AN ANALYSIS OF WHOLE TREE HARVESTING IN NORTH ITALIAN CABLE LOGGING OPERATIONS

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In the mountains, cable logging is the favourite harvesting technique, due to:
- steep terrain
- limited road access
- soil protection
Whole Tree extraction allows to optimize cable logging operations (& introduce mechanization)

Whole Tree Harvesting (WTH):
- Tree processing can be mechanized at the landing
- Simplify and speed operations
- Reduced cost compared with traditional bucking
- Safer and improved working conditions
- Removal of wood residues:
  - pro: use as fuel
  - con: soil nutrient drain
The goal of the research: comparing the WT and the FLS systems in term of productivity, cost, biomass release

**WT (Whole Tree) =** felling with chainsaw, yarding whole, processing mechanically

**FLS (Full Length Stem) =** felling and deliming with chainsaw, yarding FLS, processing with chainsaw supported by excavator
### Site characteristics

<table>
<thead>
<tr>
<th>Test and Site</th>
<th>#</th>
<th>1 - Colonno</th>
<th>2 - Gravedona</th>
<th>3 - Ossuccio</th>
<th>4 - Grandola</th>
<th>5 - Lasnigo</th>
</tr>
</thead>
<tbody>
<tr>
<td>Surface</td>
<td>ha</td>
<td>2,00</td>
<td>4,46</td>
<td>4,30</td>
<td>3,96</td>
<td>1,40</td>
</tr>
<tr>
<td>Altitude</td>
<td>m a.s.l.</td>
<td>1250</td>
<td>1300</td>
<td>1325</td>
<td>950</td>
<td>800</td>
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<tr>
<td>Slope gradient</td>
<td>%</td>
<td>45</td>
<td>50</td>
<td>42</td>
<td>60</td>
<td>70</td>
</tr>
<tr>
<td>Species</td>
<td></td>
<td>Norway spruce</td>
<td>Norway spruce</td>
<td>Beech</td>
<td>Beech</td>
<td>Hornbeam, chestnut</td>
</tr>
<tr>
<td>Management</td>
<td></td>
<td>Plantation</td>
<td>Plantation</td>
<td>Coppice</td>
<td>Coppice</td>
<td>Coppice</td>
</tr>
<tr>
<td>Treatment</td>
<td></td>
<td>Gap cut</td>
<td>Gap cut</td>
<td>Selection cut</td>
<td>Selection cut</td>
<td>Selection cut</td>
</tr>
<tr>
<td>Age</td>
<td>years</td>
<td>60</td>
<td>51</td>
<td>50</td>
<td>50</td>
<td>30</td>
</tr>
<tr>
<td>Stocking</td>
<td>m3 ha-1</td>
<td>428</td>
<td>173</td>
<td>238</td>
<td>165</td>
<td>156</td>
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<tr>
<td>Removal</td>
<td>m3 ha-1</td>
<td>428</td>
<td>67</td>
<td>123</td>
<td>123</td>
<td>78</td>
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<tr>
<td>Harvest intensity</td>
<td>% volume</td>
<td>100</td>
<td>39</td>
<td>52</td>
<td>74</td>
<td>50</td>
</tr>
<tr>
<td>Harvest intensity</td>
<td>% trees</td>
<td>100</td>
<td>59</td>
<td>72</td>
<td>75</td>
<td>66</td>
</tr>
<tr>
<td>Harvest tree</td>
<td>m3</td>
<td>0,535</td>
<td>0,268</td>
<td>0,217</td>
<td>0,273</td>
<td>0,204</td>
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<tr>
<td>Harvest tree</td>
<td>odt</td>
<td>0,230</td>
<td>0,115</td>
<td>0,147</td>
<td>0,185</td>
<td>0,088</td>
</tr>
</tbody>
</table>
Methods

Recording: time by activity, fuel consumption, output by assortments, crew size

Shift-level study: recorded by foreman, supervised by CNR

Element-level study: work sampling by CNR

Left-slash assestment after harvesting to determine residue load by residue type
Assortments

- Chips important amount with conifers, much less with broad-leaves
- Better value recovery with WTH (more timber than from FLS)
- No production of timber from coppice
Labour productivity

- Extraction most time consuming
- FLS higher labour use per unit product (ton)
- Felling much shorter with WTH
- WTH saves between 12 and 37% labour input (hour/odT)
Fuel consumption

- Fuel use generally lower for WTH
- 14 to 48% less petrol mix
- 2 to 30% less diesel
Cost

- Fuel is a very small cost component, anyway
- In most cases WTH determines savings (from 1 to 32 € odT-1)
- In some cases the increase in investment cost is not compensated by a larger decrease of labor cost
• Higher residue loads in FLS
• With conifers, FLS succeds in releasing large amounts of nutrient-rich foliage
• In coppice stands WT slash is between 20 and 25% less due to winter cutting and firewood recovery
• Large amounts of residue in all cases
Grazie per la vostra attenzione!
Thanks for your attention!

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