

Productivity and Costs of Whole-tree Bundling System in Early Thinnings

Kalle Kärhä (Metsäteho)

Juha Laitila (Metla)

Paula Jylhä (Metla)

Yrjö Nuutinen (Metla)

Productivity and Costs of Whole-tree Bundling System in Early Thinnings

- The study was conducted by Metsäteho and Metla 2007-2009
- Objectives
 - properties of whole tree bundles
 - productivity of whole-tree bundling and forwarding and long-distance transportation of whole-tree bundles
 - procurement costs of the whole-tree bundling supply chain



The Topic of this presentation



Productivity and cost of whole-tree bundling-forwarding chain



<http://www.youtube.com/watch?v=gb29cQqwbrg>

Material and Methods

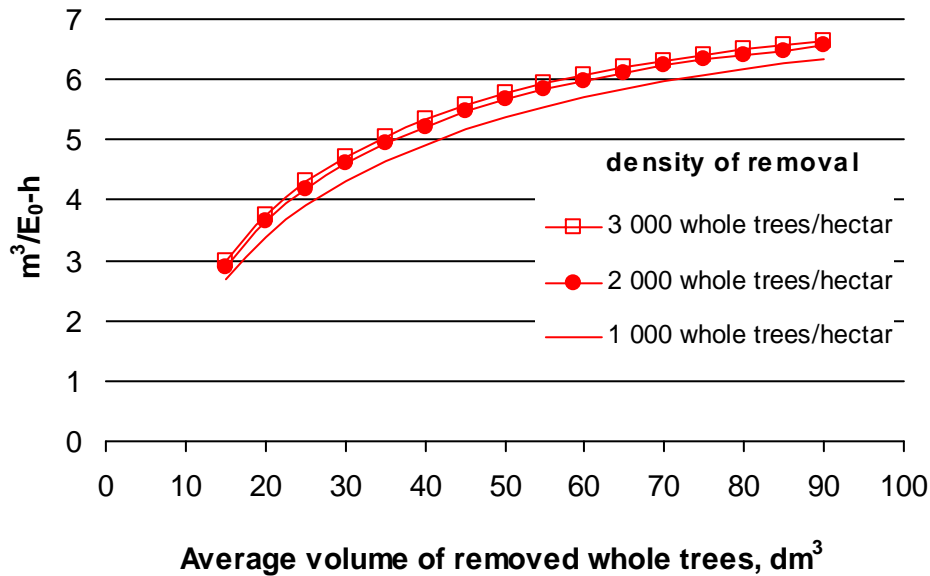
Field measurements in 2009

- 28 plots (20*50 m) in Central Finland:
 - 35-40 years old Scots pine stands, first thinnings in mineral soils
 - average BHD of cut trees 6-11 cm, average height 7.1-11.3 m
- Recordings
 - Time study of Fixteri II (two observers at the same time)
 - Stand data measurings for predicting the removal and the volume before cuttings...were needed for constructing the time consumption models
 - Measuring weight, solid volume, length and moisture content of the bundles
 - ❖ In order to analyze the properties of whole-tree bundles and their correlation with stand parameters

Field measurements in 2008

- Time study for forwarding whole tree bundles
 - time consumption of 50 load was recorded
 - 953 whole tree bundles and 160 pulp wood bundles

