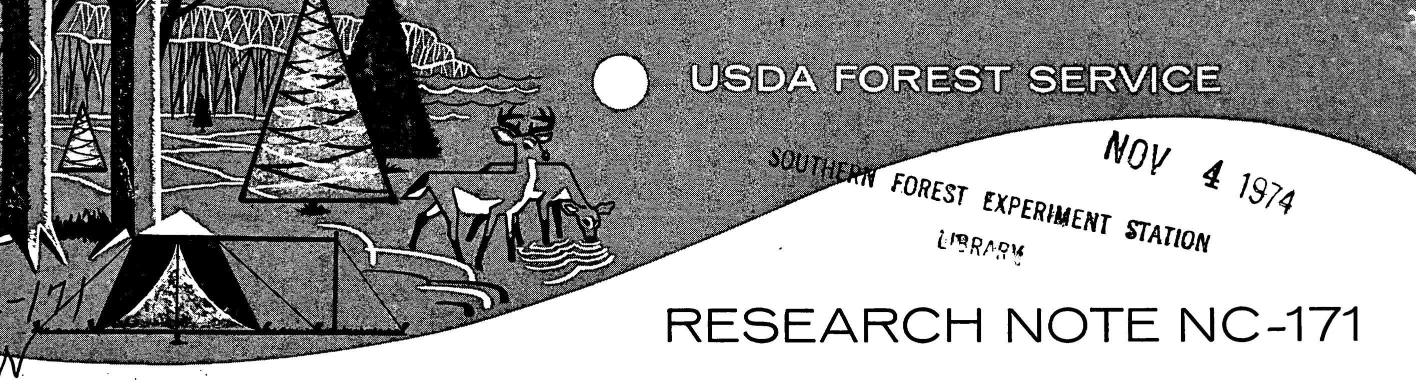

RESEARCH NOTE NC-171

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REPEATED PRESCRIBED BURNING IN ASPEN

DONALD A. PERALA

Associate Silviculturist, Northern Conifers Laboratory, Grand Rapids, Minnesota (Laboratory maintained in cooperation with the University of Minnesota)

ABSTRACT.--Infrequent burning weather, low flammability of the aspen-hardwood association, and prolific sprouting and seeding of shrubs and hardwoods make repeated dormant season burning a poor tool to convert good site aspen to conifers. Repeat fall burns for wildlife habitat maintenance is workable if species composition changes are not important.

OXFORD: 436:232.213:156.2:176.1 *Populus tremuloides*. KEY WORDS: site preparation, habitat maintenance, Minnesota, *Populus tremuloides*.

A series of prescribed burns has been suggested to prepare aspen (*Populus tremuloides* Michx.) sites for conversion to conifers or to maintain wildlife habitat (Buckman 1965, Buckman and Blankenship 1965). Recent burning experience has shown some of the difficulties in using prescribed fire for aspen conversion, at least on good sites. Habitat maintenance with fire is technically workable but woody species composition may be altered.

THE STUDY

A 60-year-old quaking aspen stand on the Chippewa National Forest, Minnesota, was harvested during early summer 1965. Aspen site index was good (70 feet at 50 years) and the soil was a Warba very fine sandy loam with clay-loam subsoil. A prescribed fire in May, 2 years after logging, consumed nearly all the slash up to 3 inches in diameter and killed most of the remaining hardwood overstory on the 22-acre test area. Such a single prescribed burn is a recommended alternative for regenerating aspen.[1/] Two and four growing seasons after this prescribed fire (May 13, 1969 and October 5, 1970) separate parts of the area were again burned using 50-to-100-foot-wide strip head fires after backfiring the downwind side of the burn area. The fire weather for the two repeat burns was similar (table 1).

