

# A Regional-Scale GIS-Based evaluation of the potential and Supply Costs of forest biomass in Sweden

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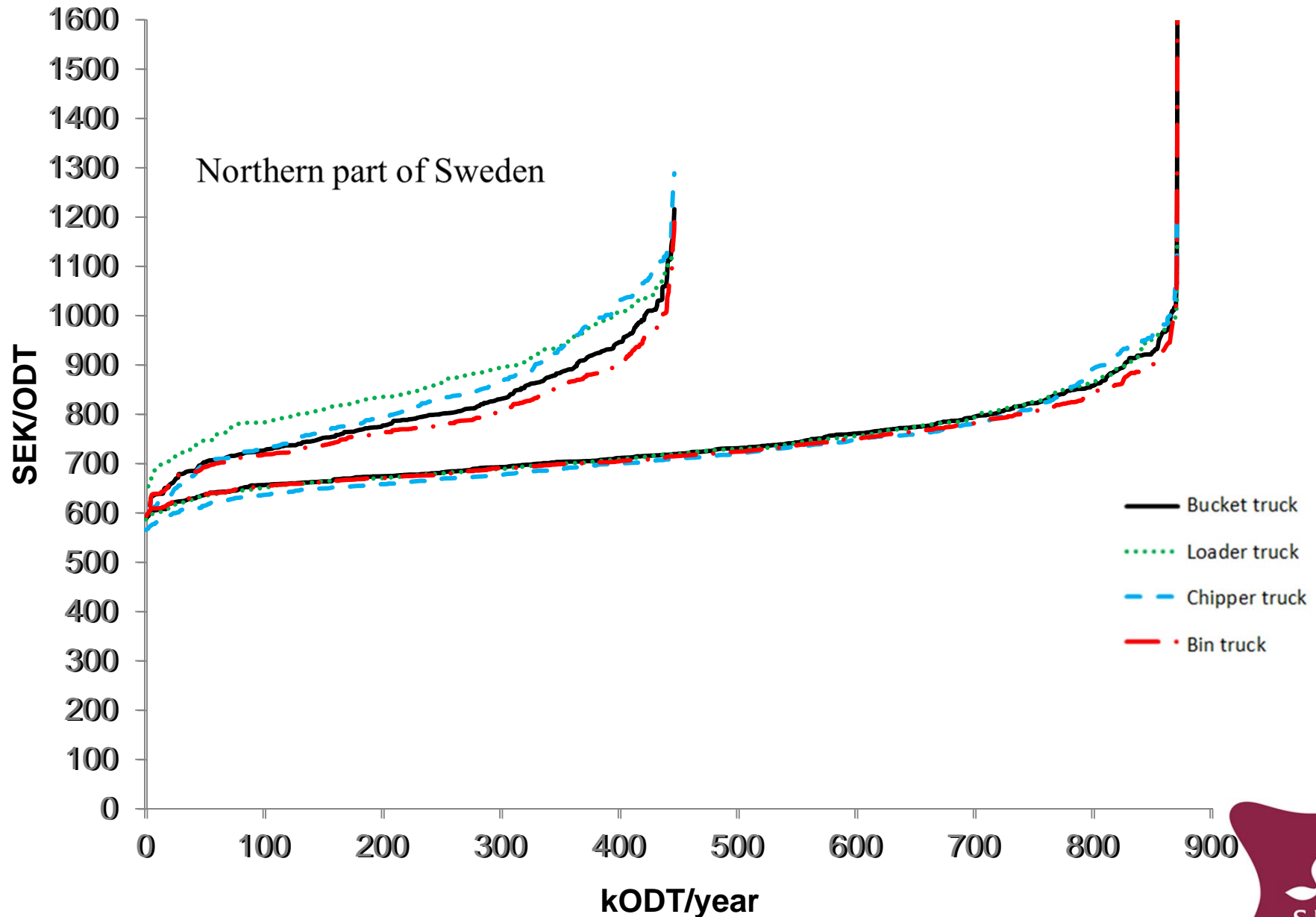
# Disposition

How much logging residues and stumps is out there and where is it located?

How much will it cost to collect it and bring it to the consumer? Regional differences?