Productivity of whole-tree bundling

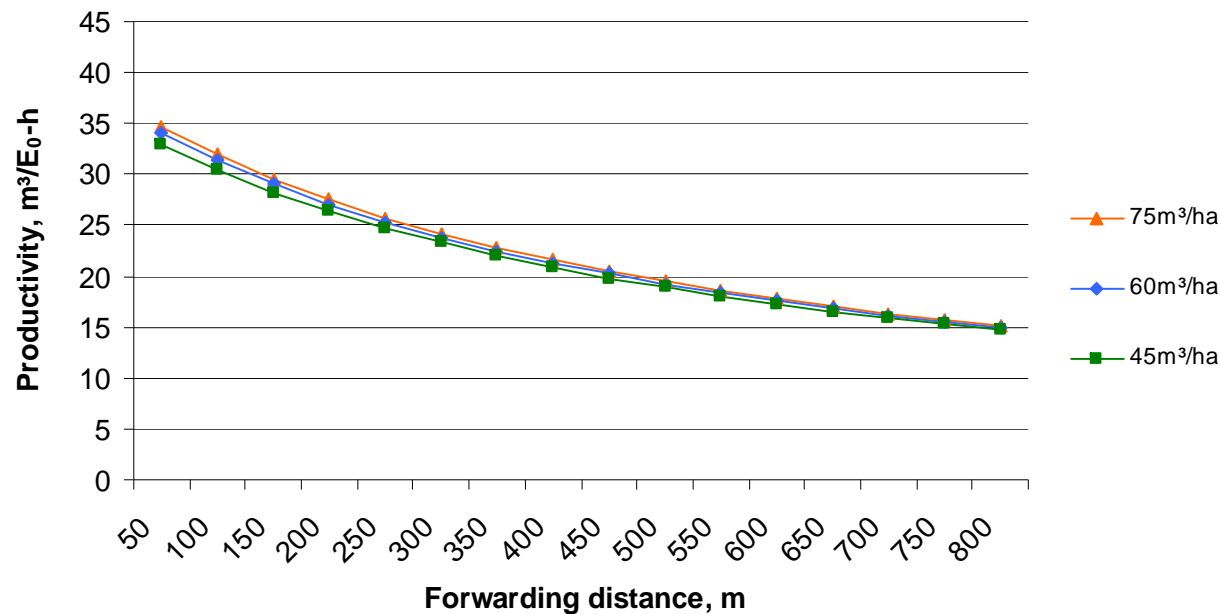


FIXTERI II: Productivity, m^3/E_0-h		
Density of removal, trees/hectar	Volume of removal, m^3	
	20	75
1000	3.4	6.1
3000	3.8	6.4

Productivity FIXTERI I vs. FIXTERI II				
Removal, trees/hectar	Volume of removal, dm^3	Productivity, m^3/E_0-h		Difference, %
		Fixteri I	Fixteri II	
1400	40	2.6	4.6	77
2850	31	3.7	5.1	38

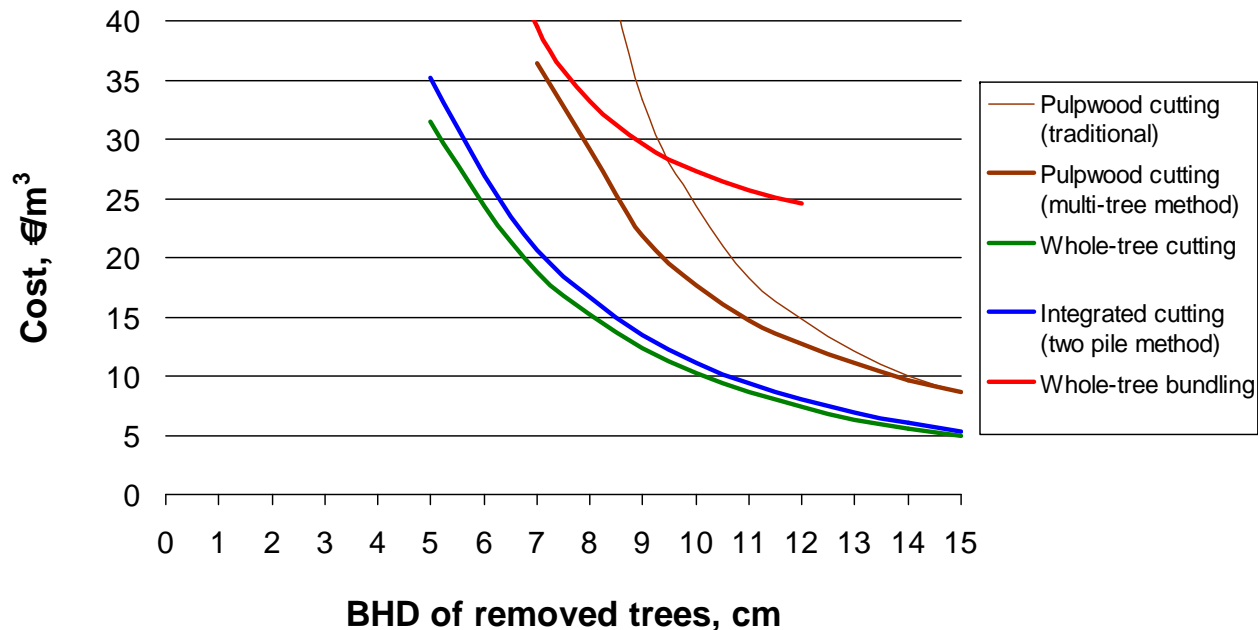
- The productivity of Fixteri II was significantly higher than Fixteri I
- Increase in average removal volume from 20 dm^3 to 75 dm^3 nearly doubled the productivity of Fixteri II

