Package ‘fwi.fbp’

Type Package

Title Fire Weather Index System and Fire Behaviour Prediction System Calculations

Version 1.7

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Depends R (>= 2.15.1)

Description Provides three functions to calculate the outputs of the two main components of the Canadian Forest Fire Danger Rating System (CFFDRS): the Fire Weather Index (FWI) System and the Fire Behaviour Prediction (FBP) System.

License GPL-2

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Description

Allows R users to calculate the outputs of the two main components of the Canadian Forest Fire Danger Rating System (CFFDRS; http://cwfis.cfs.nrcan.gc.ca/background/summary/fdr): the Fire Weather Index (FWI) System (http://cwfis.cfs.nrcan.gc.ca/background/summary/fwi) and the Fire Behaviour Prediction (FBP) System (http://cwfis.cfs.nrcan.gc.ca/background/summary/fbp). These systems are widely used internationally to assess fire danger (FWI System) and quantify fire behavior (FBP System).

The FWI System (Van Wagner, 1987) is based on the moisture content and the effect of wind of three classes of forest fuels on fire behavior. It consists of six components: three fuel moisture codes (Fire Fuel Moisture Code, Duff Moisture Code, Drought Code), and three fire behavior indexes representing rate of spread (Initial Spread Index), fuel consumption (Buildup Index), and fire intensity (Fire Weather Index). The FWI System outputs are determined from daily noon weather observations: temperature, relative humidity, wind speed, and 24-hour rainfall.

The FBP System (Forestry Canada Fire Danger Group. 1992; Hirsch 1996) provides a set of primary and secondary measures of fire behavior. The primary outputs consist of estimates of fire spread rate, fuel consumption, fire intensity, and fire description (i.e., surface, intermittent, or crown fire). The secondary outputs, which are not used nearly as often, gives estimates of fire area, perimeter, perimeter growth rate, and flank and back fire behavior based on a simple elliptical fire growth model. Unlike the FWI System, which is weather based, the FBP System also requires information on vegetation (hereafter, fuel types) and slope (if any) to calculate its outputs. Sixteen fuel types are included in the FBP System, covering mainly major vegetations types in Canada.

Details

Package: fwi.fbp
Type: Package
Version: 1.7
Date: 2015-01-07
License: GPL-2

This package includes three functions. Two functions, fwi and fwiBAT, are used for FWI System calculation, whereas one function, fbp, is used for FBP System calculation. These functions are not fully independent: their inputs overlap greatly and the user will have to provide FWI System outputs to calculate FBP System outputs. The fwi function is a low level function that is used to calculate the outputs of the FWI System for one day based on noon local standard time (LST) weather observations of temperature, relative humidity, wind speed, and 24-hour rainfall, as well as the previous day’s weather conditions. The fwiBAT function is similar to fwi, but is at a higher level in that it allows the user to directly calculate FWI System outputs from a list of consecutive daily weather observations. The fbp function calculates the outputs of the FBP System based on given
set of fire weather conditions (weather observations and their associated FWI System components), fuel type, and slope (optional).

**Author(s)**

Xianli Wang, Alan Cantin, Marc-Andre Parisien, Mike Wotton, Kerry Anderson, and Mike Flannigan

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**References**


**Examples**

```r
library(fwi.fbp)

### fwi function examples ###
# The test data is a standard test dataset (Van Wagner and Pickett 1985).
data("test_fwi")
head(test_fwi)
# Using the default initial values
fwi.out1<-fwi(test_fwi)

# Using a different set of initial values
fwi.out2<-fwi(test_fwi,init=c(80,10,16,50))

# fwi system components calculated based on previous day's
```
# fwi outputs
wii.out4<-wii(test_fwi,wii.out1)

# Using a suite of initials, assuming variables from wii.out1
# are the initial values for different records
init_suite<-wii.out1[c("ffmc","dmc","dc","lat")]
wii.out4<-wii(test_fwi,init=init_suite)

