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Anthony T. Charles and George N. White III
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TIMBER MANAGEMENT IN ONTARIO'S FLAMMABLE FORESTS

by

David L. Martell

Faculty of Forestry

University of Toronto

203 College Street

Toronto, Ontario

Canada, M5S 1A1

SUMMARY

This paper reports preliminary findings concerning the impact of fire on timber supply in Ontario. The study objectives are to assess the impact of fire on timber supply and develop procedures that can be used to incorporate fire and other uncertain destructive processes into timber management planning in Ontario.

Ontario's productive forest land is $399,275 \text{ km}^2$. During 1986, $3,833,773 \text{ m}^3$ of hardwood and $15,764,214 \text{ m}^3$ of softwood were harvested from 217,984 hectares (Smyth and Campbell, 1987). The intensive and measured protected area (i.e., the area that is fully protected) is $463,328 \text{ km}^2$. The average annual area burned in the intensive and measured protected area is roughly 70,000 ha or 0.15%, but that figure

varies significantly by region. Fire history data suggests it is reasonable to assume that roughly 2% of the protected area would burn each year without fire protection.

Forest management planning is complicated by uncertainty concerning fire, insects, disease, and weather; unplanned land withdrawals (e.g., new parks); technology and markets; and government policy (e.g., land tenure). We are focusing on the following fire-related planning problems:

1. Fire Damage Appraisal (e.g., what losses result from specific fires?)
2. Mobilization Planning (e.g., how should suppression resources be allocated to existing fires?)
3. Pre-Suppression Planning (e.g., how much should you spend on fire management each year?)

Timber Management in a Hypothetical Forest

Consider a very simple hypothetical flammable forest that contains 83,000 ha of 70 year old site class II Jack Pine. Assume the annual burn probability is 0.001, road access is established, and cut and burned areas regenerate naturally.

Suppose timber management in the hypothetical forest is planned over a 300 year planning horizon with 10 year periods and the harvest flow is constrained to be constant. We also assume the forest manager is constrained to leave in the forest, a terminal volume of 3,336,600

cubic metres. We assume a stumpage of \$30.00 per cubic metre and ignore harvest and transportation costs.

Van Wagner (1983) developed a simulation model to assess the impact of specified fire and harvest regimes on a forest. If one ignores fire and other stochastic destructive processes, timber harvest scheduling in our simple hypothetical forest can readily be modelled using one of the standard linear programming approaches described in Johnson and Scheurman (1977). If one assumes fire occurs at a deterministic average rate, one can use a mean value model like those developed by Reed and Errico (1986) and Johnson, Stuart and Crim, (1986), or the extended version of those models developed by Boychuk (1988). Gassmann (1987) used stochastic programming techniques to overcome the need to assume fire occurs at a specified constant mean rate. Although stochastic programming techniques can provide more accurate assessments of timber harvest scheduling plans under uncertainty, the computational requirements of that approach are such that initially, we opted to use the simpler Reed and Errico (1986) mean value approach.

Assessing the Impact of a Specific Fire

Fire loss is the expected economic return given the planned harvest schedule before the fire less the expected return given the revised planned harvest schedule after the fire. The mean value model was used to produce the following assessment of a 24,900 ha fire.

	Pre-fire Plan	Post-fire Plan
Present net worth (\$):	211,216,862	209,159,168
Planned cut (m ³ /period):	2,088,985	2,068,634
Area burned:	24,900 ha	(30% of the forest)
Fire loss :	\$ 2,057,694	(1% of the PNW)
	20,351 m ³ /period	(1% of the cut)

Such results can be combined with subjective probability assessments concerning final fire size to evaluate alternative mobilization strategies for fires that escape initial attack.

Pre-Suppression Planning

The mean value forest model can also be used to assess the impact of specified fire regimes on timber supply. Since fire regimes (e.g., fire occurrence probability) are influenced by budget levels, such information could be used to help evaluate alternative budget proposals. The results shown in Figure 1 indicate that if fire management reduces annual fire occurrence from 2% to 0.1% in our hypothetical forest, the optimum timber harvest (which is constrained to be constant) would roughly double.

Additional Work

We are currently developing a forest level simulation model that will be used to conduct a comparative analysis of fire and timber supply models. We also plan to develop and field test mobilization and post-fire loss assessment models that are coupled with a computer-based

geographic information system, and a procedure for assisting with the development of initial attack guidelines.

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Fig. 1. HARVEST LEVEL with ANNUAL BURNS

