

Package ‘cffdrs.core’

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Type Package

Title Canadian Forest Fire Danger Rating System

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Description This project provides a group of new functions to calculate the outputs of the two main components of the Canadian Forest Fire Danger Rating System (CFFDRS) Van Wagner and Pickett (1985) <<https://cfs.nrcan.gc.ca/publications?id=19973>> at various time scales: the Fire Weather Index (FWI) System Wan Wagner (1985) <<https://cfs.nrcan.gc.ca/publications?id=19927>> and the Fire Behaviour Prediction (FBP) System Forestry Canada Fire Danger Group (1992) <<http://cfs.nrcan.gc.ca/pubwarehouse/pdfs/10068.pdf>>.

License GPL-2

URL <https://r-forge.r-project.org/projects/cffdrs/>

BugReports

https://r-forge.r-project.org/tracker/?func=browse&group_id=1970&atid=5372

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cffdrs.core-package *Canadian Forest Fire Danger Rating System*

Description

The cffdrs.core package 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>) along with additional methods created and used Canadian fire modelling. These systems are widely used internationally to assess fire danger (FWI System) and quantify fire behavior (FBP System).

Details

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, give 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 vegetation types in Canada.

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References

1. Van Wagner, C.E. and T.L. Pickett. 1985. Equations and FORTRAN program for the Canadian Forest Fire Weather Index System. Can. For. Serv., Ottawa, Ont. For. Tech. Rep. 33. 18 p.
2. Van Wagner, C.E. 1987. Development and structure of the Canadian forest fire weather index system. Forest Technology Report 35. (Canadian Forestry Service: Ottawa).
3. Lawson, B.D. and O.B. Armitage. 2008. Weather guide for the Canadian Forest Fire Danger Rating System. Nat. Resour. Can., Can. For. Serv., North. For. Cent., Edmonton, AB.
4. Hirsch K.G. 1996. Canadian Forest Fire Behavior Prediction (FBP) System: user's guide. Nat. Resour. Can., Can. For. Serv., Northwest Reg., North. For. Cent., Edmonton, Alberta. Spec. Rep. 7. 122p.
5. Forestry Canada Fire Danger Group. 1992. Development and structure of the Canadian Forest Fire Behavior Prediction System. Forestry Canada, Ottawa, Ontario Information Report ST-X-3. 63 p. <http://cfs.nrcan.gc.ca/pubwarehouse/pdfs/10068.pdf>
6. Wotton, B.M., Alexander, M.E., Taylor, S.W. 2009. Updates and revisions to the 1992 Canadian forest fire behavior prediction system. Nat. Resour. Can., Can. For. Serv., Great Lakes For. Cent., Sault Ste. Marie, Ontario, Canada. Information Report GLC-X-10, 45p. http://publications.gc.ca/collections/collection_2010/nrcan/Fo123-2-10-2009-eng.pdf
7. Tymstra, C., Bryce, R.W., Wotton, B.M., Armitage, O.B. 2009. Development and structure of Prometheus: the Canadian wildland fire growth simulation Model. Nat. Resour. Can., Can. For. Serv., North. For. Cent., Edmonton, AB. Inf. Rep. NOR-X-417.

See Also

[fbp](#), [fireSeason](#), [fwi](#), [gfmc](#), [hffmc](#), [sdmc](#), [wDC](#)

BackRateOfSpread

Back Fire Rate of Spread Calculator

Description

Calculate the Back Fire Spread Rate. All variables names are laid out in the same manner as Forestry Canada Fire Danger Group (FCFDG) (1992).

Usage

BackRateOfSpread(FUELTYPE, FPMC, BUI, WSV, FMC, SFC, PC, PDF, CC, CBH)

Arguments

FUELTYPE	The Fire Behaviour Prediction FuelType
FFMC	Fine Fuel Moisture Code
BUI	Buildup Index
WSV	Wind Speed Vector
FMC	Foliar Moisture Content
SFC	Surface Fuel Consumption
PC	Percent Conifer
PDF	Percent Dead Balsam Fir
CC	Degree of Curing (just "C" in FCFDG 1992)
CBH	Crown Base Height

Value

BROS: Back Fire Rate of Spread

References

<https://cfs.nrcan.gc.ca/publications/download-pdf/10068> Development and Structure of the Canadian Forest Fire Behavior Prediction System." Technical Report ST-X-3, Forestry Canada, Ottawa, Ontario.