# Using only the required input variables:
wii.out5<-wii(test_fwi[,7:10])

# Daylength adjustment:
# Change latitude values where the monthly daylength adjustments
# are different from the standard ones
test_fwi$lat<-22
# With daylength adjustment
wii(test_fwi)[1:3,]
# Without daylength adjustment
wii(test_fwi,lat.adjust=FALSE)[1:3,]

########### fwiBAT function examples ###########
# The test data is a standard test
data(test_fwi)
head(test_fwi)

# using the default initial values
wii.out4<-fwiBAT(test_fwi)

# using a different set of initials
wii.out4<-fwiBAT(test_fwi,init=c(80,10,16,50))

# using only the required input variables:
wii.out5<-fwiBAT(test_fwi[,7:10])

########### fbp function examples ###########
# The dataset is the standard test data
data(test_fbp)
head(test_fbp)

# Primary output (default)
fbp(test_fbp)
# or
fbp(test_fbp,output="Primary")
# or
fbp(test_fbp,"P")
fbp

#Secondary output
fbp(test_fbp,"Secondary")
#or
fbp(test_fbp,"S")

#All output
fbp(test_fbp,"All")
#or
fbp(test_fbp,"A")

#For a single record:
fbp(test_fbp[7,])
#For a section of the records:
fbp(test_fbp[8:13,])

#fbp function produces the default values if no data is fed to
#the function:
fbp()

---

**Description**

fbp calculates the outputs from the Canadian Forest Fire Behavior Prediction (FBP) System (Forestry Canada Fire Danger Group 1992) based on given fire weather and fuel moisture conditions (from the Canadian Forest Fire Weather Index (FWI) System (Van Wagner 1987)), fuel type, date, and slope. Fire weather, for the purpose of FBP System calculation, comprises observations of 10 m wind speed and direction at the time of the fire, and two associated outputs from the Fire Weather Index System, the Fine Fuel Moisture Content (ffmc) and Buildup Index (bui). FWI System components can be calculated with the sister functions `fwi` and `fwiBAT`.

**Usage**

```r
fbp(input, output="Primary")
```

**Arguments**

- **input**
  
  The input data, a dataframe containing fuel types, fire weather component, and slope (see below). Each vector of inputs defines a single FBP System prediction for a single fuel type and set of weather conditions. The dataframe can be used to evaluate the FBP System for a single fuel type and instant in time, or multiple records for a single point (e.g., one weather station, either hourly or daily for instance) or multiple points (multiple weather stations or a gridded surface). All input variables have to be named as listed below, but they are case insensitive, and do not have to be in any particular order. Fuel type is of type character; other arguments are numeric. Missing values in numeric variables could either be assigned as NA or leave as blank.
**Inputs**

<table>
<thead>
<tr>
<th>Full names of inputs</th>
<th>Defaults</th>
</tr>
</thead>
<tbody>
<tr>
<td>id</td>
<td>N/A</td>
</tr>
<tr>
<td>FuelType</td>
<td>&quot;C2&quot;</td>
</tr>
</tbody>
</table>

**FuelType**


**Variables**

- **LAT**: Latitude [decimal degrees] 55
- **LON**: Longitude [decimal degrees] -120
- **ELV***: Elevation [meters above sea level] NA
- **FFMC**: Fine fuel moisture code [FWI System component] 90
- **BUI**: Buildup index [FWI System component] 60
- **WS**: Wind speed [km/h] 10
- **GS**: Ground Slope [percent] 0
- **Dj**: Julian day 180
- **Aspect**: Aspect of the slope [decimal degrees] 0
- **PC***: Percent Conifer for M1/M2 [percent] 50
- **PDF***: Percent Dead Fir for M3/M4 [percent] 35
- **cc***: Percent Cured for O1a/O1b [percent] 80
- **GFL***: Grass Fuel Load [kg/m²] 0.35
- **CBH**: Crown to Base Height [m] 3
- **WD**: Wind direction [decimal degrees] 0
- **Accel**: Acceleration: 1 = point, 0 = line 0
- **BUIEff**: Buildup Index effect: 1=yes, 0=no 1
- **D0**: Julian day of minimum Foliar Moisture Content 0
- **hr**: Hours since ignition 1
- **ISI***: Initial spread index 0
- **CFL**: Crown Fuel Load [kg/m²] -1
- **FMC**: Foliar Moisture Content if known [percent] 0
- **SH**: C-6 Fuel Type Stand Height [m] 0
- **SD**: C-6 Fuel Type Stand Density [stems/ha] 0
- **theta**: Elliptical direction of calculation [degrees] 0

