Forest Research Branch

FORECASTING FOREST FIRE DANGER IN THE MARITIME PROVINCES

by

P. M. Paul

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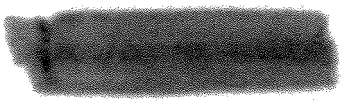

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FORECASTING FOREST FIRE DANGER IN THE MARITIME PROVINCES[1]

by
P. M. Paul[2]

I am taking the liberty of assuming that you gentlemen are familiar with the method of calculating forest fire danger and the reasons for so doing. This, I am sure, is a valid assumption for an audience of members of the Canadian Institute of Forestry. Forest fire danger can be readily calculated if a few weather measurements are made at noon and if a copy of the "Forest Fire Danger Tables" for the region is available. Fire danger ratings are used by provincial forest services and forest industries in making decisions that affect staff assignments, forest closure, and in many other ways.

The danger index is computed at noon, but because it applies to the most critical period of the day, about mid-afternoon, a short-range forecast is inherent in the design of the Danger Tables. It is, however, becoming increasingly apparent that a longer-term forecast is needed; industry and the forest services are both anxious to know tomorrow's fire danger. John Francis of the New Brunswick Forest Service has, for example, been pressing for just such a forecast for many years and on the International scene, the World Meteorological Organization has recently published a technical note on the subject (Turner, Lillywhite & Pieslak, 1961). Last February in Fredericton, a "Workshop" was organized to discuss this very problem. It was well attended by meteorologists and by provincial, federal, industrial and university foresters. Mr. Howie, Fraser Companies, Limited, stated there that without a forecast for tomorrow, the fire danger index is only "functioning at a fraction of its full potential" (Howie, 1963). Five per cent was the figure he mentioned. Indeed, Mr. Howie went on to say that he considered "a forecast of fire hazard our most pressing need in fire control at the present time". As a result of recommendations made at the Workshop, I spent nearly two months in Halifax this summer deciding if forecasting fire danger from the regional weather office is feasible. I feel it is as I will shortly explain, but first, I must provide you with a little more background information.

The Meteorological Branch, Department of Transport maintains its own personnel at synoptic stations to take frequent and detailed observations which are transmitted by teletype to the forecast office. Until recently these stations supplied the only weather data for calculating fire danger in Nova Scotia. However, many of them are not indicative of conditions in the interior of the province because of proximity to the coast and I was, therefore, asked to recommend locations for an independent network of inland forest fire weather stations. New Brunswick already had an established fire weather network so the study in Nova Scotia led quite naturally to an examination of the New Brunswick stations to see where additional ones might be set out. Suggestions for new stations were decided not only by gaps in the existing network but also by the variety of 'ecoregions' in the area. Ecoregions defined, in part, as "the geographic unit within which relationships between species and site are essentially similar, and within which silvicultural treatments may be expected to obtain comparable

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results" are clearly designated on the forest classification map for the Maritime Provinces shown in Figure 1 (Loucks, 1962). Because these ecoregions are mainly dependent on differences in landform and climate, they are to form the bases for a modification of the New Brunswick Danger Tables which will, for example, raise the danger index in the ecoregions in which fires burn more intensely than elsewhere under similar weather conditions.

The Maritimes is claimed to be a complex region for which to forecast weather because of the frequent development of secondary disturbances along the coast. For this reason the area is divided into no fewer than 10 public weather forecast regions; a large number for a land area of only 50,000 square miles. There are four forecast regions in New Brunswick, five in Nova Scotia and one for Prince Edward Island, but for forestry purposes three of the most variable regions have been divided (Figure 2). Normally we ask the forecaster to make a daily weather prediction for these 13 forestry forecast regions. There will of course be many days in which he will give the same forecast for two or more regions but there may be other days when he will provide a more specific forecast. This can be accomplished by forecasting for a smaller unit, the 'forecast area'. There are 44 of these areas in the Maritime Provinces—19 in New Brunswick, 22 in Nova Scotia and 3 in Prince Edward Island and they are either counties or subdivisions of counties (Figure 3). Suppose the boundaries of the forecast regions and areas are placed on the Maritime forest classification as shown in Figure 4. You will notice that the new boundaries do not always delineate county boundaries but often deviate to follow the forest classification.

