Promoting Approaches for Increasing the Cost-Efficiency of Energy Wood and Pulpwood Harvesting in Young Stands

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Contents

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• Background
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Metsäteho Oy

**Support**
the development of its shareholders’ wood procurement and wood production operations

**Improve**
the operating preconditions for wood supply

On the Right Track since 1945
Shareholders

Metsäteho is a limited company owned by

- Finnish forest industry firms
- Metsähallitus (State Forests Co.)
- Certain forestry organisations.
Metsäteho’s location

Helsinki, Finland
R&D Focus Areas in 2008

**Wood Resources**
- Forest Recourses and Harvesting Potential
- Forestry Profitability
- Impact of Biodiversity Conservation

**Resource Management**
- Operating Models and Profitability of Entrepreneurship
- Development of Forest Work Productivity
- Services and Information Management
- Labour Availability and Expertise

**Wood Procurement Logistics**
- Timber Measurement and Quality Control
- Timber Transportation Methods
- Harvesting and Using of Small-sized Wood
Forest land available for wood supply by stand development class in Finland

Source: Korhonen et al. 2007
First thinnings in Finland, 1995–2006

First thinnings in Finland, 1995–2006


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Proposals for fellings during the following 10-year period in Finland

Source: Korhonen et al. 2007
First thinnings in Finland, 1995–2006

First thinnings in Finland, 2000–2005

Source: Kärhä 2007
Average industrial roundwood harvesting costs in Finland, 2005

Source: Kariniemi 2006
Use of forest chips in Finland, 2000–2007

*) In energy plants, i.e. heating and power plants.

Sources: Ylitalo 2001–2008
Use of forest chips in Finland, 2000–2007

* In energy plants, i.e. heating and power plants.

Sources: Ylitalo 2001–2008
Targets for the use of forest chips & potentials for the recovering of forest biomass in Finland

Stem size and density of removal at energy wood harvesting sites

Source: Kärhä 2006
Stem size and density of removal at energy wood harvesting sites

Source: Kärhä 2006
Example: Average total supply chain costs

*Small-diameter wood chips vs. Logging residue chips*

![Chart showing average total supply chain costs for small-sized whole-tree chips and logging residue chips, with categories including overheads, road transportation, chipping, storage, forest haulage, cutting, and stumpage price. The chart visually compares the costs for each category across the two types of chips.]
Promoting Approaches

• Several research papers have discussed the problems of harvesting small-diameter wood in early thinnings.
• A lot of viable guidelines are currently available to increase cost-effectiveness in harvesting of pulpwood and energy wood from young stands.
• However, many of the most cost-effective guidelines have not been properly utilized in Finland, and similar situations are expected in other countries.
• The adoption of suitable guidelines needs to be promoted.
Study Tasks

- A study carried out by Metsäteho Oy and the University of Joensuu listed different potential approaches for reducing the harvesting costs in young stands.
- Potential approaches were also ranked in the study.
Potential approaches for more cost-efficient wood harvesting

I) Improving harvesting conditions:
   – Effective tending of seedling stands
   – Delaying harvesting operations
   – Pre-clearance of spruce undergrowth
   – New wood production methods:
     • Intensive first thinning
     • Energy wood harvesting as a part of wood production chain
   – Creating clusters of stands
Potential approaches for more cost-efficient wood harvesting

II) Rationalization of harvesting methods:

- Multiple-tree processing
- Grapple scale measuring
- Careful selection of harvested trees
- Careful selection of harvested stands
- Fewer timber assortments
- Integration of pulpwood and energy wood harvesting:
  - Whole-tree bundling
  - Two-pile cutting method
Potential approaches for more cost-efficient wood harvesting

III) Better utilization of harvesting machinery:

- Harwarders
- Machines requiring lower investments:
  - Small harvesters
  - Tracked excavator-based harvesters
- Maximization of load size
- More working hours for harvesting machinery
- Larger harvesting companies and networks
Potential approaches for more cost-efficient wood harvesting

IV) Development of harvesting machinery and working methods:
   – Advanced automation
   – Improvement of the cutting work process
   – Training of harvester operators
   – More efficient use of operators
Material and methods

• Personal interviews
  – 40 interviews
• January and February 2008
• The interviewees were divided into four groups:
  i) Managers in wood procurement organizations (10 interviewees),
  ii) Forest machine contractors (10),
  iii) Forest machine manufacturers and vendors (10), and
  iv) Wood harvesting researchers (10).
Material and methods

- The interviewees were asked to evaluate the significance of a number of factors related to problems in energy wood and industrial roundwood harvesting in early thinnings.
- The significance of different potential approaches for more cost-efficient harvesting in energy wood thinnings and first thinnings was investigated.
- The interviewees evaluated how comprehensively each approach is currently used in harvesting operations in Finland.
  - The questionnaire covered a total of 32 different approaches in energy wood harvesting and 29 in industrial roundwood harvesting.
Material and methods

- The potential of each approach to increase the cost-efficiency of wood harvesting in young stands was calculated by subtracting the current utilization score of the approach from the significance score of the approach.

\[ P_i = S_i - U_i, \]

where
\[ P_i = \text{potential of the approach } i \text{ to increase the cost-efficiency of wood harvesting} \]
\[ S_i = \text{significance of the approach } i \text{ for more cost-efficient wood harvesting}, 1, \ldots, 5 \]
\[ U_i = \text{utilization degree of the approach } i \text{ in current wood harvesting}, 1, \ldots, 5. \]
Ten most serious problems currently in industrial roundwood harvesting

