Scientific and Technical Articles/ Articles scientifiques et techniques

Logging Practices and Subsequent Development of Aspen Stands in East-Central Saskatchewan

by

I.E. Bella¹

Abstract

A study was started in 1965 to quantify the effect of logging variables on initial sucker stand density and subsequent development of aspen (*Populus tremuloides* Michx.). The study found excellent stocking and density of sucker regeneration after both summer and winter logging of 70- to 80-year-old stands in east-central Saskatchewan. Logging slash on the ground reduced suckering but the density of regeneration even with heavy slash cover was similar to that found in fire-origin stands. Winter logging resulted in more uniform and less dense sucker regeneration. Large initial differences in stand density diminished to a 30% range or less by 5 years of age. This suggests that flexibility may be exercised in harvest scheduling and method of logging.

Résumé

On a entrepris en 1965 une étude visant à quantifier les effets des variables d'exploitation forestière sur la densité initiale des peuplements en drageonnement et le développement ultérieur de peuplier faux-tremble (*Populus tremuloides* Michx.). On a constaté un excellent matériel relatif de régénération après les coupes d'été et d'hiver pratiquées dans des peuplements de 70 à 80 ans. La présence des rémanents sur le sol a réduit le drageonnement mais la densité du matériel régénéré était semblable à celle des peuplements créés par suite d'incendies, malgré la forte couverture de rémanents. Les coupes d'hiver ont donné lieu à une régénération plus uniforme par drageonnement moins dense. Les fortes différences initiales de densité de peuplement ont été ramenées à 30% ou moins avant que le matériel atteigne 5 ans. Cela porte à croire qu'on pourrait assouplir le calendrier et les méthodes d'exploitation.

Introduction

Over 40% of Canada's immense aspen (*Populus tremuloides* Michx.) resource (nearly 2 billion m³) is in the Prairie Provinces. Although only little of the annual allowable cut (AAC) of aspen is now harvested, utilization is rising and with it the need for information about silvicultural management of this species.

Adequate regeneration after logging is fundamental to responsible forest management. Regeneration is easily attained for aspen because it reproduces readily from root suckers after the parent stand is logged or killed by fire (Farmer 1962; Schier and Smith 1979; Steneker 1974). The abundance of suckers depends mainly on logging practices such as the number of trees left standing, the amount of logging slash, equipment used, and the season of harvesting.

This study was started in 1965 to quantify the effect of these logging variables on initial sucker stand density and subsequent development. Bella and DeFranceschi (1972)

summarized results of the study up to 6 years after logging. This current paper describes growth and stand development trends to 17 years after logging.

Study Area and Method

The study was conducted about 35 km south of Hudson Bay, Saskatchewan, in the Mixedwood Section (B.18a) of the Boreal Forest Region (Rowe 1972). Topography is flat to gently rolling, the soils are clay loam, and the site is moist. The original aspen stands at the time of logging were 70-80 years old and also contained a few balsam poplar (*Populus balsamifera* L.) and black spruce (*Picea mariana* (Mill.) B.S.P.). Shrub cover was relatively sparse.

The clear-cut, which left only the odd balsam poplar and black spruce, was done in two seasons: winter (March) 1966 and mid-summer (July) 1967 with chain saws and wheeled skidders. Within the two cut blocks, each over 10 ha in size, a rectangular area of 1.5 ha was sampled near the centre of cut so that shading by the adjacent stand was not a factor.

¹Northern Forestry Centre, Canadian Forestry Service, 5320 - 122 Street, Edmonton, Alberta, Canada T6H 3S5.

Along line transects 20 m apart, sample quadrats 2m² in size (1.0 X 2.0 m) were established every 40 m in August 1966 in the winter cut (400 quadrats) and in September 1967 in the summer cut (526 quadrats). Slash conditions on each quadrat were recorded at establishment as: (1) limbs only, (2) logs only, (3) limbs and logs, and (4) no slash. Logs were unmerchantable material only and even the heaviest slash condition (class 3) resulted in only partial shading of the ground. On reexamination in the autumns of 1967, 1969, and 1971 and in May 1983, data recorded included number of suckers and height of the tallest tree per species.