# Logging residues

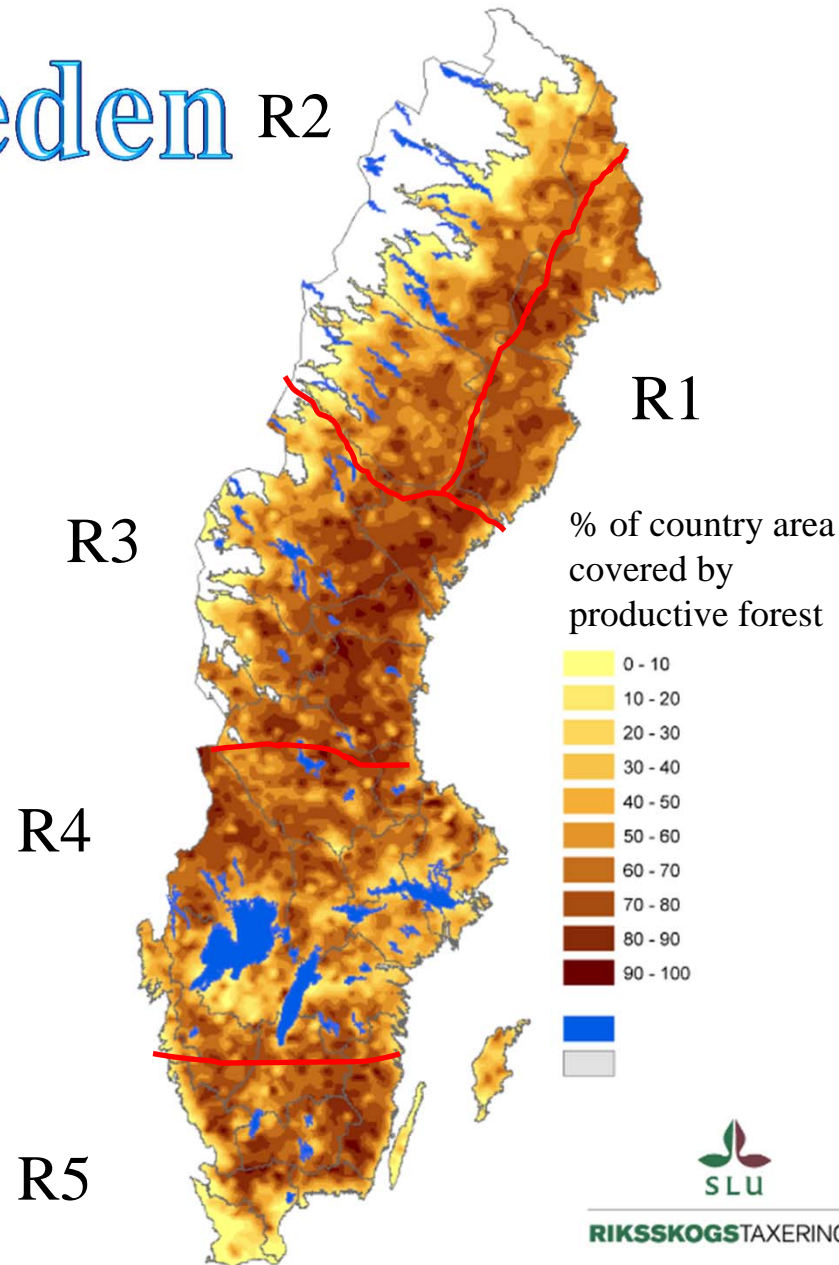
South part of Sweden



1 EURO = 10 SEK



# Sweden R2



24 million ha forest land

3200 million m<sup>3</sup> total standing volume

90 million m<sup>3</sup> annual harvesting (2010).

