# Drought code

## Description

The Drought code ($DC$) is one of the three fuel moisture code components of the Canadian forest fire weather index ($FWI$) system. The $DC$ represents the moisture content of deep compact layer of organic matter weighing about 25 kg/m2 when dry. It assesses the effects of seasonal drought on deep duff layers and heavy fuels. It requires noon temperature, precipitation and current month (in order to take daylength into account) as input data (Van Wagner 1987).

As the two other moisture codes of the $FWI$ (cf. $FFMC$ and $DMC$), the $DC$ comprises two phases: one for wetting by rain and one for drying.

## Formula

The $DC$ is calculated as follows (Van Wagner and Pickett 1985):

First, the previous day's $DC\backslash$) becomes $DC_{t-1}$.

In case of rain (i.e. if $P > 2.8$), the following procedure for wetting phases has to be chosen:

Effective rainfall $P_d$ [mm] is first calculated:

$$P_d = 0.83 \cdot P - 1.27, \text{ for } \mathrm{P} > 2.8$$

Then, the moisture equivalent of the previous day's $DC$, $Q_{t-1}$, has to be calculated:

$$Q_{t-1} = 800 \cdot e^{\frac{-DC_{t-1}}{400}}$$

Based on that $Q_{t-1}$, the moisture equivalent after rain $Q_{r_t}$ can be calculated:

$$Q_{r_t} = Q_{t-1} + 3.937 \cdot P_d$$

Finally, $Q_{r_t}$ can be converted to the the $DC$ after rain $DC_{r_t}$, which becomes the new $D_{t-1}$:

$$DC_{r_t} = 400 \cdot \ln\left(\frac{800}{Q_{r_t}}\right), \text{ if } DC_{r_t} < 0, \text{ then } DC_{r_t} = 0$$

NB: if $P \leqslant 2.8$, the above rainfall routine must be omitted.

Then, potential evapotranspiration $V$ has to be calculated as follows:

$$V = 0.36 \cdot (T_{12} + 2.8) + L_f, \text{ if } T_{12} < -2.8, \text{ then } T_{12} = -2.8$$

where the day-length factor $L_f$ for each month is given in the following table:

|        | Jan  | Feb  | Mar  | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov  | Dec  |
|--------|------|------|------|-----|-----|-----|-----|-----|-----|-----|------|------|
| $L_f$  | -1.6 | -1.6 | -1.6 | 0.9 | 3.8 | 5.8 | 6.4 | 5.0 | 2.4 | 0.4 | -1.6 | -1.6 |

NB: $V$ cannot be negative. If the above equation produces a negative result, then $V$ has to be set to 0.

Finally, $DC$ is calculated as follows:

$$DC_t = \begin{cases} DC_{t-1} + 0.5 \cdot V, & \text{for } P \leqslant 2.8 \\ DC_{r_t} + 0.5 \cdot V, & \text{for } P > 2.8 \end{cases}$$

The $DC$ is supposed to be calculated on a daily basis. The meteorological data used for its calculation have to be recorded at noon (for fire danger prediction at about 4 pm).

The $DC$ calculation starts, in regions normally covered by snow in winter, on the third day after snow has essentially left the area. In regions where snow cover is not a significant feature, the calculation starts on the third successive day with noon temperature greater than 12 °C (Lawson and Armitage 2008). The starting value of the index has to be set to 15.

# References

Original publications:
Van Wagner and Pickett (1985)
Van Wagner (1987)

Other publication:
Lawson and Armitage (2008)

*The original document is available at http://wiki.fire.wsl.ch//tiki-index.php?page=Drought+code*