What is the Keetch-Byram Drought Index?

Fact Sheet, December 2025

The Keetch-Byram Drought Index (KBDI) is a **measure of drought conditions** and an important tool for fire managers. It **provides a measure of dryness in the top 200 mm of the soil profile.** The KBDI is an indicator of drought conditions, coarse woody (logs) and live and dead fine fuel availability, which helps support fire management and response decisions.

The KBDI is **measured on a scale from 0 to 200** (saturated to completely dry) and is presented as a cumulative moisture deficiency curve. The values reflect the amount of rainfall in millimetres required to return the soil to full saturation. The KBDI is updated daily using the following factors:

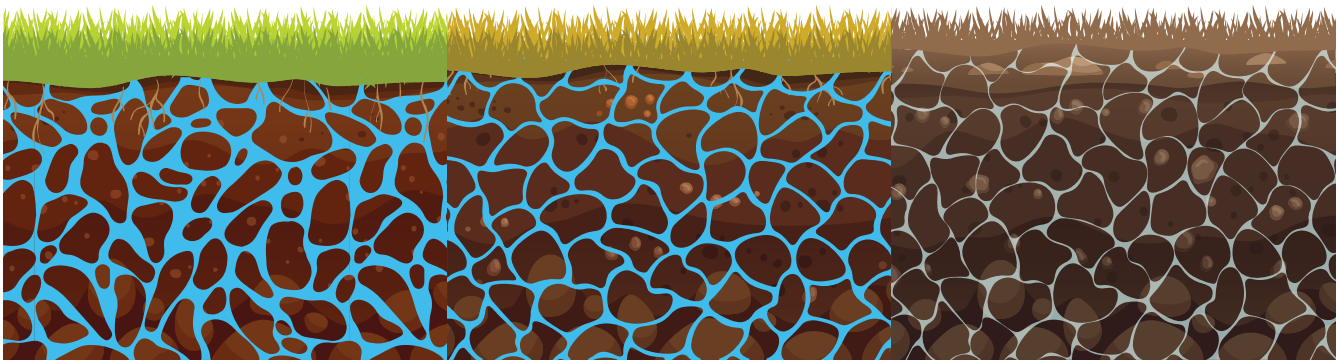
- Mean annual rainfall for the area
- Maximum temperature and relative humidity for the day
- Rainfall in the previous 24 hours
- The previous day's KBDI value

The first 5mm of rainfall are assumed to be intercepted by the canopy and lost. Therefore, only **rainfall exceeding 5mm contributes to reducing the KBDI.** In the event of consecutive days of rainfall, the entire period is treated as a single rain event.

Suppressing bushfires

The KBDI provides insight into potential fire behaviour and the ability to suppress bushfires by indicating fuel dryness. Soil moisture can significantly influence the moisture content in vegetation and organic material. Available moisture can be absorbed into unsaturated fuels, which then becomes available to evaporate. This absorption-evaporation cycle persists until fuels reach saturation or are fully cured. For fuel to ignite, the moisture present must first evaporate. Therefore, drier fuels ignite and burn more readily.

During periods of severe rainfall deficiency, reduced moisture in standing and canopy fuels enables bushfires to crown more readily. Dead or dying fine fuels may begin to cure when the KBDI exceeds 70, and fully cure when the KBDI exceeds 130, creating fuel conditions favourable for crown fires (Melton 1989). By using the KBDI, fire managers can anticipate and prepare for these heightened fire risks.



