FUEL FLAMMABILITY INDEX

The fuel flammability index is designed to show daily trends in fine fuel flammability resulting from changes in fuel moisture content according to average daily temperature and relative humidity and rainfall. The index is a reflection of the relative ease with which fuels may be ignited and may be a guide to potential fire behaviour.

The Basic Index

$$F.F.I. = \frac{4}{3} \times \frac{(25 + RA)}{SD}$$

SD = saturation deficit in millibars

RA = rainfall allowance in millimeters

and = (R + RD) - ER

where R = rainfall in millimetres

RD = residual rainfall (mm)

ER = effective rainfall

Rainfall (R)

Rainfall in excess of 30mm in 24 hours is disregarded. This applies to both measured rainfall (R) and to rainfall accumulated by carrying over any residual rainfall (RD) before subtracting the allowance for effective rainfall (ER).

eg.

On day 1, if R is 35mm and ER is 4mm then the value for RA for the first days calculation is

(35 - excess 30) - 4 = 26mm

On day 2 further R is 20mm and ER = 3mm

∴ R (20) + RD (26) = 46mm - but anything over 30mm is disregarded so ER of 3mm from 30 gives a RA for day 2 of 27mm.

Effective Rainfall (ER)

This is the amount of rain necessary to wet at least the surface fine fuels to a level of fuel moisture where they are non-flammable.

$$ER = 0.546\ (2.1 \times SD)^{0.7}$$ - daily basis

where ER = effective rainfall

SD = saturation deficit in millibars

Saturation Deficit (SD)

This is a measure of evaporation (from Prescott, 1938) and is obtained from the average daily temperature $\frac{Mx + Mn}{2}$ and the daily RH $\frac{Mx + Mn}{2}$.

Residual Rainfall Effects

Where R - ER, R+RD - ER or RD - ER>0 then the fuel flammability index is obtained from;

$$F.F.I. = 43 \times \frac{(25 + RA)}{SD}$$

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On the first day of rain, where R - ER > 0, the first days fuel flammability index is obtained from;

$$F.F.I. = \frac{4}{3} \left(\frac{25 + R - 0.546 \ (2.1 \times SD)}{SD} \right)^{0.7}$$

The difference, R - ER is then carried over to the second day and added to that days rainfall, if any.

Consequently, the index is obtained from;

$$F.F.I. = \frac{4}{3} \left(\frac{25 + (R + RD) - 0.546 \ (2.1 \times SD)}{SD} \right)^{0.7}$$

where R = rainfallin mm,
ER = $0.546 \ (2.1 \times SD)^{0.7}$,
RD = residual rain (R - ER > 0),
SD = saturation deficit.

So long as R - ER > 0 or R + RD - ER > 0 then the residual RD is carried over until finally R + RD - ER or R - ER is ≤ 0 and the calculation of F.F.I. then reverts to the basic expression,

$$FF.I. = \frac{4}{3} \times \left(\frac{25 + RA}{SD} \right)$$

where RA = 0

This expression is also used when;

(1) there is either:
   a) no rain on the first day of calculation,
   b) no rain on a subsequent day and no residual rain from the day before.

or

(2) $R - ER \leq 0$

(3) $RD - ER \leq 0$

(4) $R + RD - ER \leq 0$

Future work on this index will involve checking it against the flammability of fuels.

Two study areas will be used - Yanmah and Grimwade. Both areas are equiped with weather stations, although daily rainfall from Grimwade is necessary. The study will be run in conjunction with the A.F.F. trial and the S.M.C. trials.

Because the index is updated on a daily basis, it will be necessary to sample for fuel M.C. and fuel flammabilities daily. Obviously, no sampling will be done when fuels are "dripping wet" - ie. when it has been or is raining. Yanmah rainfall must be taken at about 0900 hours every morning. The M.C. samples may be able to be taken in the afternoon if it has not been or is not raining. The Yanmah F.F.I. and fuel moisture status will be kept running through to next wet season.

Grimwade

Daily rainfall measurements will be required. This can be kept at the Grimwade office and collected when convenient. As with Yanmah, Grimwade will be sampled when it is deemed that the fuels are not "dripping wet". As well as the A.F.F., aerial, M.C., P.M.C. samples, moisture content samples from both clearfelled and machine felled areas will also be taken at about 3 pm. Needle samples from the exterior and interior of both clear felled heaps and machine felled outrows will be

taken. As for Yanma, the F.F.I., A.F.F. and M.C. will be kept up. As well, S.D.I. maintained.

The aim of this is to

a) find or determine the flammability of fine fuels at various moisture contents,

b) to relate this to the F.F.I. in some way,

c) to see if the S.M.C. prediction system can be streamlined,

d) to see if aerial M.C. can be predicted.

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