BuildupEffect	<i>Build Up Effect Calculator</i>
---------------	-----------------------------------

Description

Computes the Buildup Effect on Fire Spread Rate. All variables names are laid out in the same manner as Forestry Canada Fire Danger Group (FCFDG) (1992).

Usage

```
BuildupEffect(FUELTYPE, BUI)
```

Arguments

FUELTYPE	The Fire Behaviour Prediction FuelType
BUI	The Buildup Index value

Value

BE: Build up effect

References

<https://cfs.nrcan.gc.ca/publications/download-pdf/10068> Development and Structure of the Canadian Forest Fire Behavior Prediction System." Technical Report ST-X-3, Forestry Canada, Ottawa, Ontario.

BuildupIndex*Build Up Index Calculator*

Description

Buildup Index Calculation. All code is based on a C code library that was written by Canadian Forest Service Employees, which was originally based on the Fortran code listed in the reference below. All equations in this code refer to that document. Equations and FORTRAN program for the Canadian Forest Fire Weather Index System. 1985. Van Wagner, C.E.; Pickett, T.L. Canadian Forestry Service, Petawawa National Forestry Institute, Chalk River, Ontario. Forestry Technical Report 33. 18 p.

Usage

```
BuildupIndex(dmc, dc)
```

Arguments

dmc	Duff Moisture Code
dc	Drought Code

Value

A single Build Up Index value

References

<http://cfs.nrcan.gc.ca/pubwarehouse/pdfs/19927.pdf> Development and structure of the Canadian Forest Fire Weather Index System. 1987. Van Wagner, C.E. Canadian Forestry Service, Headquarters, Ottawa. Forestry Technical Report 35. 35 p.

CriticalSurfaceIntensity*Critical Surface Intensity Calculator*

Description

Calculate Critical surface intensity (CSI).

Usage

```
CriticalSurfaceIntensity(FMC, CBH)
```

Arguments

FMC	Foliar Moisture Content
CBH	Crown Base Height

Details

All variables names are laid out in the same manner as Forestry Canada Fire Danger Group (FCFDG) (1992). Development and Structure of the Canadian Forest Fire Behavior Prediction System." Technical Report ST-X-3, Forestry Canada, Ottawa, Ontario.

Value

CSI

References

<https://cfs.nrcan.gc.ca/publications/download-pdf/10068> Development and Structure of the Canadian Forest Fire Behavior Prediction System." Technical Report ST-X-3, Forestry Canada, Ottawa, Ontario.

CriticalSurfaceRateOfSpread

Critical Surface Rate of Spread Calculator

Description

Calculate Critical Surface fire rate of spread (RSO). The value of each of these equations can be returned to the calling function without unnecessary additional calculations.

Usage

CriticalSurfaceRateOfSpread(CSI, SFC)

Arguments

CSI	Critical Surface Intensity
SFC	Surface Fuel Consumption

Details

All variables names are laid out in the same manner as Forestry Canada Fire Danger Group (FCFDG) (1992). Development and Structure of the Canadian Forest Fire Behavior Prediction System." Technical Report ST-X-3, Forestry Canada, Ottawa, Ontario.

Value

RSO

References

<https://cfs.nrcan.gc.ca/publications/download-pdf/10068> Development and Structure of the Canadian Forest Fire Behavior Prediction System." Technical Report ST-X-3, Forestry Canada, Ottawa, Ontario.

CrownFractionBurned	<i>Crown Fraction Burned Calculator</i>
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Description

Calculate Calculate Crown Fraction Burned.

Usage

CrownFractionBurned(ROS, RSO)

Arguments

ROS	Rate of Spread
RSO	Critical Surface Rate of Spread

Details

All variables names are laid out in the same manner as Forestry Canada Fire Danger Group (FCFDG) (1992). Development and Structure of the Canadian Forest Fire Behavior Prediction System." Technical Report ST-X-3, Forestry Canada, Ottawa, Ontario.

