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TAKE ADVANTAGE OF ADVANCE GROWTH WHEN PLANNING HARVESTING OPERATIONS

by
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INTRODUCTION

Black spruce (*Picea mariana* [Mill.] B.S.P.) advance growth is present in varying quantities throughout the black spruce-dominated forests of boreal Ontario. Foresters have observed that advance growth is more abundant on wet peatland sites than on drier uplands, and that overmaturity and low stand density tend to favor an abundance of advance growth (Fig. 1). In the era of horse-logging, much of this advance growth escaped logging damage and provided sufficient stocking for the development of new merchantable stands on some sites. With the advent of the chainsaw, the wheeled skidder and summer logging came greater site damage, and advance growth could seldom be expected to provide the basis for a new stand. At about this time, site preparation and planting became the norm for the regeneration of black spruce.

Recently, with limitations on both funding and the availability of planting stock, forest managers have become increasingly interested in the potential of advance growth to provide the growing stock for a new stand. To use advance growth in this way, managers must be able to identify those specific sites with abundant advance growth before logging, and harvest them in such a way that sufficient stocking remains undamaged. Forestry Canada, Ontario Region's Art Groot has completed a study that examines more closely the relationship between the abundance of black spruce advance growth and stand and site conditions (Groot 1984). Knowledge of such relationships will aid forest managers in identifying which forest stands contain sufficient advance growth to form the next crop after logging.

FOREST ECOSYSTEM CLASSIFICATION AND ADVANCE GROWTH SURVEY DATA

This study was facilitated by the Forest Ecosystem Classification (FEC) database (Jones et al. 1983), which provided regeneration data from 20 2- x 2-m quadrats in each of 250 stands sampled in the summer of 1980. Other information obtained from the FEC database included stand basal area (BA); percentage crown cover; percentage cover by feather mosses, *Sphagnum* spp., alder (*Alnus* spp.), *Chamaedaphne calyculata* (L.)

Moench, *Ledum groenlandicum* Oeder, shrubs and herbs; and the age and height of dominant trees.

In the summer of 1982, a separate survey was conducted to examine black spruce advance growth and associated forest conditions more closely. This "Advance Growth Survey" (AGS) was carried out in 30 undisturbed mature or overmature black spruce stands with peat depth greater than 20 cm. Regeneration data were obtained in 100 2- x 2-m quadrats in each stand. Basal area and other stand and cover information were also recorded. The height growth of advance growth stems was sampled, and each was classified as seedling or layer, single or multiple stemmed, and whether or not the main stem was vertical.

ANALYSIS

In the analysis, *stocking* refers to the proportion of quadrats that contained at least one advance growth stem. For both the FEC and AGS data, simple correlation coefficients were determined between the abundance of advance growth (stocking and density) and stand and site conditions. Multiple regression was used to relate stocking and density of black spruce advance growth to stand and site attributes.

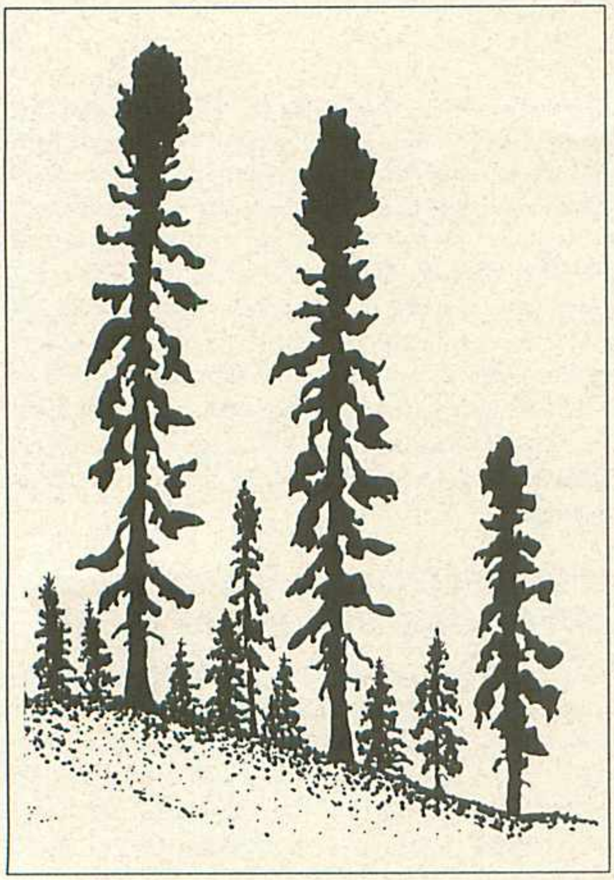

Figure 1. Overmature, low-density peatland black spruce stand, showing typical high stocking of advance growth.

