forest management note

Note No. 43 Northern Forestry Centre Edmonton, Alberta

TWO *BASIC* PROGRAMS FOR FIRE DANGER AND FIRE BEHAVIOR COMPUTATIONS

Two computer programs pertaining to the Canadian Forest Fire Danger Rating System (CFFDRS) calculate Canadian Forest Fire Weather Index (FWI) System (Canadian Forestry Service 1984) component values and predict fire behavior using procedures from the Canadian Forest Fire Behavior Prediction (FBP) System (Lawson et al. 1985). The programs were written for a NEC PC-8201A[1] lap computer (Fig. 1) but can be adapted to any computer with approximately 24 KB of memory that supports some dialect of the BASIC computer language.

The first program, named LAPFWI (Lap computer Fire Weather Index), is a program to calculate component indexes of the FWI System (Van Wagner and Pickett 1985; Van Wagner 1987) and archive fire weather data. The FWI System consists of three fuel moisture codes, Fine Fuel Moisture Code (FFMC), Duff Moisture Code (DMC), and Drought Code (DC), and three fire behavior indexes, Initial Spread Index (ISI), Buildup Index (BUI), and Fire Weather Index (FWI). Calculation of the six components making up the FWI System is based on daily observations of dry-bulb temperature, relative humidity, 10-m open wind speed, and 24-hour accumulated rainfall recorded at 1200 h local standard time (LST) at a suitable weather station (Turner and Lawson 1978). Also computed by the program is the Daily Severity Rating System (DSR), a function of the FWI component as described by Van Wagner (1970, 1987) and the Cumulative Daily Severity Rating (CDSR) as described by Harvey et al. (1986). The program is based largely on a FORTRAN program written by Van Wagner and Pickett (1985), with some notable input-output exceptions. Fire weather data (measured, forecasted, or estimated) can either be processed from an archived data file or typed in directly. Output from LAPFWI can be displayed in two formats: screen display (from typed-in data only) or print form (if a printer is available).

The second program is LAPFBP (Lap computer Fire Behavior Prediction), which is designed to evaluate fire growth and crowning potential as outlined in the 1984 interim edition of the Canadian Forest Fire Behavior Prediction (FPB) System[2] (Lawson et al. 1985) with some minor additions. Currently, the primary output of the FBP System is head fire Rate Of Spread (ROS) based on fuel type (14 major Canadian fuel types currently recognized), weather (FFMC and 10-m open wind speed), and topographic slope and aspect. Crowning potential is determined, where applicable, on the basis of the calculated ISI or slope-adjusted ROS. Other outputs include some simple elliptical fire growth model information (Van Wagner 1969): length-to-breadth ratio; area; perimeter length; head, back, and flank fire spread distances; and fire mapping information. Additions to the program not outlined in the 1984 interim edition FBP System include the following:

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[1] The exclusion of certain manufactured products does not imply rejection nor does the mention of other products imply endorsement by the Canadian Forestry Service.

[2] Alexander, M.E.; Lawson, B.D.; Stocks, B.J.; Van Wagner, C.E. 1984. User guide to the Canadian Forest Fire Behavior Prediction System: rate of spread relationships. Interim edition. Environ. Can., Can. For. Serv., Fire Danger Group, Ottawa, Ontario.

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Figure 1. The NEC PC8201A lap computer measures 30 × 21 × 3.5 cm and weighs 1.7 kg.

1. The entire FFMC diurnal and adjustment table (Alexander 1982) has been incorporated to permit predictions for any time of day between 0600 and 2000 h LST.

2. The calculation of length-to-breadth and all other elliptical growth model spread distances is based on the focus approach (Alexander 1985).

3. The additive effect of slope on length-to-breadth is computed; however, this calculation does not include the effects of slopes that are perpendicular to head fire spread.

Projection options available include time, distance, and area, allowing the operator to obtain a description of the fire after a specified elapsed time, distance traveled, or area burned. The LAPFBP program is subject to the same constraints as the FBP System, including assumed uniformity of environmental conditions over the area being considered in a single prediction.

The two programs can be run separately or as a pair. When they are run in sequence, 1-h elliptical growth projections can be made for a preselected number of FBP System fuel types common to the area of concern. When they are run alone, many actual or potential situations can be evaluated quickly. The programs were designed to run on small lap computers, making them ideally suited to both field and office use for assessing potential fire behavior for daily presuppression planning or specific fire growth potential. The portability of the lap computer and its battery-operating capacity make it usable in a variety of situations where regular microcomputers could not be used (i.e., campaign fires). The programs are, however,

simply an alternative to manual computational methods[3] (Canadian Forestry Service 1984; McAlpine 1986).

More-detailed operating instructions and program listings are available in a Northern Forestry Centre file report entitled "LAPFWI and LAPFBP - User's guide and program listings." For further information and copies of this file report, contact R.S. McAlpine at the Northern Forestry Centre. Periodic changes to both programs are tentatively planned as additions and revisions to the FWI and FBP systems are produced by further research.

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