**Outputs**

FBP output offers 3 options (see details in Values section):

<table>
<thead>
<tr>
<th>Outputs</th>
<th>Number of outputs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Primary (default)</td>
<td>7</td>
</tr>
<tr>
<td>Secondary</td>
<td>30</td>
</tr>
<tr>
<td>All</td>
<td>37</td>
</tr>
</tbody>
</table>

* Variables associated with certain fuel types. These could be skipped if relevant fuel types do not appear in the input data. ** Variables that could be ignored without causing major impacts to the primary outputs. *** Elevation is only used in the calculation of Foliar Moisture Content (FMC). However, FMC can also be calculated without elevation input. The default is to not use elevation in
the calculation of FMC.

Details

The Canadian Forest Fire Behavior Prediction (FBP) System (Forestry Canada Fire Danger Group, 1992) is a subsystem of the Canadian Forest Fire Danger Rating System, which also includes the Canadian Forest Fire Weather Index (FWI) System. The FBP System provides quantitative estimates of head fire spread rate, fuel consumption, fire intensity, and a basic fire description (e.g., surface, crown) for 16 different important forest and rangeland types across Canada. Using a simple conceptual model of the growth of a point ignition as an ellipse through uniform fuels and under uniform weather conditions, the system gives, as a set of secondary outputs, estimates of flank and back fire behavior and consequently fire area perimeter length and growth rate.

The FBP System evolved since the mid-1970s from a series of regionally developed burning indexes to an interim edition of the nationally develop FBP system issued in 1984. Fire behavior models for spread rate and fuel consumption were derived from a database of over 400 experimental, wild and prescribed fire observations. The FBP System, while providing quantitative predictions of expected fire behavior is intended to supplement the experience and judgment of operational fire managers (Hirsch, 1996).

The FBP System was updated with some minor corrections and revisions in 2009 (Wotton et al. 2009) with several additional equations that were initially not included in the system. This fbp function included these updates and corrections to the original equations and provides a complete suite of fire behavior prediction variables.

Default values of optional input variables provide a reasonable mid-range setting.

Latitude, longitude, elevation, and the date are used to calculate foliar moisture content, using a set of models defined in the FBP System; note that this latitude/longitude-based function is only valid for Canada. If the Foliar Moisture Content (FMC) is specified directly as an input, the fbp function will use this value directly rather than calculate it. This is also true of other input variables.

Note that Wind Direction (WD) is the compass direction from which wind is coming. Wind azimuth (not an input) is the direction the wind is blowing to and is 180 degrees from wind direction; in the absence of slope, the wind azimuth is coincident with the direction the head fire will travel (the spread direction azimuth, RAZ). Slope aspect is the main compass direction the slope is facing. Slope azimuth (not an input) is the direction a head fire will spread up slope (in the absence of wind effects) and is 180 from slope aspect (Aspect). Wind direction and slope aspect are the commonly used directional identifiers when specifying wind and slope orientation respectively. The input theta specifies an angle (given as a compass bearing) at which a user is interested in fire behavior predictions; it is typically some angle off of the final spread rate direction since if for instance theta=RAZ (the final spread azimuth of the fire) then the rate of spread at angle theta (TROS) will be equivalent to ROS.

Value

fbp returns a dataframe with primary, secondary, or all output variables, a combination of the primary and secondary outputs.