Average *height* increment was determined for each stem and was tested for its correlation with stem height, stand BA, and stocking of advance growth. Average annual height increment was also determined for advance growth in each stand, and one-way analysis of variance was used to determine if the stand's FEC vegetation type or operational group contributed to variation in height increment of advance growth.

The proportions of *layerings* and *seedlings* were determined, as were the proportions of stems with single leaders and of stems growing upright. These proportions were also tested for their correlations with stand BA and stocking of advance growth.

RESULTS AND DISCUSSION

Variability in Stocking

Figure 2 shows the mean, range and standard deviation of black spruce advance growth stocking by FEC operational group. The highest stocking occurred in the *Chamaedaphne* operational group (94%), followed by the *Ledum* group (69%), the Feathermoss–*Sphagnum* group (60%) and the *Alnus*–Herb poor group (50%). These are operational groups 14, 11, 8 and 12, respectively.

Although the stocking in each FEC operational group provides an overview of where advance growth may be expected, there is great variability in stocking values within individual operational groups (Walsh and Wickware 1991). Variability was almost equally great when stocking was related to FEC vegetation types. Evidently, operational group and vegetation type explain only a part of the variation in advance growth stocking.

Correlations

The abundance of advance growth was found to be correlated with a number of stand and site conditions. Stocking decreased sharply with increasing stand basal area, but also decreased with increases in herbaceous cover, crown cover, average height of dominants, and alder cover. The abundance of advance growth increased with increasing stand age and increasing cover by leatherleaf and Labrador tea.

Although these trends are useful, more precision is needed so that forest managers can decide whether or not to depend on advance growth for the regeneration of a particular site. To this end, multiple regression equations

