TECHNOLOGY TRANSFER NOTE

A DIAGRAMMATIC GUIDE TO ELLIPTICAL SHAPES OF WILDLAND FIRES   A-002

An overview of the Canadian Forest Fire Behavior Prediction (FBP) System has been prepared by Lawson et al. (1985). The FBP System includes the provision for calculating the size and shape of free-burning, wild-driven fires originating from a single ignition point. This fire growth projection is based on the 10-m open wind speed, FBP System fuel type, predicted head fire rate of spread, and elapsed time since ignition.

Fire size is expressed in convenient units -- i.e., area burned in hectares (ha) and perimeter length in metres (m) or kilometres (km) (Merrill and Alexander 1987). The fire size calculations are based on the concept of a simple elliptical fire growth model as described in general terms by Van Wagner (1969). The specific FBP System application of the model is documented in Alexander (1985). The required computations can be made manually by various means as outlined in Alexander et al. (1984), Alexander (1986), McAlpine (1986), and Alexander and McAlpine (1987). The other basic method involves programming the relevant equations on a computer such as McAlpine (1987) has done.

The elliptical fire shape is described by the length-to-breadth ratio (L/B). A comprehensive review of this property has been prepared by Alexander (1985). The L/B value does not necessarily convey a quick mental image of the elliptical shaped fire it's intended to represent. The diagrams presented in this Note (Fig. 1) should assist FBP System users with the desired visual interpretation.

These illustrations are similar to others that have been produced in various fire behavior manuals and other sources (e.g., McArthur 1966; Albini 1976; Anderson 1983, 1984; Rothermel 1983; Burrows 1984; Ontario Ministry of Natural Resources 1984; Pyne 1984; Perry 1987). However, the "Elliptical Fire Shape Guide" presented here is unique to the FBP System. The ellipses portrayed under 'forest stands' and 'logging slash' in Figure 1 are based on the 10-m open wind speed versus L/B relationships given by Equations [35] and [37] in Alexander (1985), respectively. The 'forest stands' category includes the coniferous (C-1 to C-7), deciduous (D-1), and mixedwood (M-1 and M-2) FBP System fuel types. The logging slash category obviously refers to FBP System slash fuel type groups (S-1 to S-3). The 'grasslands' ellipses are based on McArthur's (1966) original work and are specifically associated with FBP System fuel type O-1.

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November 1988

ELLIPTICAL FIRE SHAPE GUIDE
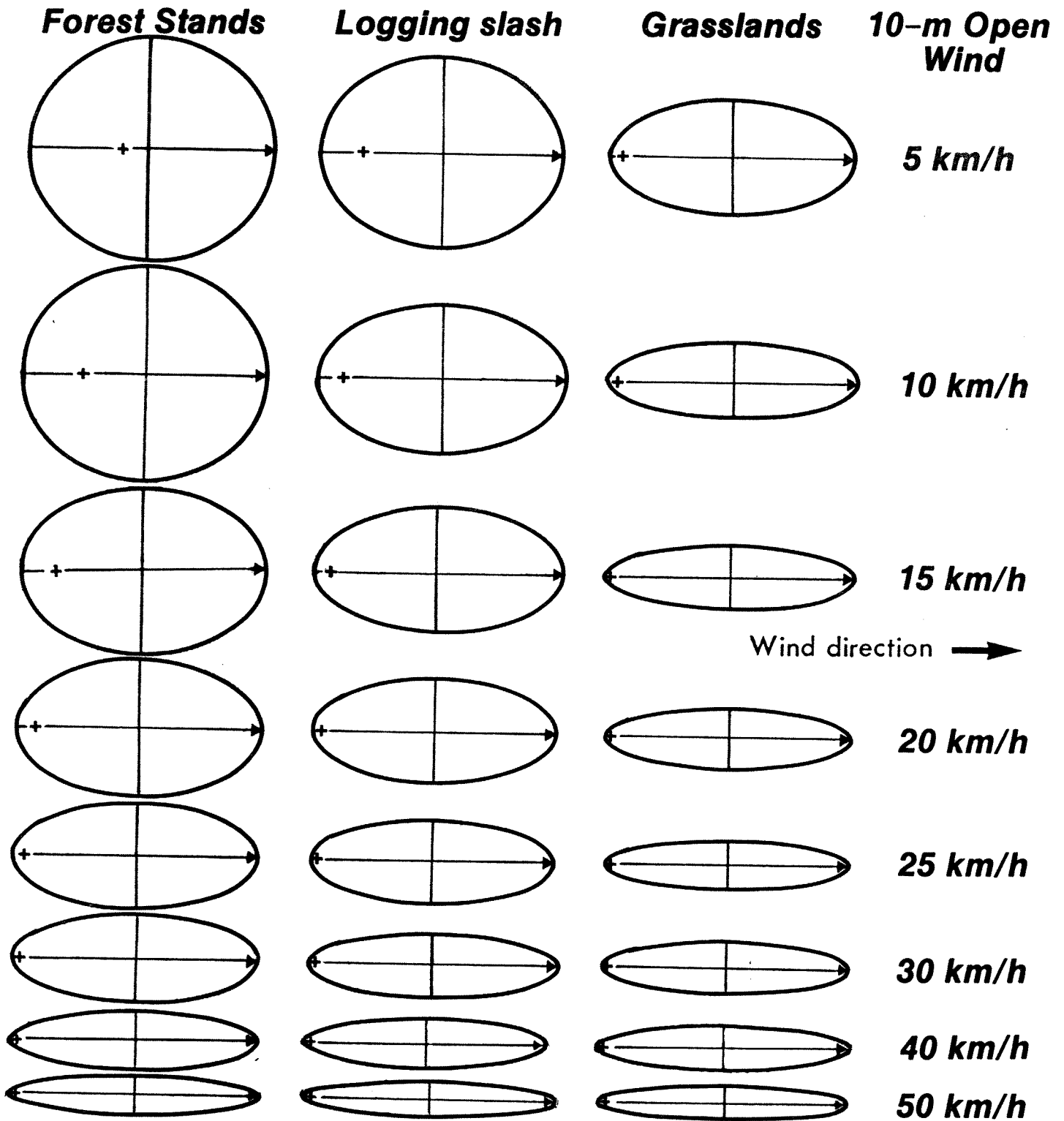
Forest Stands	Logging slash	Grasslands	10-m Open Wind
			5 km/h
			10 km/h
			15 km/h
			Wind direction ➡
			20 km/h
			25 km/h
			30 km/h
			40 km/h
			50 km/h

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Figure 1. The elliptical shapes of free-burning, wind-driven wildland fires originating from a single ignition source (+ demotes the ignition point). **Please note that it is the fire shapes and not the sizes shown that are relevant in this case.** The backfire spread becomes less pronounced, relative to the total spread distance, as wind speed increases. It is assumed that in the absence of wind and slope, a circular-shaped fire would result, with the point of ignition located at the center. The range in L/B values illustrated are: for forest stands, 1.04 to 6.48; for logging slash, 1.32 to 6.76; and for grasslands, 2.32 to 6.76.

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