# OK-FIRE Basics for *FIRE DANGER*

## (http://www.mesonet.org/index.php/okfire)

### Fire Weather Variables:

| | | |
|---|---|---|
| **Relative Humidity:** | **35-85%** | Increasing fire danger as relative humidity decreases |
| | **20-35%** | Containment becomes difficult; quick ignition; spot fires increase |
| | **< 20%** | Extreme fire behavior; spot fires frequent |
| **Wind Speed:** | **> 20 mph** | Higher speeds cause increased fire danger and spread rates; winds and gusts over 20 mph become increasingly problematic |
| **Temperature:** | | In general, higher temperatures increase fire danger, but relative humidity and wind speed are by far the most important factors among the weather variables |

Relative humidity (RH) is the most important of the three weather variables above, since if RH is sufficiently high, the moisture content of the 1-hour and 10-hour dead fuels (see below) will be high enough to impede or exclude burning even with high wind speeds. Given sufficiently low RH, the second most important weather variable then becomes wind speed.

However, ***even with suitable fire weather, the existence and levels of fire danger depend on the FUEL COMPLEX –*** the fuel moisture levels of the live and dead fuels as well as their loads. One can have low RH and high wind speed, but if most of the surface fuels are green (live fuels) with high fuel moisture, there will be minimal fire danger. A general equation for fire danger level is:

**Fuel Moisture (Live & Dead) + Fuel Loads (Live & Dead) + Weather ➡ Fire Danger Level**

### Dead Fuel Moisture:

A variable which is directly related to dead fuel is "dead fuel moisture" (DFM). In particular, 1-hour dead fuels (fine fuels like dead grasses and leaves) are critical, followed by 10-hour fuels (about ½" diameter). In OK-FIRE dead fuel moisture is calculated from weather variables using the Nelson model.

| 1-h Fuels | 10-h Fuels | Fire Behavior |
|---|---|---|
| **7-20%** | **6-15%** | Increasing fire danger as dead fuel moisture values decrease |
| **5-7%** | **5-6%** | Containment becomes difficult; quick ignition; spot fires increase |
| **< 5%** | **< 5%** | Extreme fire behavior; spot fires frequent |

However, remember that dead fuel moisture alone does not tell the entire story. One can have very low 1-h and 10-h DFM, and yet have minimal fire danger if most of the fuels are green (live fuels).

## Fire Danger Variables:

The most important of the fire danger indices produced by the Oklahoma Fire Danger Model in OK-FIRE is **Burning Index** (BI), which relates to the intensity of the headfire and its flame length. Besides being a function of weather, BI is also strongly influenced by the type, amount (loads), and greenness levels of the wildland surface fuels being modeled. ***Thus, the GREENNESS level and the selected FUEL MODEL must be appropriate for the fire danger model to produce reasonable results.***

**Greenness Level + Fuel Model + Weather ➡ Fire Danger Level**

The **daily greenness level** assigned a given Mesonet station by the MODIS satellite sensor can be found by looking at the "Relative Greenness Zoom Map" in the left menu section of OK-FIRE and zooming into your geographical area of interest. Relative Greenness (RG) is a critical variable in the fire danger model utilized in OK-FIRE. RG is used to model live fuel moisture (herbaceous and woody) and to apportion the fuel load distribution between 1-hour dead fuels and live herbaceous and live deciduous woody fuels. If you rely mainly on site-specific products (charts and tables), it is important that you ***regularly look at nearby Mesonet sites on the RG zoom map and select a station which has a RG value approximating the observed levels of greenness of your local wildland surface fuels.*** Else, if you're in an agricultural area, the Mesonet station's greenness level may be more reflective of the crops or barren fields, rather than the wildland fuels which are the focus of the fire danger predictions.

Each 500-m pixel of land in Oklahoma is modeled by one of seven "**fuel models**", each of which describes the fuel bed characteristics of the wildland surface fuels in that model ("Default Fuel Model Zoom Map" in left menu section). These "default" fuel models are used in all the OK-FIRE map products for the four fire danger indices (BI, SC, ERC, and IC). The seven fuel models are: **A** (western annual grasses; also used for urban areas and annual cropland), **B** (tall dense evergreen brush; eastern redcedar), **F** (intermediate evergreen brush), **L** (western perennial grasses), **P** (southern pine forest), **R** (hardwood forest), and **T** (tallgrass with open evergreen brush).

For **chart** and **table** products, however, the user has the ***ability to select a different fuel model*** (nine total models are available) for a given Mesonet station if the default model is deemed inappropriate ("Station Fuel Model Options" at bottom of left menu section). The fuel model currently being used by the fire danger model for that station is called the "current" fuel model, while the default model is called the "default" fuel model. The "current" fuel model can be changed by the user; the "default model" for the map products stays the same.

***Of the seven default fuel models listed above, Model T is a reliable "worst case" scenario fuel model under most situations for Oklahoma fuels,*** so you may wish to use that model for your daily fire danger assessment and forecasts. However, if you wish to model just grasses, you can use a pure grassy model like Model L. If you're in forest settings, you can use Model R (hardwood forest) or Model P (southern pine forest). Two other fuel models in addition to the seven default models are also available: G (forest with heavy downed fuels) and K (light slash).

**A general interpretation of fire danger based on Burning Index is as follows:**

| Burning Index (BI) | Flame Length | Fire Danger |
|---|---|---|
| **<20** | **< 2 feet** | **LOW** |
| **20-40** | **2-4 feet** | **MODERATE** |
| **40-80** | **4-8 feet** | **HIGH** |
| **80-110** | **8-11 feet** | **SEVERE** |
| **> 110** | **> 11 feet** | **EXTREME** |

Burning Index will, on most days, go through a daily cycle, with highest values during the daytime and lower values at night, so there typically will be a few hours of appreciable fire danger each day. ***What is important to watch for are the relative LEVELS of fire danger (higher BI values) and the DURATION of those high values (sometimes persisting through the night). Also, with respect to the 84-h forecast, the TREND in BI is important and valid, even with inexact BI values.***