I would like to quickly run through five steps explaining the mechanics proposed for forecasting fire danger in the Maritimes (Figure 5). To simplify the explanation, I am taking an example from one forecast region in northern New Brunswick, the Bay of Chaleur. It is comprised of three forecast areas, West and East Restigouche and Gloucester counties. One 'key station' in each forecast area will provide the Weather Office with a coded message containing the day's noon weather and drought and danger indices (Step 1). Naturally we would like the current data from more than one station per forecast area but we *must* regularly receive this information from at least one station or we cannot provide a satisfactory fire weather forecast. The data are plotted on maps in a form superficially resembling the symbols used on weather charts (Step 2). If the data are received from the key stations in the early afternoon, tomorrow's fire danger forecast can be in the forest service and industry offices one to two hours before closing time (Step 3). In other words, the '24-Hour Forecast' will be out in time to help the companies formulate their presuppression plans and to be available for radio and T.V. stations to inform their listeners and viewers in the early evening. Following the issuing of the forecast, maps will be prepared to show the boundaries between danger classes and to distinguish clearly actual danger indices (Step 4). On occasion the forecaster has been known to change his mind, consequently it will sometimes be necessary to revise the forecast the following morning (Step 5). The daily cycle repeats itself as soon as the morrow's noon data are received at the Weather Office.

On a trial basis, forecast messages were sent over the Meteorological Branch teletype circuit between the Halifax and Fredericton weather offices this year, but that was not a satisfactory procedure. The circuit was too crowded—we were lucky if there were two minutes available in any given hour—and it was not possible for the Meteorological Branch to give fire weather messages a very high priority. However, thanks to the impact of modern technology, the theme at this year's conference, an independent telecommunications network could be installed at reasonable cost. Teletypewriters can be rented on a monthly basis for almost the same price as it costs to send two 10 word telegrams between Fredericton and Halifax daily. And by this time I think you will realize that

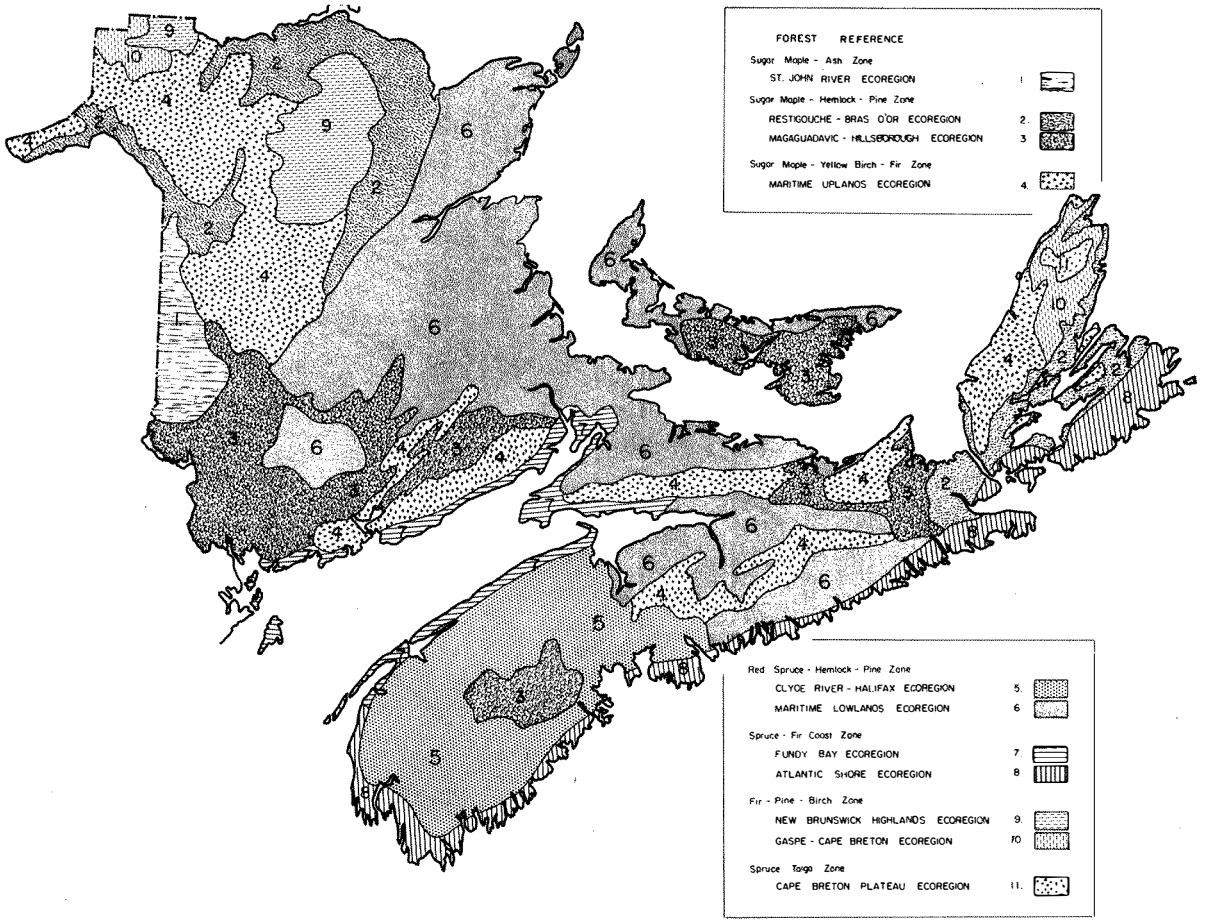


FIGURE 1. Forest classification of the Maritime Provinces.

