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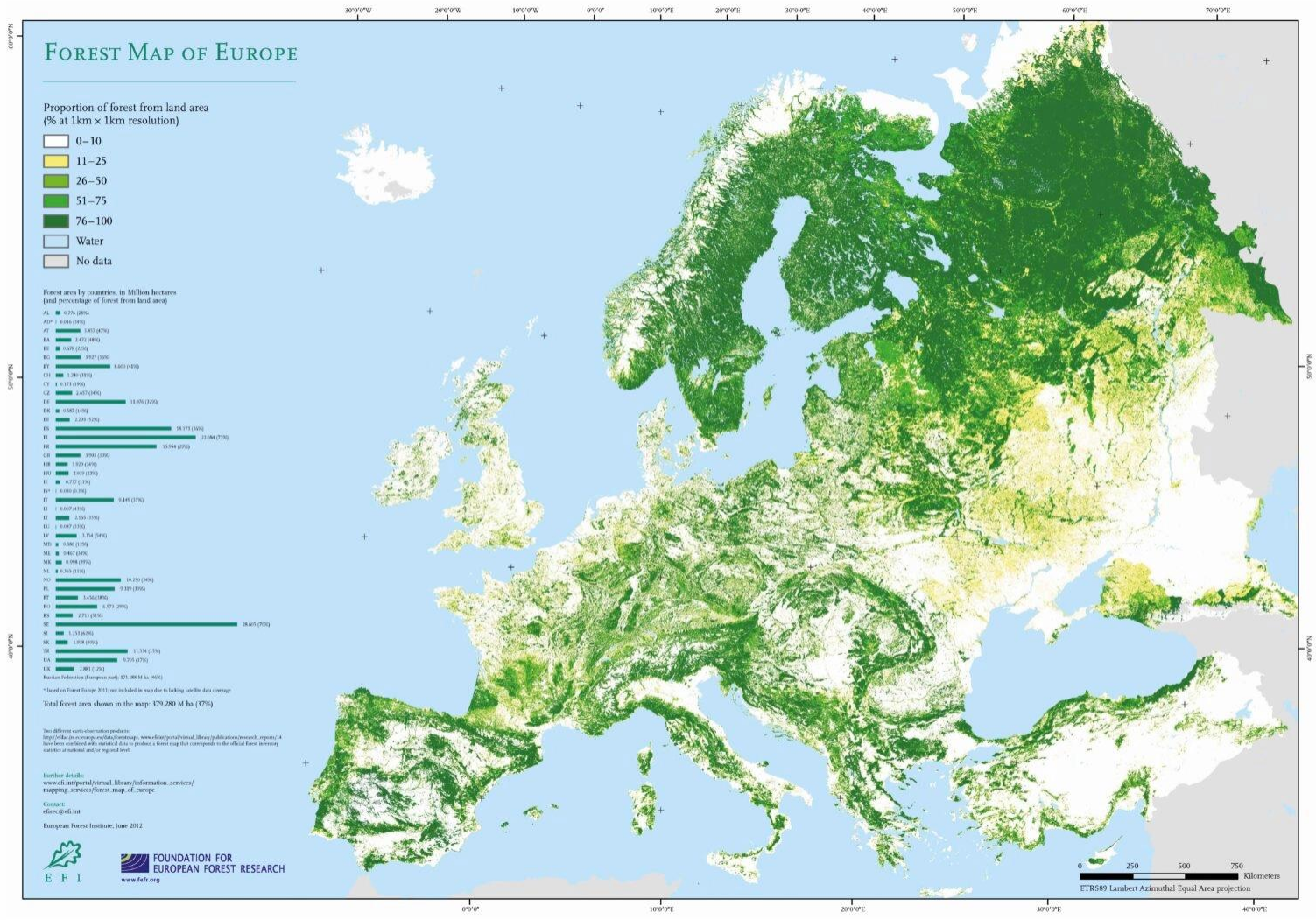
Net Forest

Thinnings of whole trees in young dense stands

Tomas Nordfjell, SLU Sweden

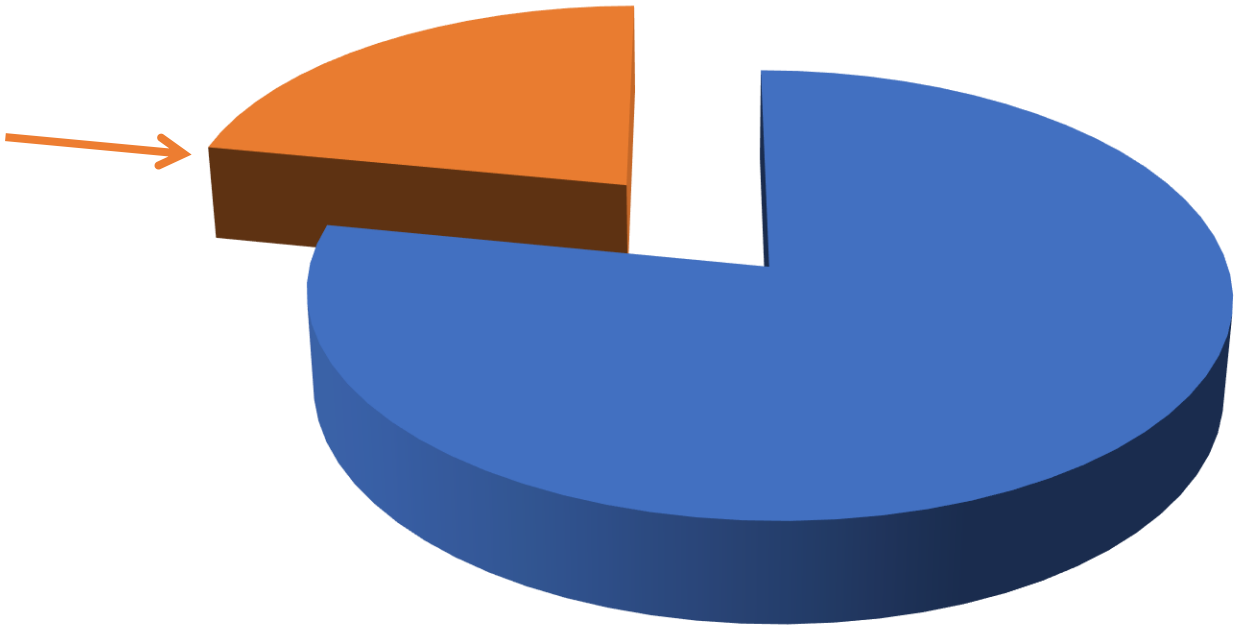
Thinnings of whole trees in young dense stands