Value

CFB

References

<https://cfs.nrcan.gc.ca/publications/download-pdf/10068> Development and Structure of the Canadian Forest Fire Behavior Prediction System." Technical Report ST-X-3, Forestry Canada, Ottawa, Ontario.

CrownFuelConsumption	<i>Crown Fuel Consumption calculation</i>
----------------------	---

Usage

CrownFuelConsumption(FUELTYPE, CFL, CFB, PC, PDF)

Arguments

FUELTYPE	The Fire Behaviour Prediction FuelType
CFL	Crown Fuel Load (kg/m^2)
CFB	Crown Fraction Burned (0-1)

PC Percent Conifer (
 \itemPDFPercent Dead Balsam Fir (
 CFC Crown Fuel Consumption (kg/m^2)
 Computes the Crown Fuel Consumption by Fuel Type. All variables names are laid out in the same manner as FCFDG (1992) or Wotton et. al (2009)
 Forestry Canada Fire Danger Group (FCFDG) (1992). "Development and Structure of the Canadian Forest Fire Behavior Prediction System." Technical Report ST-X-3, Forestry Canada, Ottawa, Ontario.
 Wotton, B.M., Alexander, M.E., Taylor, S.W. 2009. Updates and revisions to the 1992 Canadian forest fire behavior prediction system. Nat. Resour. Can., Can. For. Serv., Great Lakes For. Cent., Sault Ste. Marie, Ontario, Canada. Information Report GLC-X-10, 45p.

CrownRateOfSpreadC6 *C-6 Crown Fire Spread Calculator*

Description

Calculate crown rate of spread (RSC).

Usage

CrownRateOfSpreadC6(ISI)

Arguments

ISI Initial Spread Index

Details

All variables names are laid out in the same manner as Forestry Canada Fire Danger Group (FCFDG) (1992). Development and Structure of the Canadian Forest Fire Behavior Prediction System." Technical Report ST-X-3, Forestry Canada, Ottawa, Ontario.

Value

RSC

References

<https://cfs.nrcan.gc.ca/publications/download-pdf/10068> Development and Structure of the Canadian Forest Fire Behavior Prediction System." Technical Report ST-X-3, Forestry Canada, Ottawa, Ontario.

DistanceAtTime	<i>Distance at time t calculator</i>
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Description

Calculate the Head fire spread distance at time t. In the documentation this variable is just "D".

Usage

```
DistanceAtTime(FUELTYPE, ROSeq, HR, CFB)
```

Arguments

FUELTYPE	The Fire Behaviour Prediction FuelType
ROSeq	The predicted equilibrium rate of spread (m/min)
HR	The elapsed time (min)
CFB	Crown Fraction Burned

Details

All variables names are laid out in the same manner as Forestry Canada Fire Danger Group (FCFDG) (1992). Development and Structure of the Canadian Forest Fire Behavior Prediction System." Technical Report ST-X-3, Forestry Canada, Ottawa, Ontario.

Value

DISTt - Head fire spread distance at time t

DroughtCode	<i>Drought Code Calculator</i>
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Usage

```
DroughtCode(dc_yda, temp, rh, prec, lat, mon, lat.adjust = TRUE)
```

Arguments

dc_yda	The Drought Code from previous iteration
temp	Temperature (centigrade)
rh	Relative Humidity (
	\itemprecPrecipitation(mm)
	\itemlatLatitude (decimal degrees)
	\itemmonMonth (1-12)
	\itemlat.adjustLatitude adjustment (TRUE, FALSE, default=TRUE)
	A single drought code value
	Drought Code Calculation. All code is based on a C code library that was written by Canadian Forest Service Employees, which was originally based on the

Fortran code listed in the reference below. All equations in this code refer to that document. Equations and FORTRAN program for the Canadian Forest Fire Weather Index System. 1985. Van Wagner, C.E.; Pickett, T.L. Canadian Forestry Service, Petawawa National Forestry Institute, Chalk River, Ontario. Forestry Technical Report 33. 18 p. Additional reference on FWI system Development and structure of the Canadian Forest Fire Weather Index System. 1987. Van Wagner, C.E. Canadian Forestry Service, Headquarters, Ottawa. Forestry Technical Report 35. 35 p.