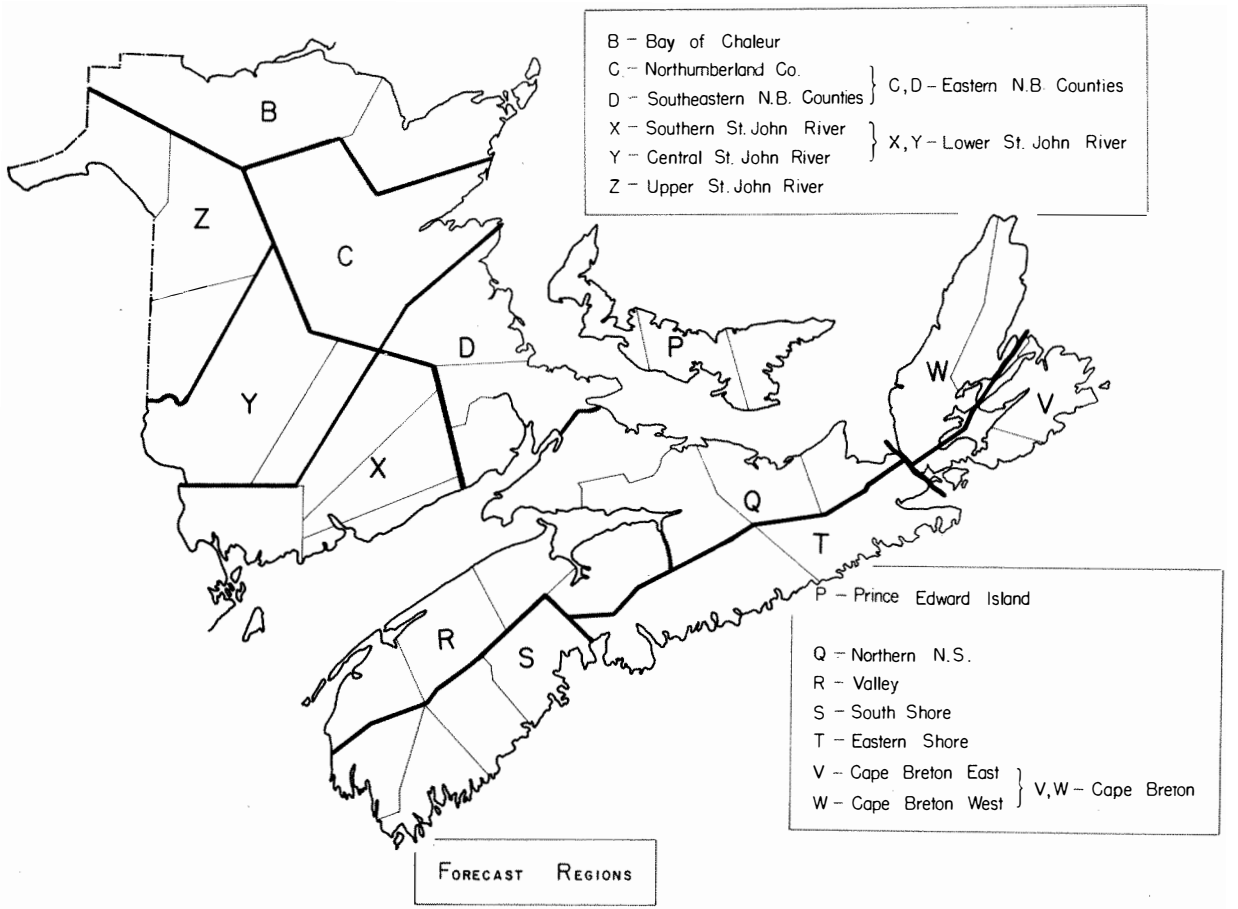


FIGURE 2. Proposed forest fire 'Forecast Regions'.

