Efficiency of Topping Trees in Cable Yarding Operations

Department of Forest and Soil Sciences

Institute of Forest Engineering

DI Christoph Huber
Prof. Dr. Karl Stampfer
Nutrient cycle of a forest ecosystem

Nutrient pool:
- stand
- soil

INPUTS:
- rainfall
- wind drift
- vertical water-flow

OUTPUTS:
- timber harvesting
- erosion
- leaching

INPUTS:
- weathering
- mineralization
Problem statement

Slash piles with high amounts of nutrient-rich compartments remain after WTH in cable logging.

Extraction of these nutrient-rich fractions raised concerns about the sustainability of WTH.
Ecological potential of topping trees

Typical tree within an initial thinning stand

<table>
<thead>
<tr>
<th>Topping diameter</th>
<th>Biomass</th>
<th>Nitrogen</th>
</tr>
</thead>
<tbody>
<tr>
<td>4 cm</td>
<td>2 %</td>
<td>8 %</td>
</tr>
<tr>
<td>6 cm</td>
<td>7 %</td>
<td>19 %</td>
</tr>
<tr>
<td>8 cm</td>
<td>14 %</td>
<td>33 %</td>
</tr>
<tr>
<td>14 cm</td>
<td>46 %</td>
<td>71 %</td>
</tr>
</tbody>
</table>
Study sites

»KLOMMEGGER«
Second thinning operation

»BERGTAL«
First thinning operation

»BAIRHÜBL«
First thinning operation

10.12.2015
Experimental setup

without topping

with topping
Topping trees after hook-on
Topping trees after hook-on

Interruption times

- Outhaul of carriage
- Spool out mainline
- Hook-on
- Lateral inhaul
- TOPPING
- Lateral inhaul
- Inhaul of carriage

**Time demand to top all trees of a single load**

- 45 sec./load
- 36 sec./load
- 27 sec./load
- 18 sec./load
- 9 sec./load

- Bairhübl
- Bergtal
- Klommegger

*10.12.2015*
Impacts on yarder-productivity

- Bairhübl
- Bergtal
- Klommeüger

Productivity, $\text{m}^3\text{ pSH}_{15}^{-1}$ vs. average tree volume, $\text{m}^3$

- Without topping or topping of lying trees
- Topping of already lifted trees
Working tasks of the chainsaw operator

Other „hooker-on“
Heart rate measurements

Excerpt of a heart rate-diagram of the study site »Bairhübl«:
Physiological measures - results

Second thinning stand

First thinning stand

- without topping
- with topping
Conclusions

- Topping of trees during lateral inhaul causes interruption times and lowers productivity

- Topping trees takes the chainsaw-operator ca. 5-10% of his entire working-time

- Topping trees during the lateral yarding process can facilitate the work of the chainsaw operator
University of Natural Resources and Life Sciences, Vienna

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Institute of Forest Engineering

DI Christoph Huber
Prof. Dr. Karl Stampfer

Peter Jordan Straße 82, A-1190 Vienna, Austria
Tel.: +43 1 47654-4310, Fax: +43 1 47654-4342
c.huber@boku.ac.at, www.wabo.boku.ac.at/ft