<http://cfs.nrcan.gc.ca/pubwarehouse/pdfs/19927.pdf> Development and structure of the Canadian Forest Fire Weather Index System. 1987. Van Wagner, C.E. Canadian Forestry Service, Headquarters, Ottawa. Forestry Technical Report 35. 35 p.

DuffMoistureCode

Duff Moisture Code Calculator

Usage

```
DuffMoistureCode(dmc_yda, temp, rh, prec, lat, mon, lat.adjust = TRUE)
```

Arguments

dmc_yda	The Duff Moisture Code from previous iteration
temp	Temperature (centigrade)
rh	Relative Humidity (
	\itemprecPrecipitation(mm)
	\itemlatLatitude (decimal degrees)
	\itemmonMonth (1-12)
	\itemlat.adjustLatitude adjustment (TRUE, FALSE, default=TRUE)
	A single duff moisture code value
	Duff Moisture Code Calculation. All code is based on a C code library that was written by Canadian Forest Service Employees, which was originally based on the Fortran code listed in the reference below. All equations in this code refer to that document.
	Equations and FORTRAN program for the Canadian Forest Fire Weather Index System. 1985. Van Wagner, C.E.; Pickett, T.L. Canadian Forestry Service, Petawawa National Forestry Institute, Chalk River, Ontario. Forestry Technical Report 33. 18 p.
	Additional reference on FWI system
	Development and structure of the Canadian Forest Fire Weather Index System. 1987. Van Wagner, C.E. Canadian Forestry Service, Headquarters, Ottawa. Forestry Technical Report 35. 35 p.
	http://cfs.nrcan.gc.ca/pubwarehouse/pdfs/19927.pdf Development and structure of the Canadian Forest Fire Weather Index System. 1987. Van Wagner, C.E. Canadian Forestry Service, Headquarters, Ottawa. Forestry Technical Report 35. 35 p.

FineFuelMoistureCode *Fine Fuel Moisture Code Calculation*

Usage

```
FineFuelMoistureCode(ffmc_yda, temp, rh, ws, prec)
```

Arguments

ffmc_yda	The Fine Fuel Moisture Code from previous iteration
temp	Temperature (centigrade)
rh	Relative Humidity (
	\itemwsWind speed (km/h)
	\itemprecPrecipitation (mm)
	A single fine fuel moisture code value

Fine Fuel Moisture Code Calculation. All code is based on a C code library that was written by Canadian Forest Service Employees, which was originally based on the Fortran code listed in the reference below. All equations in this code refer to that document.

Equations and FORTRAN program for the Canadian Forest Fire Weather Index System. 1985. Van Wagner, C.E.; Pickett, T.L. Canadian Forestry Service, Petawawa National Forestry Institute, Chalk River, Ontario. Forestry Technical Report 33. 18 p.

Additional reference on FWI system Development and structure of the Canadian Forest Fire Weather Index System. 1987. Van Wagner, C.E. Canadian Forestry Service, Headquarters, Ottawa. Forestry Technical Report 35. 35 p.

FireBehaviourPrediction

Fire Behaviour Prediction System Calculation (hidden)

Description

Fire Behavior Prediction System calculations. This is the primary function for calculating FBP for a single timestep. Not all equations are calculated within this function, but have been broken down further.

