Lumber value of dead and sound black spruce trees in the boreal forest of Québec

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1 Introduction

The forest industry in Québec (Canada) is going through an important economic crisis. It has to deal with the economic slowdown of the U.S. market and with the reduction of its annual allowable cut coming from public land. As a result, many forest industries had to shut down temporarily or permanently. In order to help the forest industry, the government of Québec decided to allocate dead and sound wood in addition to the annual allowable cut of living trees. Dead and sound wood comes from standing trees that have died recently and that do not show signs of decay. In the North Shore region of Québec it can represent as much as 20% percent of the volume of an old-growth forest. This special allowance is seen by the government as a good way to help the industry as it brings more timber to the sawmills, which is especially important in a period of economic crisis. However, the use of dead and sound wood by the sawmillers is sometimes criticized. Indeed, many sawmillers complain about the poor quality and value of the boards produced from this type of wood. Yet, the stumpage price of dead and sound trees harvested in the public forests of the province is the same as that of living trees.

The aim of this project is to compare the wood properties and value of the dead and sound wood with those of living trees.

2 Methods

Our study was conducted in the Québec North Shore region, in the northeastern part of the Canadian boreal forest. This area is mainly characterized by old-growth forests of uneven age structure. The forest stands are dominated by black spruce (*Picea mariana* (Mill.)) with balsam fir (*Abies balsamea* (L.) Mill), white birch (*Betula papyrifera* Marsh.) and trembling aspen (*Populus tremuloides* Michx.) as co-dominant species.

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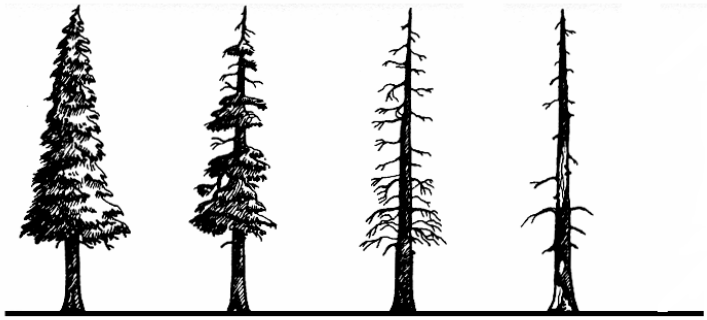
The study sites were located north of Labrieville, Québec. In each of three sites in old growth forests (over 120 years old on the ecological maps) we selected 54 merchantable black spruce trees from three different states of apparent wood decomposition (Hunter 1&2, Hunter 3, Hunter 4 – Fig.1) and three merchantable DBH classes (9.1 to 15 cm, 15.1 to 21, 21.1 cm and over). In total we selected 162 trees and each was assigned a reference number.

The state of decomposition of each standing tree was categorized following Hunter's classification which was used to help selecting live and recently dead trees. In addition, Hunter classes 3 & 4 meet the criteria developed by the government of Québec for the dead and sound wood classification: *i.e.* (i) the wood is dry and difficult to crush when pressure is applied, (ii) the bark is missing or easy to peel off, (iii) there is no evidence of wood decay (MRNFQ, 2005). Figure 1 shows the different Hunter classes used in the project.



Hunter 1	Hunter2	Hunter3	Hunter4
Live	Live but declining	Dead	Dead with bark peeling off

Figure 1: Illustration of the different states of decomposition by Hunter 1990

The trees were then felled by a harvester and extracted in full length with a forwarder. Total tree length and lengths up to 9.1 cm (merchantable) and 7 cm (pulp) diameter were measured. The trees were cut into logs of 16 to 9 feet in length using a chainsaw. Each log was marked at each end in order to identify the tree number and then transported by truck to a modern sawmill (Boisaco, Sacré-Coeur) to complete a stem analysis and sawmill conversion study. The sawmill was equipped with a 3D laser scanner and the sawing pattern was automatically optimized for each log to extract maximum value. Standard nominal 2 inch-thick (5 cm) battens and 1 inch-thick (2.5 cm) boards were produced, ranging in length from 9 to 16 feet (2.8 to 5 m). The log reference number was transferred onto each piece of lumber produced to keep track of its provenance. The boards and battens were finally transported to FPInnovations-Forintek Division and to Université Laval for further testing.

3 Preliminary results

Green lumber was graded according to NLGA Standard Grading Rules by a qualified inspector. There were 4 grades used to classify each batten (premium, no.2, no.3 and economy) while there were 2 grades used to classify the boards (utility and economy). All pieces were graded as they were and as they would be if their dimensions were optimized. The cause of downgrade was recorded.

Tables 1, 2 and 3 show the difference in lumber recovery by lumber grade between the three different states of wood decomposition.