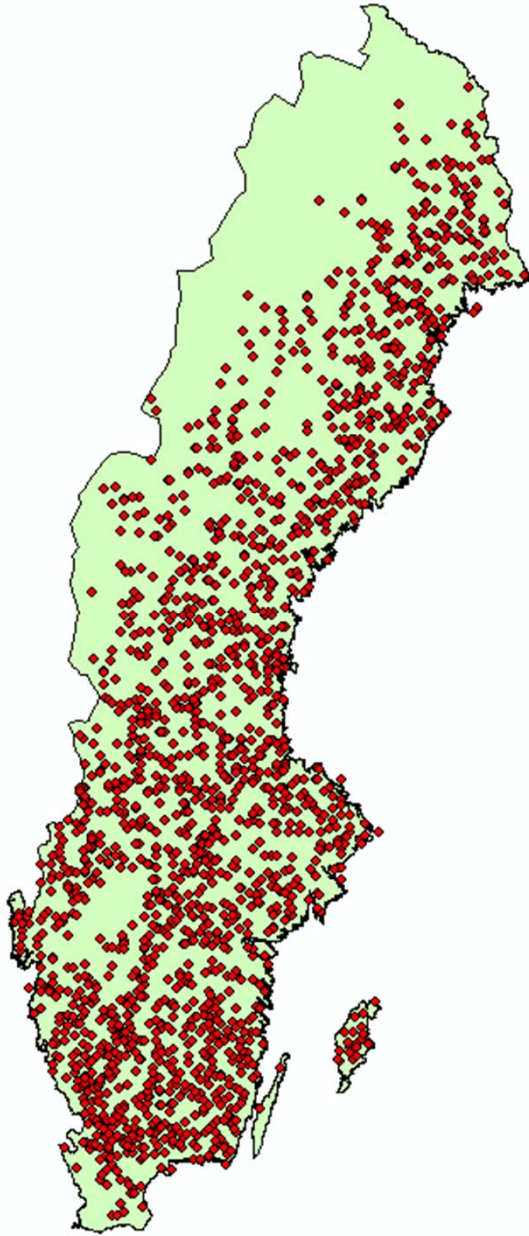


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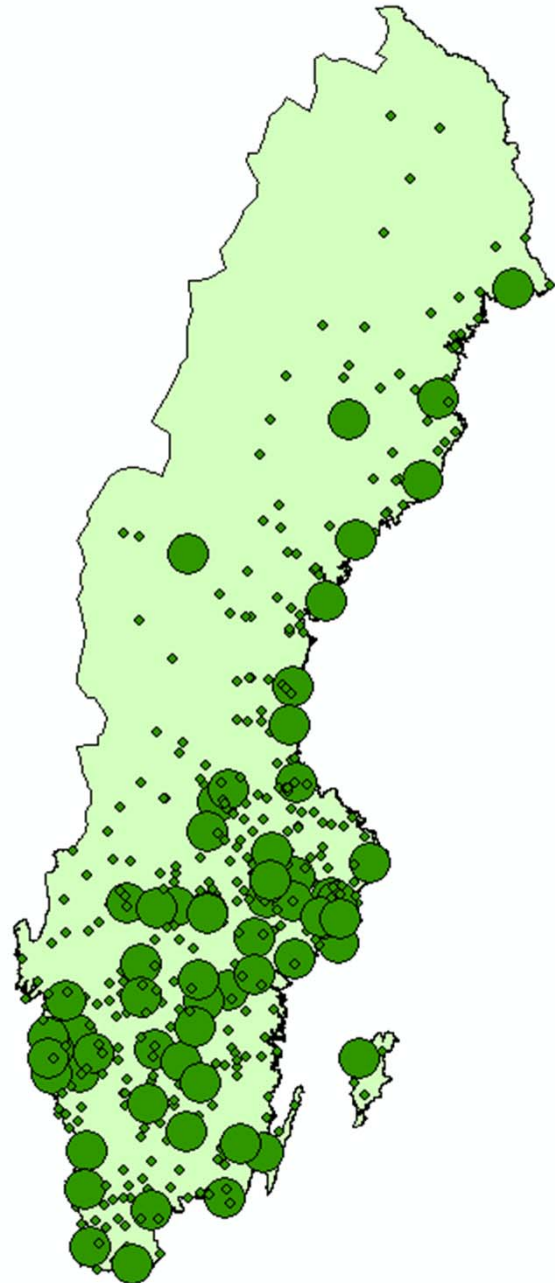


