

# QUANTIFYING THE PHYSICAL ASPECTS AND IMPACT OF FIRE IN ASPEN ECOSYSTEMS

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**ABSTRACT.**--This paper very briefly summarizes the results of a study dealing with the characteristics of fire behavior and the biological effects of fire on woody vegetation in six aspen-northern hardwood stands. Burning conditions were described in terms of the Canadian system of forest fire danger rating. The response of trees and shrubs was surveyed at the end of the first growing season following fire. A prescription for prescribed burning to improve wildlife habitat is presented.

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Although trembling aspen is considered a "fire type" (i.e., it follows or is otherwise dependent on fire) and a wealth of fire effects literature exists, surprising little empirical fire behavior data is available. In 1968 and 1970, six experimental prescribed fires were carried out within pure trembling aspen and mixed hardwood stands in Minnesota and Wisconsin (Sando 1972). These fires were initially conducted in order to formulate prescribed burning guidelines for wildlife habitat improvement (Table 1); however, they have also proved valuable in the development of a guide to predicting wildfire behavior in the context of the Canadian Forest Fire Danger Rating System (Alexander and Sando 1989).

The six fires were conducted in spring or late fall (i.e., leafless stage) when the available surface fuel loads averaged 2.5 tonnes per hectare (1.1 tons per acre). The burning conditions were rated as high to extreme by the Canadian Forest Fire Weather Index (FWI) System. The head fire rates of spread (ROS) varied from 1.5 to 8.8 metres per minute (5-29 feet per minute) and were highly correlated with the Initial Spread Index (ISI) component of the FWI System ( $r = 0.91$ ). The quantitative information on fire behavior provided by this study has been combined with other similar experimental data from eastern and northern North America (e.g., Alexander 1982, Quintilio et al. 1989) and selected wildfire observations for use in derivation of an ISI-ROS relationship for Fuel Type D-1 (leafless aspen) in the Canadian Forest Fire Behavior Prediction System (Alexander et al. 1984).

Frontal fire intensities ranged from 115 to 672 kilowatts per metre (33-194 Btu per second per foot). Extensive mortality was observed in deciduous trees less than about 8 centimetres (3 inches) diameter at breast height (DBH), but overstory stems greater than about 15 centimetres (6 inches) DBH were seldom affected. Most shrub species were readily killed by fire but quickly resprouted. The total number of woody understory stems often increased following the fires.

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Table 1.--Recommended burning prescriptions for applying prescribed fire in aspen-northern hardwood stands not subjected to cutting in order to manage for wildlife habitat improvement objectives (adapted from Sando 1972).

Prescription Element <sup>1</sup>	Effective Prescription <sup>2</sup>	Optimum Prescription
Dry-bulb Temperature	> 15.5°C (60°F)	21-27°C (70-80°F)
Relative Humidity	≤ 35%	20-30%
10-m Open Wind	18-28 km/h	18-28 km/h
20-ft Open Wind	10-15 mph	10-15 mph
Days Since Rain	≥ 4	≥ 5
Time of Year Spring	Spring	

<sup>1</sup>Both the Canadian and U.S. fire weather/danger standards for wind speed measurement are given.

<sup>2</sup>Based on the range of conditions studied.