The total forest area in Europe has **increased** with more than 36 million ha since year 1980

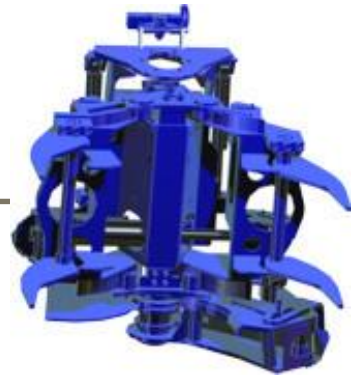
Thinnings of whole trees in young dense stands

As much as 22% of the forests in Sweden are dominated of trees with a diameter below 14 cm, and the situation is similar in most forest countries









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Many technical solutions have been tested with the aim to mechanize whole tree thinnings of young dense stands





SLU

Network of knowledge for efficient private forests

Thinnings of whole trees in young dense stands

Research has proven that some kind of harvester is a suitable base-machine for this work

Thinnings of whole trees in young dense stands

Research has proven that the cutting technique itself must be extremely fast.

Thinnings of whole trees in young dense stands

Research has also proven that the technique must be able to handle many small trees at a time

SMALLWOOD proj

New studies in this area are done in an ongoing international research project named **SMALLWOOD**.

SMALLWOOD proj

New studies in this area are done in an ongoing international research project named **SMALLWOOD**.

Previous results have been used for a technical upgrading of the technique and for using the most efficient work-method

