# Fire Weather Normals

## Description

Fire Weather Normals represent the average value of a fire weather code or index over the 30-year period from 1981 to 2010. Normals is a term used for values of climatic elements averaged over a fixed period of years and recognized as a standard for the country and element concerned. In Canada, the World Meteorological Organization standard 30-year period is used, with start dates matching the first year of each decade. The most recent period covers the years from 1971 to 2000. Historical normals of the Fire Weather Index and Fire Behavior Predication elements were calculated in accordance with this guideline. The Canadian Forest Fire Weather Index (FWI) System consists of six components that account for the effects of fuel moisture and wind on fire behavior. • The Fine Fuel Moisture Code (FFMC) is a numeric rating of the moisture content of litter and other cured fine fuels. This code is an indicator of the relative ease of ignition and the flammability of fine fuel. • The Duff Moisture Code (DMC) is a numeric rating of the average moisture content of loosely compacted organic layers of moderate depth. This code gives an indication of fuel consumption in moderate duff layers and medium-size woody material. • The Drought Code (DC) is a numeric rating of the average moisture content of deep, compact organic layers. This code is a useful indicator of seasonal drought effects on forest fuels and the amount of smoldering in deep duff layers and large logs. • The Initial Spread Index (ISI) is a numeric rating of the expected rate of fire spread. It combines the effects of wind and the FFMC on rate of spread without the influence of variable quantities of fuel. • The Buildup Index (BUI) is a numeric rating of the total amount of fuel available for combustion. It combines the DMC and the DC. • The Fire Weather Index (FWI) is a numeric rating of fire intensity. It combines the Initial Spread Index and the Buildup Index. It is suitable as a general index of fire danger throughout the forested areas of Canada. • The Daily Severity Rating (DSR) is a numeric rating of the difficulty of controlling fires. It is based on the Fire Weather Index but more accurately reflects the expected efforts required for fire suppression. The first three components, the fuel moisture codes, are numeric ratings of the moisture content of litter and other fine fuels, the average moisture content of loosely compacted organic layers of moderate depth, and the average moisture content of deep, compact organic layers. The remaining three components are fire behavior indices, which represent the rate of fire spread, the fuel available for combustion, and the frontal fire intensity; their values rise as the fire danger increases.

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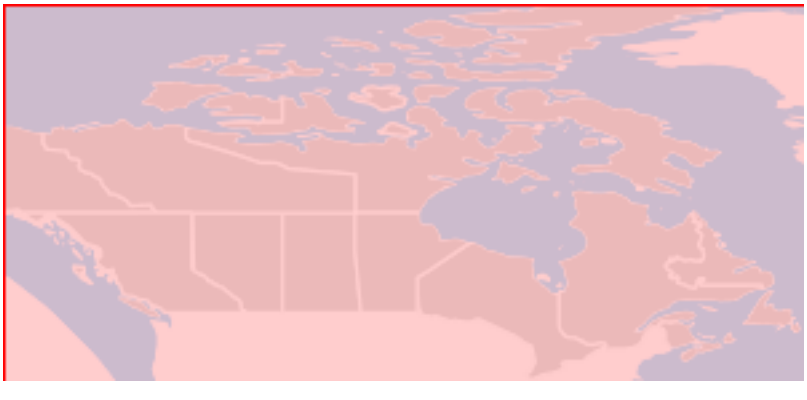
| Geographic Extent | SW:-141.003 41.676, NE:-52.617 83.114 |



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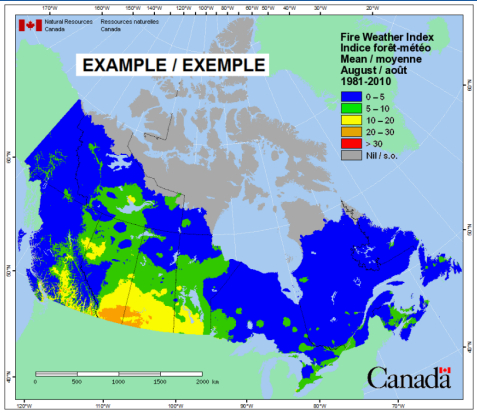
| Time Period | From:1981 - To:2010 |