Primary FBP output includes the following 7 variables:

<table>
<thead>
<tr>
<th>Variable</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>CFB</td>
<td>Crown Fraction Burned by the head fire</td>
</tr>
<tr>
<td>CFC</td>
<td>Crown Fuel Consumption [kg/m^2]</td>
</tr>
</tbody>
</table>
FD  Fire description (S=Surface, I=Intermittent, C=Crown)
HFI  Head Fire Intensity [kW/m]
RAZ  Spread direction azimuth [degrees]
ROS  Equilibrium Head Fire Rate of Spread [m/min]
SFC  Surface Fuel Consumption [kg/m^2]
TFC  Total Fuel Consumption [kg/m^2]

Secondary FBP System outputs include the following 34 variables. In order to calculate the reliable secondary outputs, depending on the outputs, optional inputs may have to be provided.

BE  BUI effect on spread rate
SF  Slope Factor (multiplier for ROS increase upslope)
ISI  Initial Spread Index
FFMC Fine fuel moisture code [FWI System component]
FMC  Foliar Moisture Content [percent]
Do  Julian Date of minimum FMC
RSO  Critical spread rate for crowning [m/min]
CSI  Critical Surface Intensity for crowning [kW/m]
FROS  Equilibrium Flank Fire Rate of Spread [m/min]
BROS  Equilibrium Back Fire Rate of Spread [m/min]
HROSt  Head Fire Rate of Spread at time hr [m/min]
FROSt  Flank Fire Rate of Spread at time hr [m/min]
BROSt  Back Fire Rate of Spread at time hr [m/min]
FCFB  Flank Fire Crown Fraction Burned
BCFB  Back Fire Crown Fraction Burned
FFI  Equilibrium Spread Flank Fire Intensity [kW/m]
BFI  Equilibrium Spread Back Fire Intensity [kW/m]
FTFC  Flank Fire Total Fuel Consumption [kg/m^2]
BTFC  Back Fire Total Fuel Consumption [kg/m^2]
DH  Head Fire Spread Distance after time hr [m]
DB  Back Fire Spread Distance after time hr [m]
DF  Flank Fire Spread Distance after time hr [m]
TI  Time to Crown Fire Initiation [hrs since ignition]
FTI  Time to Flank Fire Crown initiation [hrs since ignition]
BTI  Time to Back Fire Crown initiation [hrs since ignition]
LB  Length to Breadth ratio
LBT  Length to Breadth ratio after elapsed time hr
WSV  Net vectored wind speed [km/hr]
TROS* Equilibrium Rate of Spread at bearing theta [m/min]
**fbp**

<table>
<thead>
<tr>
<th>TROSt*</th>
<th>Rate of Spread at bearing theta at time t [m/min]</th>
</tr>
</thead>
<tbody>
<tr>
<td>TCFB*</td>
<td>Crown Fraction Burned at bearing theta</td>
</tr>
<tr>
<td>TFI*</td>
<td>Fire Intensity at bearing theta [kW/m]</td>
</tr>
<tr>
<td>TTFC*</td>
<td>Total Fuel Consumption at bearing theta [kg/m²]</td>
</tr>
<tr>
<td>TTI*</td>
<td>Time to Crown Fire initiation at bearing theta [hrs since ignition]</td>
</tr>
</tbody>
</table>

* These outputs represent fire behaviour at a point on the perimeter of an elliptical fire defined by a user input angle theta. Theta represents the bearing of a line running between the fire ignition point and a point on the perimeter of the fire. It is important to note that in this formulation the theta is a bearing and does not represent the angle from the semi-major axis (spread direction) of the ellipse. This formulation is similar but not identical to methods presented in Wotton et al (2009) and Tymstra et al (2009).

**Author(s)**

Xianli Wang, Alan Cantin, Marc-Andre Parisien, Mike Wotton, Kerry Anderson, and Mike Flannigan

**References**


**Examples**

```r
library(fwi.fbp)
# The dataset is the standard test data
# provided by Wotton et al (2009).
data("test_fbp")
head(test_fbp)
# Primary output (default)
fbp(test_fbp)
# or
fbp(test_fbp,output="Primary")
# or
fbp(test_fbp,"P")
```
Fire Weather Index function, Deprecated

Description

`fwi` is used to calculate the outputs of the Fire Weather Index (FWI) System for one day based on noon local standard time (LST) weather observations of temperature, relative humidity, wind speed, and 24-hour rainfall, as well as the previous day’s weather conditions. This function could be used for either one weather station or for multiple weather stations or a gridded surface. This is a lower-level function that allows for maximum flexibility in FWI System component calculations. This package also contains a similar high-level function, `fwibat`, to calculate FWI System outputs for an entire fire season at one weather station.

