

What is the Keetch-Byram Drought Index?

Key Points

- Drought is a prolonged, abnormally dry period when the amount of available water is insufficient to meet normal use. Drought is not simply low rainfall; if it was, much of inland Australia would be in almost perpetual drought.*
- Consistently high temperatures can aid in creating drought conditions since there is an increase in the evaporation of soil moisture.
- A degree of summer drought is normal.
- The KBDI scale ranges from zero, where the soil is saturated with water, to 200; the wilting point for vegetation.
- The KBDI scale is directly proportional to the amount of water available in the soil.

Definitions

- **Drought** is a prolonged absence or marked deficiency of precipitation (rain).*
- **Fire suppression** is the activities connected with restricting the spread of a fire following its detection and before making it safe.

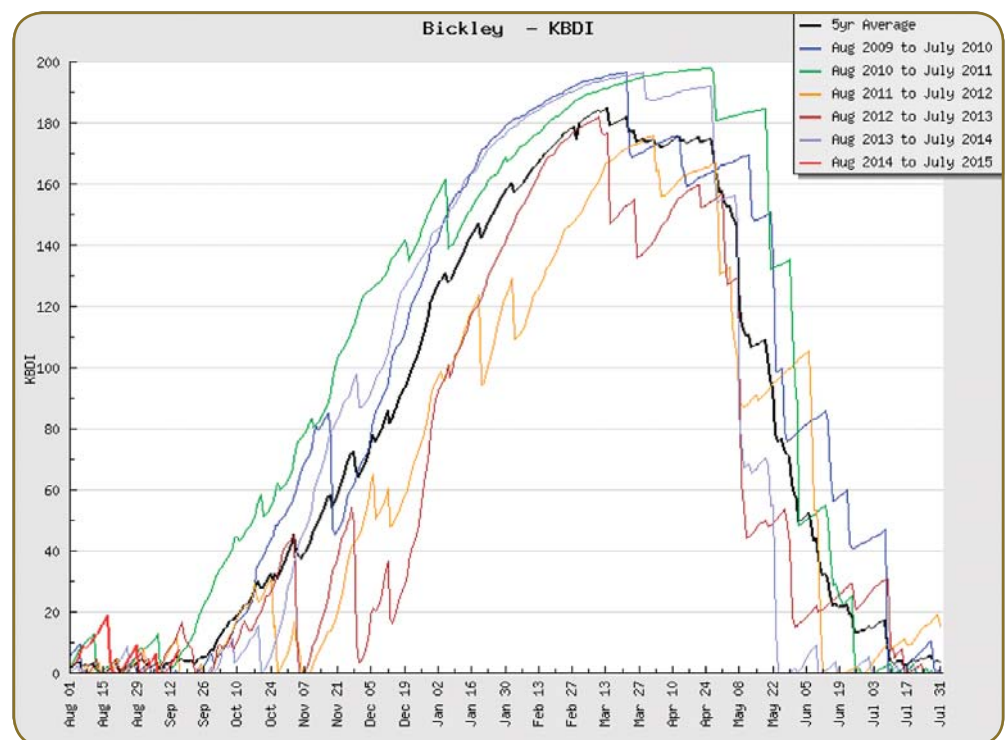
* Source: Bureau of Meteorology.

A tool used by fire managers

The Keetch-Byram Drought Index (KBDI) is a numerical value reflecting the dryness of the top layer of soils, deep forest litter, logs and living vegetation. The KBDI is expressed as a scale from 0–200, where the number represents the amounts of rainfall (in millimetres) to return the soil to saturation.

The index is calculated daily using:

- the areas mean annual rainfall
- the maximum temperature for the day
- the previous 24 hours' rainfall
- the previous day's drought index value.



Above: An example of a KBDI graph for Bickley in the Perth Hills. Source BOM.

Only rainfall in excess of 5 mm goes towards reducing the KBDI as the first 5 mm of an event is assumed to be lost, due to canopy interception. All other rainfall during an event goes into reducing the KBDI. Where several consecutive days of rainfall occur, these are considered a single rain event.

Suppressing bushfires

Soil moisture content determines the level of drought affecting vegetation and organic material in the upper layer of mineral soils and throughout the profile of organic soils. The KBDI provides a guide to fire managers of the flammability of organic material on and within the soil surface that can impact their ability to suppress bushfires.



The significance of the KBDI to fire managers depends upon the type and structure of the fuel. In areas of heavy forest fuels it is important to know when rainfall deficits start to affect fuel moisture.


During periods of severe rainfall deficit the reduced moisture contents of scrub and tree crowns enables bushfires to crown more readily and can cause normally resilient woody vegetation to die.

At a KBDI above 100, grasslands may begin to cure and forests, even with light fuel loads, can develop fuel conditions associated with the incidence of crown fires.

KBDI considerations

- For forested areas the rate of moisture loss depends upon the vegetation cover and, consequently, its transpiration capacity. This is a function of the mean annual rainfall as vegetation cover density adjusts over time to maximise the use of available moisture.
- The rate of moisture removal by vegetation as a function of the mean annual rainfall is exponential. The rate increases with increasing annual rainfall and vice versa.
- The KBDI considers the field capacity (ability to absorb water) of the soil to a depth of 20 cm.
- The rate of moisture loss from soil is determined by evapotranspiration relations and is exponential over time.
- The wilting point marks the lowest soil moisture value above which vegetation has the capacity to access moisture for transpiration.
- The KBDI uses the wilting point as the lowest soil moisture level with the rate of moisture loss (under similar conditions) directly proportional to the amount of water available in the soil for transpiration at a given time.

Detail in this Technical Information Note was sourced from Keetch, John J., and George M. Byram. *A drought index for forest fire control*. (1968).

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