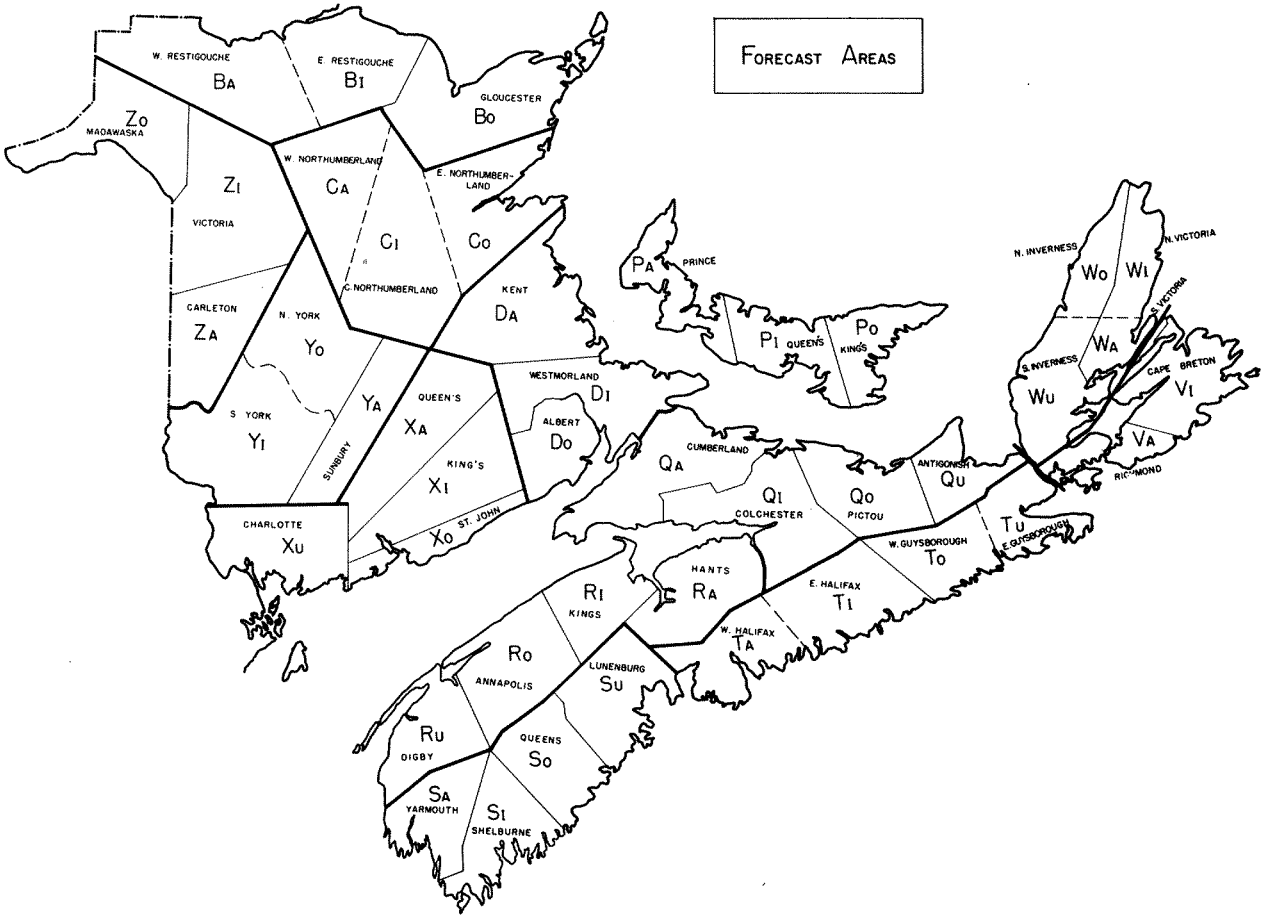


FIGURE 3. Proposed forest fire 'Forecast Areas'.

