Environmental assessment of thinning with Bracke C16c Smallwood version

Smallwood

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Polytechnic University of Madrid

Objective

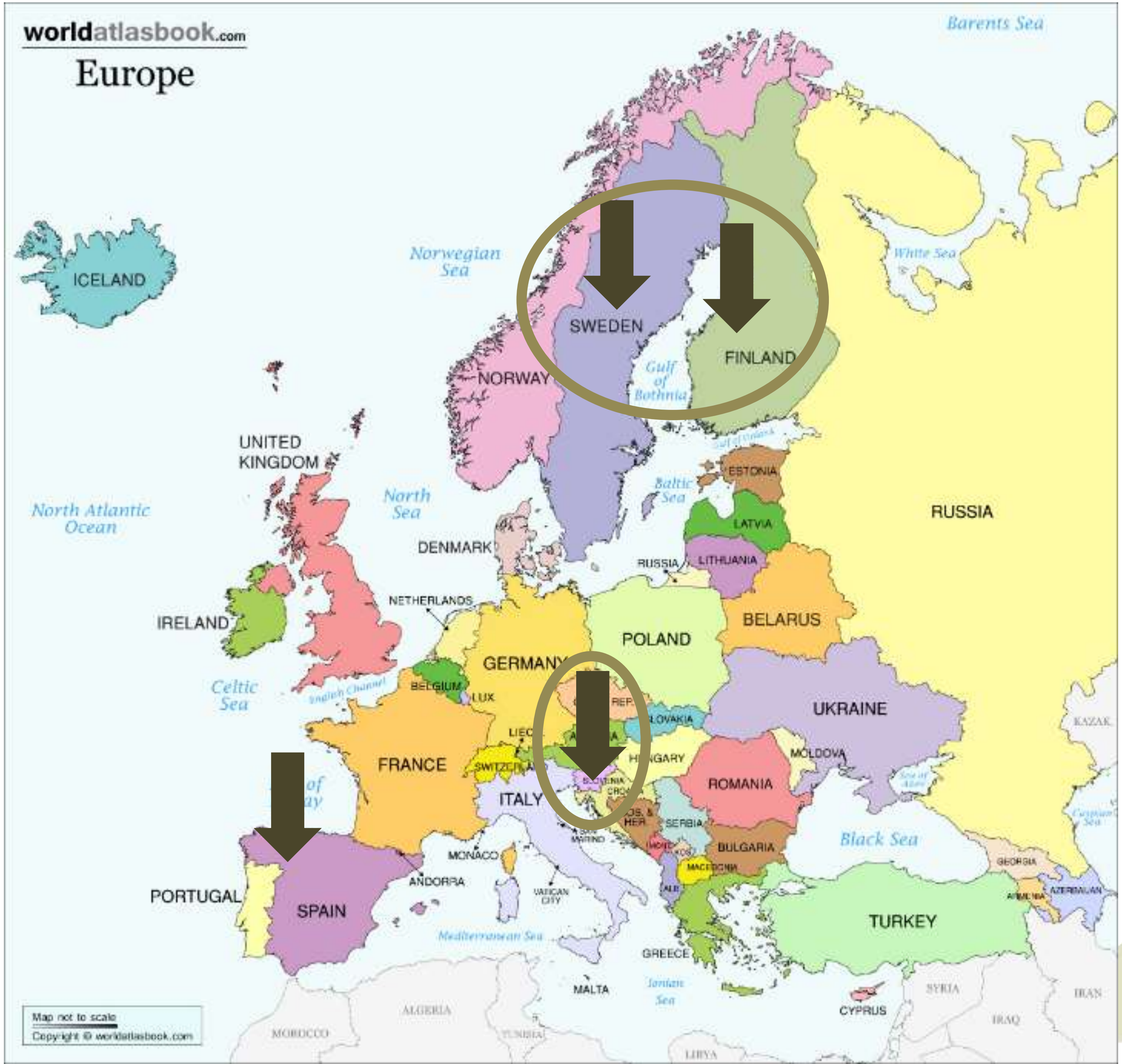
Main aim:

- To evaluate the environmental profile of the harvesting and extraction innovations in relation to the extracted wood volumes

Specific aims:

- To assess soil and tree damages in the remaining stand
- To assess harvesting emissions from a life cycle perspective

