

Fire Behaviour Forecasting



Using the Field guide to the Canadian
Forest Fire Behaviour Prediction System
AKA the “Red Book”

Rationale

- I have put this presentation together to show the processes I use to develop a fire behaviour forecast using the Red Book.
- I use this method because I want firefighters on the ground are using the Red Book and one of the major disclaimers of most fire behaviour forecast is; **“The following information is based on equilibrium fire spread at peak of the burning period with constant forecast wind and flat ground, with absence of suppression action.**
- I want the firefighters to be able to replicate my forecasted numbers and then apply any slope, wind or fuel type changes with accuracy

Fire Behaviour Forecast Form

 MFLNRORD Wildfire Service		Fire Behaviour Forecast #	
Issued Date	Issued Time	Prediction Date	Prediction Time
August, 2018	1900hrs	August, 2018	0700-2000hrs
FBAN			
SAFETY			
			
Fire Behaviour Advisory (XXXX Wx Station)			
WEATHER SUMMARY			
1300 hrs. Wx and FWI Indices for 1700 hrs. (xx km NE of fire)			
Date	Temp	RH %	WD WS Prec. FFMC ISI BUI FWI
1300 hrs. Wx and FWI Indices for 1700 hrs. (xx km S of fire)			
FIRE BEHAVIOUR GENERAL			
FIRE BEHAVIOUR SPECIFIC			
The following information is based on equilibrium fire spread at peak of the burning period with constant forecast wind and flat ground, with absence of suppression action.			
Fuel type	ROS - m/min (head)	Intensity Class & Fire Type	
		Augier Lake	
<i>Be aware of localized winds and topographical features that will affect fire behaviour. Use your red book to make adjustments for your particular on site conditions!</i>			
<i>Remember to do hourly weather readings. Practice good habits!!!</i>			
Today's Fire Behaviour "Watch for" Fuel Fuel type changes Change in spread rate, intensity.			

Fire Behaviour Forecast Form

- Safety:
 - Emphasize LACES & applicability
 - Trigger points
 - Example: *when wind reaches 20 km/h fire will crown*
 - Hazards created by the fire
 - Example: *watch for falling trees related to deep burning conditions*
 - Weather related safety issues
 - Example: *dehydration, high winds/falling trees, cold, wet, thunderstorms*
 - Reiterate Advisories, Warnings or Red Flags if applicable

Fire Behaviour Forecast Form

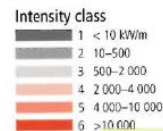
- Fire Behaviour Advisory
 - Note for which weather station
 - By fuel type
 - Time of the advisory

Fire Behaviour Advisory (Augier Lake Wx Station)	C3 Fuel Type	1400 - 1900hrs.
	S1 Fuel Type	1200 - 2200 hrs.
	M2 50%Fuel Type	1300 - 2000hrs.

Advisory times using the Red Book

Table 9.3.
Equilibrium ROS (m/min)
Fire Intensity Class

C-3 mature jack or lodgepole pine



ISI	BUI					
	0-20	21-30	31-40	41-60	61-80	81-120
1	0	0	0	0	0	<0.1
2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
3	<0.1	0.2	0.2	0.2	0.2	0.2
4	0.1	0.3	0.4	0.4	0.5	0.5
5	0.3	0.6	0.7	0.8	0.9	1
6	0.4	1	1	1	1	2
7	0.6	2	2	2	2	2
8	0.9	2	2	3	3	3
9	1	3	3	4	4	4*
10	2	4	4	5	5	5*
11	2	5	5	6	7*	7*
12	2	6	7	7	8*	8*
13	3	7	8	9	10*	11*
14	3	8	9	10*	11*	12*
15	4	9	11	12*	13*	14
16	4	10	12	14*	15*	16
17	5	12	14	16*	17	18
18	6	13	15	17*	19	20
19	6	15	17*	19	21	22
20	7	16	19*	21	23	25
21-25	9	21	24*	27	30	33
26-30	12	28*	33	38	41	43
31-35	16	36*	42	47	51	55
36-40	18	43	50	56	61	65
41-45	21	49	57	64	70	74
46-50	23	54	63	71	77	82
51-55	25	58	69	77	84	89
56-60	27	62	73	82	89	95
61-65	28	65	77	86	94	100
66-70	29	68	80	90	97	103

Constant values: foliar moisture content = 97%; CBH = 8 m. □ = average BUI. Type of fire: Black values = surface with <10% CFB, black values with * = intermittent crown with 10-89% CFB, white values = continuous crown fire, — = approximately 50% CFB value. ○ = intensity class.