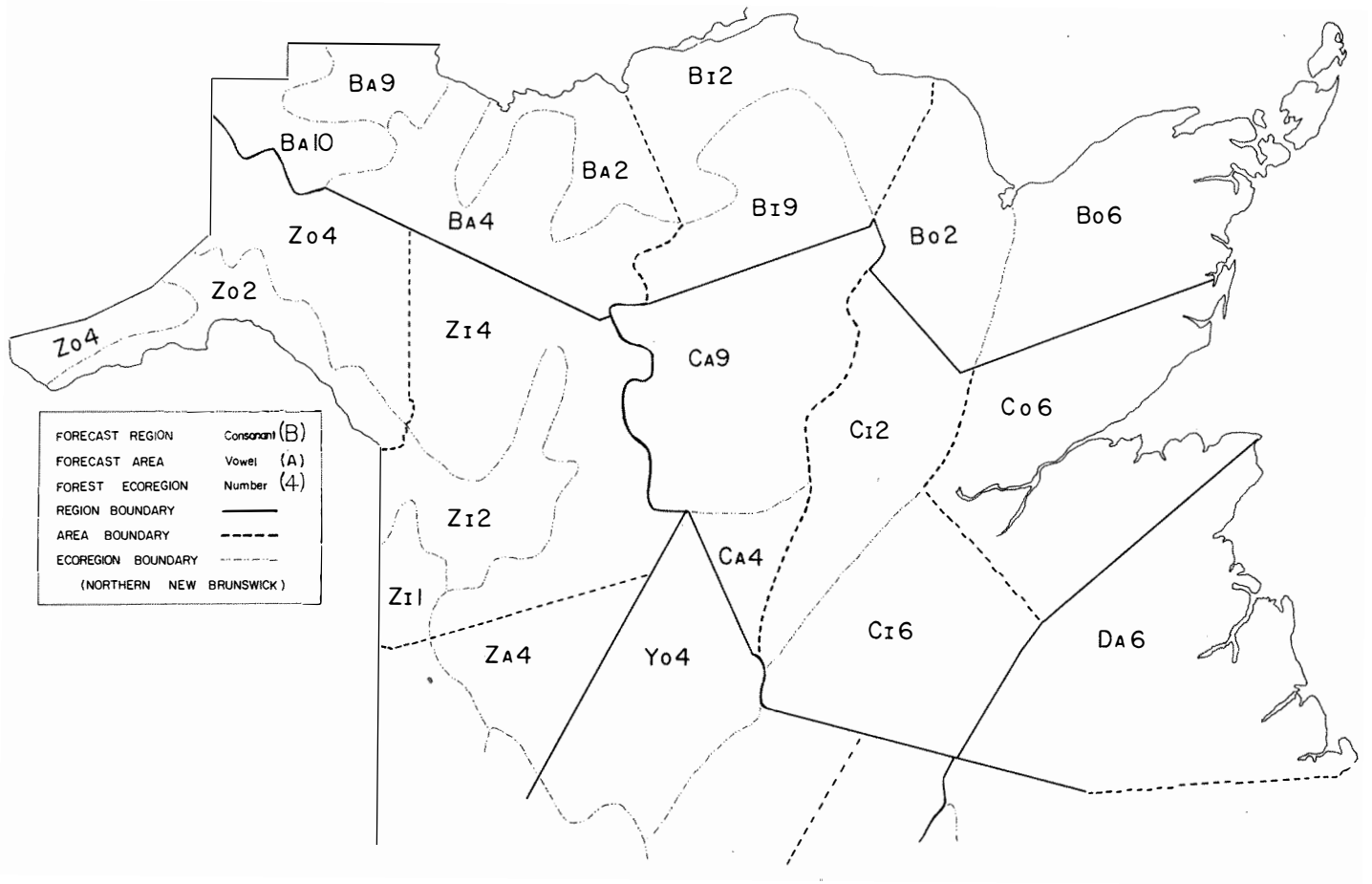


FIGURE 4. Influence of forest 'Ecoregions' on 'Forecast Region' and 'Forecast Area' boundaries.

even two 100 word telegrams are unlikely to be adequate. Teletypewriters are fast, efficient and provide a written record, thus reducing the chances of the message being misinterpreted—always a strong possibility with radio or telephone. Teletypewriters, of course, can be used for sending many messages besides fire danger forecasts so I feel quite justified in urging that they be installed at the headquarters of the provincial forest services and the offices of pulp and paper companies. A forecast service could then be provided that would effect big savings by reducing the $210,000 average annual costs in New Brunswick and Nova Scotia for damage and fire-fighting.

One of the specialized services that the forecast system could provide can be explained with a hypothetical example. Let us suppose a fire is threatening to get out of control in Gloucester County. A direct message from the Campbellton District Office of the Department of Lands and Mines to the Weather Office gives the forecaster the exact location of the fire. Being asked to forecast for a specific spot rather than a large region, he is able to make a more useful prediction. He may be aware that a front is rapidly approaching that will shift the wind from southwest to north. The Campbellton Office can be immediately advised of this strong possibility, and in turn pass the information on to the fire boss. Thus, instead of all the energy being concentrated on the northeast flank, more attention is directed to the south. The advice received may very well make the difference between the fire being swiftly extinguished or raging out of control.

I mentioned earlier that one of the functions of the forester at the Weather Office is to prepare fire danger maps and you may be wondering how we propose that they be quickly distributed to the interested parties. I hope that there will be sufficient time for, at least, one map to be sent daily over the Regional Weatherfax Network to Fredericton and other synoptic stations. This is not a truly satisfactory solution, but perhaps it will do for the present because maps would then be quickly available to the headquarters of both the Nova Scotia and New Brunswick forest services. When we become a little more sophisticated in forecasting fire danger, I would like to see installed a (if I may coin a word) "Forestfax" network to provide a two-way flow of information. Maps prepared at the Weather Office will surely assist the man-in-the-field; fire maps containing information on forest type, topography, 'spot' weather data, will certainly help the forester and the forecaster in the weather office.

