ForestValue

Bio Future 2025

ACADEMY OF FINLAND

Ministry of Agriculture and Forestry of Finland

UNIVERSITY OF EASTERN FINLAND

SMALL WOOD

Smallwood International Conference:
The pathway for efficient utilization of small diameter wood

Empirical findings on the sustainability analysis of Small diameter stands harvesting in Finland, Slovenia, Spain, and Sweden

1st June 2022, Ultuna (Sweden) & Zoom

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UNITE
FOREST-HUMAN-MACHINE INTERPLAY

Outline

Objectives & What was assessed

Sustainability and value creation analysis – preliminary results

- Sweden
- Finland
- Slovenia
- Spain

Conclusions & What next

Photograph: Teppo Hujala

Objective and steps taken

- To determine and compare the overall sustainability impacts and value-creation effects of the studied harvesting and extracting innovations
    - Constructing an analytical multi-criteria framework
    - Collecting relevant results from the project's traditional economic system analysis, socio-economic analyses and environmental analyses
    - Eliciting ratings and weightings from invited experts and stakeholders
    - Calculating and illustrating the overall sustainability and value creation results
    - (Discussing the results with stakeholders in national workshops – not reported here)

Photograph:
Brackeforest.com

Intertwined targets of assessment

Service/business model	• Improved profitability for contractors • Value proposition for forest owners
Working methods	• Boom-corridor thinning • Combined felling and chipping; biomass baling
Harvesting technology	• Felling head • Wood extraction system

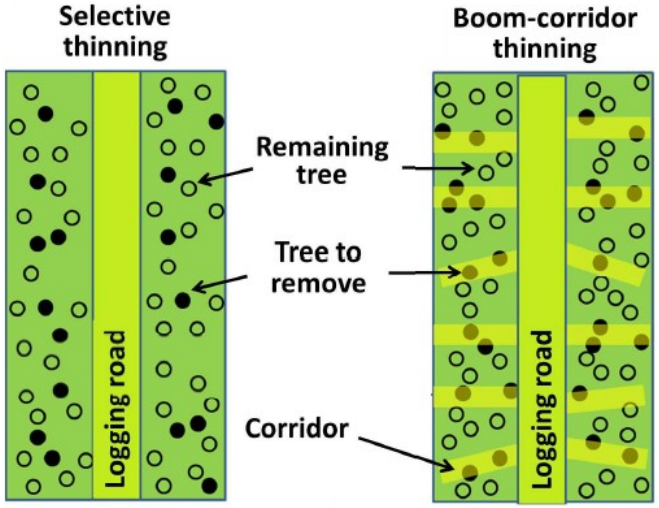
Photograph: Teppo Hujala

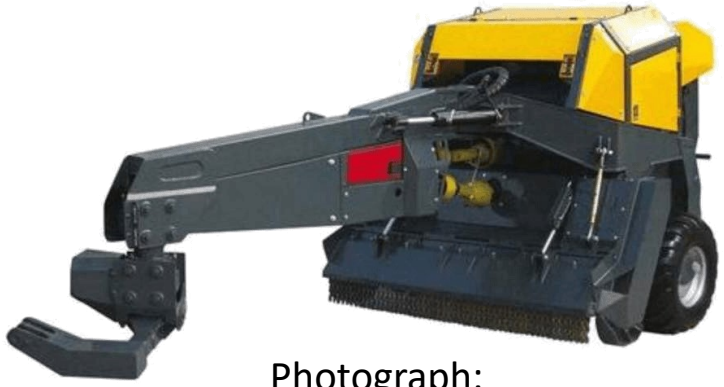
Here the assessment was connected to the national context and relational to current prevailing practise!

Assessed innovation candidates

- Bracke C16.c felling head with an additional horn-shaped support
- Boom-corridor thinning working method
- Mechanized small-diameter wood harvesting in general
- In Spain: i) BioBaler; ii) Retrabio

