Recently dead merchantable stems from the boreal forest of Québec

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Introduction

• 24% decrease of the annual allowable cut for the SPF group, for the 2008-2013 period (Bureau du Forestier en chef, 2006).

• To help the forest industry which was facing economic difficulties, the Chief forester decided to allocate dead and sound wood (recently dead merchantable stems) in addition to the annual allowable cut of living trees.

• The volume of dead and sound wood doesn’t count in the national inventory and consequently is not considered in the yield tables.

• Due to the long fire intervals that prevail in the area, the boreal forests of Québec’s North Shore region are characterized by important volume of dead wood (Lowe et al, 2011).
Definition of dead and sound wood (recently dead merchantable stems) by the Ministry of Natural Ressources

- The wood fibre is dry and difficult to break when pressure is applied
- The bark is missing or easy to peal off
- There is no evidence of wood decay

(MRNFQ, 2005)
Example: dead and sound wood
Introduction

• Therefore, it becomes important to estimate the volume of dead and sound wood to:
  
  – increase our understanding about the availability of this type of wood in our forest;

  – determine the quality of this resource;
Introduction

• The main objectives of this study are:

**Objective 1**
To model the volume of dead and sound wood and of wood decay with time since fire and to adjust the yield curves for these two aspects.

**Objective 2**
To compare wood properties and value of dead and sound wood with those of living trees.

**Objective 3**
To carry a financial analysis on the wood chain of the dead and sound wood.
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Methods: Design

Sample plots established in 2007 to form two post-fire chronosequences.

(Bouchard et al. 2008)
Objective 1

Methods: Design

Time since fire

- 0-50
  - 5 PLOTS

- 51-100
  - 5 PLOTS

- 101-150
  - 5 PLOTS

- 150-200
  - 5 PLOTS

- 200+
  - 10 PLOTS

NORTH

SOUTH

In total we established 60 plots
Methods: dead and sound wood

- Evaluation of dead and sound wood volume
  - Fixed radius plots (11.28 m radius)
  - Variable radius plots (prism of factor 2)
Results

Temporal variation of the recently dead tree volume in the North chronosequence
Objective 1

Results

Temporal variation of the recently dead tree volume in the South chronosequence

Ice storm

Volume of recently dead trees (m³/ha)

Time since fire (years)
Objective 1

Adjustment for wood decay and dead and sound wood volumes (north chronosequence)

- SI 15
- SI 12
- SI 9

Garet et al., 2008
Introduction

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Methods

(Hunter, 1990)
Methods: Design

3 stands with an irregular structure, North of Labrieville (Québec), in partnership with Boisaco
Methods: Design

In total: 162 black spruce (BS) trees were selected from 3 study sites

- **Site 1**
  - Hunter 1 & 2 (live)
    - Small (10 to 14 cm): 6 BS
    - Average (16 to 20 cm): 6 BS
    - Big (22 cm +): 6 BS

- **Site 2**
  - Hunter 3 (dead)

- **Site 3**
  - Hunter 4 (dead)

**Objective 2**
Objective 2
Objective 2

Blue: Hunter 1 & 2 (live)

Yellow: Hunter 3 (dead)

Red: Hunter 4 (dead)
Methods

- 386 logs from 9 to 16 feet (2.8 - 5 m)
- 822 pieces were produced in a modern sawmill Boisaco (Sacré-Cœur)

<table>
<thead>
<tr>
<th>Type of product</th>
<th>$n$</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 x 3</td>
<td>67</td>
</tr>
<tr>
<td>1 x 4</td>
<td>42</td>
</tr>
<tr>
<td>1 x 6</td>
<td>11</td>
</tr>
<tr>
<td>2 x 3</td>
<td>113</td>
</tr>
<tr>
<td>2 x 4</td>
<td>371</td>
</tr>
<tr>
<td>2 x 6</td>
<td>218</td>
</tr>
</tbody>
</table>
Methods

- All pieces were graded green and dry according to NLGA Standard Grading Rules (NLGA, 2008).

  - Grades used:

<table>
<thead>
<tr>
<th>2 inch lumber</th>
<th>Premium No.2 No.3 Economy</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 inch boards</td>
<td>Utility Economy</td>
</tr>
</tbody>
</table>
Methods

• Lumber pieces (2” x 4” and 2” x 6”) were tested in static bending at Laval University.

• Standard used:
  – ASTM D4761-05
  – ASTM D1990-07
  – ASTM D2915-03
Results: Proportion of board feet per NLGA grade

Objective 2

<table>
<thead>
<tr>
<th>Board Type</th>
<th>Premium</th>
<th>No.2</th>
<th>No.3</th>
<th>Economy</th>
<th>Utility</th>
<th>Economy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Battens (2')</td>
<td>30%</td>
<td>40%</td>
<td>50%</td>
<td>20%</td>
<td>10%</td>
<td>5%</td>
</tr>
<tr>
<td>Boards (1')</td>
<td>10%</td>
<td>20%</td>
<td>30%</td>
<td>20%</td>
<td>10%</td>
<td>5%</td>
</tr>
</tbody>
</table>

- Hunter 1 & 2
- Hunter 3
- Hunter 4
Objective 2

Results: lumber value (DBH)

\[ Y = b_1 x^{b_2} b_3^x \]

\[ \ln(y) = \ln(b_1) + b_2 \ln(x) + \ln(b_3) x \]
Objective 2

Results: lumber value (DBH)
Results: reasons for differences

<table>
<thead>
<tr>
<th>Tree DBH classes (cm)</th>
<th>Hunter's classes</th>
<th>Average volume of decay (dm³)</th>
<th>Average top diameter (cm)</th>
<th>Average length (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Big (21.1 +)</td>
<td>1&amp;2</td>
<td>6.11 (a)</td>
<td>8.10 (a)</td>
<td>15.39 (a)</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>33.05 (b)</td>
<td>10.41 (b)</td>
<td>13.46 (b)</td>
</tr>
<tr>
<td></td>
<td>4</td>
<td>48.70 (b)</td>
<td>11.09 (b)</td>
<td>12.46 (b)</td>
</tr>
</tbody>
</table>

Tukey’ tests performed at a confidence interval of 95% on sample tree’s characteristics.
### Results: lumber value

<table>
<thead>
<tr>
<th>Hunter 1 &amp; 2</th>
<th>367$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hunter 3</td>
<td>351$</td>
</tr>
<tr>
<td>Hunter 4</td>
<td>318$</td>
</tr>
</tbody>
</table>

**Average price/MBF**

*MBF is used to express “1000 board feet” approx. 2.4m³ of solid sawn wood.

** Lumber values were calculated in $CAN, based on 5-year (2002–2007) price index, lumber price sold at the Great lake market (*Québec Forest Industry Council, The year Book*)
Objective 2

Preliminary results: static bending
Preliminary results: static bending
Conclusion

- Recently dead merchantable stems (dead and sound wood) tend to follow a dynamic pattern of pre- and post-disturbance similar to that of coarse woody debris.

- The dynamic pattern of recently dead stems is also very dependant of local disturbances.

- Recently dead merchantable stems could represent an increase in yield of approx. 11% in old-growth forests (8% net).
Conclusion

- Lumber value of recently dead trees are worth less money than live trees, especially when comparisons are made with DBH.

- Value of lumber sawn from large trees (> 20 cm DBH) of the Hunter 4 class is significantly smaller than that of live trees.

- Hunter’s classification proved useful in addressing wood quality changes of recently dead merchantable stems.
Acknowledgments

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References