I have been discussing the forecasts as they apply to forestry personnel, but we would not forget the public normally reached through radio, T.V., and the press. Using a form, such as the one shown in Figure 6, it would take only a few minutes to fill in the information required for the purpose. For local radio stations, the fire danger forecast that is appropriate to their limited range is all that need be broadcast. This same information could be transferred to a map in the T.V. studio, as in Figure 7, and it could reappear in a small corner of the morning newspapers. I would also like to see a standard fire danger sign adopted in the Maritime Provinces; one which would be prominently displayed along highways. As the motorist drives into northwestern New Brunswick at the Quebec border, he should be greeted by a fire danger forecast for Madawaska County, and even before crossing the border into Nova Scotia, he would be on the look out for the fire danger forecast for Cumberland County. There is, of course, one drawback to signs; they must be kept up-to-date. Too often I have driven in teeming rain past a sign which read 'High' or 'Extreme'. I would also like to see Mr. Coats' (Manager of the Ontario Forestry Association) suggestion for flying coloured warning pennants from offices and provincial buildings adopted in the Maritimes (Anon., 1963). It is a good idea, but instead of the three pennants that are flown in northwestern Ontario, we should have four—green for 'Nil' and 'Low', yellow for 'Moderate', orange for 'High' and red for 'Extreme'.

MECHANICS OF FORECASTING FOREST FIRE DANGER

(BAY OF CHALEUR FORECAST REGION 'B')

1.

Station Number	Rain	Relative Humidity	Wind	Drought Index	Danger Index	Cloud Cover	Temperature	Visibility
122	0	37	W6	10	11	SC	86	10
100	0	43	W10	10	13	OV	83	
105	.02xx	49	SW8	7	6	BR	82	

FOREST FIRE WEATHER DATA FOR AUGUST 10 (Issued 10/1330ADT)

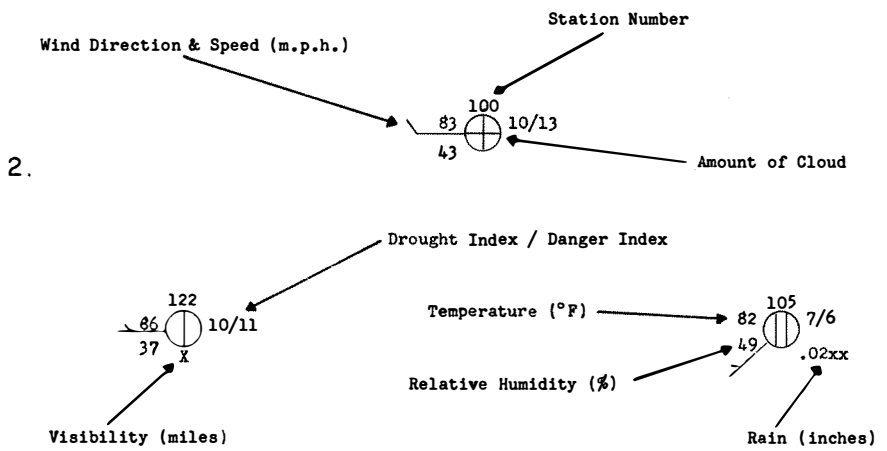
122 St. Quentin Key Station for Forecast Area 'BA' (West Restigouche Co.)

100 Campbellton Key Station for Forecast Area 'BI' (East Restigouche Co.)

105 Allardville Key Station for Forecast Area 'BO' (Gloucester Co.)

Transmitted to Maritime Weather Office.

2.



RAIN (Time Starting-Stopping)

- s Starting before Noon
- x Noon to Midnight
- y Midnight to 8:00 a.m.
- z 8:00 a.m. to Noon
- c Continuing past Noon

CLOUD COVER

- CL-ear
- SC-attered (1/10-5/10)
- BR-oken (6/10-9/10)
- OV-ercast (10/10)
- OB-scured (fog, etc.)

WIND (m.p.h.)

- Calm
- 1 - 4
- 5 - 8
- 9 - 12
- 13 - 17
- 18+

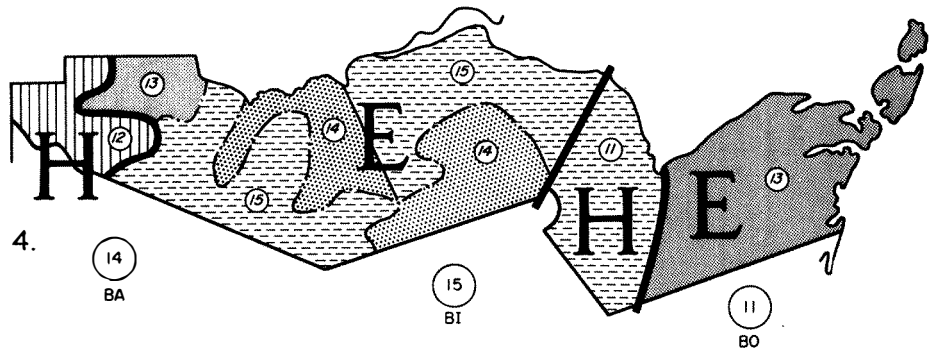
Plotted at Maritime Weather Office. (Normally completed after 24-Hour Forecast is issued.)

