bernardino National Forest Association, with assistance from the Southern Area Office have collaborated to submit a federal Forest Fire Assistance grant application that would, if successful, assist homeowners with the removal of hazardous fuels on private property. The intent is to avail forest homeowners of the opportunity to receive assistance and at the same time take ownership for reducing the structure ignitability of their homes on small urbanized forest parcels. See Appendix “Small Parcel Hazardous Fuel Reduction Program”

The Bark Beetle Situation

Significant progress has been made in the last six years on the removal of beetle killed trees. However, the beetle killed trees are just a symptom of the greater problem, which is the overstocking of the forest stands across the mountain areas. Even with the removal of thousands of trees, the forest is still over stocked. In many areas, the number of stems per acre exceeds 400 when a healthy stand will have 40-100 stems per acre depending on the site and species.

To that end work has begun to focus on thinning the green fuels rather than just removing dead trees. Most efforts on private land have been focused on trees 12 inches in diameter and smaller. While not ideal, this is the most cost effective means of reducing fuels and creating a healthier more fire safe forest. In the long term, even large diameter trees will need to be thinned to a proper spacing to promote a healthy stand.

The magnitude of the problem has necessitated a multi agency state, federal and local government response. CAL FIRE San Bernardino Unit's role has been to protect public safety by identifying and reducing fuels along major travel routes into and out of these areas. These routes would be used in the event of a wildfire not only for evacuation of residents but also for response by emergency vehicles, CAL FIRE also partners with SBNFA in the green fuels reduction program, "Forest Care". Additionally, the Unit has stepped up Forest Practice inspections of Licensed Timber Operators and contract tree fallers, especially with regard to required fire fighting tool availability. Local CAL FIRE personnel are also working with the MAST organization and local communities to identify fire safe areas of refuge such as schools, parks and community centers that would be safe locations for residents to seek temporary protection in the event of a wildfire. As mentioned previously CAL FIRE conservation camp crews have been busy removing trees that might be susceptible to falling and blocking evacuation routes or threaten areas of refuge. Because of the significant fire and falling hazard these trees posed, essential service sites such as, fire and police stations and communication and fueling facilities, were also targeted.

FREQUENCY OF SEVERE FIRE WEATHER

The San Bernardino Unit is currently experiencing the significant effects of several years of below normal rainfall. This shortage of moisture is contributing in no small way to the huge increase of conifer mortality in the San Bernardino Mountains. Fire weather is one of the most important factors to consider in a study of wildland fire history and potential for a given area. In the fire plan, past weather data will be used to calculate the Level of Service (LOS), assign a severe fire weather ranking to each quad 81st, and run the California Fire Economics Simulator, Version 2 (CFES2). In order to perform these operations, it is necessary to gather past weather records from local weather stations that cover different areas within the Unit. Each quad 81st is assigned a weather station from which the data can be collected. To insure the most complete assemblage of weather records, alternate weather stations can also be assigned. Prior to 1991, the CAL FIRE Remote Automated Weather Stations (RAWS) maintained incomplete data due to malfunctions and other equipment problems. During this period and any other time the data is not available, the weather data will come from other weather stations that cover similar areas outside the Unit.

Fire weather data will be used in several ways in future plan analysis. In the LOS program, it will be used to calculate the Burn Index (BI) and Energy Release Component (ERC) to determine the fire intensity for each fire ignition that occurred during the analysis period. From these components and other ignition information, the fire will be categorized as an initial attack success or failure. This software will also calculate the severe fire weather rank (high, medium, or low), for each quad 81st, based on the weather data, slope and other quad 81st attributes. In CFES2, the historic weather data will be used to project fire indices (BI, ERC, and Rate Of Spread (ROS)) to be used in simulating wildland fires in the future. This information will then be used to analyze how changes in fire suppression forces will affect the Unit's level of service.