- Small size of removed trees
- Low roundwood removal per hectare
- Lack of professional machine operators
- Low cutting productivity
- Dense undergrowth
- Ineffective tending of seedling stand
- High wood harvesting costs
- Low roundwood removal per stand
- Lack of machine operators
- Poor carrying capacity of the terrain
Ten most serious problems currently in industrial roundwood harvesting

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Ten most serious problems currently in energy wood harvesting

- Lack of professional machine operators
- Low cutting productivity
- Small size of removed trees
- Lack of machine operators
- High harvesting costs of energy wood
- Low energy wood removal per hectare
- Low energy wood removal per stand
- Poor carrying capacity of the terrain
- Uncertainty of Kemera support levels
- Dense undergrowth
Ten most serious problems currently in energy wood harvesting

- Lack of professional machine operators
- Low cutting productivity
- Small size of removed trees
- Lack of machine operators
- High harvesting costs of energy wood
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- Low energy wood removal per stand
- Poor carrying capacity of the terrain
- Uncertainty of Kemera support levels
- Dense undergrowth

Key:
- Officers in wood procurement organizations
- Wood harvesting contractors
- Forest machine manufacturers
- Wood harvesting researchers
- Average
Ten most significant approaches for achieving more cost-efficient industrial roundwood harvesting

- Pre-clearance of dense undergrowth
- Effective tending of seedling stand
- Improving the training of new operators
- More working hours for harvesting machinery
- Careful selection of operator candidates
- Developing cutting techniques and working methods
- Development of machine technology
- Careful selection of stands for harvesting
- Broadening the practical training
- Multiple-tree handling

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Ten most significant approaches for achieving more cost-efficient industrial roundwood harvesting

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<thead>
<tr>
<th>Approach</th>
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<th>Wood harvesting contractors</th>
<th>Forest machine manufacturers</th>
<th>Wood harvesting researchers</th>
<th>Average</th>
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- Improving the training of new operators
- More working hours for harvesting machinery
- Careful selection of operator candidates
- Developing cutting techniques and working methods
- Development of machine technology
- Careful selection of stands for harvesting
- Broadening the practical training
- Multiple-tree handling
Ten most significant approaches to achieve more cost-efficient energy wood harvesting

- Improving the training of new operators
- Careful selection of stands for harvesting
- Careful selection of operator candidates
- Developing cutting techniques and working methods
- Grapple scale measuring
- More working hours for harvesting machinery
- Harvesting energy wood as whole trees
- Development of machine technology
- Maximization of load size
- Broadening the practical training
Ten most significant approaches to achieve more cost-efficient energy wood harvesting

- Improving the training of new operators
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- Broadening the practical training
Approaches with the greatest potential to improve the cost-efficiency of roundwood harvesting

- Careful selection of operator candidates
- Pre-clearance of dense undergrowth
- Effective tending of seedling stand
- Multiple-tree handling
- Broadening the practical training
- Delaying first thinning in a controlled manner
- Improving the training of new operators
- Grapple scale measuring
- Integrated wood harvesting with the two-pile cutting method
- Integrated wood harvesting with bundling
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- Integrated wood harvesting with the two-pile cutting method
- Integrated wood harvesting with bundling
Approaches with the greatest potential to improve the cost-efficiency of energy wood harvesting
Approaches with the greatest potential to improve the cost-efficiency of energy wood harvesting

- Energy wood harvesting as a part of the wood production chain
- Careful selection of operator candidates
- Grapple scale measuring
- Delaying harvesting operation in a controlled manner
- Improving the training of new operators
- Pre-clearance of dense undergrowth
- Broadening the practical training
- Integrated wood harvesting with bundling
- Utilization of more simple harvesting machinery
- Developing cutting techniques and working methods
Approaches with the greatest potential to improve the cost-efficiency of energy wood harvesting

- Energy wood harvesting as a part of the wood production chain
- Careful selection of operator candidates
- Grapple scale measuring
- Delaying harvesting operation in a controlled manner
- Improving the training of new operators
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- Broadening the practical training
- Integrated wood harvesting with bundling
- Utilization of more simple harvesting machinery
- Developing cutting techniques and working methods
Discussion & Conclusions

- In this study, education and operator factors proved to be of most importance for improving energy wood and industrial roundwood harvesting.
- In recent years, resource questions in Finland, such as these have been very topical issues in wood harvesting.
  - The results indicated that the training structure for forest machine operators will need to be examined very carefully in the near future.
Discussion & Conclusions

• There is a great potential to increase the cost-efficiency of wood harvesting in the future through improving harvesting conditions:
  - effective tending of seedling stands,
  - delaying harvesting operations,
  - pre-clearance of dense (spruce) undergrowth, and
  - new wood production methods (implementation of energy wood harvesting as a part of the wood production chain).

• Harvesting methods can be rationalized:
  - multiple-tree handling in industrial roundwood cuttings,
  - grapple scale measurement,
  - integrated pulpwood and energy wood harvesting, and
  - careful selection of stands for harvesting.
Discussion & Conclusions

- The most profitable guidelines must be more effectively utilized immediately in wood harvesting.
  - There would be significant possibilities for cost savings in young stands.
  - Cost savings of at least 5–10% can be achieved and, in some cases even 30–40%, compared to current wood harvesting costs.
Tack så mycket!

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