	Forecast Region-Area	Rain	Relative Humidity	Wind	Drought Index	Danger Index	Cloud Cover	Temperature
	B	0	40	SW12			SC	78
3.	BA				11	14		
	BI				11	15		
	BO				8	11		

FOREST FIRE FORECAST FOR AUGUST 11 (Issued 10/1530ADT)

24 - Hour Forecast

Issued at Maritime Weather Office.



CLASS	INDEX NUMBER			
Nil	0			
Low	1	2	3	4
Moderate	5	6	7	8
High	9	10	11	12
Extreme	13	14	15	16
Map Symbol				

Facsimile Map sent from Maritime Weather Office. (Based on 24-Hour Forecast Data.)

	Forecast Region-Area	Rain	Relative Humidity	Wind	Drought Index	Danger Index	Cloud Cover	Temperature
	BA/BI	.07yz	65	W6			BR	76
5.	BA				10	6		
	BI				10	6		
	BO	0	55	SW8	8	10	SC	78

REVISED FOREST FIRE FORECAST FOR AUGUST 11 (Issued 11/0700ADT)

6 - Hour Forecast

Issued at Maritime Weather Office.

FIGURE 5. Explanation of proposed method of forecasting forest fire danger from the Maritime Weather Office. (The 24-Hour Forecast Danger Indices are shown in Figure 6.)

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FOREST FIRE DANGER FORECAST    (24-HOUR FCST)
3.30 PM  AUG. 10/196-    TOMORROW  AUG. 11/196-

NB     E  / 15  BI DA / 14  BA CI / 13  CA DI /
       H  / 12  CO / 11  BO DO XI YA / 10 XU / 9  XA XO YI /
       M  / 8  YO ZI / 7 ZA / 6 ZO /

PEI    H  / 10  PA PO / 9 PI /

NS     E  / 14 QA / 13 QI /
       H  / 11 QO / 10 RA TO / 9 RI RO TI TU /
       M  / 8  QU SA TA / 7 RU SO SU / 6 SI WU /
       L  / 4  VA WA / 3  VI WO / 2  WI /
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FIGURE 6A. Sample forest fire danger forecast message sent from Maritime Weather Office.

FOREST FIRE DANGER FORECAST

AS ISSUED BY THE DEPARTMENT OF FORESTRY FROM THE MARITIME WEATHER OFFICE AT 3.30 (Time) ~~a.m.~~ p.m. A.D.T.

Aug. 10 (Month & Date) 196- AND VALID FOR ~~today~~ tomorrow Aug. 11 (Month & Date) 196- .

NEW BRUNSWICK / PRINCE EDWARD ISLAND

	FORECAST AREA		E	H	M	L
	(N.B. DANGER INDEX:- Extreme (13-16) — High (9-12) — Moderate (5-8) — Low/Nil (0-4))					
B	WEST RESTIGOUCHE	BA	14			
	EAST RESTIGOUCHE	BI	15			
	GLOUCESTER	BO		11		
C	WEST NORTHUMBERLAND	CA	13			
	CENTRAL N'UMBERLAND	CI	14			
	EAST NORTHUMBERLAND	CO		12		
D	KENT	DA	15			
	WESTMORLAND	DI	13			
	ALBERT	DO		11		
X	QUEEN'S	XA		9		
	KING'S	XI		11		
	ST. JOHN	XO		9		
	CHARLOTTE	XU		10		
Y	SUNBURY	YA		11		
	SOUTH YORK	YI		9		
	NORTH YORK	YO			8	
Z	CARLETON	ZA			7	
	VICTORIA	ZI			8	
	MADAWASKA	ZO			6	
P	PRINCE	PA		10		
	QUEENS	PI		9		
	KINGS	PO		10		

NOVA SCOTIA

	FORECAST AREA		E	H	M	L
Q	CUMBERLAND	QA	14			
	COLCHESTER	QI	13			
	PICTOU	QO		11		
	ANTIGONISH	QU			8	
R	HANTS	RA		10		
	KINGS	RI		9		
	ANNAPOLIS	RO		9		
	DIGBY	RU			7	
S	YARMOUTH	SA			8	
	SHELBURNE	SI			6	
	QUEENS	SO			7	
	LUNENBURG	SU			7	
T	WEST HALIFAX	TA			8	
	EAST HALIFAX	TI		9		
	WEST GUYSBOROUGH	TO		10		
	EAST GUYSBOROUGH	TU		9		
V	RICHMOND	VA				4
	CAPE BRETON	VI				3
W	SOUTH VICTORIA	WA				4
	NORTH VICTORIA	WI				2
	NORTH INVERNESS	WO				3
	SOUTH INVERNESS	WU			6	

FORECAST REGION

B	BAY OF CHALEUR	XI	Lower St. John River	Q	NORTHERN N.S.
CD	Eastern N.B. Counties	X	SOUTHERN ST. JOHN RIVER	R	VALLEY
C	NORTHUMBERLAND CO.	Y	CENTRAL ST. JOHN RIVER	S	SOUTH SHORE
D	SOUTHEASTERN N.B. COS.	Z	UPPER ST. JOHN RIVER	T	EASTERN SHORE

VW	Cape Breton
V	CAPE BRETON EAST
W	CAPE BRETON WEST
P	PRINCE EDWARD ISLAND

FIGURE 6B. Sample forest fire danger forecast message transferred to standard form.