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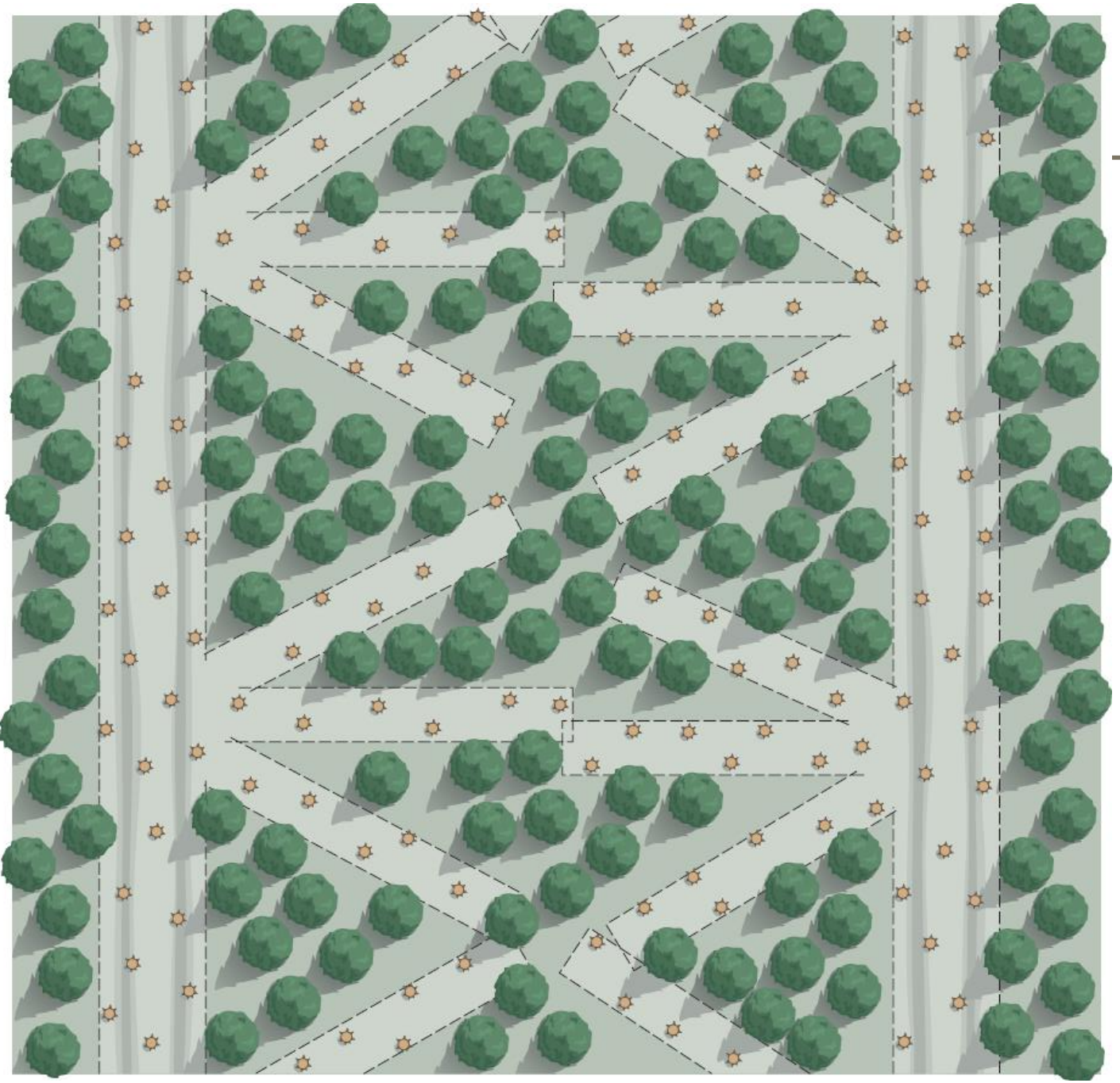
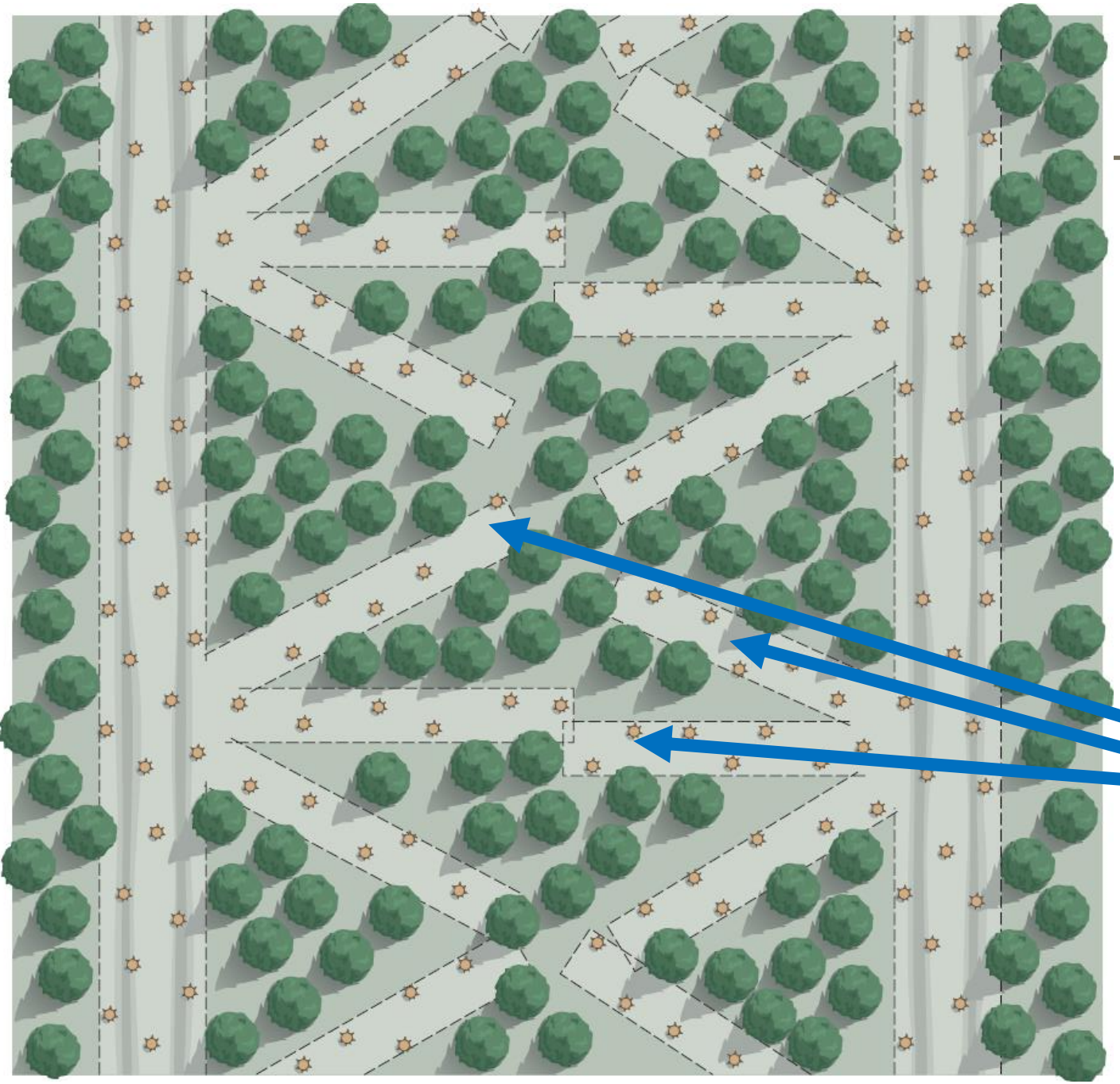