Usage

```
FireBehaviourPrediction(input = NULL, output = "Primary")
```

Arguments

input	Data frame of required and optional information needed to calculate FBP function. View the arguments section of the fbp manual (fbp.Rd) under "input" for the full listing of the required and optional inputs.
output	What fbp outputs to return to the user. Options are "Primary", "Secondary" and "All". <code>_Default:_</code> "Primary"

Value

output: Either Primary, Secondary, or all FBP outputs in a data.frame

FireIntensity	<i>Fire Intensity Calculator</i>
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Description

Calculate the Predicted Fire Intensity

Usage

```
FireIntensity(FC, ROS)
```

Arguments

FC	Fuel Consumption (kg/m ²)
ROS	Rate of Spread (m/min)

Details

All variables names are laid out in the same manner as Forestry Canada Fire Danger Group (FCFDG) (1992). Development and Structure of the Canadian Forest Fire Behavior Prediction System." Technical Report ST-X-3, Forestry Canada, Ottawa, Ontario.

Value

FI: Fire Intensity (kW/m)

FireWeatherIndex	<i>Fire Weather Index Calculation.</i>
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Description

All code is based on a C code library that was written by Canadian Forest Service Employees, which was originally based on the Fortran code listed in the reference below. All equations in this code refer to that document.

Usage

```
FireWeatherIndex(isi, bui)
```

Arguments

isi	Initial Spread Index
bui	Buildup Index

Details

Equations and FORTRAN program for the Canadian Forest Fire Weather Index System. 1985. Van Wagner, C.E.; Pickett, T.L. Canadian Forestry Service, Petawawa National Forestry Institute, Chalk River, Ontario. Forestry Technical Report 33. 18 p.

Additional reference on FWI system

Development and structure of the Canadian Forest Fire Weather Index System. 1987. Van Wagner, C.E. Canadian Forestry Service, Headquarters, Ottawa. Forestry Technical Report 35. 35 p.

Value

A single fwi value

FlankRateOfSpread	<i>Flank Fire Rate of Spread Calculator</i>
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Description

Calculate the Flank Fire Spread Rate.

Usage

FlankRateOfSpread(ROS, BROS, LB)

Arguments

ROS	Fire Rate of Spread (m/min)
BROS	Back Fire Rate of Spread (m/min)
LB	Length to breadth ratio

Details

All variables names are laid out in the same manner as Forestry Canada Fire Danger Group (FCFDG) (1992). Development and Structure of the Canadian Forest Fire Behavior Prediction System." Technical Report ST-X-3, Forestry Canada, Ottawa, Ontario.

Value

FROS Flank Fire Spread Rate (m/min) value

FoliarMoistureContent *Foliar Moisture Content Calculator*

Description

Calculate Foliar Moisture Content on a specified day. All variables names are laid out in the same manner as Forestry Canada Fire Danger Group (FCFDG) (1992). Development and Structure of the Canadian Forest Fire Behavior Prediction System." Technical Report ST-X-3, Forestry Canada, Ottawa, Ontario.

Usage

FoliarMoistureContent(LAT, LONG, ELV, DJ, D0)

Arguments

LAT	Latitude (decimal degrees)
LONG	Longitude (decimal degrees)
ELV	Elevation (metres)
DJ	Day of year (offeren referred to as julian date)
D0	Date of minimum foliar moisture content. _If D0, date of min FMC, is not known then D0 = NULL._

Value

FMC: Foliar Moisture Content value

InitialSpreadIndex *Initial Spread Index Calculator*

Description

Computes the Initial Spread Index From the FWI System. Equations are from Van Wagner (1985) as listed below, except for the modification for fbp takene from FCFDG (1992).

Usage

InitialSpreadIndex(ffmc, ws, fbpMod = FALSE)

Arguments

ffmc	Fine Fuel Moisture Code
ws	Wind Speed (km/h)
fbpMod	TRUE/FALSE if using the fbp modification at the extreme end

Details

Equations and FORTRAN program for the Canadian Forest Fire Weather Index System. 1985. Van Wagner, C.E.; Pickett, T.L. Canadian Forestry Service, Petawawa National Forestry Institute, Chalk River, Ontario. Forestry Technical Report 33. 18 p.

Forestry Canada Fire Danger Group (FCFDG) (1992). Development and Structure of the Canadian Forest Fire Behavior Prediction System." Technical Report ST-X-3, Forestry Canada, Ottawa, Ontario.