Productivity of forwarding of whole-tree bundles



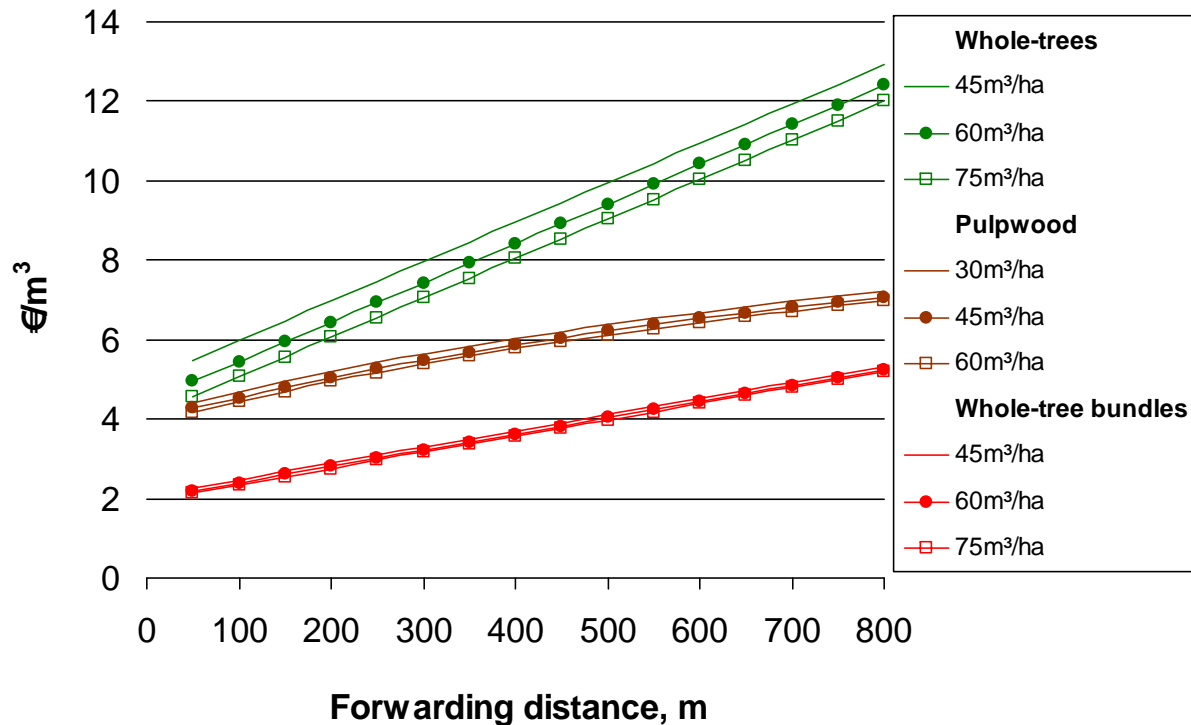
- Whole tree bundling increased the size of grapple load in loading and unloading
- load size increased significantly compared to conventional forwarding
- the average load size was 22 bundles (0.5 m^3/bundle)
- Forwarding productivity 23.8 $\text{m}^3/\text{E}_0\text{-hour}$ (whole tree removal 60 $\text{m}^3/\text{ha}/\text{forwarding distance 300 m}$)