# Forest National Inventory



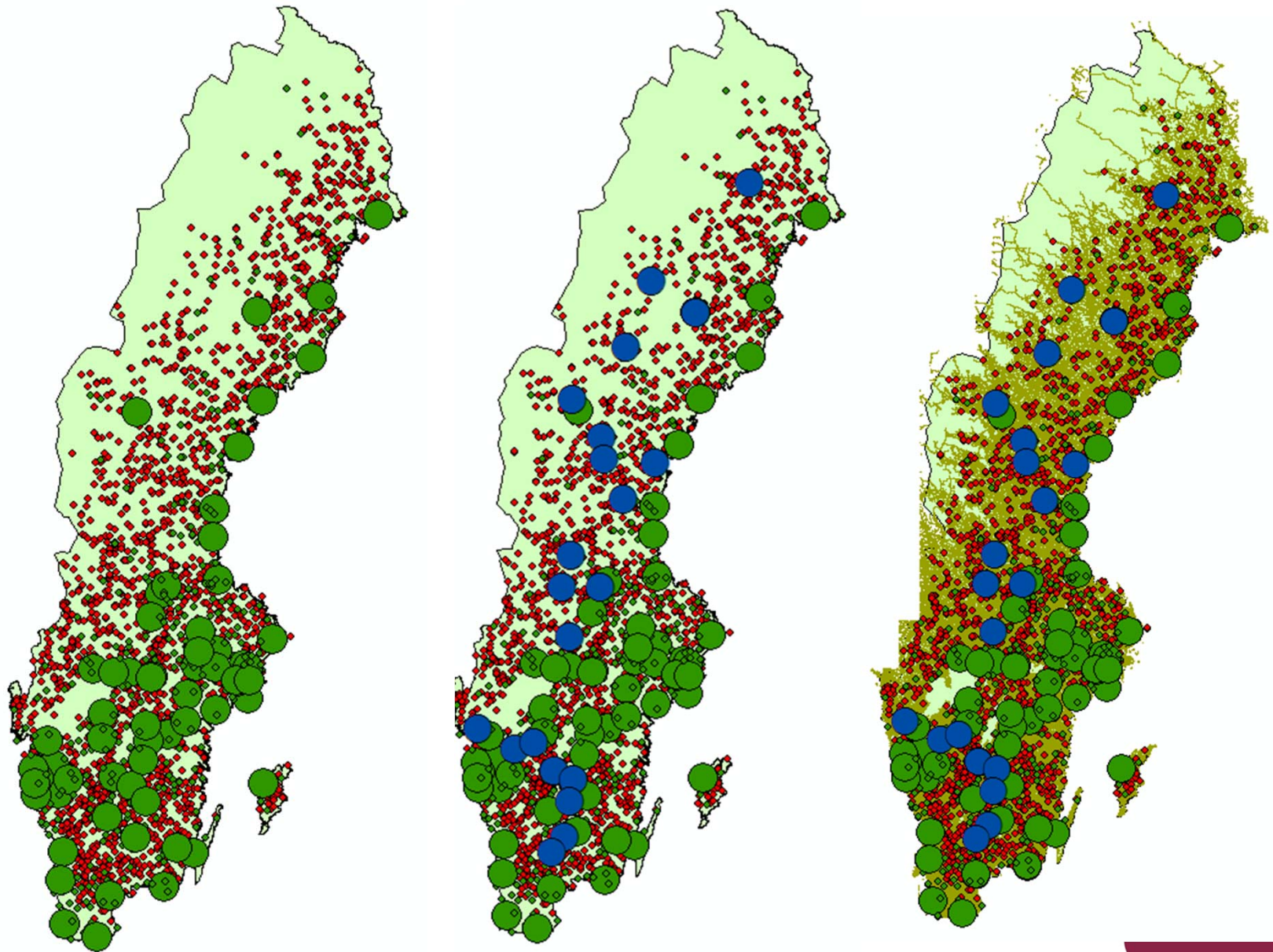
Represents an area of 27 to  
187 ha that will be final harvested  
a certain year (a total of 170 000 ha)

# District heating and CHP plants



## Input energy

- ◆ < 99 GWh/year biomass
- > 100 GWh/year biomass



● Terminals

		<b>Harvesting site</b>	<b>Roadside</b>	<b>Road transport</b>	<b>Facility /terminal</b>
<b>Slash</b>	System 1	Forwarder	Chipper mounted on forwarder chassis	Truck equipped with loader	
	System 2	Forwarder	-	Truck equipped with loader	Crusher
	System 3	Forwarder	Chipper mounted on truck	Chipper truck	
	System 4	Forwarder	Chipper mounted on forwarder chassis	Container truck	
<b>Stumps</b>	System 1	Stump harvester, forwarder	chipper crusher	container truck	
	System 2	Stump harvester, forwarder	-	truck equipped with loader	Crusher





