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CWFC Facts 004

Canadian Wood Fibre Centre

Fibre Facts

Root and butt rots contribute to merchantable volume losses in precommercially thinned balsam fir stands

Intensive forest management practices for restocking of harvested and naturally disturbed sites have focused on methods for better tree growth and stem form at younger rotation ages, with little consideration of the impacts of such practices on forest pests, such as root and butt rots. Precommercial thinning (PCT) is a silvicultural treatment commonly used in Atlantic Canada to release overstocked young balsam fir (*Abies balsamea* L.) stands. Natural Resources Canada's Canadian Wood Fibre Centre is currently studying the effects of PCT on root and butt rots in semi-mature, pre-commercially thinned balsam fir stands, in order to understand their impacts in relation to growth, yield and fibre quality.

Root and butt rots are one of the most important pests affecting overall average growth and yield in Boreal spruce-fir forests. They are considered the "hidden enemy" (Whitney 1988), as the damage caused by their causal agents, decay fungi, occurs underground, unnoticed. These fungi kill small lateral roots and decay structural heartwood of major roots and butt sections of living trees. As a result, wood volume losses occur due to reduced growth, tree mortality, windthrow and scaled butt cull. An extensive study in naturally regenerated mature conifer stands in Ontario revealed root rot damage was greatest in balsam fir, intermediate in black spruce (*Picea mariana* (Mill.) B.S.P.) and least in white spruce (*Picea glauca* L.) (Whitney 1989).

In the mid 1970s, Newfoundland and Labrador started a PCT program in some of their more productive balsam fir stands. Ground-level decay of stumps assessed after a 1995 commercial thinning (CT) in some of the oldest (35–40 years old) PCTs and windthrow in other PCTs caused some concern.

A cooperative study in 1997 between Natural Resources Canada and the Newfoundland and Labrador Forest Service revealed alarming increases in the incidence and severity of butt rot in balsam fir stands concomitant with an increase in stand age and time since thinning. Therefore, comparison studies of root and butt rot in unthinned vs. PCT balsam fir stands in Newfoundland and Labrador and New Brunswick were conducted. The objectives of these studies were to:

1) determine the incidence and severity of root rot in unthinned and PCT balsam fir stands in Atlantic Canada;
2) assess the impact that silvicultural treatments, specifically PCT, have on root rot development and resulting losses to wood fibre yields;
3) isolate and identify the major root rot fungi;
4) determine the variability of root rot by host species as affected by forest site type; and
5) develop hazard rating systems and treatment options to effectively manage for root rot.

Butt rot.

Initial Results

From a silvicultural perspective, PCT has reduced competition which has enabled increased growth and yields on New Brunswick's better sites compared with Newfoundland and Labrador, and overall increased stem size in both regions. However, initial results from these studies indicate that the damage caused to balsam fir by root and butt rots are occurring well before the projected stand harvest age of 60 years. As a result of PCT, the incidence of root and butt rots has increased with a higher percentage of balsam fir trees having advanced butt rot decay. Furthermore, PCT has contributed to increased severity of merchantable volume losses due to scaled butt cull. These results are clearly depicted in Table 1.

To optimize the use of forest fibre, managers need to know the current status and potential future losses caused by root and butt rots. Studies have shown that root rot is highly variable, with forest site conditions being an important factor. Analysis of data from the Newfoundland and Labrador wood defect and density study (1976–1981) is providing insight into environmental and site factors influencing the incidence and severity of root disease in balsam fir stands. The 2008 assessment of butt rots at the Green River spacing trial in New Brunswick may provide insight regarding optimal spacing conditions to limit root and butt rot development in treated stands (Refer to Fibre Fact Note # 2: "Green River Precommercial Thinning Research"). Many of the major root-decay-causing fungi isolated correspond to known balsam fir butt rot fungi. However, in the PCT stands, a number of unknown aggressive decay agents have been isolated. DNA extraction and molecular sequencing techniques are being used by Natural Resources Canada's Canadian Wood Fibre Centre to identify these unknowns. Research to obtain a better understanding of the cause, effects, and impacts of this problem is ongoing.

Table 1. PCT and unthinned stands in New Brunswick and Newfoundland and Labrador: impacts on diameter, butt rot decay, and merchantable volume.

	Average stem DBH* (cm)	Percentage balsam fir with advanced butt rot decay (%)	Percentage of merchantable volume lost due to scaled butt cull (%)
Newfoundland and Labrador			
Unthinned stands	9.9	13.3	0.7
PCT stands	14.6	27.5	7.3
New Brunswick			
Unthinned stands	8.9	21.4	1.0
PCT stands	13.3	37.9	2.7

*DBH = diameter at breast height

References

Whitney, R.D. 1988. The Hidden Enemy: Root rot technology transfer. Can. For. Serv., Sault Ste. Marie, ON 35 p.

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