Usage

```r
fwi(input,yda.fwi=NULL,init=c(ffmc_yda=85,dmc_yda=6,dc_yda=15, lat=55),
    out="all",lat.adjust="TRUE")
```

Arguments

- `input` A dataframe containing input variables of daily weather observations taken at noon LST. Variable names have to be the same as in the following list, but they are case insensitive. The order in which the input variables are entered is not important.
- `id` (optional) Unique identifier of a weather station or spatial point (no restriction on data type)
- `lat` (recommended) Latitude (decimal degree, default=55)
The FWI values calculated for the previous day that will be used for the current day’s calculation. This input should be a dataframe that contains fwi outputs from the previous day. When yda.fwi is fed to the function, the initial (i.e., "startup") values in the function would be ignored.

In some situations, such as the first day of the fire season, there are no previous-day values to calculate the current day’s FWI System codes. In such a case, initial ("startup") values have to be provided. If neither initial values nor previous day’s values are specified, the function will use default values (see below). The init argument can also accept a dataframe with the same number of rows as that of the input data if the initial values are to be applied to more than one point (e.g. a grid), station, or year.

The function offers two output options, out="all" will produce an output include both the input and the FWI System outputs; out="fwi" will generate only the FWI system components.

The function offers options for whether day length adjustments should be applied to the calculations. The default value is "TRUE".

The Canadian Forest Fire Weather Index (FWI) System is a major subsystem of the Canadian Forest Fire Danger Rating System, which also includes Canadian Forest Fire Behavior Prediction (FBP) System. The modern FWI System was first issued in 1970 and is the result of work by numerous researchers from across Canada. It evolved from field research which began in the 1930’s and regional fire hazard and fire danger tables developed from that early research.

The modern System (Van Wagner 1987) provides six output indices which represent fuel moisture and potential fire behavior in a standard pine forest fuel type. Inputs are a daily noon observation of fire weather, which consists of screen-level air temperature and relative humidity, 10 meter open wind speed and 24 accumulated precipitation.

The first three outputs of the system (the Fire Fuel Moisture Code, the Duff Moisture Code, and the Drought Code) track moisture in different layers of the fuel making up the forest floor. Their
calculation relies on the daily fire weather observation and also, importantly, the code value from the previous day as they are in essence bookkeeping systems tracking the amount of moisture (water) in to and out of the layer. It is therefore important that when calculating FWI System outputs over an entire fire season, an uninterrupted daily weather stream is provided; one day is assumed to be the time step in the models and thus missing data must be filled in.

The next three outputs of the System are relative (unitless) indicators of aspects of fire behavior potential: spread rate (the Initial Spread Index), fuel consumption (the Build-up Index) and fire intensity per unit length of fire front (the Fire Weather Index). This final index, the fwi, is the component of the System used to establish the daily fire danger level for a region and communicated to the public. This final index can be transformed to the Daily Severity Rating (dsr) to provide a more reasonably-scaled estimate of fire control difficulty.

Both the Duff Moisture Code (dmc) and Drought Code (dc) are influenced by day length (see Van Wagner, 1987). Day length adjustments for different ranges in latitude can be used (as described in Lawson and Armitage 2008 (http://cfs.nrcan.gc.ca/pubwarehouse/pdfs/29152.pdf)) and are included in this R function; latitude must be positive in the northern hemisphere and negative in the southern hemisphere.