SMALL wood

Net Forest

And, this is the work method for this kind of thinning

Boom corridor thinning

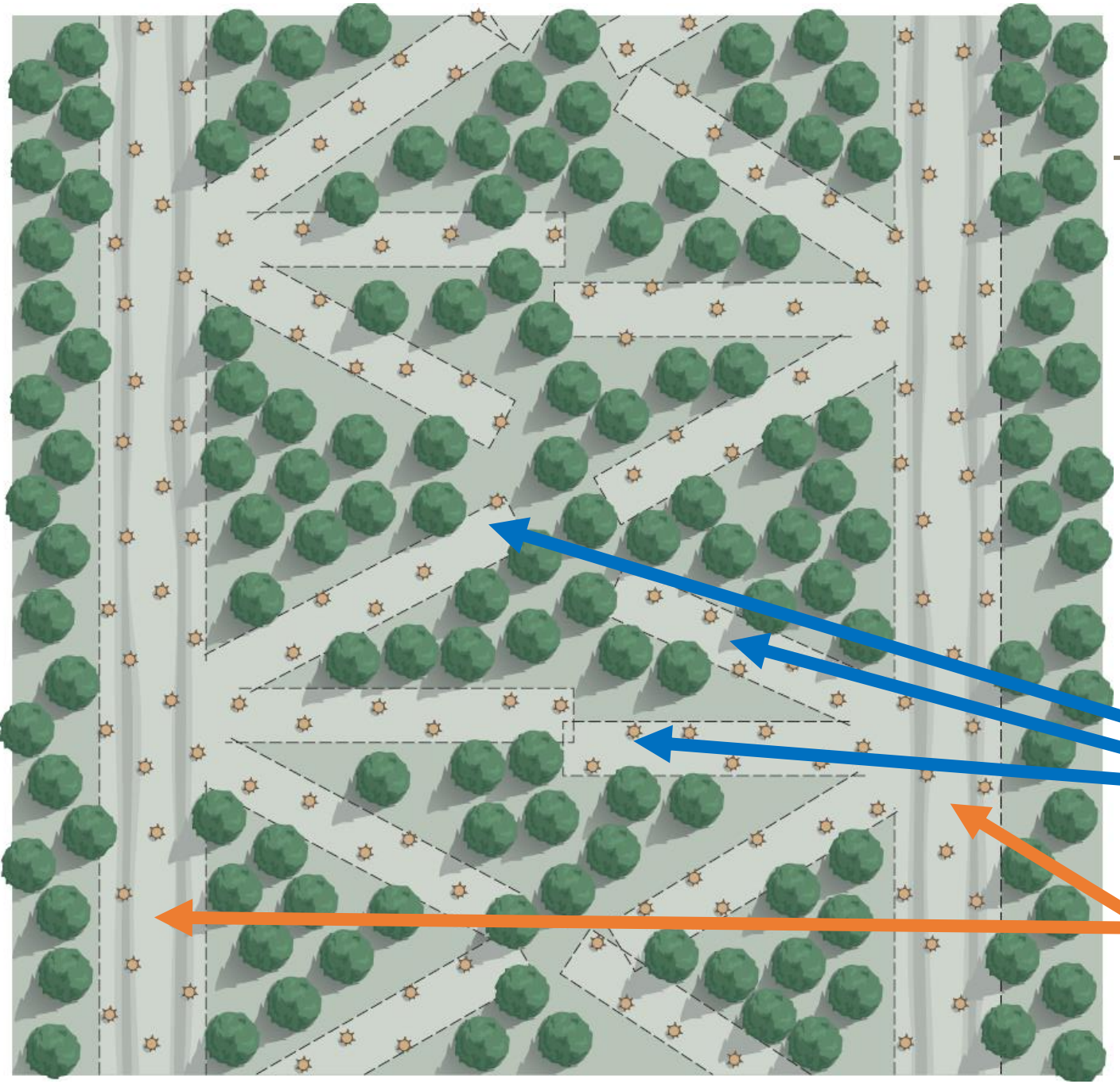


SMALL wood

Net Forest

And, this is the work method for this kind of thinning

Boom corridor thinning



SMALL wood

Net Forest

And, this is the work method for this kind of thinning

Boom corridor thinning

Boom corridors

Ordinary striproads

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Thinnings of whole trees in young dense stands

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Thinnings of whole trees in young dense stands

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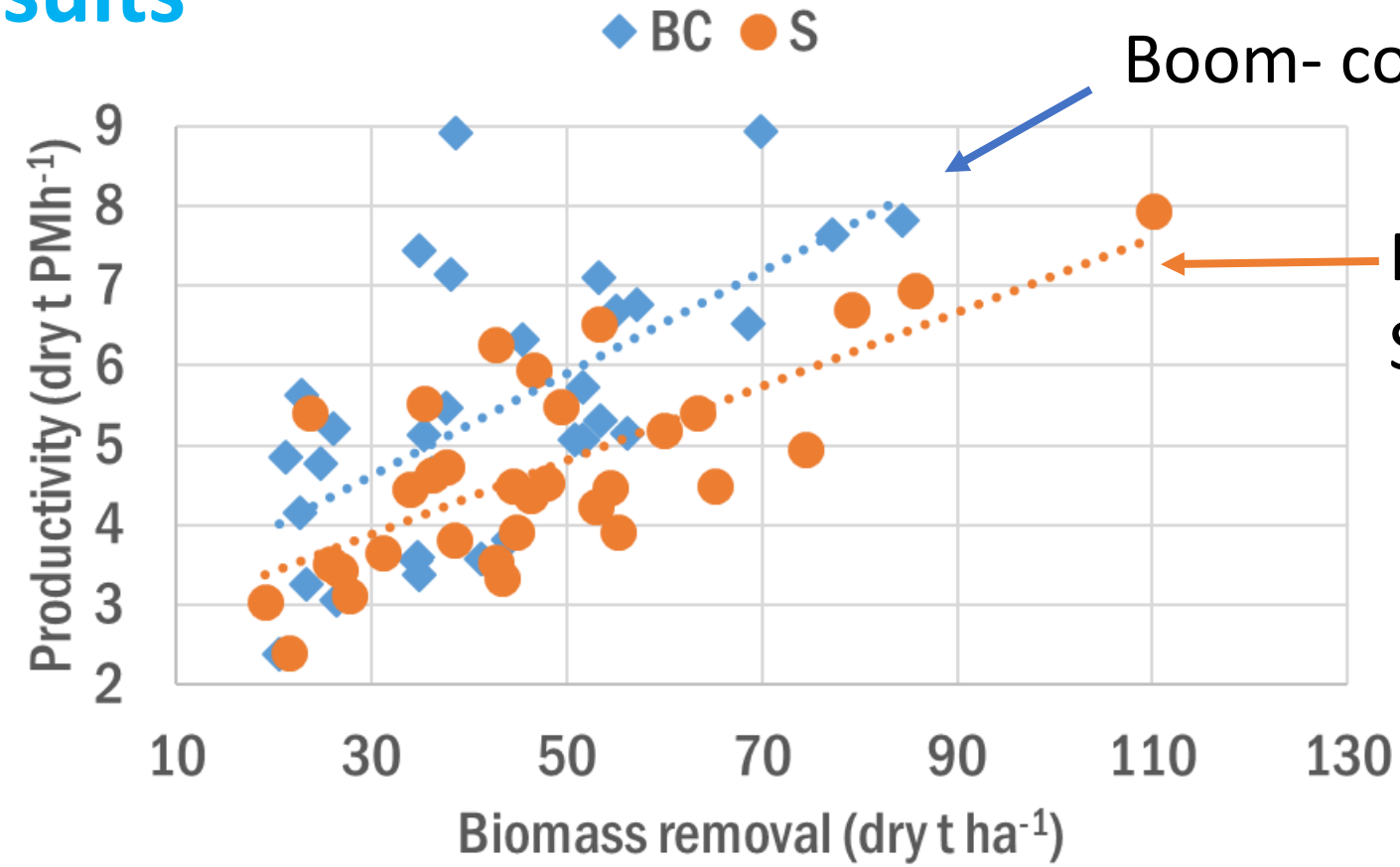
Results