# System 1 (Bucket truck)



# System 2 (Loader truck)



# System 3 (Chipper truck)



# System 4 (Bin truck)



# System 1



# System 2



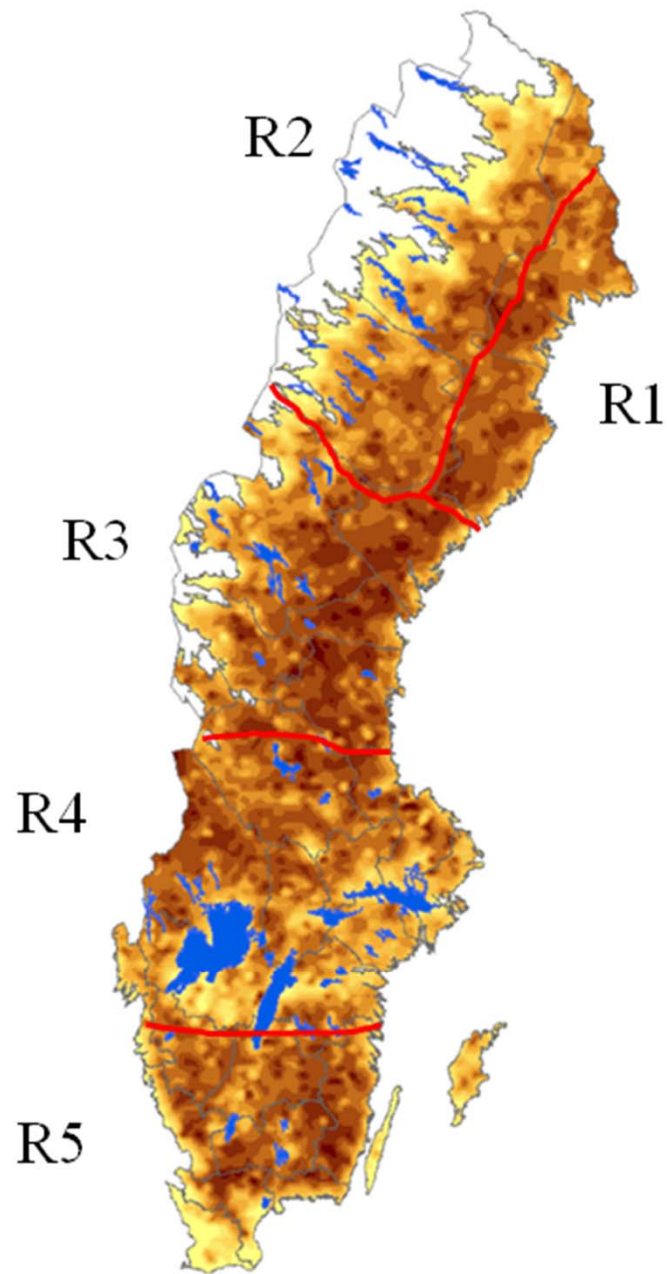
Fotos by: Magnus Matisons & David Lindberg

