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OBSERVATIONS ON WINDFALL AND DECAY IN A SECOND-GROWTH BALSAM FIR STAND IN THE LOWER ST. LAWRENCE MODEL FOREST

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INTRODUCTION

The susceptibility of balsam fir to windfall has been attributed to stem decay, the species' shallow rooting habit, or a combination of these two factors. In the boreal forest, stem decay is more common on humid sites than on dry ones.

Decay in second-growth balsam fir stands and the resulting timber losses are matters of serious concern to forest managers. Consequently, if managers have an assessment of the amount of decayed wood, they can make more informed decisions about the suitable cutting cycle for stands, the species that should be favoured and the silvicultural treatments that should be undertaken.

The goal of this study was to assess the extent of decay and its relationship to windfall in a second-growth balsam fir stand in the Lower St. Lawrence region.

MATERIALS AND METHODS

The stand examined in this study is a 56-year-old regular high forest dominated by balsam fir, which originated from a clearcut. The stand, which is situated in the balsam fir-yellow birch forest domain, ranges from the middle to the base of a medium angle slope with southwestern exposure, on moderate to well-drained till deposits.

Commercial thinning was conducted in the stand in 1994. In the summer of 1996, an inventory was undertaken on twenty-four 400 m^2 plots, which included assessing the amount of decay on balsam firs randomly selected among the standing trees, and recording information about stems blown down by the wind. The windthrown and decayed stems were dissected and measured in order to determine the total and merchantable volumes with the volumes of decay and cull of the stem.

RESULTS AND DISCUSSION

Of the 1100 trees inventoried, 120 balsam fir were sampled, and stump rot was observed in 26 of these, while decay at breast height was found in 10 stems. In the trees with stump rot, there was a significant correlation between the diameter of the decayed column and the stump diameter.

Only balsam fir exhibited wind damage, with a total of 74 trees blown down or broken. Of these, only four healthy stems had been uprooted and the rest had broken in the trunk region. Among the latter, the healthy stems had broken at a height of about 6 m, whereas the decayed stems had snapped about 90 cm above the ground ***(Table 1)***. The large majority (86%) of the fallen stems exhibited decay.

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Table 1.

Mean values for the 74 balsam fir affected by windfall

	Uprooted		Broken	
	Healthy	Decayed	Healthy	Decayed
Number	4	0	6	64
dbh (cm)	18.0	–	17.3	19.3
Height of break (m)	–	–	5.9	0.9

Red heart rot in balsam fir ***(photos 1 and 2)*** was observed in trees of varying diameter and height, with decay affecting 15% of mean merchantable volume and cull, 27%. More than 86% of the decayed stems were in the diameter range from 12 to 24 cm, which corresponds to the stand's diameter range. At breast height, the diameter of the decay ranged from 8 to 20 cm; however, decay at this level was found in only 29% of cases. The positive and significant correlations between the decay volume and tree taper indicate that the larger and stouter the stem, the greater the likelihood of there being a substantial volume of decay.

Through an approach similar to volume table, the decay volume (V_d) and the cull volume (V_c) can be estimated with satisfactory precision from the stump rot diameter (d_s) using the following equations:

$$V_d = -1.711d_s + 0.224d_s^2$$

$$V_c = -2.903d_s + 0.401d_s^2$$

Photo 1

Rupture of the stem of a balsam fir caused by advanced butt rot.

Photo 2

Presence of red heart rot and carpenter ants on the stump of a balsam fir.

To determine whether drainage had an impact on the decay volume, the decayed balsam fir located at midslope were compared with those at the bottom of the slope. Although the trees were morphologically similar, significant differences existed in both decay as a percentage of total volume and decay as a percentage of merchantable volume. The trees at the bottom of the slope showed mean rates of decay of 15.2% and 19.1% in terms of total volume and merchantable volume respectively, whereas at midslope the corresponding rates were 9.9% and 11.3%.

CONCLUSION

This research showed that breakage associated with windfall in balsam fir is primarily attributable to weakening of the wood's mechanical properties caused by decay at the stem base, rather than to the shallow anchoring of the root system. Decay was present above all in the stump and the lower part of the bole; it was rarely found higher than breast height.

Trees at the base of the slope showed a mean rate of decay in terms of total volume and merchantable volume that was significantly higher than that for stems located at midslope, a situation indicating that drainage affects the amount of decay present.

With regard to the possible effect of thinning on windfall, no significant correlation was found between the extent of windfall and thinning intensity.

Finally, the effect that decay has on wood structure increases with the age of the balsam fir. In view of this, shorter pathological rotations should be envisaged in some cases to reduce volume losses in older stands.

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