Cost of whole-tree bundling



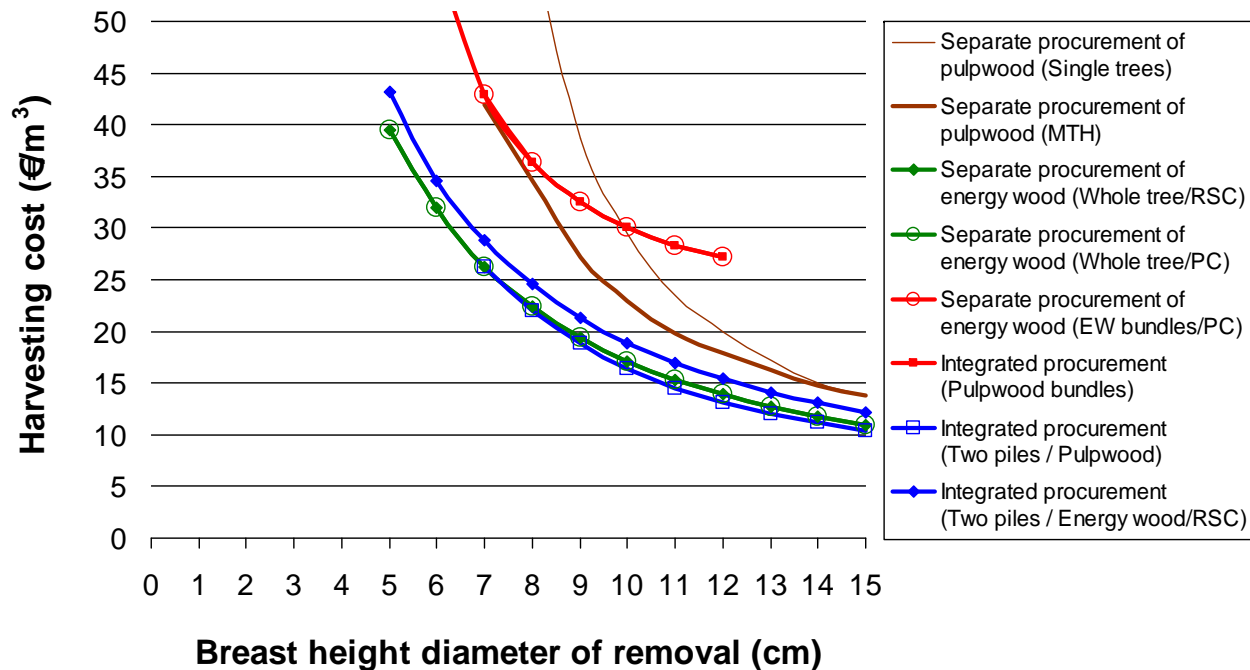
- The cost of whole tree bundling is relatively high compared to industrial round wood and energy wood cutting
- Bundling is an additional process which increases the total cost of cutting

Forwarding costs of whole-tree bundles



- The forwarding costs of whole tree bundles were significantly the lowest
- The forwarding costs of whole trees were over double compared to whole tree bundles
- The forwarding costs of conventional pulpwood 60% bigger

Costs of different logging methods (=cutting+forwarding)



- The lowest logging costs were for the whole tree method and integrated of pulpwood and energy wood method
- For energy production the logging costs of whole tree bundles are significantly higher than the logging costs of separate whole trees

