RESEARCH NOTE NC-40

NORTH CENTRAL FOREST EXPERIMENT STATION, FOREST SERVICE—U.S. DEPARTMENT OF AGRICULTURE

Folwell Avenue, St. Paul, Minnesota 55101

RATE OF PERIMETER INCREASE RELATED TO TIMBER SPREAD INDEX AND NORTHEASTERN FUEL TYPES

ABSTRACT. — Gives the average rates of perimeter increase for fires in four broad fuel type groups by four spread index classes.

Information on how fast fires spread in different fuels is limited. Acquiring data under controlled conditions is costly and time consuming. Yet, fire control organizations need to associate spread indexes with real rates of spread to make efficient use of the National Fire Danger Rating System. As a step in that direction, individual fire report forms from the Eastern Region (formerly Region 7), U.S. Forest Service, were analyzed to obtain rates of perimeter increase from time of discovery to attack. Data from 1950 to 1958 are summarized here.

Rates of spread were computed by Timber Spread Index classes for four fuel type groups (table 1). Each group includes fuel types that had similar average rates of spread under all burning conditions. These groupings avoid perpetuating the use of a complex fuel classification system that does not reflect differences in spread characteristics. Users should associate their fire problem areas with one of four broad fuel type groups.

Fuel type group A, which had the slowest spreading fires, is associated with northern conifers, hardwood and hemlock hardwood, and conifer slash (Eastern Region fuel types 1, 2, 3, and 8).[1] Group B is a summary of fires in southern pine and hardwood-southern pine slash fuels (fuel types 6, 7, and

1 *Banks, W. G. and H. C. Frayer. Rate of forest fire spread and resistance to control in the fuel types of the Eastern Region, U.S. Forest Serv. Fire Control Notes 27(2): 10-13. 1966.*

Table 1.—Average and standard deviation of perimeter increase rate at time of initial attack

Fuel type group[1/]	Spread index class							
	0-10		11-20		21-30		31-40	
	Average and standard deviation	Observations	Average and standard deviation	Observations	Average and standard deviation	Observations	Average and standard deviation	Observations
	Chains/hour	Number	Chains/hour	Number	Chains/hour	Number	Chains/hour	Number
A	9.3 ± 8.9	6	11.2 ± 11.3	15	6.5 ± 4.9	3	16.0 ± 16.6	3
B	10.5 ± 9.8	32	23.7 ± 26.5	92	30.4 ± 26.9	70	36.7 ± 29.4	24
C	15.8 ± 19.0	21	19.5 ± 23.1	85	25.1 ± 23.2	277	29.3 ± 26.2	142
D	20.9 ± 11.9	155	28.8 ± 19.0	465	33.2 ± 23.2	43	46.2 ± 48.1	17

1/ A = Northern conifers, hardwood cutover, hemlock-hardwood cutover, and new conifer slash.
B = Southern pine reproduction and hardwood and southern pine slash.
C = Northern and Appalachian hardwoods and hardwood reproduction.
D = Grass, fern, and weeds.

10). Group C represents northern and Appalachian hardwood fires (fuel types 4 and 5). Group D, the fastest spreading fires, represents flashy fuels such as grass, weeds, and ferns (fuel type 11).

Fires reported as zero rate of spread were not included. Burning Index (model 8-200) values as given on the report forms were converted to Timber Spread Index values on the basis of a relation between the two measures. This step added to the large variation evident in the standard deviations.

Average spread rates ranged from 9 chains per hour perimeter increase to 46 chains per hour (table 1). Spread rates increased steadily with increase in spread class for each fuel type group.

These spread rates may be useful in planning. It must be pointed out that the large standard deviations associated with the average spread values mean it is not possible to accurately predict actual spread rates for individual fires. Factors not included in the Spread Index computation, such as slope and aspect, influence spread rates. Also fires occurring at a different time or place from the danger-rating observation have introduced error. However, based on the currently used fuel type classification and Timber Spread Index, values shown are a best estimate of the actual perimeter spread rate that initial attack crew will encounter.

The next step is to collect sufficient data to determinte rates of spread for specific fuel types, or fuel types classified by a system based on rate of spread. In the meantime, these data give a first approximation of these values.

NONAN V. NOSTE
Associate Fire Control Scientist

August 1967