

# Non-native species to spread the risk and increase the forest adaptation potential

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# Non-native species

- The opposite to native species
- Native species is a species which has evolved in the area or was dispersed to the area after the last glaciation independent of human activity
- Almost no native conifers in Denmark
- Norway spruce is not native to southern Sweden

# Low tree-species diversity



# Non-native species in five Nordic countries

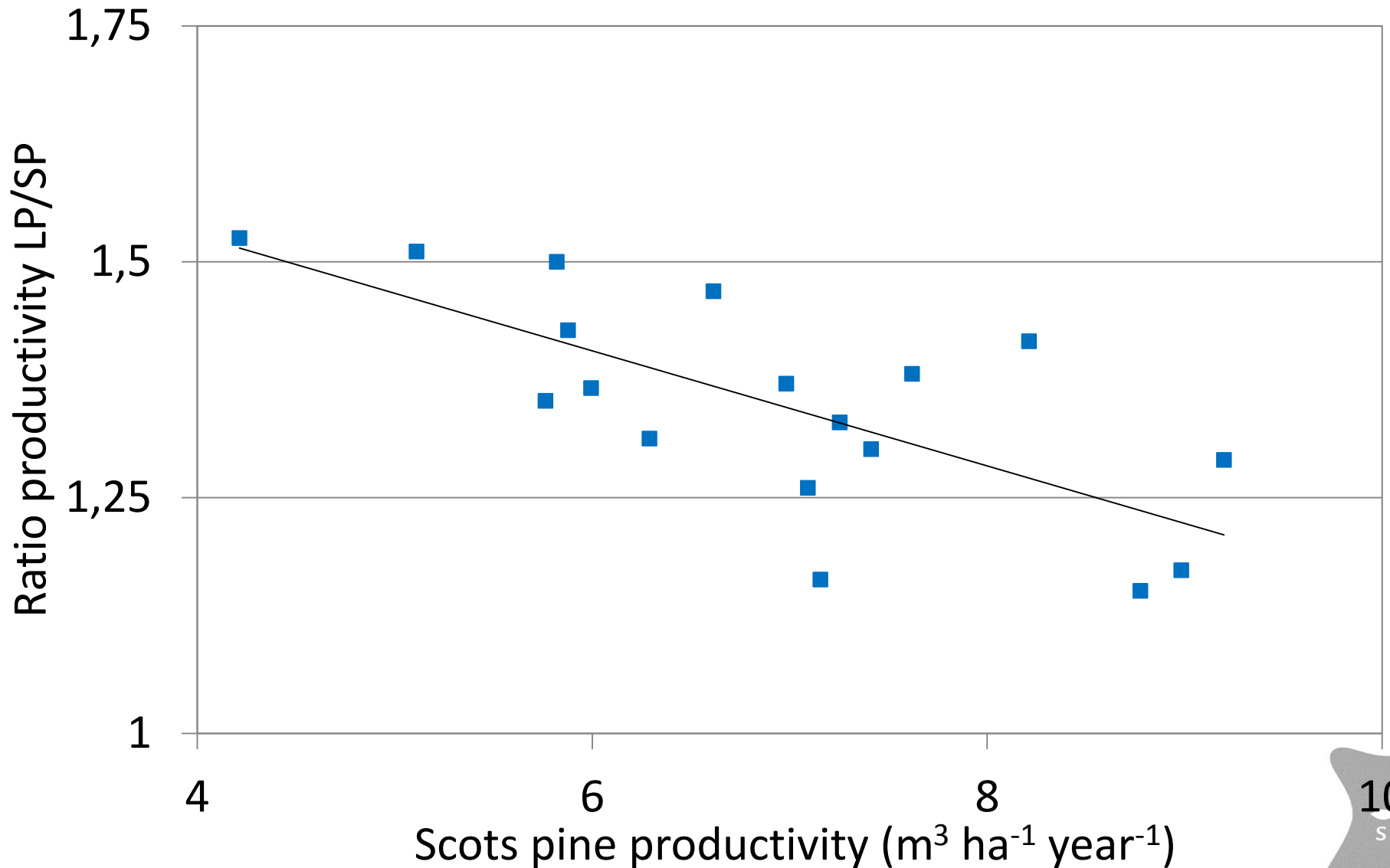
Country	Introduced species (ha)	% of total forest area
Sweden	639 000	2
Norway	80 000	1
Denmark	192 000	35
Finland	22 000	<<1
Iceland	20 900	-
Total	953 900	1.5

