Towards Better Pre-clearance Guideline of Undergrowth in First Thinnings: Case Study Stora Enso Wood Supply Finland

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- Present level of pre-clearance of undergrowth in first-thinning stands?
- Harmful undergrowth for cutting?
- Characteristics of a good pre-clearance?

- New pre-clearance guideline at Stora Enso WSF.
Pre-clearance Guidelines in First-thinning Stands Harvested by Stora Enso WSF

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Undergrowth:
\[ d_{1.3} < 7 \text{ cm}. \]

Pre-clearance limits:
Dense undergrowth is cleared if density of conifer undergrowth (>2.0 m) exceeds 2,000 trees/ha and deciduous undergrowth (>2.0 m) >8,000 trees/ha.

Implementation of pre-clearance:
1) 1 m radius around butt of merchantable stems is cleared.
2) other undergrowth >1.5 m high is cleared.
Undergrowth: $d_{1.3} < 7\, \text{cm}$.

Pre-clearance limits: Dense undergrowth which hinders cutting.

Implementation of pre-clearance:
1) 1 m radius around butt of merchantable stems is cleared (stump height < 10 cm).
2) Other undergrowth >1.5–2.0 m high is cleared.
3) One full year prior to cutting.
■ Undergrowth: 
  \( d_0 < 4 \text{ cm} \).

■ Pre-clearance limits: 
  *Dense undergrowth which hinders cutting.*

■ Implementation of pre-clearance (= *Visibility* clearance):  
  1) 0.5–1.0 m radius around butt of removed stems is cleared.  
  2) other single undergrowth tree (\( d_0 < 4 \text{ cm} \)) is cleared.  
  3) One full year prior to cutting.
Minimum Stem Size at Stora Enso WSF

- Minimum stem size (BHD) 8 cm from spring 2013 in first thinnings harvested by Stora Enso WSF. = Smaller trees as undergrowth.

- Both in industrial roundwood and in energy wood cuttings.

- Very high cutting costs of small-diameter stems!
Aims

1) To clarify experiences in current guidelines used in Stora Enso WSF’s first thinnings.

2) To define the approaches of harvester operators, forest machine contractors, as well as SE WSF officers what is a good undergrowth pre-clearance.

3) To produce one, uniform guideline for undergrowth pre-clearance in first-thinning stands harvested by Stora Enso WSF.
Telephone Interviews in 2013

- Three survey groups:
  1) Harvester operators (N=88)
  2) SE WSF’s contractors (N=43)
  3) SE WSF officers (N=60).

- Structured questionnaires in June 2013.

- Telephone interviews in July–September 2013 by two students (Seppo Immonen & Jani Rissanen).

- Survey period from July 2012 to June 2013.
153 Interviews

- Research data consisted of 153 interviews (80.1%) divided into three survey groups:
  1) Harvester operators (n=75 | N=88; 85.2%)
  2) SE WSF’s contractors (n=41 | N=43; 95.3%)
  3) SE WSF officers (n=37 | N=60; 61.7%).

- Almost a half of the respondents are harvester operators.
  - Average cutting volume from first thinnings per operator: 11,089 m$^3$ (Tornator 4,873 m$^3$) in July 2012–June 2013.
Highlights of the Study
Present Level of Pre-clearance of Undergrowth in First Thinnings between July 2012 – June 2013

All first thinnings at Stora Enso WSF vs. Tornator’s first thinnings

Share of first thinnings (%)

- No clearance; No need
- No clearance; Should have been done
- Weak clearance
- Good clearance

Towards Better Pre-clearance Guideline December 10, 2015
Present Level of Pre-clearance of Undergrowth in First Thinnings between July 2012 – June 2013

*All first thinnings at Stora Enso WSF vs. Tornator’s first thinnings*

- **Share of first thinnings (%)**
  - **Harvester operators**
  - **SE WSF’s contractors**
  - **SE WSF officers**
  - **Total**

- **Graph Legend**
  - □ No clearance; No need
  - ■ No clearance; Should have been done
  - □ Weak clearance
  - □ Good clearance

- **Data Points**
  - **December 10, 2015**
    - 12%
    - 45%
    - 36%
    - 12%
    - 45%
    - 36%

Towards Better Pre-clearance Guideline  December 10, 2015
What is Harmful Undergrowth for Cutting?