Photograph: Raul Fernandez Lacruz

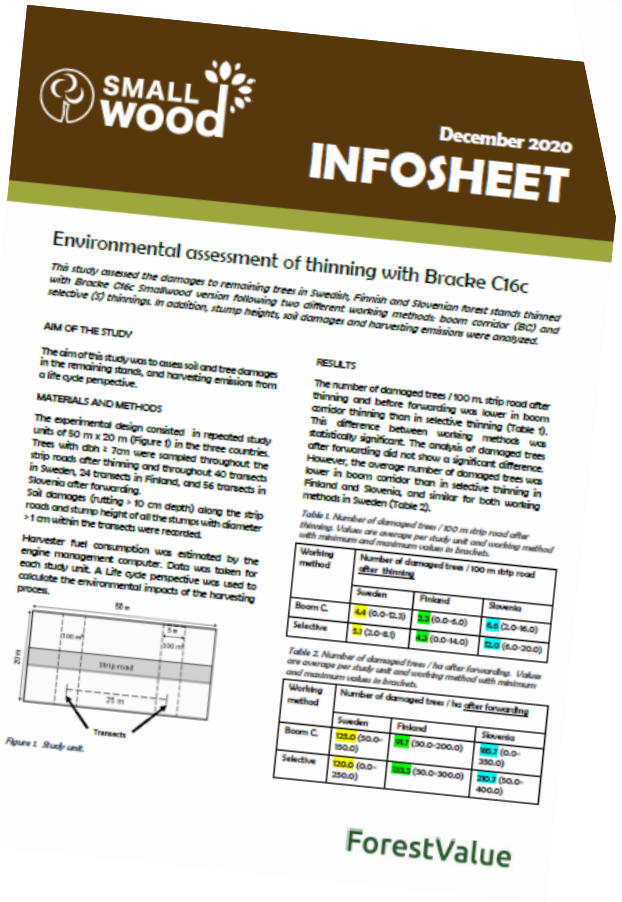




Photograph: grpanderson.com

Photograph: Eduardo Tolosana

Background information for the rating exercise – Finnish example



Expert rating, Sweden (+ Stakeholder rating for comparison)

Bracke C16.c N=4+7

Dimension	Criterion	Average Weight	Average Rating	Difference to current best practice, %	Weighted average	Stakeholder rating: Difference to current best practice, %
Econ	Operational efficiency	38 %	122,50	22,5	9,4	13,6
	Investment payoff	32 %	102,50	2,5		0,7
	Harvesting damages	30 %	100,00	0,0		5,0
Ecol	Fire risk	26 %	101,25	1,3	1,0	2,9
	Climate benefits	29 %	102,50	2,5		10,7
	Biodiversity	25 %	100,00	0,0		-5,7
	Ground water	21 %	100,00	0,0		0,0
Soc-cult	Attractive to forest owners	29 %	108,75	8,8	5,6	0,0
	Attractive to contractors	27 %	111,25	11,3		12,1
	Recreational benefits	22 %	93,75	-6,3		-7,9
	Rural jobs	22 %	106,25	6,3		10,7
Value creation	Business model renewal	32 %	102,50	2,5	4,6	11,4
	National upscaling	36 %	103,75	3,8		10,0
	European upscaling	33 %	107,50	7,5		15,7

Expert rating, Finland (+ Stakeholder rating for comparison)

Bracke C16.c N=2+5

Dimension	Criterion	Average Weight	Average Rating	Difference to current best practice, %	Weighted average	Stakeholder rating: Difference to current best practice, %
Econ	Operational efficiency	38 %	85,00	-15,0	-16,6	3,0
	Investment payoff	33 %	80,00	-20,0		-1,0
	Harvesting damages	30 %	85,00	-15,0		5,0
Ecol	Fire risk	18 %	90,00	-10,0	-7,2	6,0
	Climate benefits	34 %	90,00	-10,0		8,2
	Biodiversity	35 %	100,00	0,0		3,8
	Ground water	14 %	85,00	-15,0		2,0
Soc-cult	Attractive to forest owners	31 %	85,00	-15,0	-16,80	11,0
	Attractive to contractors	24 %	75,00	-25,0		3,4
	Recreational benefits	19 %	95,00	-5,0		3,0
	Rural jobs	26 %	80,00	-20,0		11,0
Value creation	Business model renewal	24 %	65,00	-35,0	-23,25	4,4
	National upscaling	34 %	75,00	-25,0		10,0
	European upscaling	42 %	85,00	-15,0		13,0

Expert rating, Slovenia

Bracke C16.c N=8

Dimension	Criterion	Average Weight	Average Rating	Difference to current best practice, %	Weighted average
Econ	Operational efficiency	34 %	208,13	108,1	52,7
	Investment payoff	34 %	137,19	37,2	
	Harvesting damages	32 %	109,38	9,4	
Ecol	Fire risk	23 %	108,91	8,9	1,7
	Climate benefits	26 %	102,03	2,0	
	Biodiversity	22 %	93,75	-6,3	
	Ground water	28 %	101,88	1,9	
Soc-cult	Attractive to forest owners	26 %	104,69	4,7	19,31
	Attractive to contractors	34 %	158,59	58,6	
	Recreational benefits	14 %	101,88	1,9	
	Rural jobs	26 %	92,50	-7,5	
Value creation	Business model renewal	38 %	141,88	41,9	60,28
	National upscaling	29 %	174,97	75,0	
	European upscaling	34 %	168,41	68,4	

Expert rating, Spain (+ Stakeholder rating for comparison)