Location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Europe
Barents Sea
ICELAND
Norwegian Sea
White Sea
SWEDEN
FINLAND
NORWAY
Gulf of Bothnia
UNITED KINGDOM
North Atlantic Ocean
North Sea
Baltic Sea
ESTONIA
LATVIA
RUSSIA
DENMARK
RUSSIA
LITHUANIA
NETHERLANDS
IRELAND
POLAND
BELARUS
GERMANY
Celtic Sea
BELGIUM
LUX
UKRAINE
FRANCE
MOLDOVA
ROMANIA
ITALY
SERBIA
BULGARIA
Black Sea
MONACO
ANDORRA
PORTUGAL
SPAIN
TURKEY
Mediterranean Sea
GREECE
MALTA
CYPRUS
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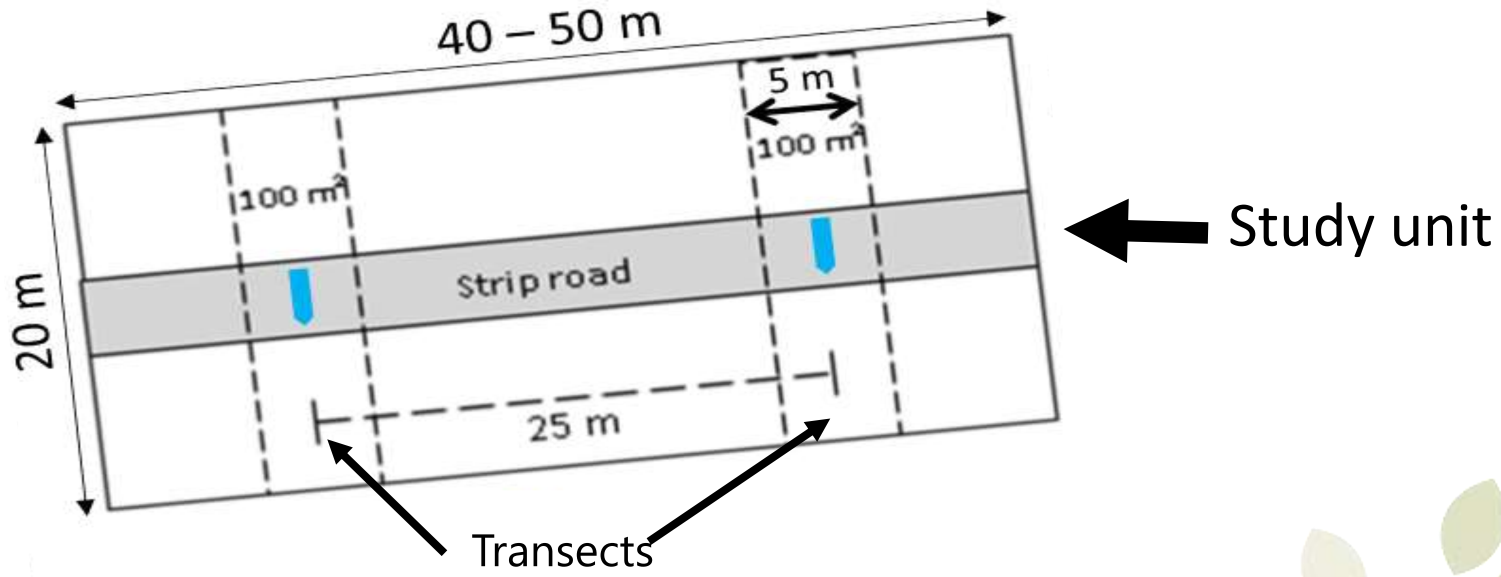
Methodology

Tree and soil damages

Trees with dbh ≥ 7cm were sampled throughout the strip roads after thinning and throughout the transects after forwarding.



Soil damages (rutting > 10 cm depth) were measured along the strip road before forwarding

Stump height

was measured in all the stumps with diameter > 1 cm within the transects

Harvesting emissions

Harvester fuel consumption was estimated by the engine management computer. Data was taken for each study unit.

A Life cycle perspective was used to calculate the environmental impacts of the harvesting process.

Results

Damaged tree number per working method

Working method	Number of damaged trees / 100 m strip road after thinning		
	Sweden	Finland	Slovenia
Boom C.	4.4 (0.0-12.3)	2.3 (0.0-6.0)	6.6 (2.0-16.0)
Selective	5.1 (2.0-8.1)	4.3 (0.0-14.0)	12.0 (6.0-20.0)

Values are average per study unit and working method with minimum and maximum values in brackets.