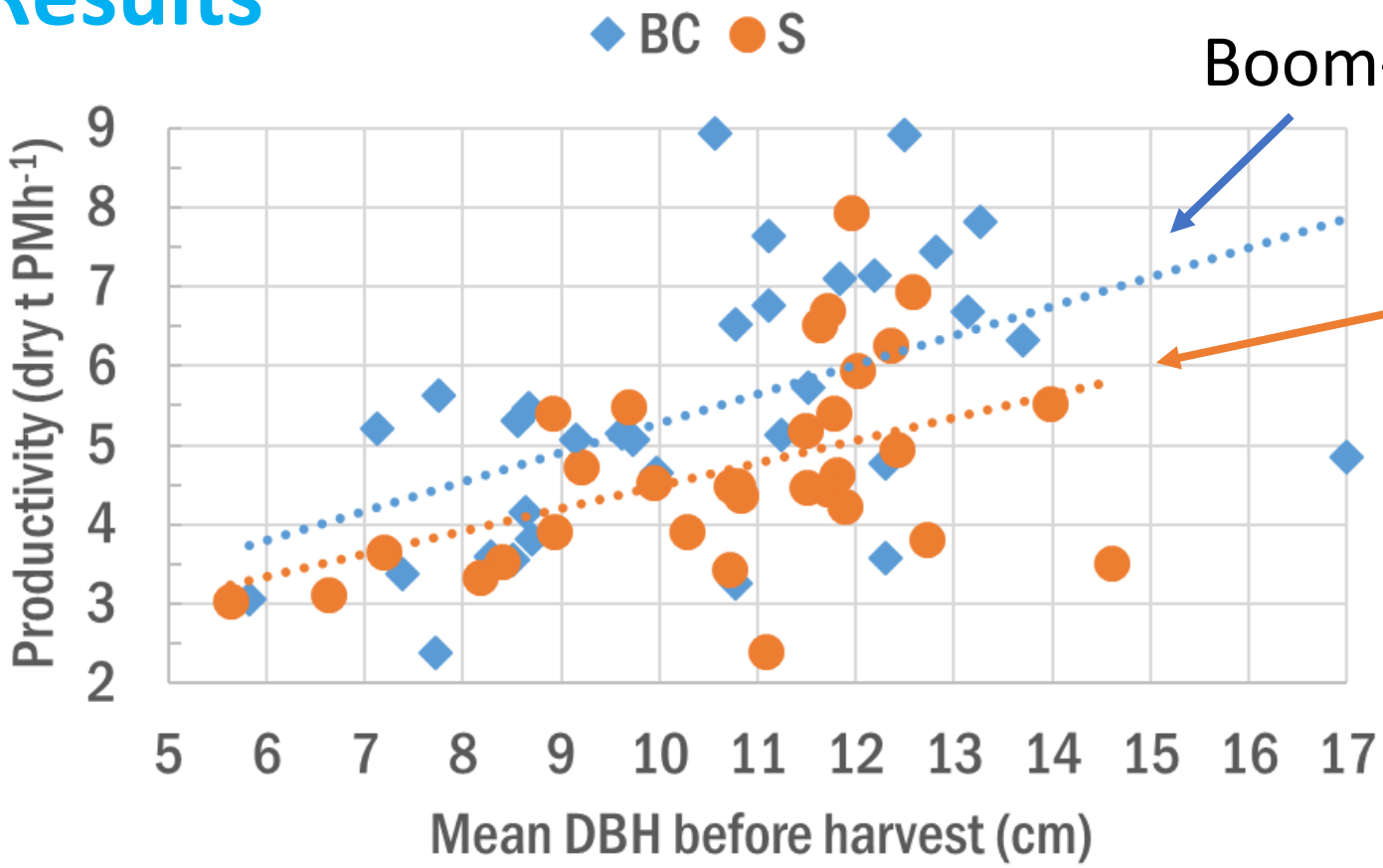


Boom- corridor thinning

Reference

Selective thinning

Results



Boom- corridor thinning

Reference
Selective thinning

Summary: Results for stands with 8-13 cm Dbh and a thinning removal of 30-55 dry tons biomass/ha (about 60-110 m³ solid biomass/ha)

The selective reference work method:

4.0 - 5.5 dry tons biomass/productive machine hour

Summary: Results for stands with 8-13 cm dbh and a thinning removal of 30-55 dry tons biomass/ha (about 60-110 m³ solid biomass/ha)

The selective reference work method:

4.0 - 5.5 dry tons biomass/productive machine hour

The Boom-corridor work method:

4.5 – 6.5 dry tons biomass/productive machine hour

The future then?

