## SMALLWOOD

# Small diameter wood utilization with innovative stand management for multifunctional forests and a growing sustainable bio-economy

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### SMALLWOOD

#### **Overall objective:**

To develop and evaluate <u>new technologies and new business</u> and operational models that can support a sustainable management and utilization of different types of small diameter wood.

## Project partners



	Partner	Country	Respective funding organization	Contact person
SLU	Swedish University of Agricultural Sciences (SLU)	Sweden	Vinnova/Formas/SWEA	Prof.dr. Tomas Nordfjell
	Universidad Politécnica de Madrid (UPM)	Spain	ES/MINECO-AEI	Prof.dr. Eduardo Tolosana
GOZDARSKI INŠTITUT SLOVENUJE	Slovenian Forest Institute (SFI)	Slovenia	SI/MIZS	Dr. Nike Krajnc
UNIVERSITY OF EASTERN FINLAND	University of eastern Finland, School of Forest Sciences (UEF)	Finland	FI/MMM and FI/AKA	Prof.dr Teppo Hujala
University of Maribor Faculty of Economics and Business	Faculty of Economics and Business, University of Maribor (FEB)	Slovenia	SI/MIZS	Prof.dr. Zdenka Ženko
Bracke	Bracke Forest	Sweden	Vinnova/Formas/SWEA	CEO Klas-Håkan Ljungberg

#### SMALLWOOD Project WPs

WP1 Project management and monitoring SDS3 Fire prev. SDS1 Conv. SDS2 Coppice SDS4 Linear areas bush areas thinning stands stands WP2 Harvesting- and supply systems for innovative and sustainable management of multifunctional SDS Functionality, productivity, possible logistic systems, future development of treated stands, economic system analysis, applicability within different management systems WP3 Socio economic aspects of the SDS stand managements Private forest owner motivation, acceptance from the public opinion, business opportunities and rural development. WP4 Environmental assessment of the SDS managements Tree damages, soil damages like rutting and soil compaction, material and energy consumption and emissions to air, water and soil. WP5 Overall analyses of the economic, social and environmental values of the SDS managements Analyses that include results from traditional economic system analysis (WP2), socio economic analyses (WP3) and LCA analyses (WP4) into multi criteria decision analyses.

#### WP6 Communication and project transnational outreach

#### SMALLWOOD Project WPs



#### WP6 Communication and project transnational outreach



## Preliminary results WP2 Harvesting and supply systems

ForestValue presentation, 17-18<sup>th</sup> November 2020 (Webinar)

Tomas Nordfjell, Professor in Forest Technology at SLU.

#### Materials and Methods

We upgraded and evaluated the accumulating felling head Bracke C16.c, with a Komatsu 901.4 as base machine, during the first thinning of dense forests.

The innovation: unique for these trials, a "horn-shaped" support was mounted between the head and the rotator, aiming to stabilize the handling of long trees during the movement of the crane.



#### Materials and Methods

Field trials were performed in Sweden, Finland and Slovenia during the Fall-Spring 2019/2020, using the same head, base-machine and operator. (Postponed in Spain due to the Covid-19 pandemic)







Materials and Methods

The thinning trials aimed to compare **two working methods**:

The novel, boom-corridor (BC) thinning with a conventional, selective **(S)** thinning from bellow as reference:



#### **Boom-corridor thinning (BC)**



#### **Conventional selective thinning (S)**



#### Materials and Methods

- 1. Marking and pre-inventory of 1000 m<sup>2</sup> study units within a number of stands;
- 2. Time study of the Bracke C16c SMALLWOOD version;
- 3. Forwarding and scaling of biomass;
- 4. Post-inventory of study unitem





#### Materials and Methods

Bräcke, northern Sw	eden	
20 study units		
Age of the stand	26 years, PCT in 2002	
Species (% trees ≥7 cm)	25% broadl, 64% pine, 11%	
ALL AND AND	spruce	
Mean DBH arit / BA-	4.3 cm / 11.4 cm	
weighted		
Mean height arit / BA-	5.7 m / 10.3 m	
weighted		

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All drone images in this presentation were taken by Christian Höök (SLU)

#### Materials and Methods

Kontiolahti (1), east	tern Finland
6 study units	
Age of the stand	27 years, not PCT
Species (%trees ≥7 cm)	70% broadl, 30% spruce
Mean DBH arit / BA- weighted	4.5 cm / 8.4 cm
Mean height arit / BA-	5.7 m / 9.2 m
weighted	
Mean density (trees ≥1	7 767 trees ha <sup>-1</sup> (5 150–12
cm)	700)
Mean density (trees ≥4	4 083 trees ha <sup>-1</sup> (2 650–6

#### Materials and Methods

Kontiolahti (2), east 6 study enits	
Age of the stand	26 years, not PCT
Species (%trees ≥7 cm)	95% broadl, 5% spruce
Mean DBH arit / BA-	4.5 cm / 8.3 cm
weighted	
Mean height arit / BA- weighted	6.4 m / 10.5 m
Mean density (trees ≥1	10 558 trees ha-1 (9 350–11
cm)	950)
Mean density (trees $\geq 4$	5 658 trees ha <sup>-1</sup> (4 800–6

#### Materials and Methods

18 study units

Mozelj (1), southern Slovenia

Species Mean DBH arit Mean density (trees 21 cm) Mean standing

Mix of broadleavesTilia cordataMix of broadleavesOther broadleaves5.3 cmBetula pendula8 mCorylus avellana11 083 trees ha<sup>-1</sup> (7 850–15450)231 m³ ha<sup>-1</sup>

Fagus sylvatica

pseudoplatanus Fraxinus excelsior

Ulmus glabra

Acer

volume

#### Materials and Methods





Finally then

## Preliminary

# RESULTS!

#### Results

In general, the novel BC thinning method gave a higher productivity than the conventional S method. All study units in all stands in all countries (n=64): Overall **<u>16% higher productivity</u>** with the novel BC method (average 5.4 and 4.7 dry tonnes/PMh). Differences <u>almost</u> statistically significant (p = 0.054).

9 Productivity (dry tonnes PMh<sup>-</sup> 8 7 Boom corridor thinning 6 Selective thinning (reference) 4 3 2 Study unit

◆ BC ■ S

#### Results

In general, the novel BC thinning method gave a higher productivity than the conventional S method. All study units in all stands in all countries (n=64): <u>Productivity as function of mean DBH before harvest</u>.



#### Results

In general, the novel BC thinning method gave a higher productivity than the conventional S method. All study units in all stands in all countries (n=64): <u>Productivity as function of biomass removal</u>.





## **SMALLWOOD** international experiences

## Sweden and Finland have often bad ground conditions!

## Slovenia has often steep terrain!





## Thanks for your attention!

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