Fire Danger Rating Areas

Timber West

This area is the Douglas-fir/Ponderosa Pine forest of the CAL FIRE Direct Protection Area in Trinity County. It is in the Interior Conifer Q81st Planning Belt. The area is managed for timber production; therefore logging slash is a common fuel component. Sufficient undergrowth of ceanothus and manzanita is present to require consideration of a live fuel component. Fire Behavior fuel model 10 and NFDRS fuel model G are used in this area. The larger communities within this area are Hayfork, Lewiston, and Weaverville. Smaller communities exist as well as various areas of urbanization. Most of the urbanization lies in the lower elevations of Trinity County in valleys or along streams.

The terrain is very steep; there is a large amount of heavy fuels, and travel times are long in this area.

Trinity County has experienced several catastrophic fires in recent history, damaging not only valuable timberlands, but also causing significant structure and private property loss.

Indicates a General Assessment of Fire Danger Potential based on historic weather

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The Burning Index (BI) reflected on this and the following graph is a measure of fire intensity. It is represented by a number that relates to the potential amount of effort needed to contain a single fire in a particular rating area. It combines the Spread Component (SC) which rates the forward rate of spread, and the Energy Release Component (ERC), which is the estimated potential available energy released per unit area in the flaming zone of a fire. The BI generally, is ten times the flame length of the fire (BI of 40 = 4 foot flame length).³

³ http://www.fs.fed.us/r2/fire/drgloss.htm Common terms - National Fire Danger Rating System (NFDRS)
Brush Area

The mid elevations (1,000 – 2,000 ft.) surrounding the Sacramento Valley are merged into the brush area. The area is typically chaparral with chamise and manzanita. These elevations include oak woodland fuels with a high mixture of brushy fuels. Communities include the City of Shasta Lake, Mountain Gate, Shasta, Keswick, and French Gulch.

Most of the lands to the northwest of Redding were void of vegetation by the early 1900’s due to copper mining and smelter operations. This area now consists of mostly brush fields that are 50 years old or older. There have been few significant fires in this area, as the brush did not contain sufficient dead material to sustain the fires (fuel models 5 and 6)\(^4\). The brush in these areas now has sufficient dead fuel and fine fuel to sustain large and damaging fires (Fire Behavior fuel model 4, NFDRS model F).

The lands to the west of Redding located at the base or lower levels of the mountains are covered mostly in brush or oak woodland with a heavy brush under story.

Most of the land west of Redding is highly urbanized which creates a high threat to life and property from wildfire. Subdivisions that were developed prior to 1982 often have narrow one-lane roads and no community water systems. Often the structures have a single access road. Some subdivisions were developed with “Fire Emergency Access” roads, however many of these roads are not maintained and are overgrown to the point of being impassable.

Communities in the Brush Area, west of Redding, include Igo, Centerville, Shasta, Keswick, The City of Shasta Lake, and portions of the City of Redding.

The brush area east of Redding is generally located in rangeland. However urbanization in the brush area exists in the western edge of the communities of Shingletown, Whitmore, Oak Run, Round Mountain, and Montgomery Creek. This area has experienced significant fires in the past and with the current urbanization can expect future fires to be more damaging.

Brush Area – Arbuckle Remote Automated Weather Station

\(^4\) “Aid to Determining Fuel Models for Estimating Fire Behavior” H.E. Anderson
Valley Floor (Grass Area)

This is the south-central part of the Unit extending from the Sacramento River outwards to an approximate elevation of 1000 feet. This is the most urbanized area of the Unit and includes the cities of Anderson, Redding, and the communities of Bella Vista, Cloverdale, Millville, Olinda, and Palo Cedro. The area is typically grassy woodland with blue oak, valley oak, gray pine, and annual grasses. There are also large areas covered by brush types and some of the woodland areas have a dense brush under story.

Significant fires have occurred on the valley floor, especially during the North Wind events. Because the primary fuel is annual grasses, each year the fire danger is recurring.

The fine fuels react quickly to weather changes, especially wind. Fire Behavior model 2 and NFDRS model C are used.