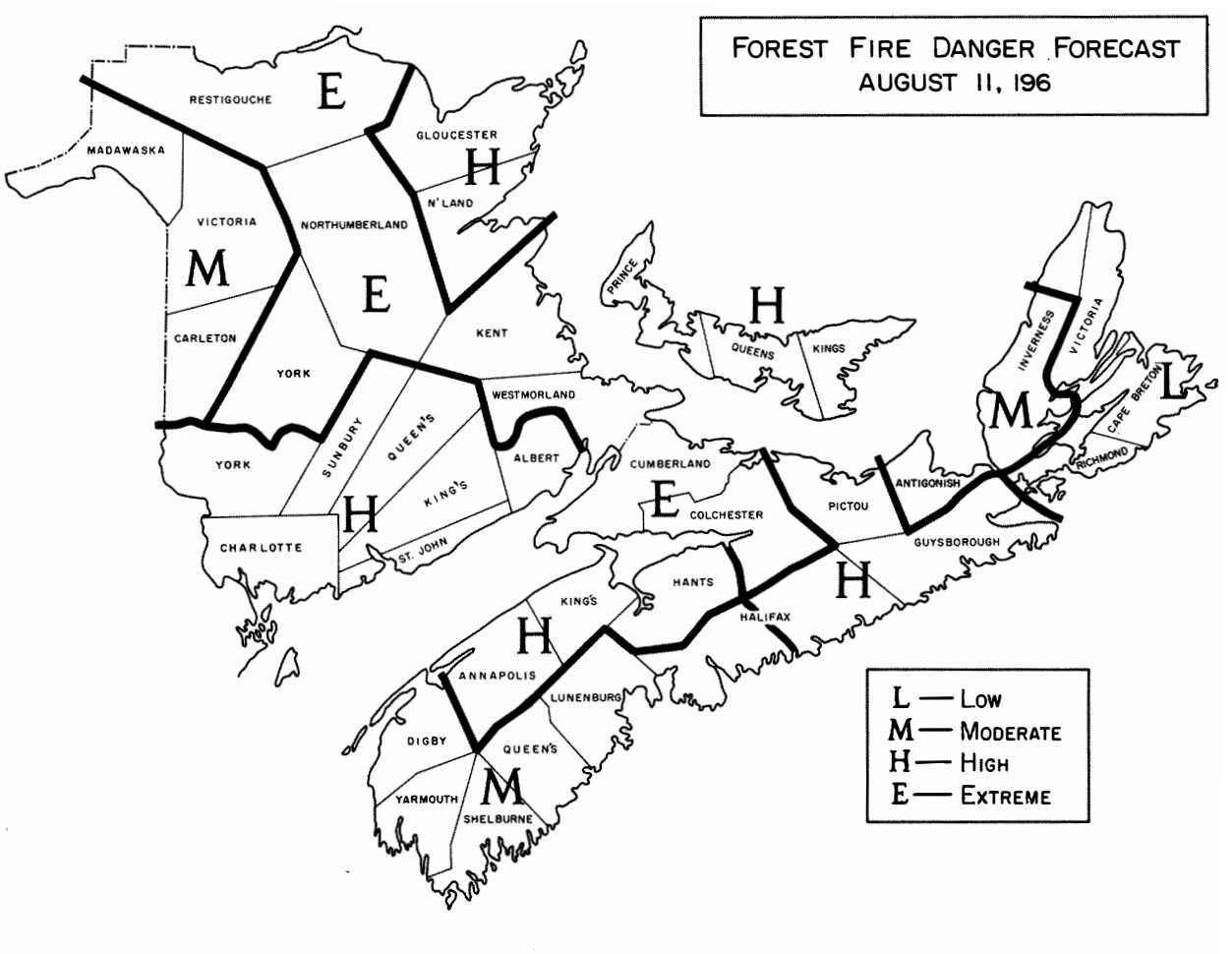

FIGURE 7. Forest fire danger forecast map. (Data taken from Figure 6B).

In conclusion I would like to stress again how much we can all benefit by the originating of forest fire danger forecasts from regional weather offices. By us all, I am including the general public, who have a large stake in our natural resources, as well as those of us present today who have a direct concern with forestry. For a fire danger forecast system to function efficiently three C's are needed—(1) Communication, (2) Cooperation and (3) Coordination. The *communication* problem can be easily solved by installing teletypewriters; we already have good *cooperation* between forestry interests and the Meteorological Branch; and we should *coordinate* our activities at the regional weather office.

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