Value

ISI - Initial Spread Index

IntermediateSurfaceRateOfSpreadC6

C-6 Conifer Plantation Intermediate Surface Fire Spread Rate Calculator

Description

Calculate intermediate surface fire rate of spread, before BUI effect is applied (RSI).

Usage

IntermediateSurfaceRateOfSpreadC6(ISI, FMC)

Arguments

ISI	Initial Spread Index
FMC	Foliar Moisture Content

Details

All variables names are laid out in the same manner as Forestry Canada Fire Danger Group (FCFDG) (1992). Development and Structure of the Canadian Forest Fire Behavior Prediction System." Technical Report ST-X-3, Forestry Canada, Ottawa, Ontario.

Value

RSI

References

<https://cfs.nrcan.gc.ca/publications/download-pdf/10068> Development and Structure of the Canadian Forest Fire Behavior Prediction System." Technical Report ST-X-3, Forestry Canada, Ottawa, Ontario.

LengthToBreadthRatio *Length-to-Breadth ratio*

Description

Computes the Length to Breadth ratio of an elliptically shaped fire. Equations are from listed FCFDG (1992) except for errata 80 from Wotton et. al. (2009).

Usage

LengthToBreadthRatio(FUELTYPE, WSV)

Details

All variables names are laid out in the same manner as Forestry Canada Fire Danger Group (FCFDG) (1992). Development and Structure of the Canadian Forest Fire Behavior Prediction System." Technical Report ST-X-3, Forestry Canada, Ottawa, Ontario.

Wotton, B.M., Alexander, M.E., Taylor, S.W. 2009. Updates and revisions to the 1992 Canadian forest fire behavior prediction system. Nat. Resour. Can., Can. For. Serv., Great Lakes For. Cent., Sault Ste. Marie, Ontario, Canada. Information Report GLC-X-10, 45p.

@param FUELTYPE The Fire Behaviour Prediction FuelType @param WSV The Wind Speed (km/h)

Value

Length to Breadth ratio value

LengthToBreadthRatioAtTime
Length-to-Breadth ratio at time t

Description

Computes the Length to Breadth ratio of an elliptically shaped fire at elapsed time since ignition. Equations are from listed FCFDG (1992) and Wotton et. al. (2009), and are marked as such.

Usage

LengthToBreadthRatioAtTime(FUELTYPE, LB, HR, CFB)

Arguments

FUELTYPE	The Fire Behaviour Prediction FuelType
LB:	Length to Breadth ratio
HR:	Time since ignition (hours)
CFB:	Crown Fraction Burned

Details

All variables names are laid out in the same manner as Forestry Canada Fire Danger Group (FCFDG) (1992). Development and Structure of the Canadian Forest Fire Behavior Prediction System." Technical Report ST-X-3, Forestry Canada, Ottawa, Ontario.

Wotton, B.M., Alexander, M.E., Taylor, S.W. 2009. Updates and revisions to the 1992 Canadian forest fire behavior prediction system. Nat. Resour. Can., Can. For. Serv., Great Lakes For. Cent., Sault Ste. Marie, Ontario, Canada. Information Report GLC-X-10, 45p.

Value

Length to Breadth ratio at time since ignition

RateOfSpread	<i>Rate of Spread Calculation</i>
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Usage

RateOfSpread(FUELTYPE, ISI, BUI, FMC, SFC, PC, PDF, CC, CBH)

Arguments

ISI	Intiial Spread Index
BUI	Buildup Index
FMC	Foliar Moisture Content
SFC	Surface Fuel Consumption (kg/m ²)
PC	Percent Conifer (
	\itemPDFPercent Dead Balsam Fir (
	\itemCCConstant
	\itemCBHCrown to base height(m)
	\itemFUELTYPETheFire Behaviour Prediction FuelType
	ROS - Rate of Spread (m/min) value
	Computes the Rate of Spread prediction based on fuel type and FWI conditions. Equations are from listed FCFDG (1992) and Wotton et. al. (2009), and are marked as such.
	All variables names are laid out in the same manner as Forestry Canada Fire Danger Group (FCFDG) (1992). Development and Structure of the Canadian Forest Fire Behavior Prediction System." Technical Report ST-X-3, Forestry Canada, Ottawa, Ontario.
	Wotton, B.M., Alexander, M.E., Taylor, S.W. 2009. Updates and revisions to the 1992 Canadian forest fire behavior prediction system. Nat. Resour. Can., Can. For. Serv., Great Lakes For. Cent., Sault Ste. Marie, Ontario, Canada. Information Report GLC-X-10, 45p.