# Some examples of possible “new” tree species in Sweden

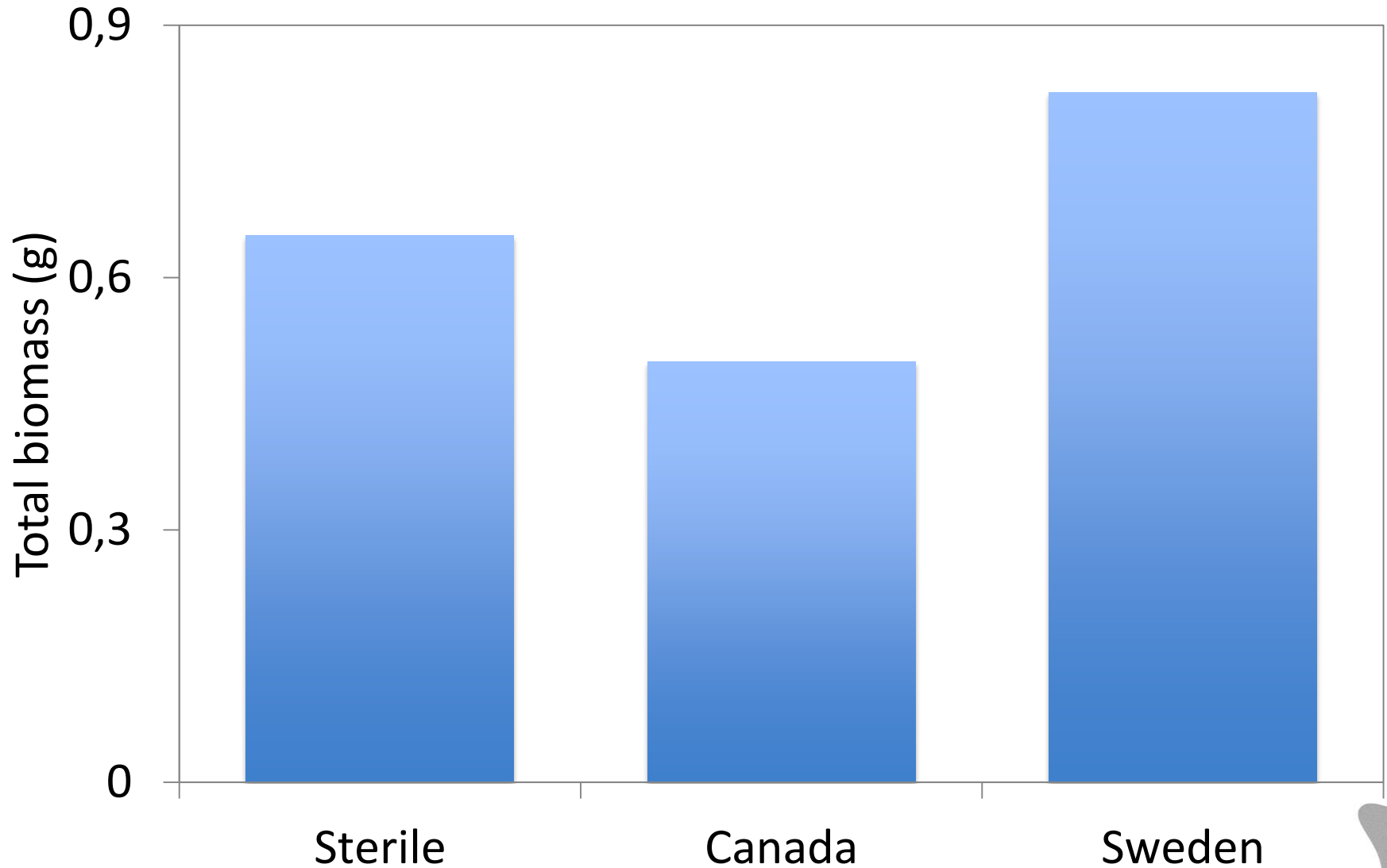
- Lodgepole pine (contorta)
- Hybrid larch
- Hybrid aspen
- Sitka spruce
- Douglas fir

# Lodgepole pine

## Productivity comparison with Scots pine



# Lodgepole pine in different soils





# Storm damage!





# Hybrid larch and Hybrid aspen

## Simulated production and economy

	Hybrid larch	Hybrid aspen	Norway spruce
Rotation length (years)	35	100 (4 x 25)	57
Mean annual production ( $\text{m}^3 \text{ha}^{-1} \text{year}^{-1}$ )	12.9	21.2	13.5
Land expectation value ( $\text{€ ha}^{-1}$ )	6 000	6 400	4 500