Table 1: Green optimized lumber recovery for the live trees (Hunter 1 & 2)

Thickness	Grade	Total bf	% bf	Total value ($)	MBF ($)
Battens (2')	Premium	728.7	27.8	311.38	427.33
	2	1333.8	51.0	504.89	378.53
	3	270.3	10.3	78.76	291.34
	Economy	121.0	4.6	29.95	247.55
Boards (1')	Utility	141.8	5.4	41.58	293.18
	Economy	16.3	0.6	3.36	205.47
Reject	Reject	5.0	0.2	0.00	0.00
	Total	2617.0	100.0	969.93	370.62

* bf is the short form of lumber volume unit " board foot" , equal to the amount of timber equivalent to a piece 12'' × 12'' × 1''. MBF is used to express "1000 board feet".
** Lumber values were calculated in $CAN, based on 5-year (2002–2007) price index.

Table 2: Green optimized lumber recovery for the dead trees (Hunter 3)

Thickness	Grade	Total bf	% bf	Total value ($)	MBF ($)
Batten (2')	Premium	565.2	25.2	240.23	425.07
	2	963.7	43.0	364.27	378.00
	3	445.5	19.9	131.16	294.42
	Economy	160.7	7.2	38.63	240.41
Board (1')	Utility	90.9	4.1	26.91	296.00
	Economy	13.0	0.6	2.63	202.31
Reject	Reject	0.0	0.0	0.00	0.00
	Total	2238.9	100.0	803.83	359.03

Table 3: Green optimized lumber recovery for the dead trees (Hunter 4)

Thickness	Grade	Total bf	% bf	Total value ($)	MBF ($)
Batten (2')	Premium	282.2	12.5	120.09	425.61
	2	795.2	35.3	297.81	374.52
	3	684.7	30.4	200.83	293.32
	Economy	363.3	16.1	85.01	233.98
Board (1')	Utility	101.4	4.5	29.72	293.08
	Economy	24.4	1.1	5.02	205.43
Reject	Reject	3.0	0.1	0.00	0.00
	Total	2254.2	100.0	738.48	327.60

There was an important decrease in mean value per board foot with an increase in the state of decomposition, particularly for the Hunter 4 category. This is because living trees (Hunter 1&2) produce a greater proportion of premium and no.2 lumber (Figure 2).

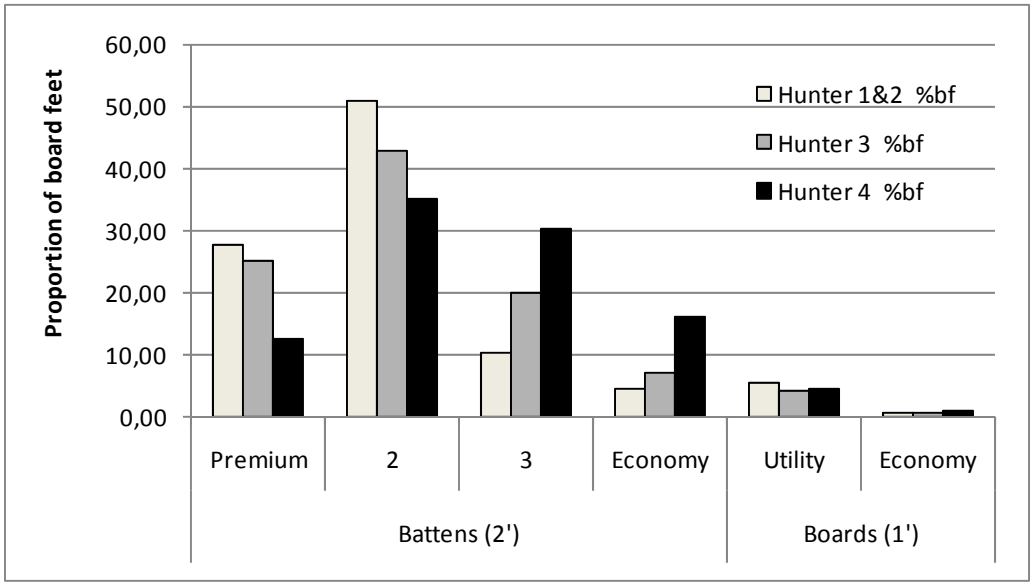


Figure 2: Proportion of green optimized lumber obtained from each decomposition category.

4 Discussion and conclusion

Hunter's classification seems to prove useful in order to assess the quality of standing dead trees. Our results indicate that trees of the Hunter 4 class are worth C$43.20 less than live trees, *i.e.* a difference of 11.6%. This difference is important in the current economic context where production cost approaches the price of the no.2 & premium lumber. Stumpage costs should be adjusted to reflect this reality. Further analyses will aim to calculate the value/m^3 of the trees from each decomposition category.

5 Acknowledgements

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