RateOfSpreadAtTheta	<i>Rate of spread at a point along the perimeter calculator</i>
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Description

Computes the Rate of Spread at any point along the perimeter of an elliptically shaped fire. Equations are from Wotton et. al. (2009).

Usage

RateOfSpreadAtTheta(ROS, FROS, BROS, THETA)

Arguments

ROS	Rate of Spread (m/min)
FROS	Flank Fire Rate of Spread (m/min)
BROS	Back Fire Rate of Spread (m/min)
THETA	
FUELTYPE	The Fire Behaviour Prediction FuelType

Details

Wotton, B.M., Alexander, M.E., Taylor, S.W. 2009. Updates and revisions to the 1992 Canadian forest fire behavior prediction system. Nat. Resour. Can., Can. For. Serv., Great Lakes For. Cent., Sault Ste. Marie, Ontario, Canada. Information Report GLC-X-10, 45p.

Value

ROSTHETA - Rate of spread at point theta(m/min)

RateOfSpreadAtTime	<i>Rate of spread at time t calculation</i>
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Description

Computes the Rate of Spread prediction based on fuel type and FWI conditions at elapsed time since ignition. Equations are from listed FCFDG (1992).

Usage

RateOfSpreadAtTime(FUELTYPE, ROSeq, HR, CFB)

Arguments

FUELTYPE	The Fire Behaviour Prediction FuelType
ROSeq	Equilibrium Rate of Spread (m/min)
HR	Time since ignition (hours)
CFB	Crown Fraction Burned

Details

All variables names are laid out in the same manner as Forestry Canada Fire Danger Group (FCFDG) (1992). Development and Structure of the Canadian Forest Fire Behavior Prediction System." Technical Report ST-X-3, Forestry Canada, Ottawa, Ontario.

Value

ROSt - Rate of Spread at time since ignition value

RateOfSpreadC6	<i>C-6 Conifer Plantation Fire Spread Calculator</i>
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Description

Calculate rate of spread (ROS).

Usage

RateOfSpreadC6(RSC, RSS, CFB)

Arguments

RSC	Crown Fire Spread Rate (m/min)
RSS	Surface Fire Spread Rate (m/min)
CFB	Crown Fraction Burned

Details

All variables names are laid out in the same manner as Forestry Canada Fire Danger Group (FCFDG) (1992). Development and Structure of the Canadian Forest Fire Behavior Prediction System." Technical Report ST-X-3, Forestry Canada, Ottawa, Ontario.

Value

ROS

References

<https://cfs.nrcan.gc.ca/publications/download-pdf/10068> Development and Structure of the Canadian Forest Fire Behavior Prediction System." Technical Report ST-X-3, Forestry Canada, Ottawa, Ontario.

SlopeAdjust

*Slope Adjusted wind speed or slope direction of spread calculation***Usage**

```
SlopeAdjust(
  FUELTYPE,
  FPMC,
  BUI,
  WS,
  WAZ,
  GS,
  SAZ,
  FMC,
  SFC,
  PC,
  PDF,
  CC,
  CBH,
  ISI
)
```

Arguments

FUELTYPE	The Fire Behaviour Prediction FuelType
BUI	The Buildup Index value
WS	Windspeed (km/h)
WAZ	Wind Azimuth
GS	Ground Slope (
	\itemSAZSlope Azimuth
	\itemFMCFoliar Moisture Content
	\itemSFCSurface Fuel Consumption (kg/m ²)
	\itemPCPercent Conifer (
	\itemPDFPercent Dead Balsam Fir (
	\itemCCCConstant
	\itemCBHCrown Base Height (m)
	\itemISIInitial Spread Index
	\itemoutputType of variable to output (RAZ/WSV, default=RAZ)
	list(RAZ, WSV) - Rate of spread azimuth (degrees) and Wind Slope speed (km/hr)
	Calculate the net effective windspeed (WSV), the net effective wind direction (RAZ) or the wind azimuth (WAZ).
	All variables names are laid out in the same manner as FCFDG (1992) and Wotton (2009).
	Forestry Canada Fire Danger Group (FCFDG) (1992). "Development and Structure of the Canadian Forest Fire Behavior Prediction System." Technical Report ST-X-3, Forestry Canada, Ottawa, Ontario.

