Real-time Drought Assessment System of Texas A&M Forest Service

Texas A&M Forest Service (TFS) uses Keetch-Byram Drought Index (KBDI) for determination of drought conditions within the State of Texas. The KBDI is based on a daily water balance, where a drought factor is balanced with precipitation and soil moisture (assumed to have a maximum storage capacity of 8-inches) and is expressed in hundredths of an inch of soil moisture depletion.

The KBDI attempts to measure the amount of precipitation necessary to return the soil to full field capacity. It is a closed system ranging from 0 to 800, where 0 represents a saturated soil, and 800 an absolutely dry soil. At any point along the scale, the KBDI value indicates the amount of precipitation it would take to bring the moisture level back to zero, or saturation.

KBDI was developed by John L. Keetch and George Byram with the US Forest Service Southeastern Research Station to correlate the effects of drought on wildfire potential. This relationship is reflected in the following table:

0 – 200: Soil moisture and large class fuel moistures are high and do not contribute much to fire intensity. Typical of early spring following winter precipitation.

200 – 400: Fuels are beginning to dry and contribute to wildfire intensity. Heavier fuels will still not readily ignite and burn. This is often seen in late spring or early summer.

400 – 600: Lower litter and duff layers contribute to fire intensity and will burn actively. Wildfire intensity begins to increase significantly. Larger fuels could burn or smoulder for several days. This is often seen in late summer and early fall.

600 – 800: Often associated with more severe drought with increased wildfire occurrence. Intense, deep-burning fires with extreme intensities can be expected. Live fuels can also be expected to burn actively at these levels.

Data sources

1. RADAR Rainfall – NEXRAD (Figure 1) data from West Gulf River Forecast Centre (WGRFC)
2. Raingage rainfall – Daily rainfall data from First Order Station of National Weather Service (NWS)
3. Maximum temperature – Daily maximum temperature data from First Order station of NWS
4. Mean annual precipitation (30 yr average) - http://www.prism.oregonstate.edu/

Process of calculating KBDI on a daily basis

KBDI (Figure 2) assumes that a reduction in drought occurs only when daily rainfall exceeds 0.20 inches (called net rainfall). The computational steps involve reducing the drought index by the net rain amount and increasing the drought index by a drought factor. Detailed procedure for calculation of KBDI is described in Keetch and Byram (1968).

Daily RADAR rainfall data, raingage data and maximum temperature are downloaded automatically everyday for starting the KBDI calculation. The hourly rainfall data are then accumulated for 24 hours from 8:00AM previous day to 8:00AM current day for calculating the daily rainfall. This daily NEXRAD rainfall data at a spatial resolution of 4km × 4km is then bias corrected based on raingage data to calculate effective rainfall. Daily maximum temperature data from NWS is spatially interpolated using Inverse Distance Weighting (IDW) at a spatial resolution 4km × 4km for compatibility with rainfall data. The effective rainfall and temperature data are then used for calculating the daily KBDI.

The KBDI calculated at 4km × 4km resolution is then aggregated over each county to map the average, maximum and minimum KBDI across each county. Further, a threshold map of KBDI is also developed by identifying 4km × 4km regions with index values greater than 575 for enhanced fire hazard warning.

Process of forecasting KBDI:

The process of forecasting the KBDI is exactly the same as explained previously except that the same maximum temperature of the current day was assumed to continue during the forecast period WITHOUT ANY RAINFALL.

Texas KBDI pages:

http://texasforestservice.tamu.edu/

http://ticc.tamu.edu/PredictiveServices/Drought.htm

http://twc.tamu.edu/kbdi

Reference:
Keetch, John J. and Byram, George M. 1968. Res. Pap. SE-38. Asheville, NC: U.S. Department of Agriculture, Forest Service, Southeastern Forest Experiment Station. 35 p.