Results and Discussion

Initial sucker density after the first growing season was about twice as high after a summer cut (even exceeding 200 000 per ha) as after a winter cut (Fig. 1 and 2). The greatest number of suckers occurred with no slash cover and the numbers generally declined as the amount of slash increased. The greatest difference in number of suckers between summer and winter cuts occurred where no slash was present. Average sucker density differed more both relatively and absolutely with slash condition after summer cutting than after winter cutting. Variation in sucker density was also greater after the summer cut.

Slash shades the ground and thus inhibits soil warming and suckering (Maini and Horton 1966). The presence of foliage on limbs after summer logging probably amplified the shading effect and the differences in sucker densities between slash condition classes (Fig. 1); however, this greater shading effect seemed to be more than offset by the destruction of ground vegetation and disturbance of the humus layer during summer logging, which results in higher soil and root temperatures and promotes root suckering (Maini and Horton 1966; Steneker 1974). In contrast, winter logging causes relatively little disturbance or related soil warming.

Figure 1. Number of trees per hectare by slash conditions for summer and winter cuts.

The large initial differences in stand density owing to season of cut and slash conditions had diminished to a range of 30% or less five years after cutting (Fig. 1). The same

Figure 2. (a) First year growth of suckers after summer logging aspen.
(b) A 17-year-old aspen stand.

relative range of densities remained to ages of 16 and 17 years. By this time, stand density differences due to slash conditions virtually disappeared on winter-logged areas. After summer logging, however, slight differences remained between two extreme treatments. The ranking order of treatments also remained the same in terms of sucker density.

Height growth of the largest suckers per quadrat (2 m²) was slightly greater in the first growing season after winter cut than after summer logging. This was probably owing to the difference in the length of the first growing season, which was considerably shorter after summer logging. Another factor that likely had some influence was the nutrient level of the root systems; these were obviously somewhat depleted after summer logging. The difference in height growth of the largest suckers persisted to the last measurement (age 16 for summer and 17 for winter logging; Fig. 3). Height growth was consistently best under the slash condition class "Logs Only" regardless of season of logging, and was significantly better ($P < 0.05$) than those under slash condition classes "Limbs and Logs" and "Limbs Only" after summer logging.

Figure 3. Average height of tallest aspen per quadrat by slash conditions.

To find out whether the densities and thus expected yield of these stands are similar to those of fire origin, values for height and number of trees per hectare were extrapolated to age 20 and compared with appropriate yield tables for aspen in Saskatchewan (Kirby *et al.* 1957). On the basis of height, these stands would fall in the "Good Site" quality class for which these yield tables show 5500 trees/ha, a value well below even the most conservative extrapolated values for the study stands. This suggests more than adequate sucker regeneration under any of the logging and slash conditions studied.

Clear Thinking on Foggy Bottom [Report in Globe and Mail, March 7, 1986]

Federal Environment Minister Thomas McMillan says he is not muzzling scientists and other Environment Canada officials, but that he intends to stick to new rules that prevent those employees from speaking freely to the public.

"We're not trying to muzzle public servants; we're trying to open up the system," Mr. McMillan said in an interview in Toronto yesterday.

In conclusion, excellent stocking (nearly 100% based on 2-m² quadrats one year after logging) and more than adequate density of sucker regeneration after both summer and winter logging indicate that flexibility can be exercised in harvest scheduling in aspen stands. Although logging slash will reduce suckering, the density of regeneration will be more than adequate even with heavy slash cover. This means that full tree logging is not a prerequisite for adequate aspen regeneration because the slash left following conventional logging had no major effect on aspen stocking and stand density after the initial 5-year period. Winter logging results in more uniform and less dense regeneration and thus may be favored over summer logging. Other considerations, however, such as access, possible soil compaction, and the presence of shrub cover, may be important in scheduling harvest. For example, summer logging may be advantageous in stands with heavy shrub cover that would be destroyed by logging and thus reduce competition for the aspen suckers. On wetter sites with clay soils, winter logging facilitates harvesting and prevents soil compaction that can result in unstocked patches or reduced growth of suckers.

Acknowledgements

This study was established by R.M. Waldron, then with the Forest Research Branch, Canada Department of Forestry, Winnipeg, Manitoba. The staff of MacMillan Bloedel Ltd. at Hudson Bay, Saskatchewan has contributed in all phases of the fieldwork, and Robert Brooks provided the two photos for this paper.

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