Timber East

The Timber East area is the forested area east of Redding. The area extends from the 2,000-foot elevation of the Sacramento Valley to Highway 89. The majority of the area is managed for timber production. This is a mixed species conifer forest that varies from the Timber West Zone in topography, weather and some hardwood species. Slash and brush are part of the fuel component.

Several communities exist within this zone including, Shingletown, Whitmore, Oak Run, Round Mountain, Montgomery Creek, and Burney.

Significant damaging fires have occurred in this area resulting in large structure and timber loss.

Fire Behavior Fuel Model 9 and NFDRS Fuel Model U are used in this area.
Northeast Plateau

The Northeast Plateau is the area of CAL FIRE DPA east of highway 89. Much of the area is high elevation sagebrush, juniper and Ponderosa Pine. Large tracks of agricultural lands are in the Fall River Valley.

The larger communities in this area are Cassel, Fall River, and McArthur with significant urbanization occurring outside of these communities.

With the exception of the irrigated Fall River Valley, the area has experienced damaging fires. The most significant fires were located to the north of Highway 299E and east of Highway 89. Large and damaging fires have also occurred along Highway 89 south of the SRA lands near and around the communities of Hat Creek and Old Station.

Portions of this area are remote and travel times are long. The fuels are very sensitive to changes in the wind speed and direction.

Fire Behavior Fuel Model 6 and NFDRS Fuel Model T are used in this area.
Fuels

The ability to predict fire behavior and rate fire danger became possible with the development of fuel models for specific types of fuels. The fuel models used in this assessment are those developed by the United States Department of Agriculture - Forest Service and are described in “Aid to Determining Fuel Models for Estimating Fire Behavior” (Anderson, Hal; 1982)

Understanding the current fuel situation in the unit is paramount in determining the fire risk to assets. Fuel is any organic material that is living or dead, in or on the ground or above ground level that can ignite and burn. There are two classes of fuels; live and dead. Fuels are usually classified into four groups; grasses, brush, timber and logging slash. The fuel bed is a complex system that includes seven principal characteristics: fuel loading, fuel size and shape, compactness, horizontal continuity, vertical arrangement, chemical content and moisture content. The combined effects of fuel, weather, and topography determine how fire behaves.

5 Albini, “Estimating Wildfire Behavior Effects” and Rothermel “How to Predict the Spread and Intensity of Forest and Range Fires”.
6 Intermediate Wildland Fire Behavior S-290
Definitions

Fuel Loading:
The mass of fuel per unit area, live and dead, grouped by particle size classes, expressed in tons per acre.

Fuel Size and Shape:
The surface-area-to-volume ratio. Typically small flat fuels such as grass have a higher surface-area-to-volume than larger fuels such as logs.

Fuel Compactness:
The spacing between fuel particles. Closely compacted fuels have less surface area exposed, restrict oxygen, and inhibit convective and radiant heat transfer.

Fuel Horizontal Continuity:
Horizontal distribution of fuels at various levels or planes. Continuous horizontal fuels allow the fire to spread easier than sparsely distributed horizontal fuels.

Fuel Vertical Arrangement:
The relative height of fuels located above the ground. This is the ladder fuel component.

Chemical Content:
Chemicals makeup of individual fuel. Some fuels contain chemical compounds that are more volatile than others.

Moisture Content:
The amount of water in fuel expressed as the percentage of the oven-dry weight of the same fuel.

In order to consider the fuel bed characteristics the Fire Plan fuels assessment categorizes fuels in three broad levels – Surface fuels, Ladder fuels, and Crown Fuels. Combining these fuel levels with topography (slope) allows a fuel hazard ranking.

Surface Fuels
The fuel at ground level that is most likely to carry the fire; for example grass, pine needles or leaves, brush, or slash. This fuel will carry active fire without the addition of wind or topographic influence.

The surface fuel in the left foreground is a grass fuel model 1.
The surface fuel model on the right is a fuel model 9: needle and leaf litter with the majority of ground litter less than three inches in diameter.