## Resources

## Preview Image




## Data Classification

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| GC Core Subject Thesaurus | Forest fires, Risk management |
| Topic category | Environment |

## Metadata Contact

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| Resource Name | Resource Type | Language | Format |
|---|---|---|---|
| Fire Weather Normals | Web Service | English, French | HTML |
| Fire Weather Normals - grids | Dataset | English, French | TIFF |

**Additional Information**

**Dataset Identification**

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|---|---|
| Date | 2018 (Publication) |
| Date Type | Publication |
| Date | 2018-02-01 (Creation) |
| Date Type | Creation |
| Status | Planned |
| Maintenance and Update Frequency | Daily |
| Use Limitation | Open Government Licence - Canada (http://open.canada.ca/en/open-government-licence-canada) |
| Access Constraints | License |
| Use Constraints | Other restrictions |
| Use Constraints | License End User |
| Other constraints | Please note, an End-User Agreement is required for accessing these data. Please refer to this agreement for information regarding restrictions of use: http://cfs.nrcan.gc.ca/common/cwfis/End_User_Agreement_gen_EN.html |
| Spatial representation type | Vector |
| Metadata language | English |
| Supplemental Information | FWI and FBP Historical Normals Data Sources and Methods for Daily Maps<br><br>Fuel Types<br>The Canadian Forest Fire Behavior Prediction (FBP) System (Forestry Canada Fire Danger Group 1992) fuel type map was derived from a satellite image-based land cover classification of Canada (Cihlar and Beaubien 1998). The satellite imagery was acquired between 11 April and 31 October 1995 by the Advanced Very High Resolution Radiometer (AVHRR) sensor on the National Oceanic and Atmospheric Administration satellite 14 and was processed to produce a composite image representative of the summer months. The image was obtained from the Canada Centre for Remote Sensing.<br><br>Unfortunately, the land cover classification did not distinguish between different coniferous species. |

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The coniferous cover was all classified as either C1 or C2, depending on density. Shrubs were classified as D1 and croplands as O1. The resulting fuels map therefore gives only a general idea of the fuel types present and would not be suitable for operational fire management.

Elevation (view elevation map)
The elevation grid was derived from the US Geological Survey's 1 x 1 km hydrologically correct digital elevation model (DEM) for North America, downloaded from the USGS web site. The DEM is a hydrologically corrected version of GTOPO30, a 30-arcsecond global DEM assembled by the USGS. In Canada, the data for GTOPO30 were taken from two sources, Digital Chart of the World and Digital Terrain Elevation Data, both produced by the US National Imagery and Mapping Agency (formerly the Defense Mapping Agency).

Weather Data (view weather stations map)
Hourly and daily weather data for Canada for 1971 to 2000 were obtained from the Meteorological Service of Canada. Data components used were the noon temperature, relative humidity, and wind speed, as well as daily precipitation and snow on ground.
The analysis window (fire season) was set to 1 April 1 to 30 September, both because of data availability and because this period encompasses the fire season in most areas of the country.

FWI Calculation Start-up
To determine spring start-up dates and starting fuel moisture code values, the procedures described in Turner and Lawson (1978) were used. There are two methods, depending on snow cover.

Method 1
For stations that reported snow cover, start-up occurred when there had been no snow for three consecutive days. Start-up values were as follows:
• FFMC set to 85
• DMC set to 6
• DC set to 15

Method 2
For stations that never reported snow cover, start-up occurred when the noon temperature was 12°C or higher for three consecutive days. Start-up values were as follows:
• FFMC set to 85

• DMC set to 2 times the number of days since precipitation
• DC set to 5 times the number of days since precipitation

Daily Weather Grids
Daily raster maps (grids) of temperature, relative humidity, wind speed, and precipitation were created by interpolating values between weather stations. The interpolation method was inverse distance weighting (IDW). Values were assigned to each grid cell by calculating a weighted mean of the values of the six nearest reporting stations. For each cell, the station values were weighted by the inverse of the square of the distance to the cell. The weather grids were then used as inputs to the Fire Weather Index (FWI) and Fire Behavior Prediction (FBP) grid calculations.