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# RESULTS

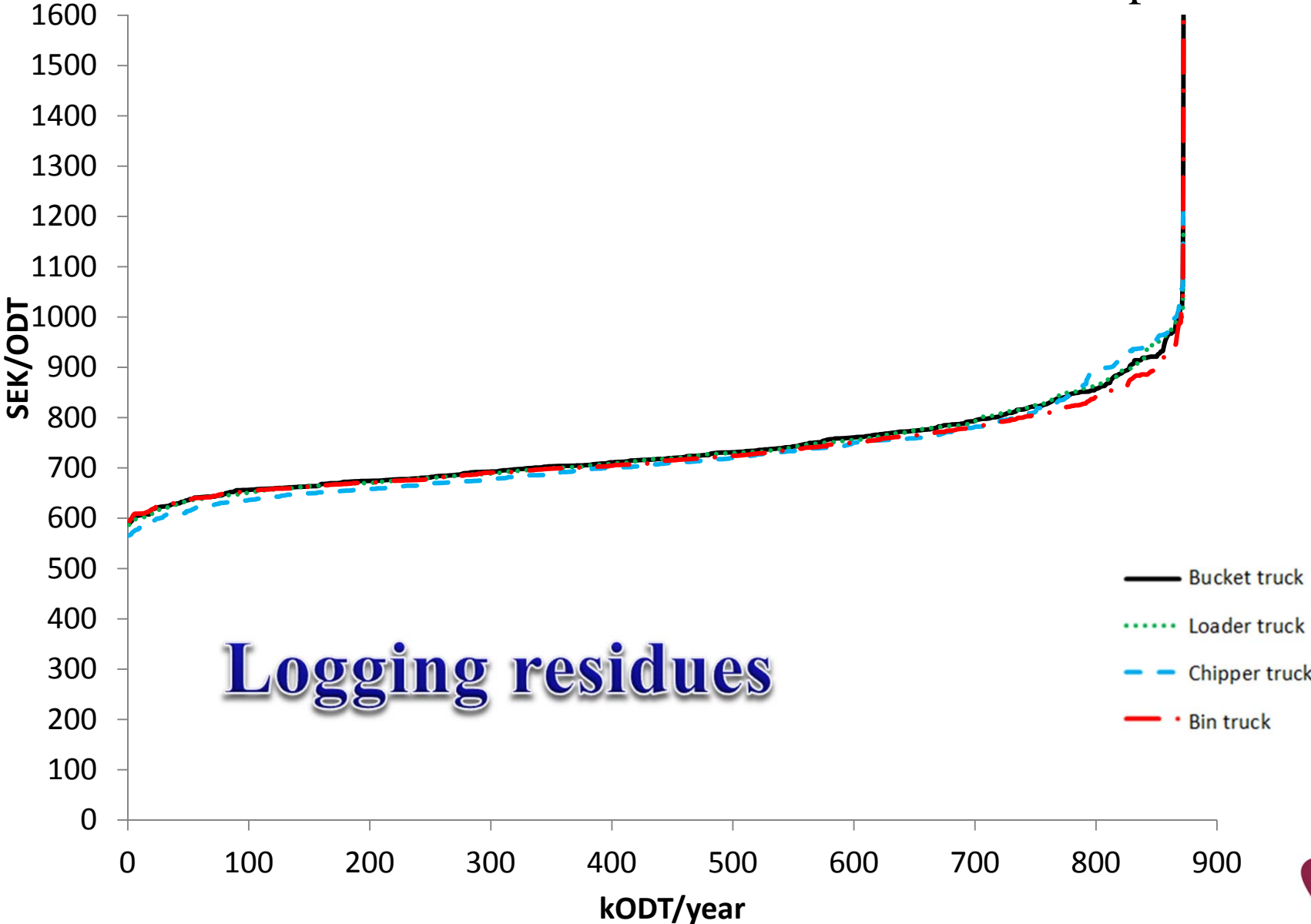




Regional potentials of logging residues,  
and stumps from final fellings and  
young trees from first thinnings  
(mODT)

	Slash	Stumps	Small trees	Sum
R <sub>1</sub>	0.36	0.51	0.10	<b>0.97</b>
R <sub>2</sub>	0.46	0.63	0.17	<b>1.26</b>
R <sub>3</sub>	0.61	0.87	0.44	<b>1.92</b>
R <sub>4</sub>	0.87	1.17	0.69	<b>2.73</b>
R <sub>5</sub>	0.87	1.06	0.58	<b>2.51</b>
Whole Sweden	<b>3.17</b>	<b>4.24</b>	<b>1.98</b>	<b>9.39</b>