- Advisory are issued when head fire intensity exceeds 4,000 kW/m
- With a ISI of 9 (FFMC of 92 and wind of 10km/h) and a BUI of 100, the R.O.S. is 4 m/min and intensity 5 (4,000 – 10,000 kW/m)
- This fuel type will be out of advisory with a R.O.S. of 3 m/min and an ISI of 8

Advisory times using the Red Book

51 Initial Spread Index / BISI

FMC	Effective wind speed (km/h)										
	0	5	10	15	20	25	30	35	40	45	50
77	1	1	1	2	2	3	4	5	7	9	9
78	1	1	1	2	3	3	4	5	7	8	9
79	1	1	2	2	3	4	5	6	8	9	10
80	1	1	2	2	3	4	5	7	9	10	11
81	1	2	2	3	3	4	6	7	10	11	13
82	1	2	2	3	4	5	6	8	11	13	14
83	2	2	3	3	4	6	7	9	12	15	16
84	2	2	3	4	5	6	8	11	14	17	18
85	2	3	3	4	6	7	10	12	16	19	21
86	2	3	4	5	7	9	11	14	18	22	24
87	3	4	5	6	8	10	13	16	21	25	28
88	3	4	5	7	9	11	15	19	24	29	32
89	4	5	6	8	10	13	17	22	28	33	37
90	4	6	7	9	12	15	19	25	32	39	43
91	5	6	8	11	14	17	22	29	37	45	50
92	6	7	9	12	16	20	26	33	43	51	57
93	7	8	10	14	18	23	30	38	49	59	66
94	8	10	12	16	21	27	34	44	57	68	76
95	9	11	14	18	24	31	39	51	65	78	87
96	10	13	16	21	27	35	45	58	74	89	99
97	11	15	19	24	31	40	51	66	85	102	114
98	12	17	21	28	36	46	59	76	97	117	130
	0	1.4	2.8	4.2	5.6	6.9	8.3	9.7	11.1	12.5	13.9

Use red values for the head fire and black values for the backfire.

- FFMC of 92 and wind speed of 10 km/h gives us a ISI of 9 We need to reduce the ISI to 8 to be out of an advisory... which equals a FFMC of 91

Advisory times using the Red Book

FFMC diurnal **afternoon & overnight**

Daily FFMC

Local daylight time (h)

1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300	2400	0100	0200	0300	0400	0500	0600	0700
41	43	48	50	51	53	53	52	51	50	49	48	47	46	45	44	43		
48	52	57	60	61	62	62	61	59	58	56	55	54	52	51	50	49		
57	61	65	68	70	70	70	69	68	66	65	63	62	60	59	58	56	55	
59	63	67	70	72	72	72	71	69	68	66	65	63	62	61	59	58	57	
62	66	70	74	74	73	72	71	69	68	66	65	63	62	61	59	58		
63	67	71	73	75	75	74	73	72	70	69	67	66	64	63	61	60	59	
64	68	72	74	76	76	75	74	72	71	69	68	66	65	64	62	61	60	
66	69	73	75	77	77	76	75	73	72	70	69	67	66	64	63	62	60	
67	71	75	76	78	78	77	76	74	72	71	69	68	67	65	64	63	61	
69	72	76	78	79	79	77	76	75	73	72	70	69	67	66	65	63	62	
71	74	77	79	80	80	79	78	77	76	74	73	71	70	68	67	66	64	63
74	76	79	80	81	81	80	79	78	77	75	73	72	71	69	68	66	65	64
76	78	80	81	82	82	81	80	79	77	76	74	73	71	70	69	67	66	65
78	80	81	82	83	83	82	81	80	78	77	75	74	72	71	70	68	67	66
80	81	82	83	84	84	83	82	81	79	78	76	75	73	72	70	69	68	67
82	82	83	84	85	85	84	83	82	80	79	77	76	74	73	71	70	69	68
83	84	85	85	86	86	85	84	83	81	79	78	77	75	74	72	71	70	68
84	85	86	86	87	87	86	85	83	82	80	79	78	76	75	73	72	71	70
85	86	87	87	88	88	87	86	84	83	81	80	79	77	76	74	73	72	71
86	87	88	89	89	89	88	87	85	84	82	81	80	78	77	75	74	73	72
88	88	89	90	90	90	89	88	86	85	83	82	81	79	78	77	75	74	73
89	89	90	91	91	91	90	89	87	86	84	83	82	80	79	78	76	75	74
90	90	91	92	92	92	91	90	88	87	85	84	83	81	80	79	77	76	75
91	91	92	93	93	92	91	89	88	86	85	84	82	81	80	79	77	76	75
92	93	93	94	94	93	92	90	89	88	86	85	84	82	81	80	79	77	76
93	94	94	95	95	94	93	91	90	89	87	86	85	83	82	81	80	79	77
94	95	95	96	96	95	94	92	91	90	88	87	86	85	84	82	81	80	79
95	96	96	97	97	96	95	93	92	91	90	88	87	86	85	84	83	81	80
96	97	97	98	98	97	96	94	93	92	91	90	88	87	86	85	84	83	81
97	98	98	99	99	98	97	95	94	93	92	91	90	88	87	86	85	84	83
98	99	99	100	100	99	98	96	95	94	93	92	91	90	89	88	86	85	84