Next step is to also compress and buck when harvesting to make the extraction and truck transportation more efficient.

This has also been done on a research scale.

Feed rollers added to the felling head

Without feed rollers

Thinnings of whole trees in young dense stands

Without feed rollers

With feed rollers

Without feed rollers

With feed rollers

20% larger load, and the material is also more easy to handle

Conclusions about the system

The productivity is high enough for good economy if, and only if, there is a stable and long-lasting demand on the market for this assortment (bioenergy, and in the future most likely bio-chemical products)

SMALLWOOD project partners

Partner	Country	Respective funding organization	Contact person
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
Slovenian Forest Institute (SFI)	**Slovenia**	SI/MIZS	Dr. Nike Krajnc
University of eastern Finland, School of Forest Sciences (UEF)	**Finland**	FI/MMM and FI/AKA	Prof.dr Teppo Hujala
Faculty of Economics and Business, University of Maribor (FEB)	**Slovenia**	SI/MIZS	Prof.dr. Zdenka Ženko
Bracke Forest	**Sweden**	Vinnova/Formas/SWEA	CEO Klas-Håkan Ljungberg

SMALLWOOD, a ForestValue ERA-NET

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Ministry of Economy, Industry and Competitiveness (MINECO).
ForestValue has received funding from the **European Union's Horizon 2020 research and innovation programme** under grant agreement N° 773324.

Smallwood website:

http://www.smallwood.eu/

The End of this presentation

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SLU
Umeå, Sweden

More about project results:

http://www.smallwood.eu/

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Net Forest

Ground pressure on forest machines

Tomas Nordfjell, SLU Sweden

Ground pressure from forest machines

This presentation is about an Excel tool for calculation of the average ground pressure on forwarders.

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Ground pressure from forest machines

The average ground pressure on a forest machine is the weight of the loaded machine divided with the total surface area of the wheels or tracks on the ground.

This calculation model is based on rough assumptions, but is nevertheless a useful tool for gaining insight into a forest vehicle's impact on the ground

Ground pressure from forest machines

The model calculates separately for the front and rear section of a vehicle.

The difference in ground pressure between the front and rear section is quite large for a loaded forwarder.

Ground pressure from forest machines

Pressure is the force per unit area. The force consists of the mass of a forwarder and its load, and how this mass is distributed on the front and rear section of the vehicle.

The surface is the tire surface that contacts the ground. The size of that surface depends on how much the tire sinks into the ground. This model assumes a fairly large sinkage that corresponds to 15% of the tire's diameter.

Ground pressure from forest machines

A calculation example for a standard forwarder !

Ground pressure from forest machines

Those are the variables to fill in !

Forwarder without tracks - Calculation of average ground pressure

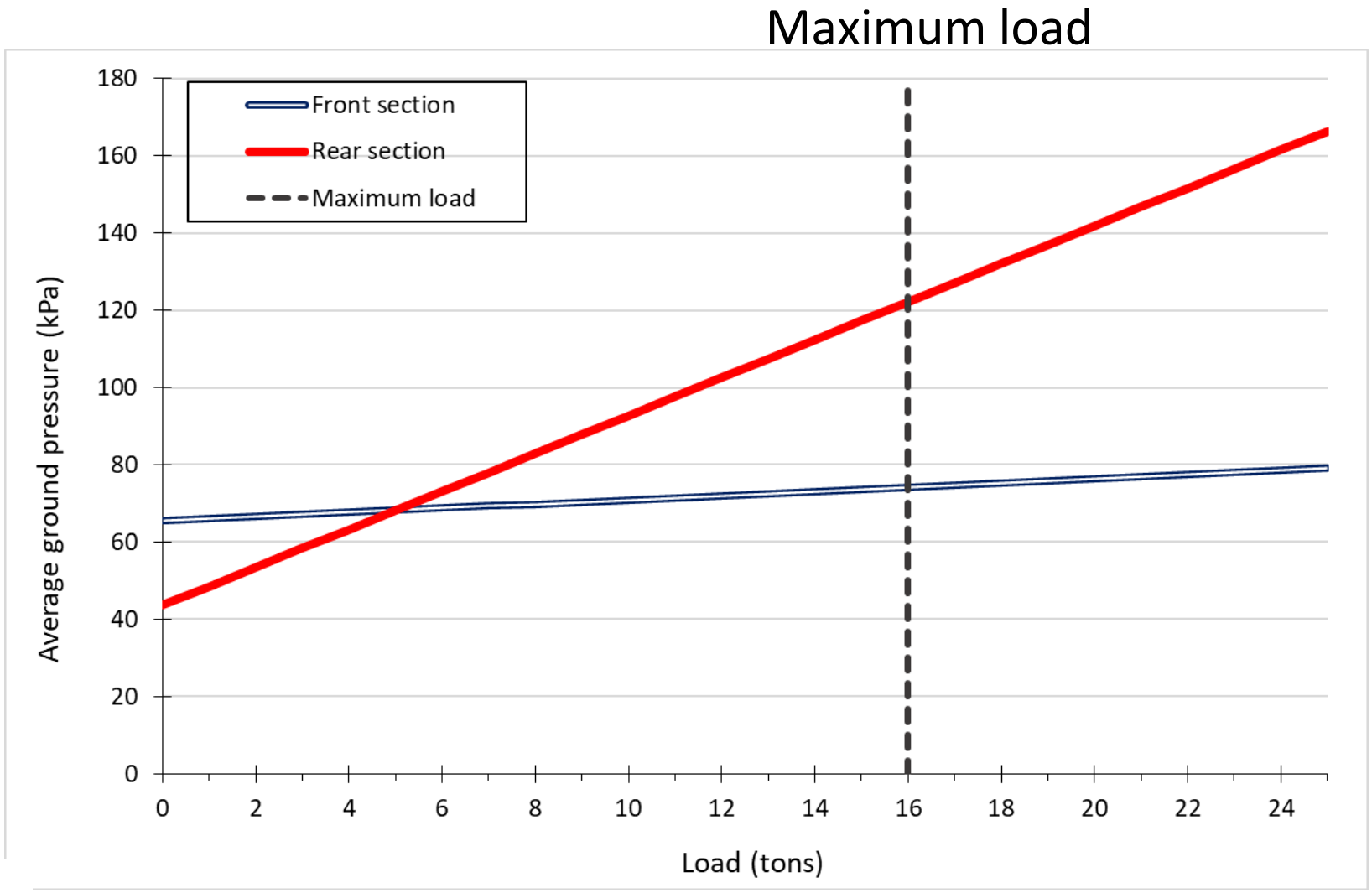
Variable	**Own choice**	Unit
Kerb weight without load		tons
Proportion of kerb weight on front section		%
Proportion of load on front section		%
Maximum load capacity		tons
Number of tires on front section		n
Width on tires front section		cm
Diameter on tires front section		cm
Number of tires on rear section		n
Width on tires rear section		cm
Diameter on tires rear section		cm

