

P1.4

THE MANN GULCH FIRE AND THE CANADIAN FOREST FIRE DANGER RATING SYSTEM

M.E. Alexander
Canadian Forest Service, Edmonton, Alberta

The year 1999 marks the 50th anniversary of the Mann Gulch Fire that occurred in western Montana on August 5, 1949 (Matthews 1999). There has been considerable interest amongst the Canadian wildland fire community in the 1949 Mann Gulch Fire ever since the publishing of MacLean's (1992) book "Young Men and Fire" and Rothermel's (1993) publication on the "Mann Gulch Fire: A Race That Couldn't Be Won" which were soon followed by Canadian folk singer James Keelaghan's song "Cold Missouri Waters" a year later.

In order to supplement the usefulness of the Mann Gulch Fire as case study material in wildland fire training in Canada, the burning conditions and potential fire behavior have been examined in light of the two major subsystems of the Canadian Forest Fire Danger Rating System (CFFDRS) (Stocks et al. 1989, Alexander et al. 1996), namely the Canadian Forest Fire Weather Index (FWI) System (Canadian Forestry Service 1984; Van Wagner 1987) and the Canadian Forest Fire Behavior Prediction (FBP) System (Forestry Canada Fire Danger Group 1992; Taylor et al. 1997). Towards this end, daily 12 p.m. Mountain Standard Time (MST) weather observations (i.e., dry-bulb temperature, relative humidity and wind speed) were obtained for the Helena Airport (elevation: 1063 m MSL; 30 km southwest of the fire area) and climatological observations (principally rainfall) were in turn acquired for the Holter Dam site (elevation: 1063 m MSL; 14.5 km northwest of the fire area) in order to calculate the six standard components of the FWI System.

The 12 p.m. MST fire weather observations at the Helena airport on August 5, 1949 were as follows: dry-bulb temperature - 32.8 °C; relative humidity - 24%; and 10-m open wind - 30 km/h.

* Corresponding author address:

M. E. Alexander, Canadian Forest Service,
Northern Forestry Centre, 5320-122 Street,
Edmonton, Alberta, Canada T6H 3S5;
e-mail: malexand@nrcan.gc.ca

No rain had occurred at Holter Dam for 8 days; a daily maximum temperature of 37.8 °C was recorded at the climatological station.

The three fuel moisture codes and three fire behavior indexes comprising the FWI System as calculated at 12 p.m. MST were: Fine Fuel Moisture Code (FFMC) - 95.5; Duff Moisture Code (DMC) - 141; Drought Code (DC) - 436; Initial Spread Index (ISI) - 42.2; Buildup Index (BUI) - 156; and the Fire Weather Index (FWI) - 90.

The following predictions of selected fire behavior characteristics using the FBP System are based on a 18% slope; 120% foliar moisture content (cf. Philpot and Mutch 1971) and 100% degree of curing at 15 minutes elapsed time "T" since ignition for a point source fire based on the FWI System components prevailing at 12 p.m. MST:

FBP System Fuel Type C-7 (Ponderosa Pine - Douglas-fir)

Head fire rate of spread @ time "T": 25 m/min
Head fire intensity @ time "T": 28 500 kW/m
Forward spread distance (5:45-6:00 p.m. MST):
375 m

FBP System Fuel Type O-1b (Standing Grass; 3.0 t/ha fuel load)

Head fire rate of spread @ time "T": 197 m/min
Head fire intensity @ time "T": 17 700 kW/m
Forward spread distance (5:45-6:00 p.m. MST):
2955 m

For comparison sake, the Mann Gulch Fire was estimated to have advanced between 1115-1160 m during the 15-minute interval from 5:45-6:00 pm MST (Rothermel 1993). For the FBP System predictions to match this, the portion of montane forest cover (FBP System fuel type C-7) to grasslands (FBP System fuel type O-1b) would have had to be approximately 60:40, which doesn't appear to be all that unrealistic based on the available photographic evidence.

Presumably this CFFDRS hindsight analysis adds to the existing body of knowledge (e.g., Krumm 1953, Byram 1954) concerning the state of the fire environment associated with the Mann Gulch Fire during the afternoon of August 5, 1949.

REFERENCES

- Alexander, M.E., B.J. Stocks, and B.D. Lawson, 1996: The Canadian Forest Fire Danger Rating System. *Initial Attack*, **1996 Spring**, 5-8.
- Byram, G.M., 1954: *Atmospheric conditions related to blowup fires*. Stn. Pap. No. 35. USDA For. Serv., Southeast. For. Exp. Stn., Asheville, NC, 34 pp.
- Canadian Forestry Service, 1984: *Tables for the Canadian Forest Fire Weather Index System*. 4th ed. For. Tech. Rep. 25. Can. For. Serv., Ottawa, ON, 48 pp.
- Forestry Canada Fire Danger Group, 1992: *Development and structure of the Canadian Forest Fire Behavior Prediction System*. Inf. Rep. ST-X-3. For. Can., Ottawa, ON, 63 pp.
- Krumm, W.R., 1953: *Meteorological conditions associated with the Mann Gulch Fire*. U.S. Weather Bureau, Missoula, MT, 11 pp.
- Maclean, N., 1992: *Young men & fire: a true story of the Mann Gulch Fire*. Univ. Chicago Press, 301 pp.
- Matthews, M., 1999: Walking with the Old Testament God. A return to Mann Gulch. *Wildland Firefighter*, **3(3)**, 28-35.
- Philpot, C.W., and R.W. Mutch, 1971: *The seasonal trends in moisture content, ether extractives, and energy of ponderosa pine and Douglas-fir needles*. Res. Pap. INT-102. USDA For. Serv., Intermt. For. Range Exp. Stn., Ogden, UT, 21 pp.
- Rothermel, R.C., 1993: *Mann Gulch Fire: a race that couldn't be won*. Gen. Tech. Rep. INT-299. USDA For. Serv., Intermt. Res. Stn., Ogden, UT, 10 pp.
- Stocks, B.J., B.D. Lawson, M.E. Alexander, C.E. Van Wagner, R.S. McAlpine, T.J. Lynham, and D.E. Dube, 1989: The Canadian Forest Fire Danger Rating System: an overview. *For. Chron.*, **65**, 450-457.
- Taylor, S.W., R.G. Pike, and M.E. Alexander, 1997: *Field guide to the Canadian Forest Fire Behavior Prediction (FBP) System*. Spec. Rep. 11. Can. For. Serv., North. For. Cent., Edmonton, AB, 60 pp.
- Van Wagner, C.E., 1987: *Development and structure of the Canadian Forest Fire Weather Index System*. For. Tech. Rep. 35. Can. For. Serv., Ottawa, ON, 37 pp.