KBDI = 0
Saturated

KBDI = 200
Dry

Considerations for the Keetch-Byram Drought Index

- **Annual cycles:** High temperatures can aid in creating drought conditions since evaporation increases loss of soil moisture. A degree of moisture deficiency is normal in summer.
- **Drought Declaration:** The responsibility for declaring drought rests with State and Federal Governments; the Bureau of Meteorology provides supportive data but does not issue declarations.
- **Drought Factor (DF):** Is a daily measure of both long-term influences and immediate effects of recent rainfall on fine forest fuels. It is calculated using time since the last rainfall, rainfall quantity and KBDI values, ranging from 1 (wet) to 10 (maximum fine fuel availability).
- **DF and KBDI use in Fire Behaviour Models:** The Bureau of Meteorology uses the KBDI to calculate the drought factor, which is a key input in many fire behaviour models.
- **Evapotranspiration Relations:** Soil moisture loss follows an exponential curve, with evapotranspiration rates influencing how quickly soils dry over time.
- **Fine fuels:** Combustible material made up of dead leaves and twigs less than 6 mm in diameter and live vegetation less than 3 mm in diameter.
- **Fuel Type and Structure Sensitivity:** The KBDI's importance varies with fuel type and structure. In areas with dense surface litter, the KBDI is particularly effective for assessing fire risk. Coarse fuels take longer than fine fuels to respond to changes in moisture availability.
- **Moisture Loss in Forested Areas:** The rate of moisture loss in forested regions is influenced by vegetation cover and its transpiration capacity, which is linked to rainfall. Over time, vegetation density adjusts to optimise moisture use, meaning areas with higher rainfall experience faster moisture loss, while areas with lower rainfall retain moisture longer.
- **Rainfall deficiency:** Rainfall which is within the lowest ten percent for the period, with the most severe cases falling within the lowest five percent.
- **Soil dryness (KBDI):** KBDI decreases as soil moisture increases and uses a zero to two hundred scale that represents the rainfall needed to fully saturate the top two hundred millimetres of soil.
- **Topography, Vegetation and Soil Type:** While KBDI calculations assume uniform conditions without accounting for specific topographical, vegetative or soil type variations. These factors typically need to be modelled separately for more accurate fire behaviour predictions.

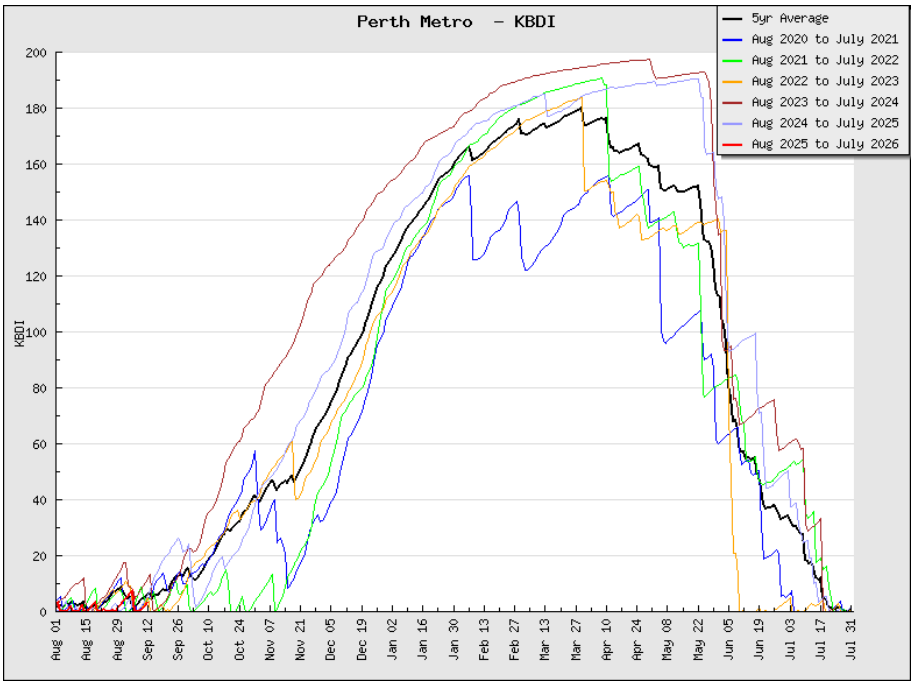


Figure 1: An example of a KBDI graph for Perth Metro. Source BOM. A typical Mediterranean climate, where KBDI values increase over summer as the soil dries and then rapidly decrease with significant winter rains.

Further Information

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