Wotton, B.M., Alexander, M.E., Taylor, S.W. 2009. Updates and revisions to the 1992 Canadian forest fire behavior prediction system. Nat. Resour. Can., Can. For. Serv., Great Lakes For. Cent., Sault Ste. Marie, Ontario, Canada. Information Report GLC-X-10, 45p.

SurfaceFuelConsumption

Surface Fuel Consumption Calculator

Usage

SurfaceFuelConsumption(FUELTYPE, FFMC, BUI, PC, GFL)

Arguments

FUELTYPE	The Fire Behaviour Prediction FuelType
FFMC	Fine Fuel Moisture Code
BUI	Buildup Index
PC	Percent Conifer (

\itemGFLGrass Fuel Load (kg/m²)
 SFC Surface Fuel Consumption (kg/m²)
 Computes the Surface Fuel Consumption by Fuel Type. All variables names are laid out in the same manner as FCFDG (1992) or Wotton et. al (2009)
 Forestry Canada Fire Danger Group (FCFDG) (1992). "Development and Structure of the Canadian Forest Fire Behavior Prediction System." Technical Report ST-X-3, Forestry Canada, Ottawa, Ontario.
 Wotton, B.M., Alexander, M.E., Taylor, S.W. 2009. Updates and revisions to the 1992 Canadian forest fire behavior prediction system. Nat. Resour. Can., Can. For. Serv., Great Lakes For. Cent., Sault Ste. Marie, Ontario, Canada. Information Report GLC-X-10, 45p.

SurfaceRateOfSpreadC6 *C-6 Conifer Plantation Fire Spread Calculator*

Description

Calculate surface fire rate of spread (RSS).

Usage

SurfaceRateOfSpreadC6(FUELTYPE, RSI, BUI)

Arguments

FUELTYPE	The Fire Behaviour Prediction FuelType
RSI	Intermediate Surface Fire Rate of Spread
BUI	Buildup Index

Details

All variables names are laid out in the same manner as Forestry Canada Fire Danger Group (FCFDG) (1992). Development and Structure of the Canadian Forest Fire Behavior Prediction System." Technical Report ST-X-3, Forestry Canada, Ottawa, Ontario.

Value

RSS

References

<https://cfs.nrcan.gc.ca/publications/download-pdf/10068> Development and Structure of the Canadian Forest Fire Behavior Prediction System." Technical Report ST-X-3, Forestry Canada, Ottawa, Ontario.

TotalFuelConsumption *Total Fuel Consumption calculation*

Description

Computes the Total (Surface + Crown) Fuel Consumption by Fuel Type. All variables names are laid out in the same manner as FCFDG (1992) or Wotton et. al (2009)

Forestry Canada Fire Danger Group (FCFDG) (1992). "Development and Structure of the Canadian Forest Fire Behavior Prediction System." Technical Report ST-X-3, Forestry Canada, Ottawa, Ontario.

Usage

TotalFuelConsumption(CFC, SFC)

Arguments

CFC	Crown Fuel Consumption (kg/m ²)
SFC	Surface Fuel Consumption (kg/m ²)

Details

Wotton, B.M., Alexander, M.E., Taylor, S.W. 2009. Updates and revisions to the 1992 Canadian forest fire behavior prediction system. Nat. Resour. Can., Can. For. Serv., Great Lakes For. Cent., Sault Ste. Marie, Ontario, Canada. Information Report GLC-X-10, 45p.

Value

TFC Total (Surface + Crown) Fuel Consumption (kg/m²)

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