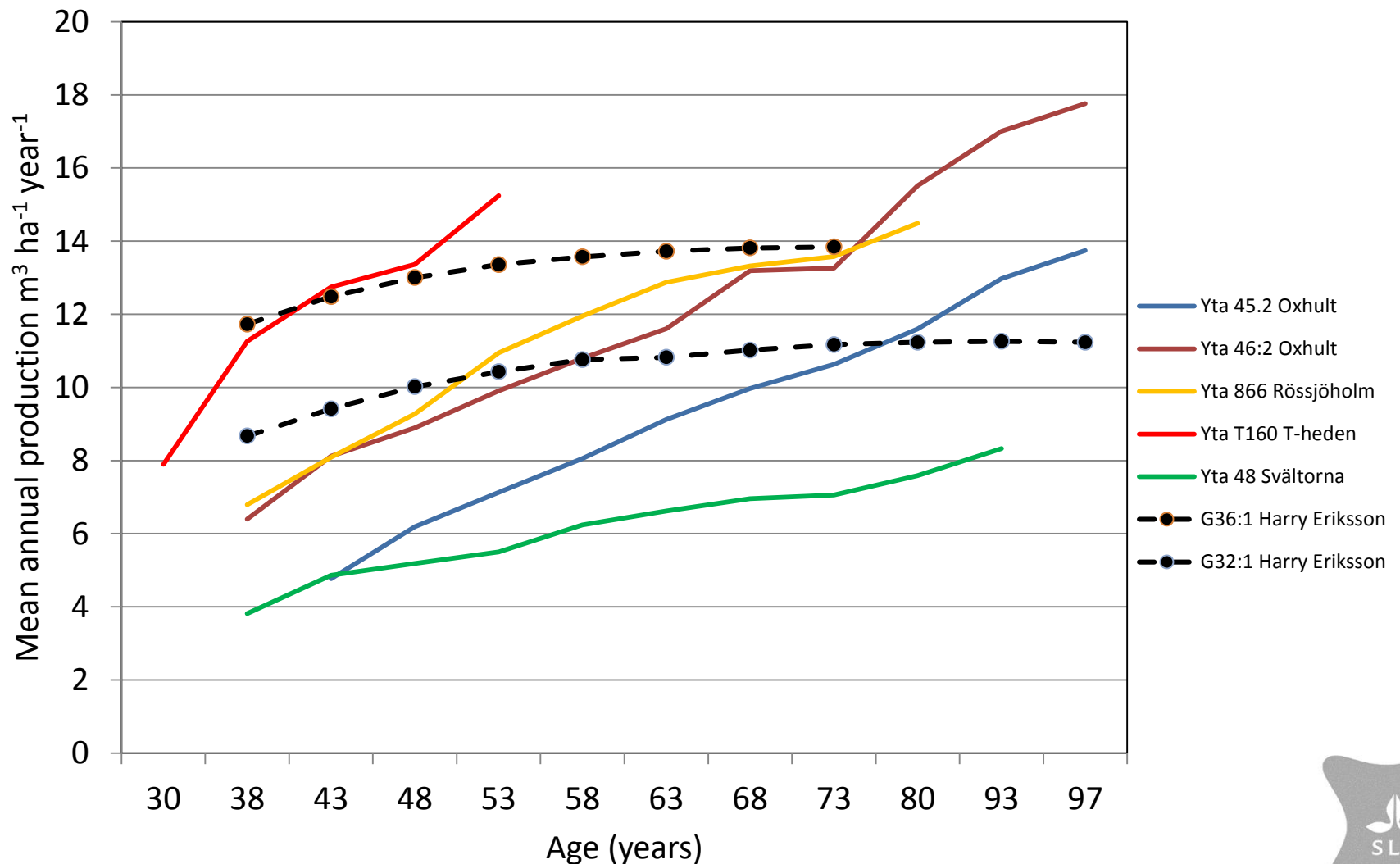
# Comparison of production Sitka spruce vs. Norway spruce

	Increased production	Country
Karlberg (1961)	20-50 %	Sweden
Jansson & Johansson (1980)	22-26 %	Sweden
Henriksen (1988)	9 – 24 %	Denmark
Skovsgaard (1997)	10-80 %	Denmark
Öyen & Tveite (2001)	34 %	Norway
Tengberg (2005)	14 %	Sweden



# Douglas fir

Production in permanent sample plots and in two simulated Norway spruce stands



# Domestic exotic tree species

- Beech in central Sweden
- Oak in the southern parts of northern Sweden
- Genetically improved birch in southern Sweden
- Finnish birch in northern Sweden
- Alder
- Scots pine in southern Sweden

# Non-native broadleaves

- Sycamore maple
- Red- and sugar maple
- Oaks from North-America
- Walnut
- Wild service tree (*Sorbus torminalis*)
- Etc..

# Selection of genetic material (Sweden)

- Plantval for Norway spruce and Scots pine with an option to compensate for climate change
- Seed orchards for Lodgepole pine (no climate change compensation)
- Initial work on hybrid aspen and Douglas fir

# Possible problems

- Invasiveness
- Hybridization
- Biodiversity
- Pests and pathogens
- Public acceptance



# Conclusion

- There are number of possible candidates for enriching our tree-species tool-box
- But research and development is needed especially on choice of provenances. And this has to start now!!
- Therefore, we need to select a number of non-native trees for which we do serious preparation for introduction
- Research is also need on possible negative aspects and a dialog process should be initiated
- Browsing need to be reduced!