Bracke C16.c N=3+3

Dimension	Criterion	Average Weight	Average Rating	Difference to current best practice, %	Weighted average	Stakeholder rating: Difference to current best practice, %
Econ	Operational efficiency	37 %	216,67	116,7	68,5	40,0
	Investment payoff	33 %	146,67	46,7		36,7
	Harvesting damages	30 %	133,33	33,3		-16,7
Ecol	Fire risk	67 %	103,33	3,3	-11,2	10,0
	Climate benefits	1 %	33,33	-66,7		3,3
	Biodiversity	1 %	66,67	-33,3		0,0
	Ground water	33 %	56,67	-43,3		-10,0
Soc-cult	Attractive to forest owners	10 %	53,33	-46,7	21,44	63,3
	Attractive to contractors	53 %	150,00	50,0		73,3
	Recreational benefits	1 %	66,67	-33,3		23,3
	Rural jobs	35 %	100,00	0,0		26,7
Value creation	Business model renewal	75 %	150,00	50,0	33,23	36,7
	National upscaling	13 %	83,33	-16,7		20,0
	European upscaling	13 %	83,33	-16,7		3,3

Expert rating, Spain (+ Stakeholder rating for comparison)

BIOBALER N=2+2

Dimension	Criterion	Average Weight	Average Rating	Difference to current best practice, %	Weighted average	Stakeholder rating: Difference to current best practice, %
Econ	Operational efficiency	43 %	95	-5,0	-13,7	-10,0
	Investment payoff	39 %	70	-30,0		-20,0
	Harvesting damages	19 %	100	0,0		0,0
Ecol	Fire risk	38 %	105	5,0	11,0	40,0
	Climate benefits	36 %	125	25,0		5,0
	Biodiversity	15 %	100	0,0		-10,0
	Ground water	10 %	100	0,0		-25,0
Soc-cult	Attractive to forest owners	34 %	88	-12,5	-0,86	80,0
	Attractive to contractors	22 %	80	-20,0		15,0
	Recreational benefits	18 %	100	0,0		25,0
	Rural jobs	26 %	130	30,0		5,0
Value creation	Business model renewal	31 %	130	30,0	21,66	35,0
	National upscaling	39 %	120	20,0		10,0
	European upscaling	30 %	115	15,0		10,0

Expert rating, Spain (+ Stakeholder rating for comparison)

RETRABIO N=2+3

Dimension	Criterion	Average Weight	Average Rating	Difference to current best practice, %	Weighted average	Stakeholder rating: Difference to current best practice, %
Econ	Operational efficiency	38 %	110	10,0	0,0	43,3
	Investment payoff	38 %	90	-10,0		-10,0
	Harvesting damages	25 %	100	0,0		-11,7
Ecol	Fire risk	30 %	120	20,0	19,8	20,0
	Climate benefits	34 %	140	40,0		33,3
	Biodiversity	26 %	100	0,0		-13,3
	Ground water	9 %	100	0,0		0,0
Soc-cult	Attractive to forest owners	27 %	110	10,0	9,49	1,7
	Attractive to contractors	26 %	105	5,0		6,7
	Recreational benefits	20 %	100	0,0		-13,3
	Rural jobs	27 %	120	20,0		33,3
Value creation	Business model renewal	37 %	120	20,0	10,56	20,0
	National upscaling	33 %	105	5,0		6,7
	European upscaling	30 %	105	5,0		13,3

Conclusions

The intertwined target of assessment and experts'/stakeholders' varying perspectives can be seen in the results (especially in Finland)

The numbers represent innovation candidates' relative up-/downgrading in percentages compared to current prevailing practice

- The numbers may only be viewed as indicative
- …to point to relative strengths/weaknesses and aspects to praise and issues to tackle

Overall, the highest contribution of Bracke C16.c was in economic sustainability with high contextual variation in socio-cultural sustainability (note: trade-offs were not studied here)

Slovenia exhibited high interest in mechanized smallwood harvesting

Swedish evaluators trusted a lot in the upscaling potential, reasons for that?

Both BioBaler and Retrabio had upscaling potential in Spain and beyond, despite some notable negative sustainability impacts

What next? Some suggestions

More **evidence** for assessing the **environmental** sustainability of smallwood harvesting, both on forest stands and in forest use

- Preferably **absolute**, not relational sustainability impacts

Photograph: Satu Helenius

Continuing studies to address the aspects that received **high negative sustainability impacts**: what is wrong with those innovation candidates and what could be done?

More focus on **business model renewal** and **success factors for upscaling**

Using **digital twins of forests** to do harvesting tests with **spatially realistic** virtual forests, simulators, and a higher number of test persons (students and entrepreneurs)

Thank you!