At the start of a fire season, or simply the start of a daily weather stream, the FWI System calculation requires an estimate of yesterday’s moisture conditions. The default initial (i.e., "start-up") fuel moisture code values (FFMC=85, DMC=6, DC=15) provide a reasonable set of conditions for post-snowmelt springtime conditions in eastern/central Canada, the Northern U.S., and Alaska; physically these spring start-up values represent about 3 days of drying from complete moisture saturation of the fuel layer. In areas or years with particularly dry winters (or parts of the world without significant snow cover) these start-up values for FFMC and DMC may still be appropriate as these two elements respond relatively quickly to changes in the weather. The DC component however, because of its very long response time, can take considerable time to adjust to unrealistic initial values and some effort to estimate over-winter value of the DC may be necessary. Users can look again to Lawson and Armitage (2008) for a more detailed description of code calculation startup issues and the over-winter adjustment process.

Value

fwi returns a dataframe which includes both the input and the FWI System variables as described below:

Input Variables

<table>
<thead>
<tr>
<th>Variable</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>ffmc</td>
<td>Fine Fuel Moisture Code</td>
</tr>
<tr>
<td>dmc</td>
<td>Duff Moisture Code</td>
</tr>
<tr>
<td>dc</td>
<td>Drought Code</td>
</tr>
<tr>
<td>isi</td>
<td>Initial Spread Index</td>
</tr>
<tr>
<td>bui</td>
<td>Buildup Index</td>
</tr>
<tr>
<td>fwi</td>
<td>Fire Weather Index</td>
</tr>
<tr>
<td>dsr</td>
<td>Daily Severity Rating</td>
</tr>
</tbody>
</table>

Author(s)

Xianli Wang, Alan Cantin, Marc-Andre Parisien, Mike Wotton, Kerry Anderson, and Mike Flannigan
References


Examples

```r
library(fwi.fbp)
# The test data is a standard test
# dataset (Van Wagner and Pickett 1985).

data("test_fwi")
head(test_fwi)
# Using the default initial values
fwi.out1<-fwi(test_fwi)

# Using a different set of initial values
fwi.out2<-fwi(test_fwi,init=c(80,10,16,50))

# fwi system components calculated based on previous day's
# fwi outputs
fwi.out3<-fwi(test_fwi,fwi.out1)

# Using a suite of initials, assuming variables from fwi.out1
# are the initial values for different records
init_suite<-fwi.out1[,c("ffmc","dfmc","dc","lat")]
fwi.out4<-fwi(test_fwi,init=init_suite)

# Using only the required input variables:
fwi.out5<-fwi(test_fwi[,7:10])

# Daylength adjustment:
# Change latitude values where the monthly daylength adjustments
# are different from the standard ones
test_fwi$lat<-22
# With daylength adjustment
fwi(test_fwi)[1:3,]
# Without daylength adjustment
fwi(test_fwi, lat.adjust=FALSE)[1:3,]
```
Description

These functions are provided for compatibility with older versions of 'fwi.fbp' only, and will be defunct at the next release.

Details

The ‘fwi.fbp’ package has been deprecated, and all functions have replacements within the cffdrs package. https://cran.r-project.org/package=cffdrs

The following functions are deprecated and will be made defunct. Use the replacements from the ‘cffdrs’ package indicated below (links will not work without the ‘cffdrs’ package installed):

- fwi: fwi
- fwiBAT: fwi
- fbp: fbp

Author(s)

Alan Cantin <Alan.Cantin@Canada.ca>

See Also

Deprecated
init

The function offers two output options, out="all" will produce an output include both the input and the FWI System outputs; out="fwi" will generate only the FWI system components.

lat. adjust

The function offers options for whether day length adjustments should be applied to the calculations. The default value is "TRUE".

Details

The Canadian Forest Fire Weather Index (FWI) System is a major subsystem of the Canadian Forest Fire Danger Rating System, which also includes Canadian Forest Fire Behavior Prediction (FBP) System. The modern FWI System was first issued in 1970 and is the result of work by numerous researchers from across Canada. It evolved from field research which began in the 1930’s and regional fire hazard and fire danger tables developed from that early research.