RESULTS AND DISCUSSION

The repeat fall burn was much more successful than the repeat spring burn. The spring fire merely crept along the layer of dried leaves and herbaceous vegetation matted down overwinter by snow. Burn coverage was only 76 percent and more decomposed organic layers were still wet and did not burn at all. In the fall, however, standing vegetation carried the fire well and burn coverage was 85 percent. The forest floor was much drier due to transpiration, and mineral soil was exposed on 10 percent of the area where the forest floor was entirely consumed (fig. 1).

1/ *Donald A. Perala. Prescribed burning in an aspen-mixed hardwood forest. Can. J. For. Res. (In press.)*

Table 1.--*Fire weather recorded at 1:00 p.m. CST (See Deeming et al. (1972) for more detailed description of the fuel model, further explanation of terms, and computational procedures.)*

Item	Date of burn: May 13, 1969	Date of burn: Oct. 5, 1970	Comment
Fuel model	F	F	Low flammability brush model
Slope class	1	1	0 to 20 percent slope
State of weather	1	1	Scattered clouds
Temperature, °F			
Dry bulb	69	84	
Wet bulb	53	65	
Dew point	37	53	
Relative humidity, percent	32	35	
1-hr TL fuel moisture, percent	5	5	Dead fuels less than 1/4 in. diameter
Herbaceous vegetation condition	10	20	Percent fine fuels alive
Fine fuel moisture, percent	6	8	1-hr TL adjusted for live fine fuels
Ignition component	48	42	Probability (100=max.) that fine fuel can be ignited.
Wind speed, mph	6	6	
Spread component	0	2	Rate of fire spread (13=max.)
10-hr TL fuel moisture, percent	7	7	Dead fuels 1/4 in. to 1 in. diameter
100-hr TL fuel moisture, percent	12	15	Dead fuels 1 in. to 3 in. diameter
Energy release component	7	6	Rate of combustion (85=max.)
Burning index	0	3	Effort needed to contain fire (58=max.)

The repeat spring burn stimulated hardwood and shrub sprouting, except for aspen. Only 42 percent of the aspen suckers were killed and the 8,800 stems remaining per acre were more than enough to suppress sprouting of new suckers (fig. 2).

The repeat fall burn, however, stimulated aspen suckering as well as associated hardwood and shrub sprouting. Almost all woody regeneration was top-killed, and some of the interconnecting aspen root system was exposed (fig. 1, Center). Shrub regeneration increased by 21 percent over the single burn or about the same as it did following the spring repeat burn (fig. 2). Associated hardwood regeneration increased by 138 percent, about three times the increase following the spring burn. This greater increase was almost entirely due to seeding of paper birch (*Betula papyrifera* Marsh.) (fig. 1, Right). Aspen increased 129 percent, 80 percent due to seeding.

Shrub volume growth recovered rapidly after repeated burning but aspen growth was less than after the first burn (fig. 3). This increased the percentage of shrub volume and lowered the aspen percentage (table 2). The associated hardwood percentage was relatively unaffected by repeated burning. These observations agree with findings of Buckman and Blankenship (1965), although we did not reduce the number of aspen suckers as they did (except by thinning with a mild spring fire).

Figure 1.--*(Left) Aspen burned off at ground line by a severe deep burn in old decomposed log, (Center) interconnecting aspen root system exposed by fire, and (Right) dense seedling regeneration of paper birch and aspen was common on deeply burned soils after 2 years.*