The difference between working methods was statistically significant

Damaged tree number per working method

Working method	Number of damaged trees / ha after forwarding		
	Sweden	Finland	Slovenia
Boom C.	125.0 (50.0-150.0)	91.7 (50.0-200.0)	185.7 (0.0-350.0)
Selective	120.0 (0.0-250.0)	133.3 (50.0-300.0)	210.7 (50.0-400.0)

Values are average per study unit and working method with minimum and maximum values in brackets.

Damage characteristic

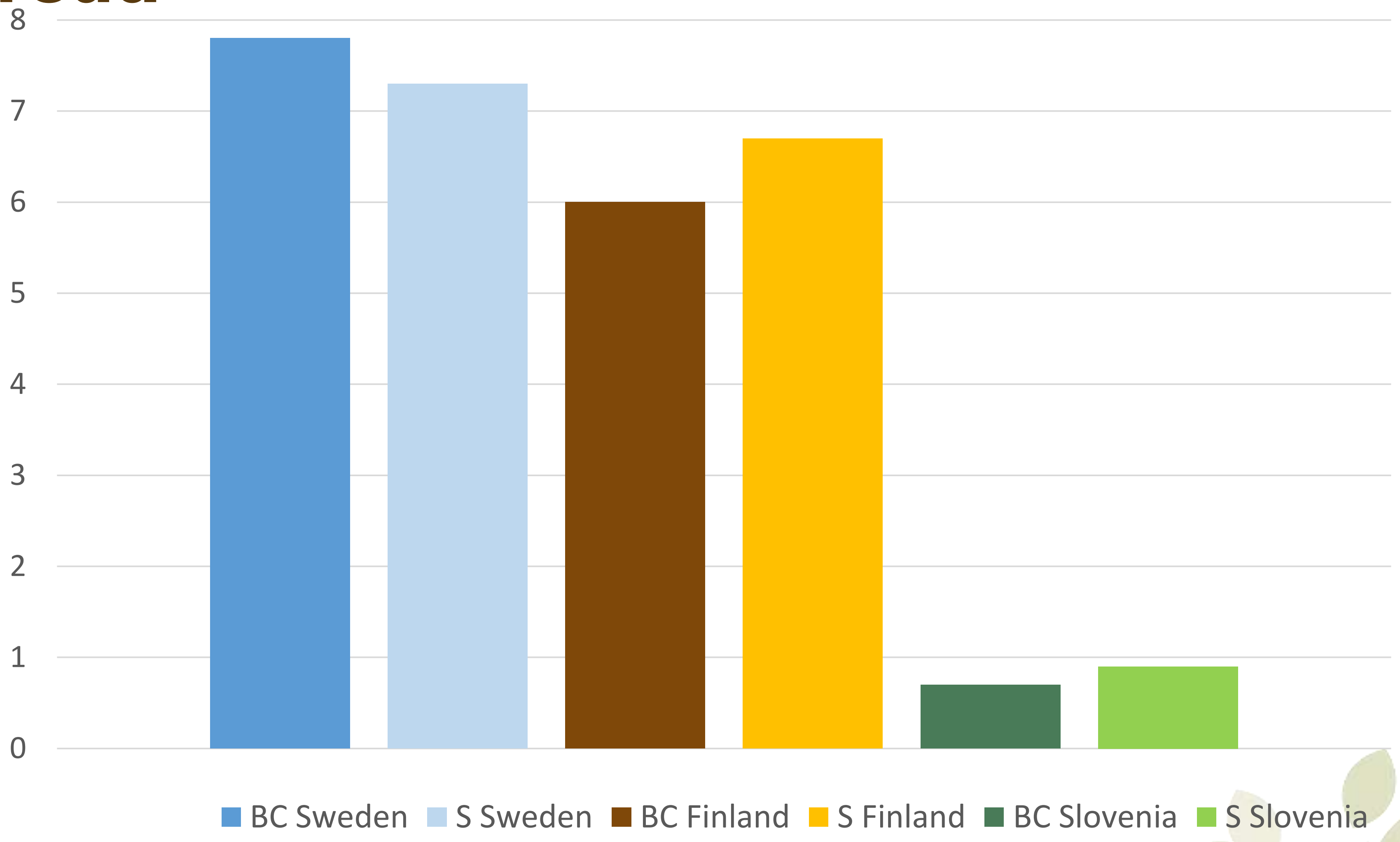
In Sweden and Finland most of the damages were "**bark squeezed**" at stem heights **higher than 100 cm** and **smaller than 50 cm²** for both working methods.