The modern System (Van Wagner 1987) provides six output indices which represent fuel moisture and potential fire behavior in a standard pine forest fuel type. Inputs are a daily noon observation of fire weather, which consists of screen-level air temperature and relative humidity, 10 meter open wind speed and 24 accumulated precipitation.

The first three outputs of the system (the Fire Fuel Moisture Code, the Duff Moisture Code, and the Drought Code) track moisture in different layers of the fuel making up the forest floor. Their calculation relies on the daily fire weather observation and also, importantly, the code value from the previous day as they are in essence bookkeeping systems tracking the amount of moisture (water) into and out of the layer. It is therefore important that when calculating FWI System outputs over an entire fire season, an uninterrupted daily weather stream is provided; one day is the assumed time step in the models and thus missing data must be filled in.
The next three outputs of the System are relative (unitless) indicators of aspects of fire behavior potential: spread rate (the Initial Spread Index), fuel consumption (the Build-up Index) and fire intensity per unit length of fire front (the Fire Weather Index). This final index, the fwi, is the component of the System used to establish the daily fire danger level for a region and communicated to the public. This final index can be transformed to the Daily Severity Rating (dsr) to provide a more reasonably-scaled estimate of fire control difficulty.

Both the Duff Moisture Code (dmc) and Drought Code (dc) are influenced by day length (see Van Wagner, 1987). Day length adjustments for different ranges in latitude can be used (as described in Lawson and Armitage 2008 (http://cfs.nrcan.gc.ca/pubwarehouse/pdfs/29152.pdf)) and are included in this R function; latitude must be positive in the northern hemisphere and negative in the southern hemisphere.

At the start of a fire season, or simply the start of a daily weather stream, the FWI System calculation requires an estimate of yesterday’s moisture conditions. The default initial (i.e., "start-up") fuel moisture code values (FFMC=85, DMC=6, DC=15) provide a reasonable set of conditions for post-snowmelt springtime conditions in eastern/central Canada, the Northern U.S., and Alaska; physically these spring start-up values represent about 3 days of drying from complete moisture saturation of the fuel layer. In areas or years with particularly dry winters (or parts of the world without significant snow cover) these start-up values for FFMC and DMC may still be appropriate as these two elements respond relatively quickly to changes in the weather. The DC component however, because of its very long response time, can take considerable time to adjust to unrealistic initial values and some effort to estimate over-winter value of the DC may be necessary. Users can look again to Lawson and Armitage (2008) for a more detailed description of code calculation startup issues and the over-winter adjustment process.

Value

fwiBAT returns a data.frame which may include both the input and the FWI System outputs (default) or the FWI System outputs only as described below:

Input Variables

May include id, long, lat, yr, mon, day, temp, rh, ws, and prec when option out='all' (default) is chosen

ffmc Fine Fuel Moisture Code
dmc Duff Moisture Code
dc Drought Code
isi Initial Spread Index
bui Buildup Index
fwi Fire Weather Index
dsr Daily Severity Rating

Author(s)

Xianli Wang, Alan Cantin, Marc-Andre Parisien, Mike Wotton, Kerry Anderson, and Mike Flannigan
test_fbp

References


Examples

```r
library(fwi.fbp)
# The test data is a standard test
# dataset for FWI system(Van Wagner and Pickett 1985).

data("test_fwi")
head(test_fwi)

# using the default initial values
fwi.out<-fwIBAT(test_fwi)

# using a different set of initials
fwi.out<-fwIBAT(test_fwi,init=c(00,10,16,50))

# using only the required input variables:
fwi.out<-fwIBAT(test_fwi[,7:10])
```

test_fbp *Fire Behaviour Prediction Sample Data Set*

Description

This data set is a set of input data for each of the test cases in the publication supplied below.

Usage

test_fbp

Format

A data frame containing 24 columns, 20 rows, and 1 header line

Source

References


Fire Weather Index Sample Input Data Set

Description

This data set is the sample input data that was used in original FWI program calibration.

Usage

test_fwi

Format

A data frame containing 10 columns and 49 rows, with 1 header line

Source


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