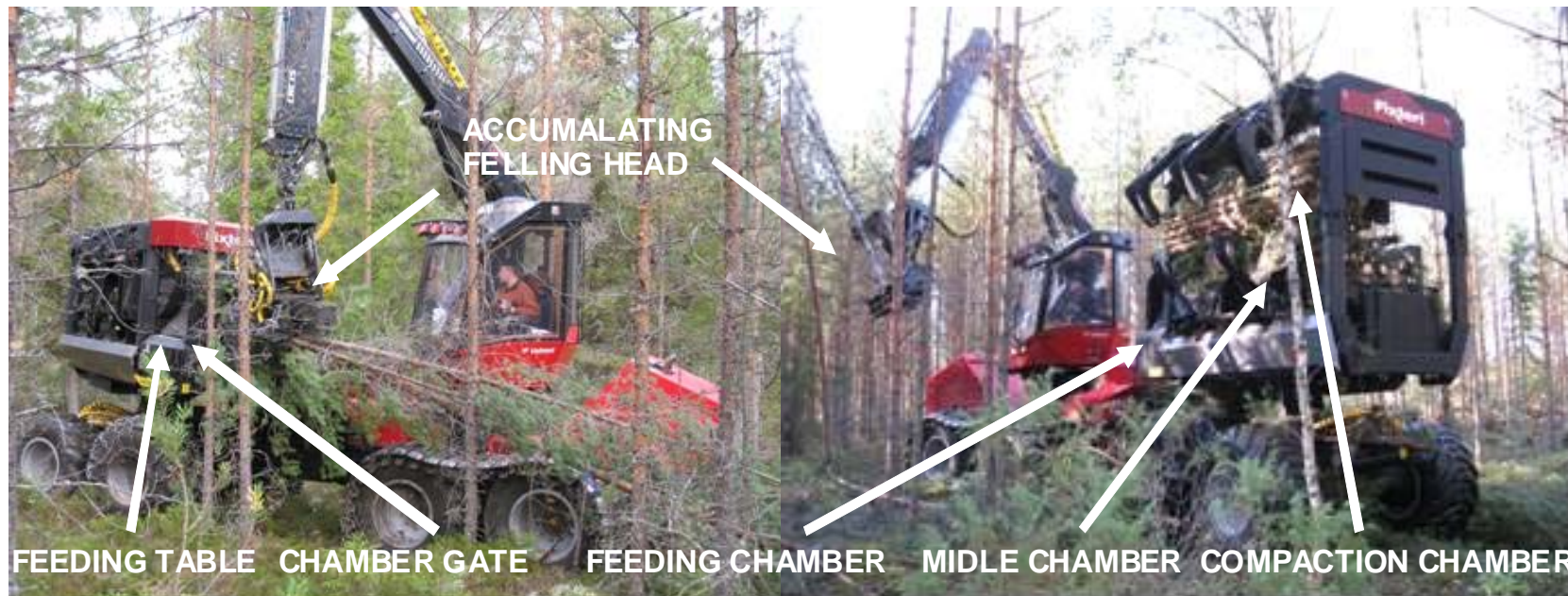
CONCLUSIONS

- The results of this study showed that the productivity of the whole-tree bundler Fixteri II was significantly higher compared with the first prototype Fixteri I
 - For the Fixteri II, the proportion of grapple bunches of not less than 2 whole trees was averagely 80% and the number of trees per grapple bunch averaged 2.9 trees
 - Respective values of Fixteri I 19%/1.3 trees
 - Higher level of simultaneous working processes: For Fixteri II the proportion of simultaneous work elements of the total effective working time was 36%...respectively for Fixteri I 26% (Jylhä and Laitila 2007)

CONCLUSIONS

Important reasons for the increased performance level!

- the improved grapple version was able to feed the trees directly to the bundling unit
- The hydraulic capacity and engine of the base machine of the second prototype was bigger compared to the first version



Development suggestions

- Decreasing the crane cycle time and increasing the number of whole trees per grapple bunch strengthening the construction of the accumulation head
- The movements of the harvester head can be rationalized by automating the crane functions
- Placing the feeding table and the bundling on the front side of the machine



FINAL CONCLUSION

- Our study revealed the developing potential of the whole-tree bundler Fixteri II in early thinnings
 - The optimal scope of application for whole-tree bundling is in first-thinning stands with a removal stem size of 7-10 cm bhd
 - The most competitive method for whole-tree bundling is the integrated procurement of pulpwood and energy wood

- The wood procurement chain of whole-tree bundling from young stands is not yet competitive
 - The efficiency of the whole-tree bundling supply chain must be improved from it's current level

THANK YOU FOR YOUR ATTENTION!

**Shut your mouth,
Roger! BUNDLING HAS A
FUTURE!**