*Undergrowth density that hinders cutting*

**Towards Better Pre-clearance Guideline**

**Graph:**
- **Y-axis:** Undergrowth density (trees/ha)
- **X-axis:** Harvester operators, SE WSF's contractors, SE WSF officers, Total

- **Conifer tree:** 1,152 trees/ha
- **Mixed conifer & deciduous:** 1,353 trees/ha
- **Deciduous tree:** 1,669 trees/ha

**Legend:**
- Conifer tree
- Mixed conifer & deciduous
- Deciduous tree

**Box:**
- **Conifer:** 1,152 trees/ha
- **Mixed conifer & deciduous:** 1,353 trees/ha
- **Deciduous:** 1,669 trees/ha
What is Harmful Undergrowth for Cutting?

*Undergrowth height that hinders cutting*

<table>
<thead>
<tr>
<th>Undergrowth height (m)</th>
<th>Conifer tree</th>
<th>Mixed conifer &amp; deciduous tree</th>
<th>Deciduous tree</th>
</tr>
</thead>
<tbody>
<tr>
<td>Conifer: 1.42 m</td>
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<tr>
<td>Mixed conifer &amp; deciduous: 1.62 m</td>
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<tr>
<td>Deciduous: 1.86 m</td>
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Good Undergrowth Pre-clearance

Clearance around butt of merchantable stems; Minimum radius size

<table>
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<tr>
<th>Radius around butt of stems (m)</th>
<th>Average: 1.24 m</th>
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<tbody>
<tr>
<td>Harvester operators</td>
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<tr>
<td>SE WSF’s contractors</td>
<td></td>
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<tr>
<td>SE WSF officers</td>
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<tr>
<td>Total</td>
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Towards Better Pre-clearance Guideline   December 10, 2015
Good Undergrowth Pre-clearance
Clearance around butt of merchantable stems; Maximum stump height

![Graph showing stump height around butt of stems for different groups: Harvester operators, SE WSF’s contractors, SE WSF officers, Total. The average stump height is 10.8 cm.]

Average: 10.8 cm
Good Undergrowth Pre-clearance

Timing of clearance

Harvester operators | SE WSF’s contractors | SE WSF officers | Total

Clearance before cutting (months)

Average: 9.2 months
New Pre-clearance Guideline at Stora Enso Wood Supply Finland
UNDERGROWTH:
× All trees with diameter at breast height ($d_{1.3}$) less than 8 cm.

PRE-CLEARANCE LIMITS:
× Harvesting sites with dense undergrowth is cleared.
× Pre-clearance is carried out when **undergrowth height** exceeds 1.5 m **AND density** is
  ▪ In summertime harvesting more than 2,000 undergrowth trees/ha
  ▪ In wintertime harvesting more than 2,000 conifer undergrowth trees/ha and more than 4,000 deciduous undergrowth trees/ha.

IMPLEMENTATION OF PRE-CLEARANCE:
× A circular area (1 m radius) around the butt of merchantable stems is pre-cleared.
× Undergrowth in the circular area is cut as low as possible to leave 5–10 cm stumps.
× **On the intermediate areas of the forest stand**, only the taller (over 1.5 m high) undergrowth that may hinder cutting is pre-cleared.
× Whole harvesting site is cleared.
× Pre-clearance is carried out one full year prior to a cutting operation, if possible.
WITHOUT PRE-CLEARANCE:

- Small-sized moist areas
- Areas of retention tree groups
- Shores and buffer zones of rivers and creeks
- Rare tree species
- Tree-like rowan (*Sorbus aucuparia* L.), common juniper (*Juniperus communis* L.) and sallow (*Salix carpea* L.) stems outside circular areas
- Forest sites of Forest Law 10 §
- Part of spruce undergrowth can be left to fill in patchy or open stands.
Benefits of the Novel Guideline

- With increased precision, pre-clearance operations within first thinnings are able to be directed to stands having a real need.
- The quality of the pre-clearings has improved thanks to the unambiguous pre-clearance guideline.
- A positive impact on our harvesting productivity and costs of first-thinning wood.