Ladder Fuels
This is the vertical arrangement component of fuels. These fuels might consist of small trees, brush, low hanging branches, and leaf or needle litter suspended in the branches of shrubs of trees. This fuel is typically ignited by surface fuel fire. The burning of the ladder fuels easily allows the fire to move into the canopy fuels or if the canopy is open to cause individual torching of trees.

In the foreground of the left photograph grass, leaf litter, and dead woody material can carry the fire to the brush that in turn ignites the lower branches of the trees.

In the photograph at the right the forest floor grasses and leaf/needle litter can ignite the younger trees and shrubs and take the fire to the crown of the trees.

Both of these depict a continuous horizontal and vertical arrangement of the fuels.
**Crown Fuels**

This is the tops of the vegetation whether timber or tall shrubs. Canopy closure is the major concern. Canopy closure is usually given as a percentage. It can be demonstrated by looking at the canopy from the air and seeing what percentage of the ground is visible. If 25% of the ground is visible than there is a 75% canopy closure. Typically a crown fire will be sustained if the canopy closure is greater than 50%. Unless strong winds are present, crowning fires are unlikely without a closed canopy.

Here a fire is burning in a mixed coniferous forest where continuous crown fuels exist. This area also has widespread, continuous ladder fuels.

In the foreground of this photograph, both the ladder and continuous crown fuels have been removed creating a more fire safe environment.
The following three maps indicate the fuel rankings for surface, ladder and crown fuels. The fourth map calculates a total fuel ranking which combines the fuels and slope factor. The crown and ladder fuels in the timber belts within the State Responsibility Area were reassessed in 2002. The fuels were not reassessed in the USFS protection area and have a lower ranking on these maps. Sample evaluations indicate that the crown and ladder scores in the USFS DPA should be elevated. An additional three maps indicate the surface fuel types of the Unit.

The Unit’s brush belt fuel types and fuel ranking are in error. Sampling of the Brush Zone indicates that the crown and ladder fuels are at a higher volume than indicated. The Brush Zone shown on the Grass and Brush Zone fuel map indicates grass in many areas where brush has become the primary surface fuel. A goal for the fire plan is to ground truth the brush and grass fuel zones. Some fuel corrections were made in the urbanized areas west of Redding in 2003. Maps utilizing the current fuel data indicate a lower fuel ranking than actually exists in portions of the Brush and Grass Zones.

The following guidelines are used to rank the Q81st fuels. The ranking considers both the spatial continuity of the fuel attribute and how much area of the Q81st cell is covered.

<table>
<thead>
<tr>
<th>Continuity</th>
<th>% of Q81 Area</th>
</tr>
</thead>
<tbody>
<tr>
<td>Not Present</td>
<td>&lt; 30% Ladder Fuel Canopy</td>
</tr>
<tr>
<td>Present, Spatially Limited</td>
<td>&gt; 30% Ladder Fuel Canopy</td>
</tr>
<tr>
<td>Present, Spatially Extensive</td>
<td>&gt; 30% Ladder Fuel Canopy</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>Continuity</td>
<td>% of Q81 Area</td>
</tr>
<tr>
<td>Not Present</td>
<td>&lt; 50% Over story Canopy</td>
</tr>
<tr>
<td>Present, Spatially Limited</td>
<td>&gt; 50% Over story Canopy</td>
</tr>
<tr>
<td>Present, Spatially Extensive</td>
<td>&gt; 50% Over story Canopy</td>
</tr>
</tbody>
</table>

The fuel hazard ranking system is based on estimates of potential fire behavior associated with the particular fuel type: and as such have a direct relationship to the characteristics – rate of spread, fire line intensity, heat intensity, heat per unit area, etc.- that are a result of that fuel complex burning under a particular set of weather conditions. The idea is to provide a basic means of stratifying the landscape into areas of low, medium, and high hazard as it is related to fire behavior potential.7

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7 Appendix VIII of the “Unit Vegetation-based Products” of the California Fire Plan

2008 Shasta – Trinity Unit Fire Plan