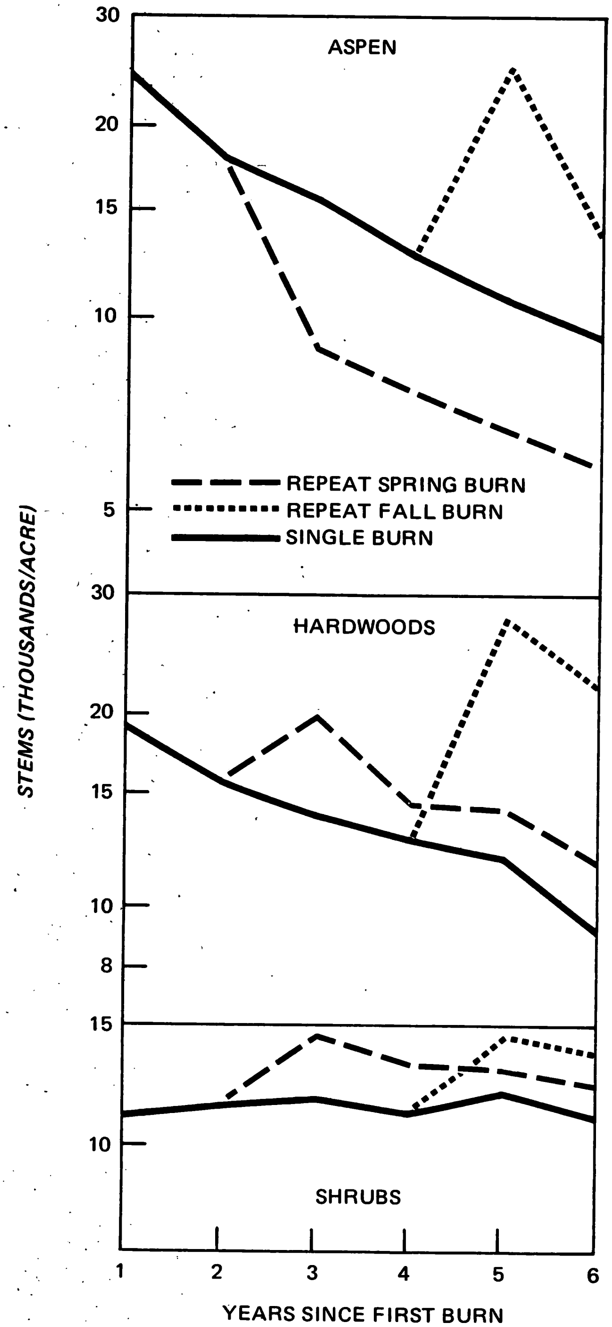

Figure 2.--*Regeneration after repeated burning.*

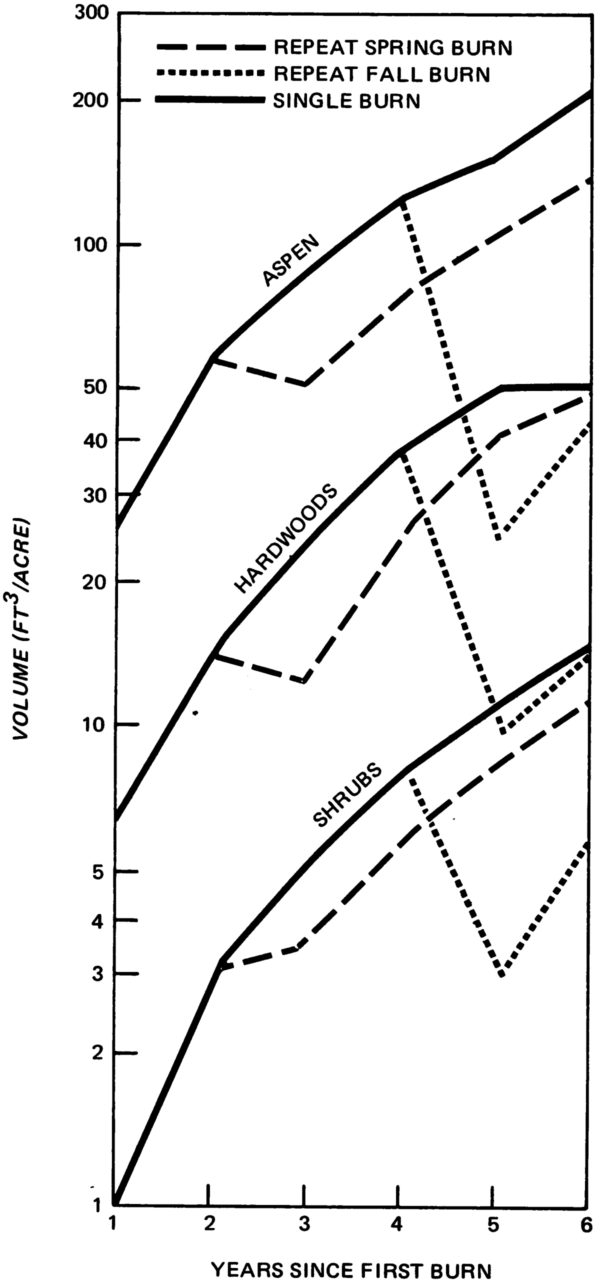

Figure 3.--*Recovery of volume growth after repeated burning.*

Repeated burning affected species composition (by volume) of associated hardwoods and shrubs. The most notable changes were increases of oaks, *Quercus macrocarpa* Michx., *Q. rubra* L., (by seedling sprouts and stump sprouts); willows, *Salix* spp., (by seeding); and hazel, *Corylus cornuta* Marsh., (by sprouting from underground stems); and a decline of mountain maple, *Acer spicatum* Lam., from 54 percent to 10 percent of all shrub volume. Post (1965) also noted that fire diminished mountain maple.

Table 2.—*Volume and composition of woody plants 2 years after single and repeated burning*

Woody plants	Single burn		Spring repeat burn		Fall repeat burn	
	Volume composition					
	Ft³	*Percent*	*Ft³*	*Percent*	*Ft³*	*Percent*
Shrubs	3	4	6	5	6	9
Associated hardwoods	14	19	25	23	14	22
Aspen	58	77	79	72	45	69
All	75	100	110	100	65	100

CONCLUSIONS

Repeated burning in cutover aspen stands after 2 or 4 years reduced aspen suckering vigor, but fire is an impractical tool for converting these species-rich, low flammability aspen stands to conifers. Suitable fire weather is capricious in the Lake States and several years may pass before repeat burns are possible. Most associated hardwoods and shrubs vigorously maintain themselves, and aspen itself readily seeds in to re-occupy exposed mineral soil. On sandy soils more suitable for conversion to conifers, repeated burning might be somewhat more successful in eliminating aspen, especially during the growing season