In Slovenia most of the damages were “**bark scratched**” at stem height **higher than 100 cm** for both working methods, and **smaller than 50 cm^2** in boom corridor thinning. Damages **larger than 200 cm^2** were the most abundant damage size in selective thinning.

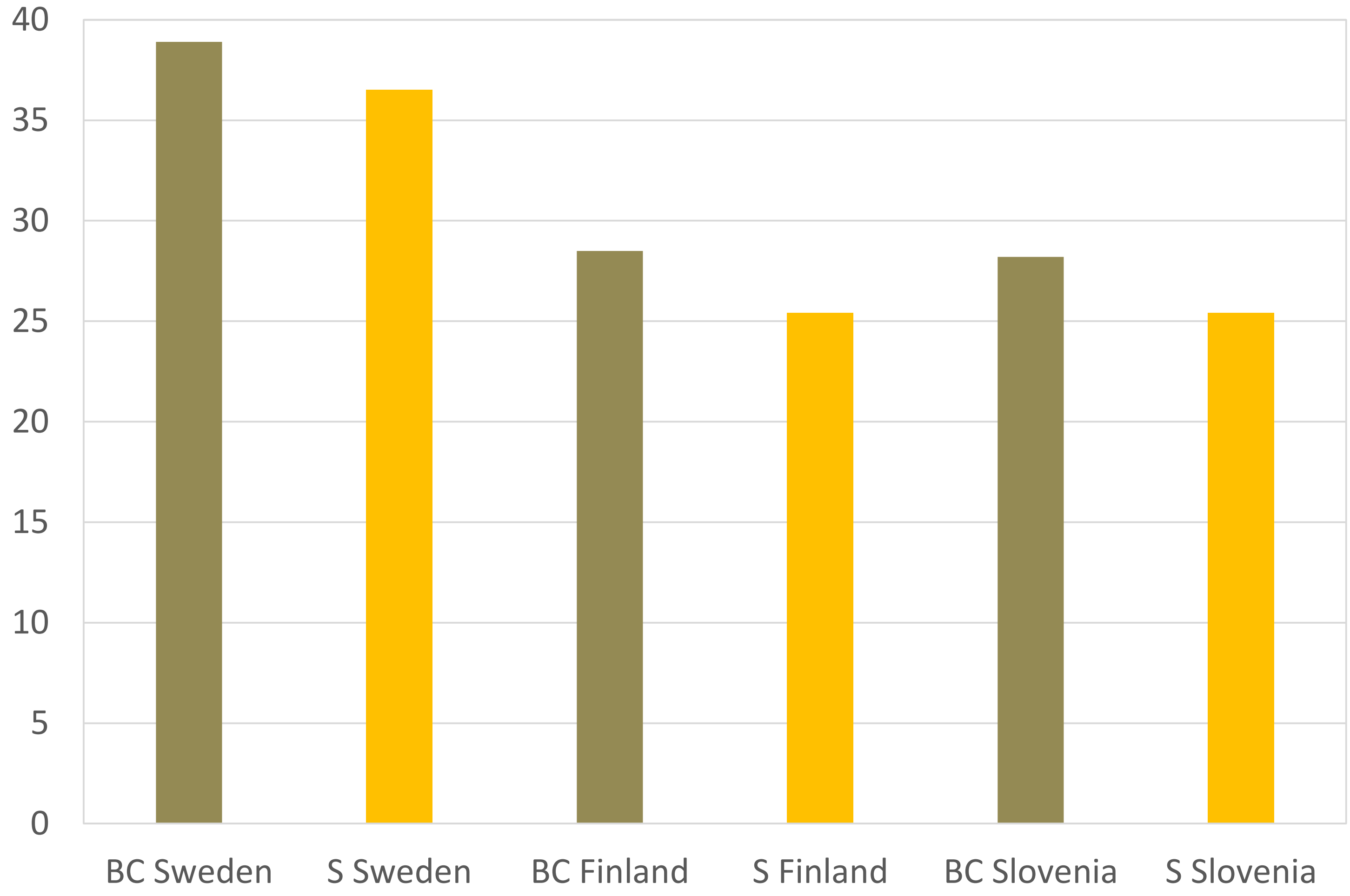
The main **damage cause** was the **harvester head** movement for all countries and for both working methods.