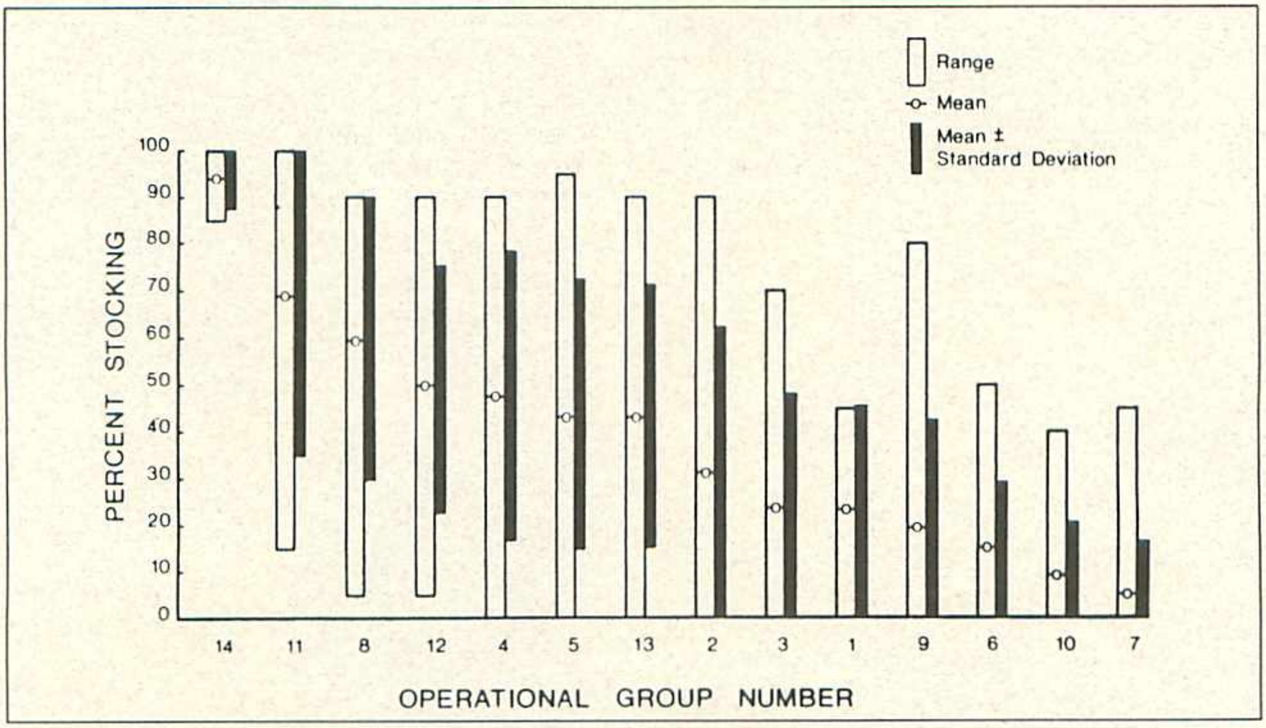

*Figure 2. Mean, standard deviation, and range of percentage stocking to black spruce advance growth of FEC operational groups. See Jones et al. (1983) for complete description of operational groups. (OG1 = Very shallow soil over bedrock; OG2=*Vaccinium*; OG3 =* Diervilla*; OG4 = Feathermoss–coarse soil; OG5 = Feathermoss–fine soil; OG6 =* Lycopodium*; OG7 = Mixedwood–herb rich; OG8 = Feathermoss–*Sphagnum*; OG9 = Conifer–herb/moss rich; OG10 = Hardwood–* Alnus*; OG11 =* Ledum*; OG12 =* Alnus*–herb poor; 0G13 =* Alnus*–herb rich; OG14 =* Chamaedaphne*).*

were developed from the AGS data, with percent stocking of black spruce used as the dependent variable. The best of these models (with r^2=0.824) included the following variables: stand basal area, percent cover by alder, and the proportion of black spruce in the total stand basal area. The relationship between stocking to advance growth and stand basal area and percent alder cover is illustrated in Figure 3.

The height growth of advance growth stems in the understory was slow, averaging only 2.3 cm/year. Height increment increased with increasing total height of the stem and with advance growth stocking, and decreased with increasing stand basal area. Although these correlations were statistically significant, no stand attribute accounted for more than 12% of the variation in height of advance growth. Neither vegetation type nor operational group showed a significant correlation with height growth.

Layering

The proportion of layerings in the subsample of advance growth was found to be 81%; 86% of these had a single leader and 55% of the stems displayed an upright orientation.

CONCLUSIONS AND MANAGEMENT IMPLICATIONS

Black spruce advance growth is abundant on the wettest, most nutritionally and floristically poor site types. Advance growth is most abundant in the *Chamaedaphne* operational group, is relatively abundant in the *Ledum* operational group and somewhat less abundant in the Feathermoss–*Sphagnum* group. However, there is great variability in stocking within operational groups and even within FEC vegetation types. Regression models that employ stand attributes such as basal area, stand composition, and percent cover by alder provide more consistent estimates of advance growth stocking. Most advance growth originates as layers and most has a single upright stem.

In the absence of better information, a precut stocking to black spruce advance growth of at least 80% is recommended to ensure satisfactory natural regeneration from this source. Harvesting in the winter, minimizing machinery travel over cutovers, careful mechanical felling, off-ground forwarding, and full-tree harvesting are recommended to reduce damage to advance growth during logging operations.

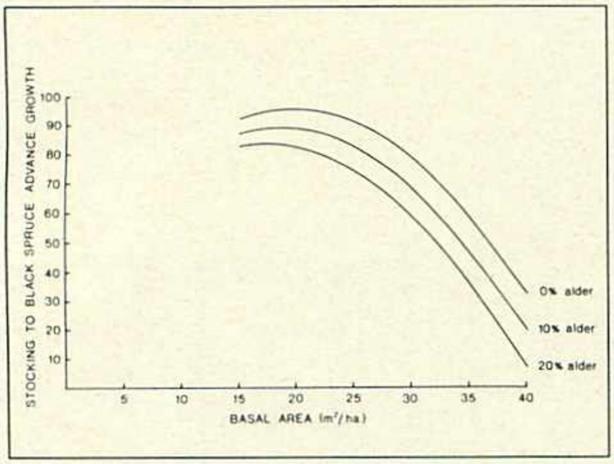

Figure 3. Stocking to advance growth in pure peatland black spruce stands as a function of stand BA and percent cover by alder.

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Art Groot studies regeneration of lowland boreal forest cutovers by preserving advance growth and direct seeding. He is completing his Ph.D. thesis on the microclimate of forest clearcuts.

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