South part of Sweden

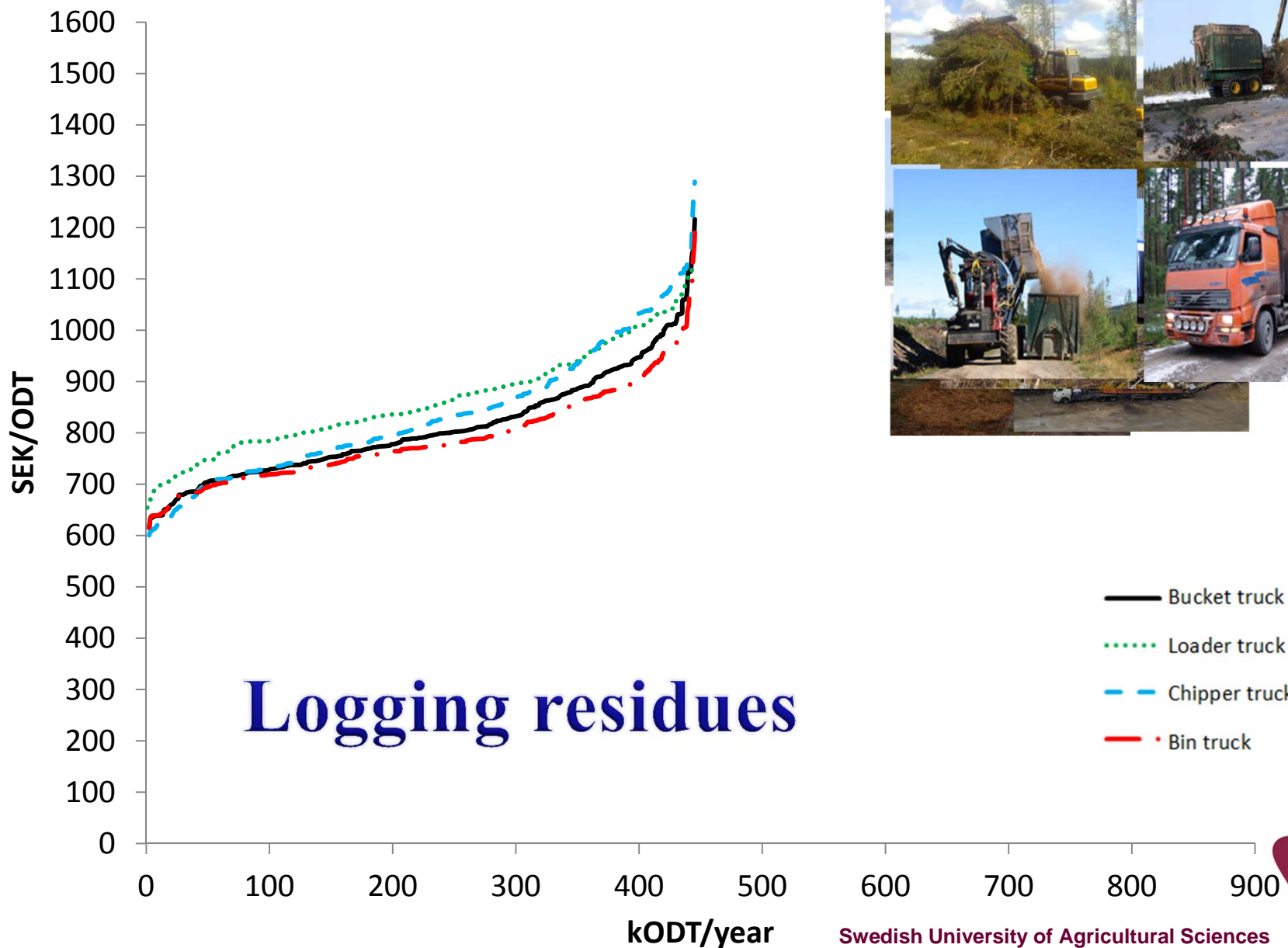


Logging residues

1 EURO= 10 SEK



# Northern part of Sweden

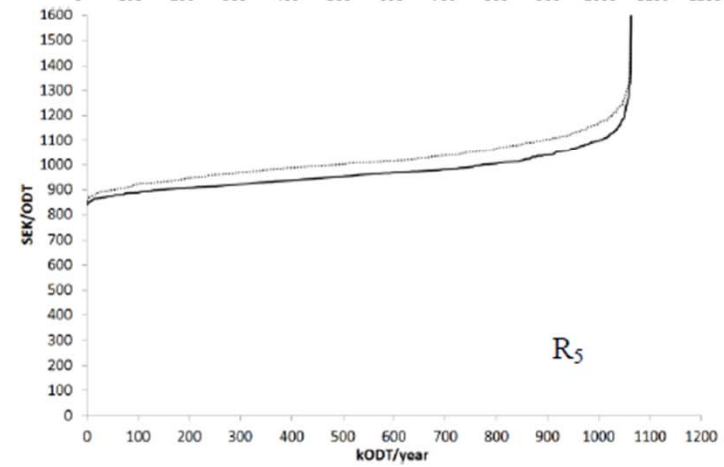
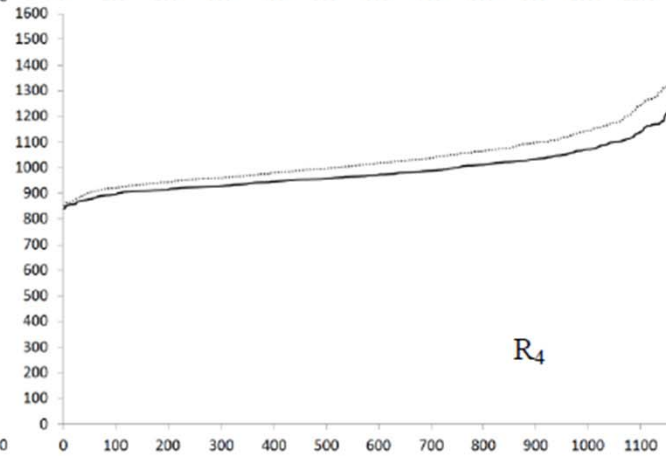
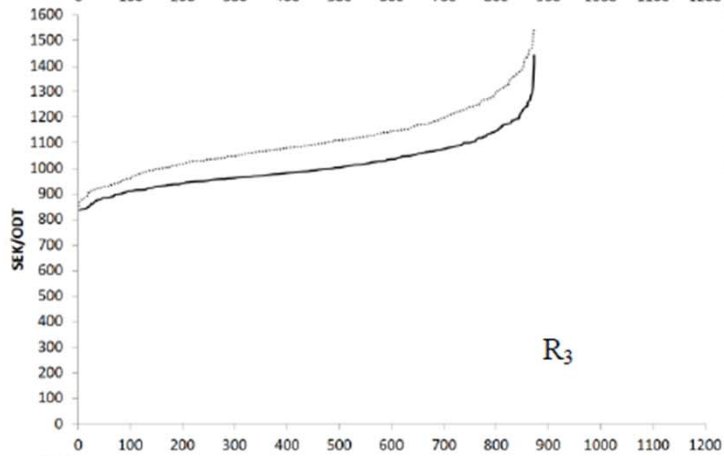
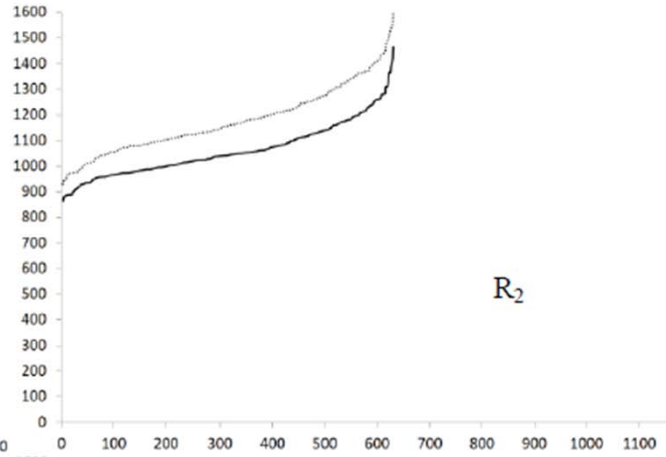
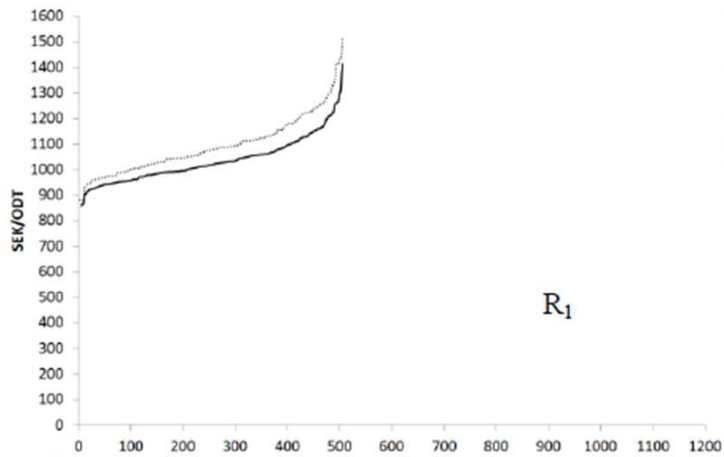