The **destroyed tree number** was **very low** in all countries and for both working methods (between 0 and 0.3 trees per study unit)

Soil damages m/100 m strip road



Average stump height (cm)

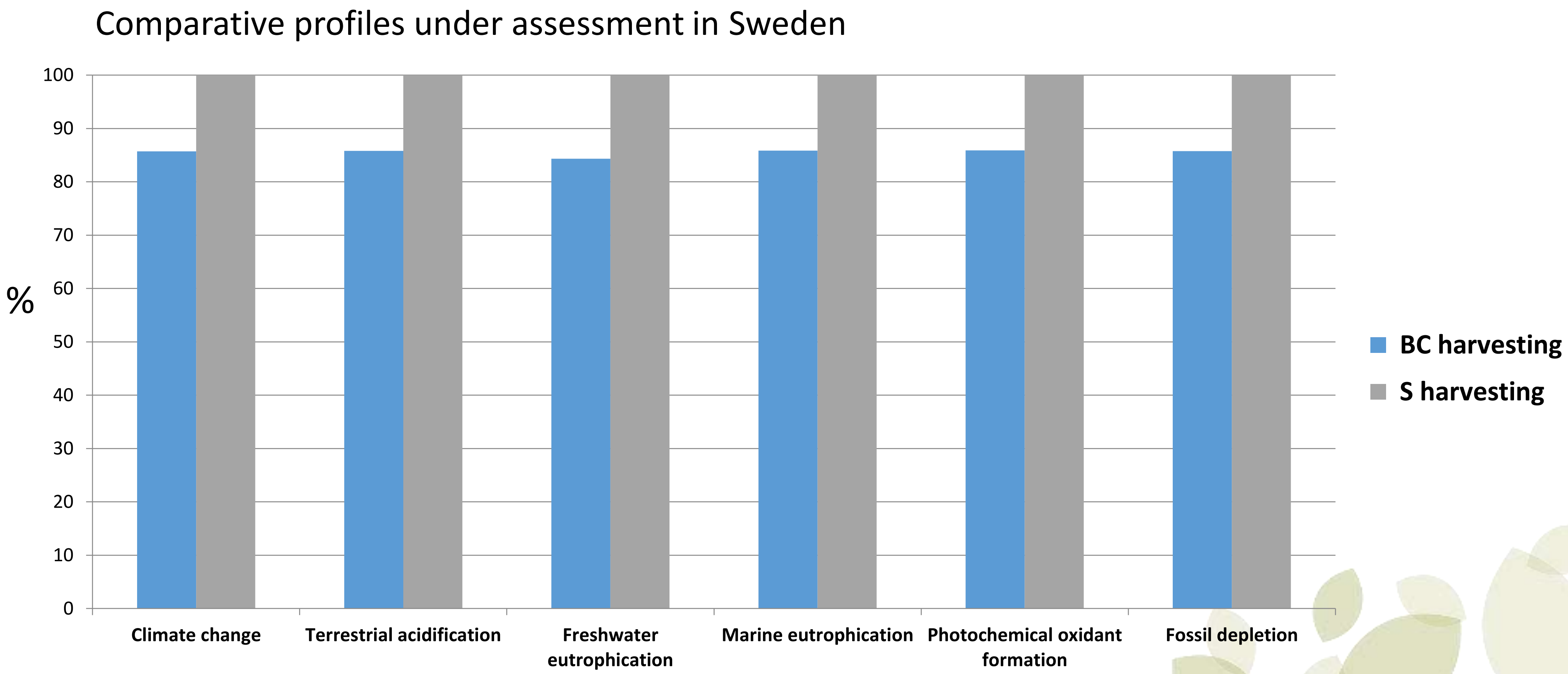


Harvesting fuel consumption

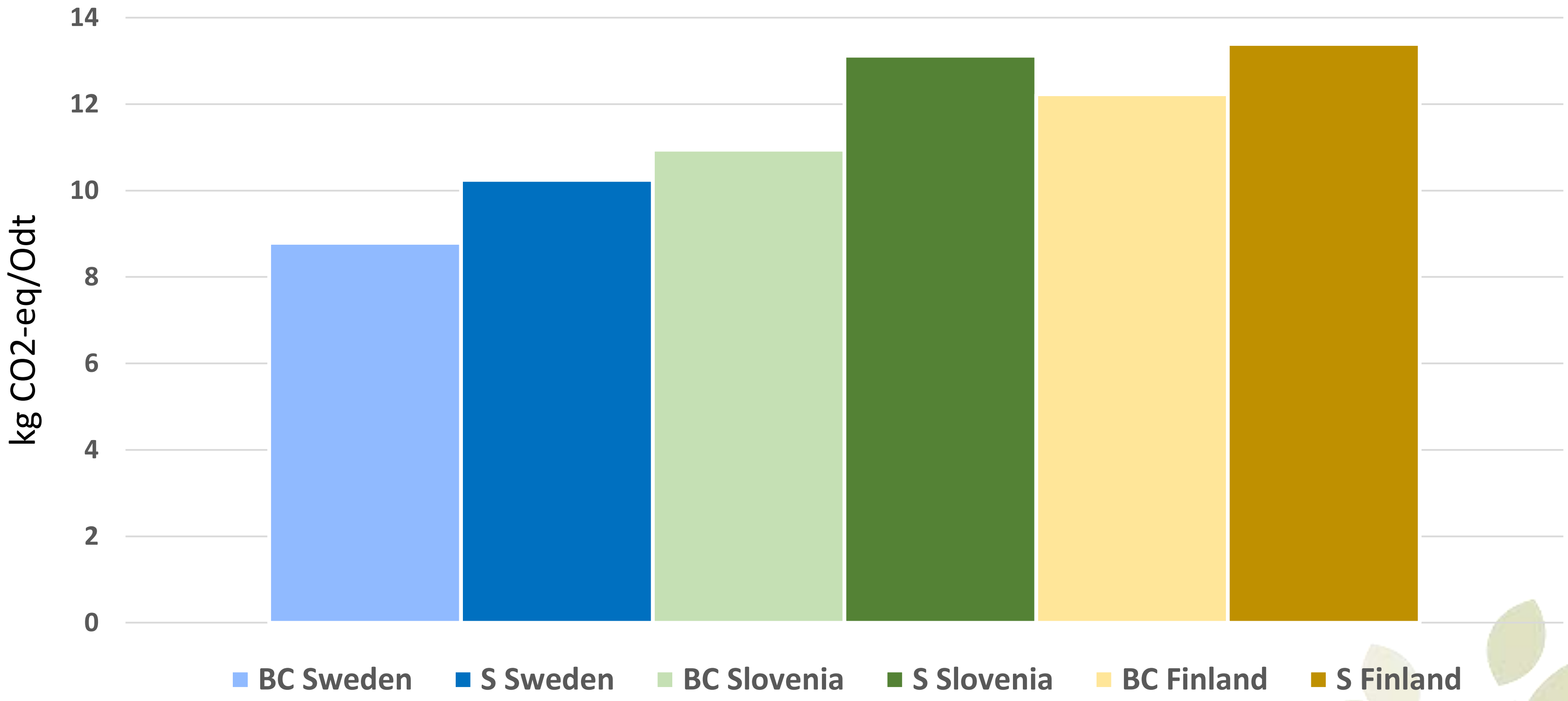
Working method	**Average diesel consumption (l/Odt)**		
	Sweden	Finland	Slovenia
Boom corridor	2.34	3.15	2.84
Selective	2.72	3.45	3.43

Harvesting emissions

Boom corridor thinning exhibited the lowest emissions on average in all the environmental impact categories.



In terms of greenhouse gas emissions, BC harvesting emissions were 14%, 16% and 9% lower than S harvesting in Sweden, Slovenia and Finland respectively.



There was no statistical difference between the working methods in the variables analyzed, with the exception of the number of damaged trees /100 m strip road after thinning.

Conclusions

- Damages on soil, the average stump height, the tree damage characteristics and the main cause of tree damages were similar in both working methods.

- The number of damaged trees observed after thinning was lower in boom corridor thinnings than in selective thinning.

- Although there was no statistical difference in emissions between the working methods, boom corridor thinning seems to be more energy efficient than selective thinning due to a lower time consumption, and therefore a lower fuel consumed.

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