Local standard time (h)

To estimate the FFMC during the afternoon or overnight, find today's FFMC in the Daily FFMC column, then move across the row to the column that corresponds to the prediction time.

- A FFMC of 91 will be reached @1500 hrs to 1900 hrs.
- I would set an Advisory time period of 1400 to 2000 hrs.
- Things to consider:
 - Inversions
 - Burning period
 - Operational period

Fire Behaviour Forecast Form

- Weather Summary:
 - High temperature or a descriptor
 - Low relative humidity or a descriptor
 - Wind speeds and directions (ensure discussion of shifts, changes and timing of events)
 - Precipitation (timing, duration)
 - Moisture codes
 - Air mass stability
 - Short outlook for the next day(s)

WEATHER SUMMARY
<p>Friday - Cloudy with local sprinkles, becoming mainly sunny early afternoon. Winds shifting to NW 10 to 15 km/h early in the morning become W 15 to 20 km/h early afternoon and NW 20km/h gusts 30km/h late afternoon. High temperatures near 23°C and minimum RH 25%.</p> <p>Saturday - The ridge builds in from offshore, for a sunny day. Winds NW 15 to 25 km/h with gusts to 35 km/h. High temperatures near 26°C and minimum RH 20%</p> <p>Outlook - The ridge holding offshore, for another sunny day. High temperatures near 28°C and minimum RH 20%. Winds with be SW 20 k/h will gusts to 30km/h.</p>

Fire Behaviour Forecast Form

FIRE BEHAVIOUR SPECIFIC		
The following information is based on equilibrium fire spread at peak of the burning period with constant forecast wind and flat ground, with absence of suppression action.		
Fuel type	ROS - m/min (head)	Intensity Class & Fire Type
Augier Lake		
C-3 (Fully stocked conifer stands)	3.0	IC -5 -Surface
S-1 (slash blocks)	12.0	IC -6 -Surface
M-2 (Leaf mixwood)	6.0	IC -5 - Intermittent Crown
<i>Be aware of localized winds and topographical features that will affect fire behaviour. Use your red book to make adjustments for your particular on site conditions!</i>		

- Fire Behaviour Specific
 - Fuel types
 - Rates of spread (number, descriptor)
 - Fire intensity class (number, descriptor or flame length)
 - Fire type (surface, torching or intermittent crowning, continuous crowning)
 - Spotting (when, where, how far)
 - Relate the fire behaviour that is expected to occur with the suppression tactics that are being applied
 - Example: *dozer lines in Division C will be tested*
 - Timing of changes in fire behaviour throughout the operational period

Fire Behaviour Forecast Form

- Other
 - Header –simple, time date etc.

 MFLNRORD Wildfire Service			Fire Behaviour Forecast #	13
			R11498 – Shovel Lake	
Issued Date	Issued Time	Prediction Date	Prediction Time	FBAN
August 9, 2018	1900hrs	August 10, 2018	0700-2000hrs	Dana Hicks

- Comments at the bottom
- Fire Behaviour “Watch For”

<u>Be aware of localized winds and topographical features that will affect fire behaviour.</u> Use your red book to make adjustments for your particular on site conditions!
<u>Remember to do hourly weather readings.</u> Practice good habits!!!
Today's Fire Behaviour "Watch for" Weather Approaching dry cold front Potential for low level jet at height of convection column, increasing convective circulation and surface spread.



Hope this help you with the process!!!!!!