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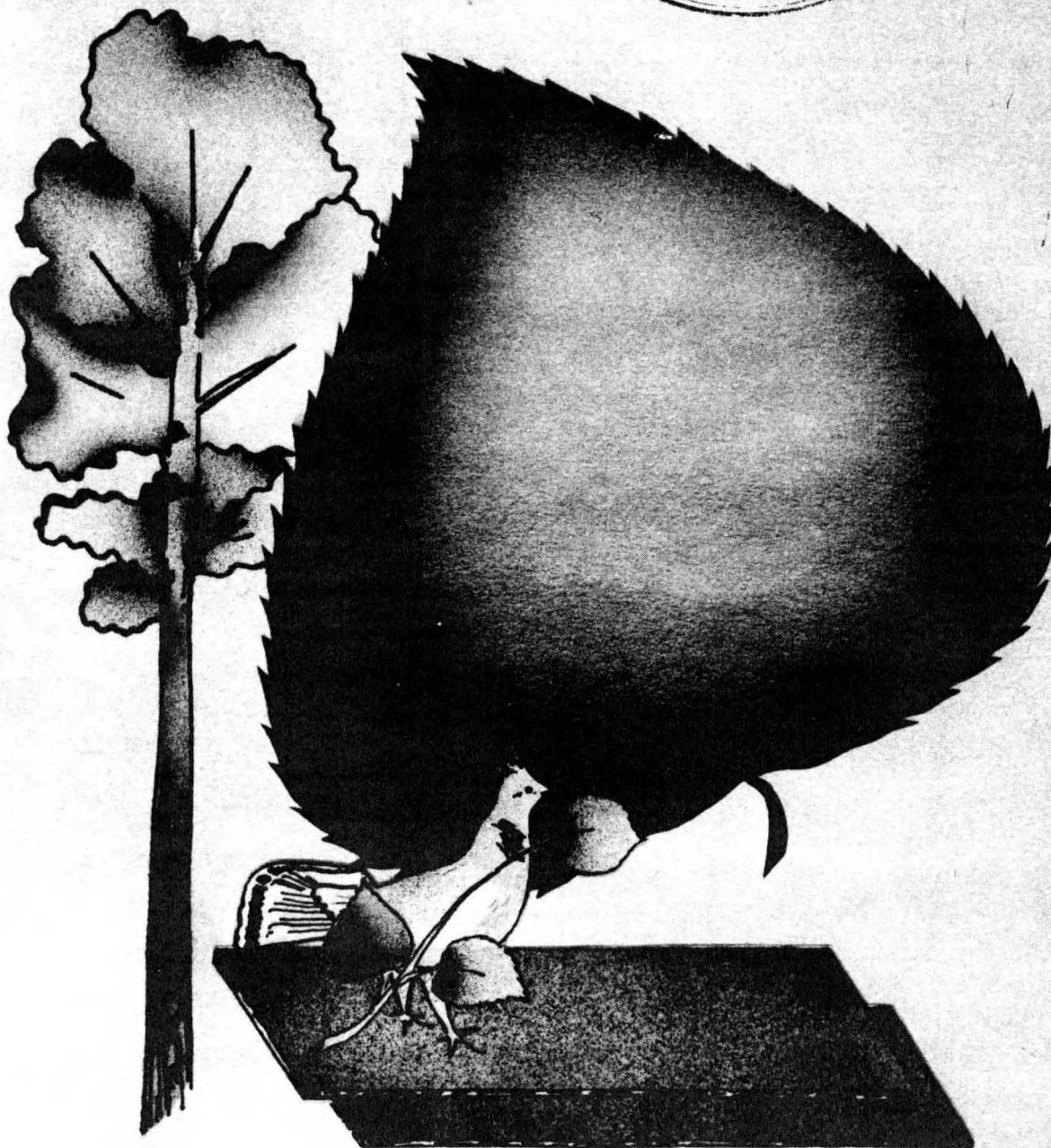
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# Aspen Symposium '89

## Proceedings





Duluth, Minnesota

July 25-27, 1989

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appropriation to study the aspen resource

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1990. **Aspen Symposium '89, proceedings.** In: Adams, Roy D., ed; 1989 July 25-27; Duluth, MN. Gen. Tech. Rep. NC-140. St. Paul, MN: U.S. Department of Agriculture, Forest Service, North Central Forest Experiment Station. 348 p.

This proceedings of Aspen Symposium '89 contains 31 papers balanced between the subjects of aspen ecology and silvics, aspen management and silviculture, and aspen products and utilization. It also includes eight brief papers based on poster presentations.

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**KEY WORDS:** Aspen, ecology, management, utilization.