## Logging residues



- Bucket truck
- ..... Loader truck
- - - Chipper truck
- · - Bin truck

1 EURO = 10 SEK



VS.



# Stumps



# Final observations

- ✓ Increase use of terminals near the source  
(e.g. upgrading and mixing according to customer demand)
- ✓ Use systems suitable for different regions
- ✓ Increase payload on the trucks (e.g. pre-crushing of stumps)
- ✓ Establish bioenergy combines (e.g. heat, electricity, pellets)

# Section of planning and operational efficiency



Tomas Nordfjell



Iwan Wästerlund



Dan Bergström



Fulvio di Fulvio



Dag Fjeld



Magnus Matisons



Ola Lindroos

+ 8 Phd students



Dimitris Athanassiadis



Swedish University of Agricultural Sciences  
Dep of Forest Resource Management



*Thank you to*

## Efficient forest fuel Supply Systems (ESS program)

**Botnia-Atlantica** 



EUROPEISKA UNIONEN  
Europeiska regionala  
utvecklingsfonden

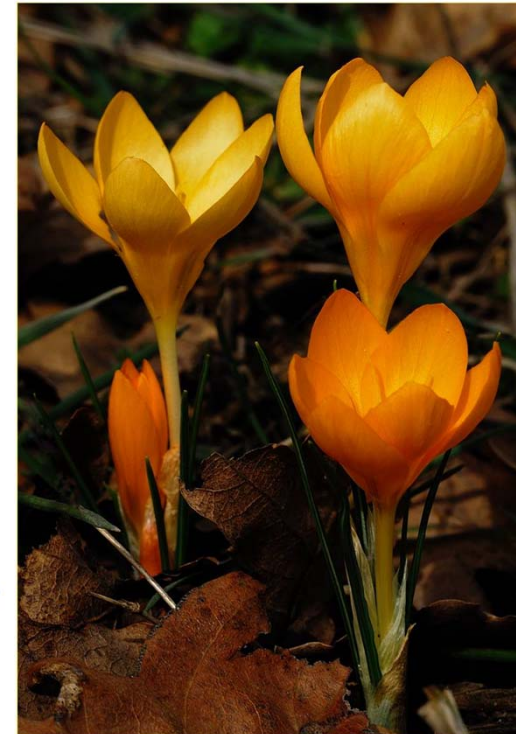
Gränsöverskridande samarbete över fjäll och hav  
Meret, vuoret ja rajat ylittävä yhteistyö  
Grenseoverskridende samarbeid over fjell og hav  
Cross-border cooperation over mountain and sea

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