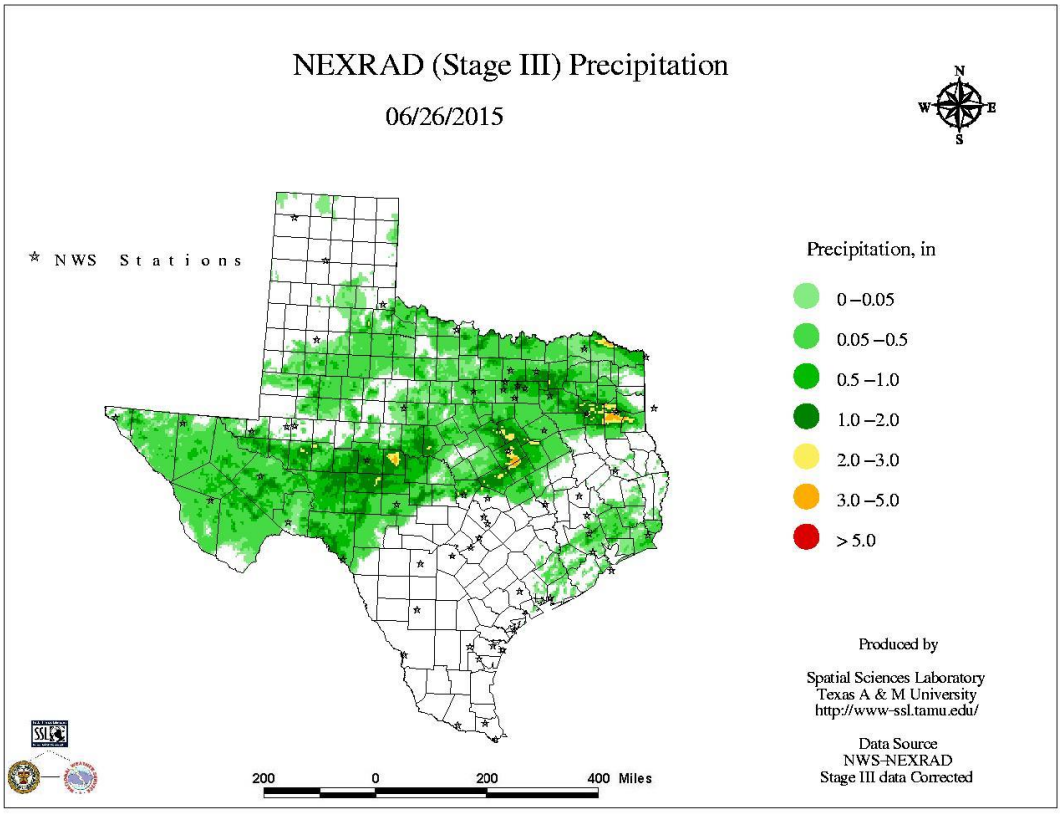

Figure 1. Typical NEXRAD data image published at http://twc.tamu.edu/nexrad

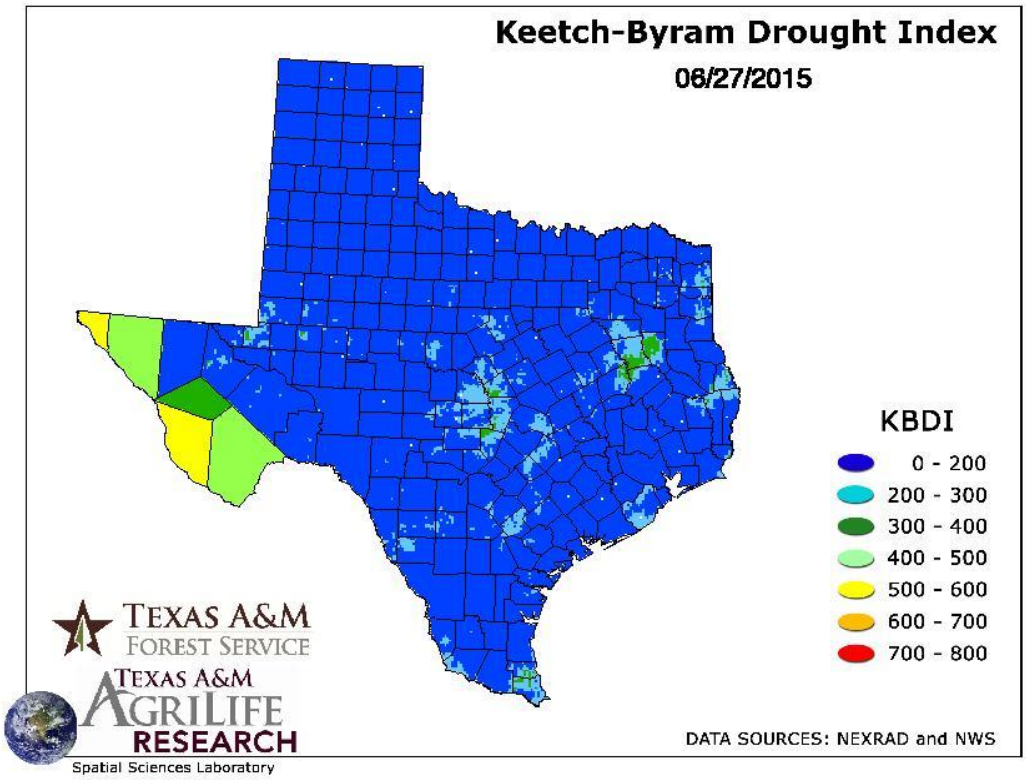

Figure 2 Typical KBDI image published at http://twc.tamu.edu/kbdi