when suckering capacity is lowest. However, severe drought would be required to cure the green herbaceous growth, the primary fuel available for repeat burns. Horton and Hopkins (1965) were also pessimistic about prescribed fire to convert aspen to conifers.

Repeat fall burns can be used to maintain wildlife habitat in the aspen type. Suggested burning weather and rating components based on model F (Deeming et al. 1972) are:

Air temperature	>65°F
Relative humidity	<35 percent
Ignition component	40 to 50
Energy release component	6 to 8
Spread component	2 to 4
Burning index	3 to 4
Wind	6 to 12 mph
Number of days since 0.1 inch rain	>5

One drawback is the change in species composition following repeated burning. Mountain maple, a preferred browse by big game, decreases with repeated burning while less palatable hazel and willow are encouraged.

LITERATURE CITED

Buckman, Robert E. 1965. Silvicultural use of prescribed burning in the Lake States. Soc. Am. For. Proc. 1964: 38-40.

Buckman, Robert E., and Lytle H. Blankenship. 1965. Repeated spring prescribed burning reduces abundance and vigor of aspen root suckering. J. For. 63: 23-25.

Deeming, John E., James W. Lancaster, Michael A. Fosberg, R. William Furman, and Mark J. Schroeder. 1972. National fire danger rating system. USDA For. Serv. Res. Pap. RM-84, 165 p. Rocky Mt. For. & Range Exp. Stn., Fort Collins, Colo.

Horton, K. W., and E. J. Hopkins. 1965. Influence of fire on aspen suckering. Can. For. Res. Branch Dep. For. Publ. 1095, 19 p.

Post, L. J. 1965. Vegetative reproduction of mountain maple. Can. For. Res. Branch Dep. For. Publ. 1097, 11 p.

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