Elevation Correction
Temperature and relative humidity grids were not built using straight interpolation. Instead, values were adjusted for elevation using the elevation grid. For temperature, the adjustment was based on the United States Standard Lapse Rate of -6.5°C/km; that is, for every kilometer gain in elevation, the temperature was assumed to drop by 6.5°C. For relative humidity, the mixing ratio (ratio of water vapor to dry air by weight) was estimated for each station and interpolated. The relative humidity for each grid cell was then calculated using the elevation-adjusted temperature grid.

Daily FWI Grids
The grids for fuel moisture codes (FFMC, DMC, and DC) were built using both interpolation and calculation. Because the fuel moisture code calculations require the previous day's values as inputs, values for areas where new stations were starting up were interpolated rather than calculated. In areas where the previous day's values were available, the fuel moisture codes were calculated on a cell-by-cell basis using the previous day's grids, together with the current day's weather grids, as inputs. In the output maps, the non-calculating areas were assigned a value of zero.

In addition, four ecozones (Wiken 1986) were masked out of the moisture code grids (and all the subsequent FWI and FBP grids based on them) because of the inapplicability

of the FWI and FBP models to these areas:
• Arctic Cordillera
• High Arctic
• Low Arctic
• Prairies

The FWI System fire behavior indices (not to be confused with the Fire Behavior Prediction System outputs) were calculated from the fuel moisture codes. These calculations were done on a cell-by-cell basis to produce the ISI, BUI, and FWI grids. Lastly, the Daily Severity Rating (DSR) grid was calculated from the FWI grid. The DSR gives a relative rating of fire control difficulty, or the amount of work required to suppress a fire.

Daily FBP Grids
The FBP System outputs included the Rate of Spread (ROS), Total Fuel Consumption (TFC), Head Fire Intensity (HFI), and Crown Fraction Burned (CBF). Each of these outputs was calculated on a cell-by-cell basis, using the weather and FWI System grids and the fuel type grid as inputs.

Normals
For each component, daily grids were built for the fire season (1 April to 30 September) of each year. All grid processing was done in ArcView using the Spatial Fire Management System. The arithmetic mean values were then calculated from the daily grids on a cell-by-cell basis. The monthly normals represent the arithmetic mean of all the daily grids for that month from all 30 years (1971–2000), calculated for each cell in the grid. The fire season normals represent the arithmetic mean of all the daily grids for all 6 months from all 30 years, a total of over 5000 daily values.

References
Forestry Canada Fire Danger Group. 1992. Development and structure of the Canadian Forest Fire Behavior Prediction System. Forestry Canada, Ottawa, ON. Information Report ST-X-3.

Turner, J.A.; Lawson, B.D. 1978. Weather in the Canadian Forest Fire Danger Rating System. A user guide to national standards and practices. Environment Canada, Pacific Forest Research Centre, Victoria, BC. BC-X-177.

Wiken, E.B., compiler. 1986. Terrestrial ecozones of Canada. Ecological Land Classification Series. Environment Canada, Hull, QC.

## Distribution Information

### Distribution format

| | |
|---|---|
| Name | TIFF |
| Version | Grid |

## Metadata Record

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|---|---|
| File Identifier | 6bcd2b24-d887-40ac-90a4-8f491e0305f9 |
| Hierarchy Level | Dataset |
| Date Stamp | 2020-01-10T19:50:13 |
| Metadata language | English (Other language:French) |
| Character set | UTF8 |
| Metadata standard name | North American Profile of ISO 19115:2003 - Geographic information - Metadata |
| Metadata standard version | CAN/CGSB-171.100-2009 |

### Reference System Information

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| Unique resource identifier | EPSG:3978 |
| Codespace | http://www.epsg-registry.org |