



Rapid Assessment of Fire Threat

Fire threat is what we expect to happen with respect to wildfire for a piece of ground. The expectation is based on a combination of two measures: 1) the likelihood of fire occurring, and 2) the expected fire behavior under severe weather conditions.

Likelihood of fire occurrence can be measured using historical fire rotation for a forest type and region, and can be generally differentiated between lower (dry) and upper (wet) montane forest types. Lower montane or dry forest types include the ponderosa pine and mixed conifer stands typical of the lower west slope of the Sierra or Klamath region. Upper montane or high elevation forest types are typically covered by snow for a large portion of the winter, spring and into the summer, including red-fir and lodgepole pine types.

Expected fire behavior can be estimated based on fuel characteristics and terrain (slope) for a given severe weather condition. Stands with high surface fuel loads, significant ladder fuels, high density or tree crown connectivity, and steep slopes (>25%) would generally support very high fire behavior. Surface fuels include dead and downed material (needles, branchwood, logs) as well as shrubs. Ladder fuels include small trees, low branches and other vegetation that can transfer fire into the forest canopy. Examples of overly-dense stands include those with significant natural infill of shade-tolerant species (e.g. white fir, incense cedar) due to fire exclusion, or older plantations initiated at high density that have never been thinned.

The following tables and figures can be used as reference points for evaluation of hazardous fuels. It is important to note that these are very generalized and not comprehensive. Fire behavior for a given site is a combination of these factors, plus weather and topography. Site-specific assessment of fuels and potential fire behavior can be performed via expert opinion, fire behavior models, or both.

Slope Classes:

Slope affects fire spread by pre-heating and drying fuels ahead of the flaming front. A slope of ~20% can sustain fire spread without wind. The following can be considered reasonable classes for high, moderate and low slope terrain.

Steep	Moderate	Low
>25%	11 – 25%	Flat – 10%

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Surface Fuel Loads:

Surface fuel loads that can support flame lengths > 2.5 meters (~8 ft) under severe weather conditions can be considered hazardous, depending on forest canopy structure. Some examples include TL5, TU5 and TU3 in Scott and Burgan (2005). Fuel models TL3 and TL1 can be considered examples of moderate and low fuel loads, respectively.

Fuel Model TL5 (185): High Load Conifer Litter



Fuel Model TU5 (165): Very High Load, Dry Climate Timber-Shrub



Fuel Model TL3 (163): Moderate Load Conifer Litter





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Fuel Model TL1 (181): Low Load Compact Conifer Litter



For more references or detail, see:

Blonski, K. S., & Schramel, J. L. (1981). Photo series for quantifying natural forest residues: southern Cascades, northern Sierra Nevada. Gen. Tech. Rep. PSW-56. Berkeley, Calif.: U.S. Department of Agriculture, Forest Service, Pacific Southwest Forest and Range Exp. Stn. 145 p.

Scott, J. H., & Burgan, R. E. (2005). Standard fire behavior fuel models: a comprehensive set for use with Rothermel's surface fire spread model. Gen. Tech. Rep. RMRS-GTR-153. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. 72 p.



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Ladder Fuels:

Ladder fuels allow for transmission of fire from the surface fuel complex into forest canopy. Capacity for ladder fuels to transmit fire to the canopy depends on their type, arrangement and distance to the continuous tree canopy. Presence of mostly continuous ladder fuels within 2.5 meters (~8 ft) of continuous green tree canopies can be considered hazardous. Patchy or discontinuous ladder fuels can be considered moderate.



Fire suppressed stand in the Teakettle Experimental Forest with white fir (*Abies concolor*) 20- to 30-in d.b.h. with ladder fuel potential. Photo: Malcolm North, from: North, M., Stine, P., O'Hara, K., Zielinski, W., & Stephens, S. (2009). An ecosystem management strategy for Sierran mixed-conifer forests. Gen. Tech. Rep. PSW-GTR-220 (Second printing, with addendum). Albany, CA: U.S. Department of Agriculture, Forest Service, Pacific Southwest Research Station. 49 p



Transmission of fire into tree crowns. Source: NPR and US Forest Service. <http://www.npr.org/2012/08/23/159373770/the-new-normal-for-wildfires-forest-killing-megablazes>

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Density and Crown Connectivity:

Measures of relative density or stocking for forest stands depend on forest type. Connectivity of tree crowns is a related but better measure of fire hazard. Canopy cover of <50% can be considered low hazard, 50-75% moderate, and >75% high.