Ground pressure from forest machines

Forwarder without tracks - Calculation of average ground pressure

Variable	**Own choice**	Unit
Kerb weight without load	20	tons
Proportion of kerb weight on front section	60	%
Proportion of load on front section	10	%
Maximum load capacity	16	tons
Number of tires on front section	4	n
Width on tires front section	75	cm
Diameter on tires front section	120	cm
Number of tires on rear section	4	n
Width on tires rear section	75	cm
Diameter on tires rear section	120	cm

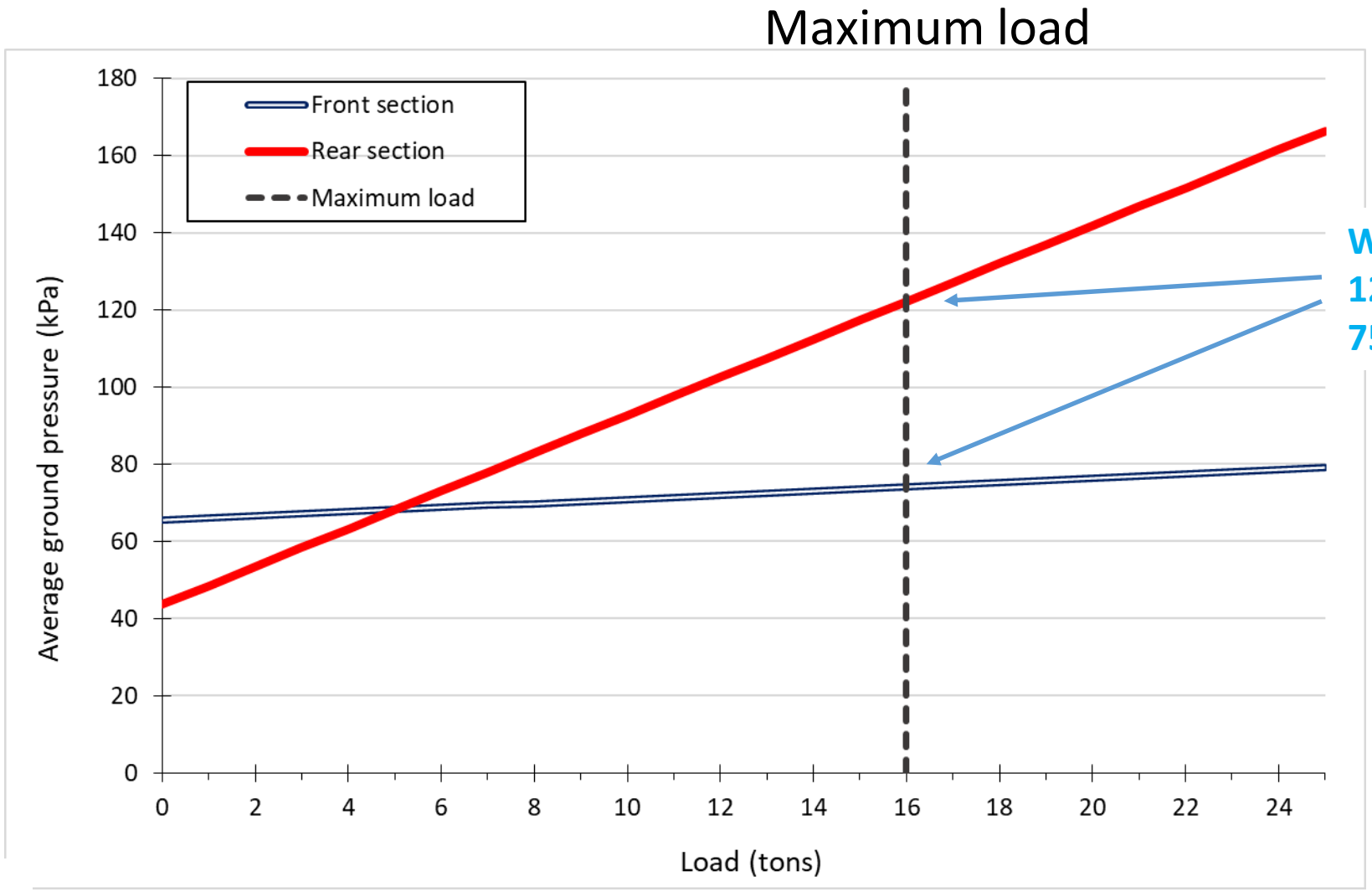
Ground pressure from forest machines



Rear section

Front section

Ground pressure from forest machines



Rear section

When fully loaded,
122 kPa on rear section, and
75 kPa on front section

Front section

Ground pressure from forest machines

This was an example on an existing forwarder. The tool has also a separate sheet for machines with tracks.

