# 100-hour timelag dead fuel moisture model

## Description

The 100-hour timelag fuel moisture $MC_{100}$ is the moisture content of the 100-hour timelag fuels, which consist of dead roundwood in the size range of 1 to 3 inches in diameter and the forest floor from 0.75 inch to 4 inches below the surface (Deeming et al. 1977).

The calculation of the 100-hour timelag fuel moisture model requires latitude (in degrees or radians, cf. below), maximum and minimum daily air temperature [°F] and relative humidity [%] at early to midafternoon time, as well as precipitation duration during the previous 24 hours [hr] as input variables (Bradshaw et al. 1983).

NB: the calculation of the 100-hour timelag fuel moisture model requires precipitation duration (in hours) as input variable, which is not a standard meteorological variable.

## Formula

The 100-hour fuel class responds very slowly to changes in environmental conditions. Therefore, an equilibrium moisture content ($EMC$) representing the average drying-wetting potential of the atmosphere for the preceding 24 hours is used for its calculation (Cohen & Deeming 1985).

The 100-hour dead fuel moisture model is calculated as follows (Cohen & Deeming 1985):

First, the weighted 24-hour average $EMC$ is calculated:

$$EMC_{24} = \frac{N_{nfdrs} \cdot EMC_{min} + (24 - N_{nfdrs}) \cdot EMC_{max}}{24}$$

where $N_{nfdrs}$ is the daylight hours (cf. NFDRS formulation), $EMC_{max}$ the 24-hr maximum $EMC$, and $EMC_{min}$ the 24-hr minimum $EMC$. The 24-hour average $EMC_{max}$ is obtained by substituting $T$ [°F] and $H$ [%] by $T_{max}$ and $H_{min}$ in the standard $EMC$ equation (cf. Equilibrium moisture content), and the 24-hour average $EMC_{min}$ is obtained by substituting $T$ [°F] and $H$ [%] by $T_{min}$ and $H_{max}$ in the standard $EMC$ equation.

Then, the weighted 24-hour average moisture condition $D$ [%] is calculated as follows (Cohen & Deeming 1985):

$$D = \frac{(24 - P_{dur}) \cdot EMC_{24} + P_{dur} \cdot (0.5 \cdot P_{dur} + 41)}{24}$$

where $P_{dur}$ is the 24-hours precipitation duration (in hours).

Finally, the 100-hour timelag fuel moisture model $MC_{100}$ [%] on day i is calculated as follows (Cohen & Deeming 1985):

$$MC_{100_t} = MC_{100_{t-1}} + (D_t - MC_{100_{t-1}}) \cdot (1 - 0.87e^{-0.24})$$

where $MC_{100_{t-1}}$ is the $MC_{100}$ value from the previous day.

The 100-hour timelag fuel moisture model is aimed to be calculated on a daily basis. The meteorological data used for its calculation have to be recorded at early to mid-afternoon time (1 to 3 pm).

NB1: The model used in the 1978 NFDRS version (cf. Burgan et al. 1977 and Deeming et al. 1977) to calculate the 100-hour timelag fuel moisture differs from the model presented here (cf. Cohen & Deeming 1985): in the 1978 version, daylength was not considered, and the 24-hour average $EMC$ was a function of the simple averages of the 24-hour temperature and relative humidity extremes.

NB2: If the starting value is not known or accurate, usally a starting value of 30 [%] is set. This usually allows consistent results after a four-weeks calculation period (Deeming et al. 1977).

# References


Burgan et al. (1977)
Deeming et al. (1977)
Bradshaw et al. (1983)
Cohen & Deeming (1985)


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