The tool can also be used to evaluate the effect of possible technical changes.

Ground pressure from forest machines

This was an example on an existing forwarder. The tool has also a separate sheet for machines with tracks.

The tool can also be used to evaluate the effect of possible technical changes.

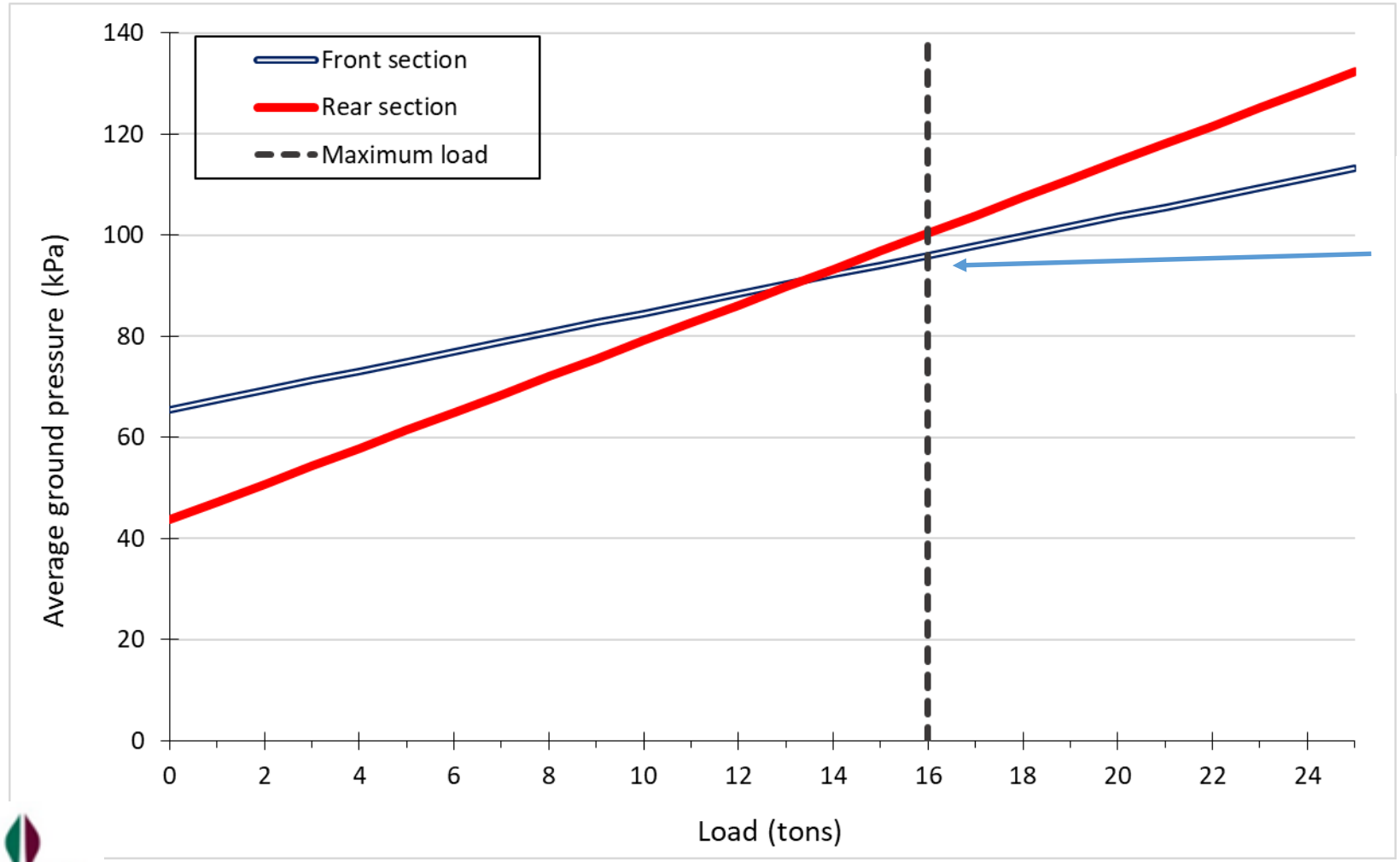
Let us see how the situation will change if it was possible to distribute a larger proportion of the load to the front part of the forwarder?

Ground pressure from forest machines

Forwarder without tracks - Calculation of average ground pressure

Variable	**Own choice**	Unit
Kerb weight without load	20	tons
Proportion of kerb weight on front section	60	%
Proportion of load on front section Change to 40%	~~10~~	%
Maximum load capacity	16	tons
Number of tires on front section	4	n
Width on tires front section	75	cm
Diameter on tires front section	120	cm
Number of tires on rear section	4	n
Width on tires rear section	75	cm
Diameter on tires rear section	120	cm

Ground pressure from forest machines



~~When fully loaded,~~
~~122 kPa on rear section, and~~
~~75 kPa on front section~~

In this case almost the same value for both rear and front section!
100 kPa on rear section, and
95 kPa on front section

Ground pressure from forest machines

Tool for calculating the ground pressure of a forest vehicle‘s:

https://www.slu.se/globalassets/ew/org/inst/sbt/forskning/net4forest/ground-pressure-forwarder-2021-05-04.xlsx

Ground pressure from forest machines

Thank you

Tomas Nordfjell
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Umeå, Sweden

Department pages:

https://www.slu.se/en/departments/forest-biomaterials-technology/research/ongoing-projects/net4forest/

https://www.slu.se/institutioner/skogens-biomaterial-teknologi/forskning_in/forskningsprojekt-vid-sbt/net4forest/

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