

# Local adaptation in silver birch growth and stem quality traits in Latvia

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## INTRODUCTION

- High importance of *Betula pendula* in wood processing industry in the Eastern Baltic region determines active breeding.
- Breeding for adaptability requires assessment of regional and population-wise differences in growth performance and stem quality.
- High genetic diversity, yet low population genetic differentiation (Zhuk et al. 2009). Phenotypic differentiation might be present due to strong local adaptation.
- The aim - to detect geographic patterns of local adaptation based on growth and stem quality variation.

## MATERIALS & METHODS

- Two progeny trials with open-pollinated silver birch progenies of plus-trees from 26 provenances across Latvia.
- Principal Component (PC) Analysis to assess the main patterns of growth and quality traits of the provenances at the age of 14 years.
- Relationship between geographical location and PCs.
- The narrow-sense heritability  $h^2$  calculated for each of the determined regions.

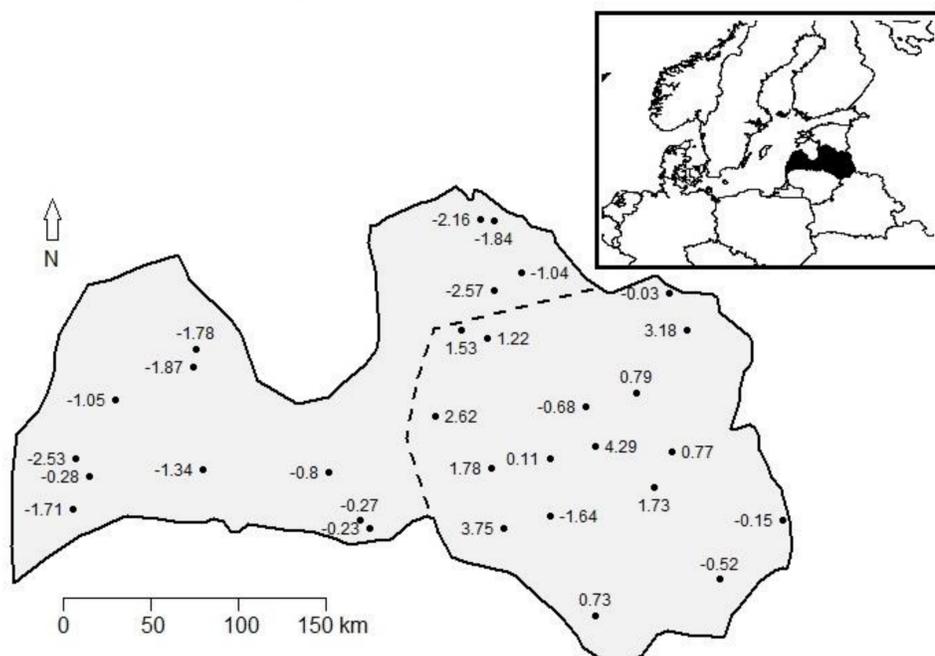
Means and narrow sense heritability indices of the studied traits for the distinguished provenance regions of Latvia.

Trait	Mean $\pm$ sd		$h^2 \pm$ se	
	Western	Eastern	Western	Eastern
Height, m	11.8 $\pm$ 1.9	12.3 $\pm$ 1.9	0.28 $\pm$ 0.04	0.61 $\pm$ 0.06
DBH, cm	9.06 $\pm$ 2.8	9.8 $\pm$ 2.8	0.32 $\pm$ 0.04	0.42 $\pm$ 0.05
Stem volume, dm <sup>3</sup>	45.2 $\pm$ 26.6	53.2 $\pm$ 29.9	0.29 $\pm$ 0.04	0.41 $\pm$ 0.05
Spike knots, %	57.3	59.1	0.05 $\pm$ 0.02	0.07 $\pm$ 0.02
Double leaders, %	9.7	11.4	0.15 $\pm$ 0.04	0.16 $\pm$ 0.01
Lost top, %	52.3	49.2	0.03 $\pm$ 0.02	0.01 $\pm$ 0.02
Stem straightness	2.2	2.2	0.45 $\pm$ 0.06	0.26 $\pm$ 0.06
Stem quality	2.8	2.8	0.24 $\pm$ 0.04	0.28 $\pm$ 0.06
Branch angle score	2.0	2.0	0.51 $\pm$ 0.11	0.30 $\pm$ 0.12

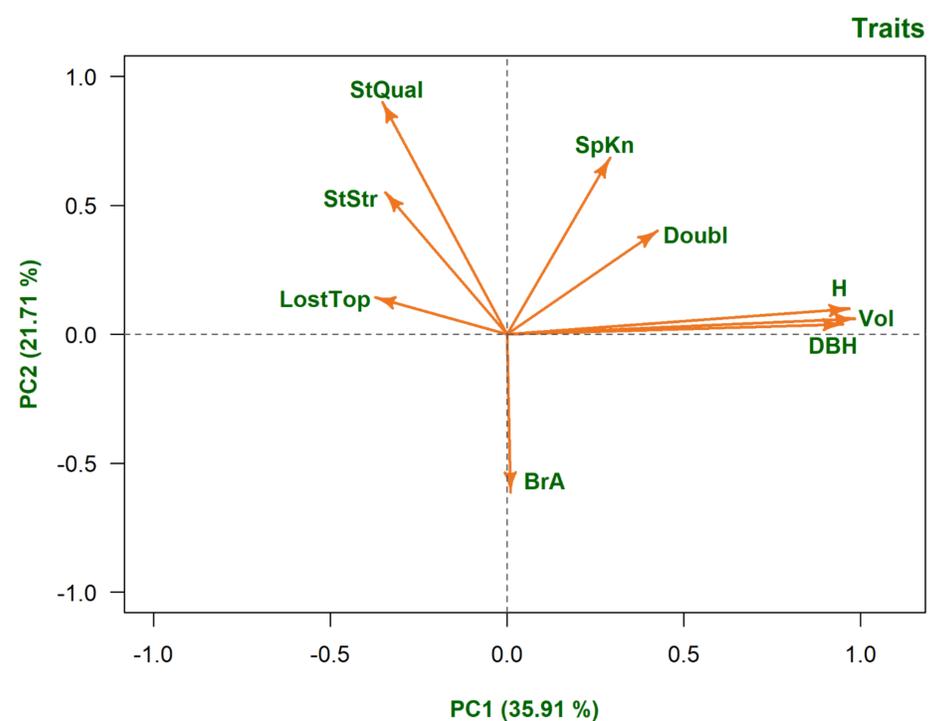
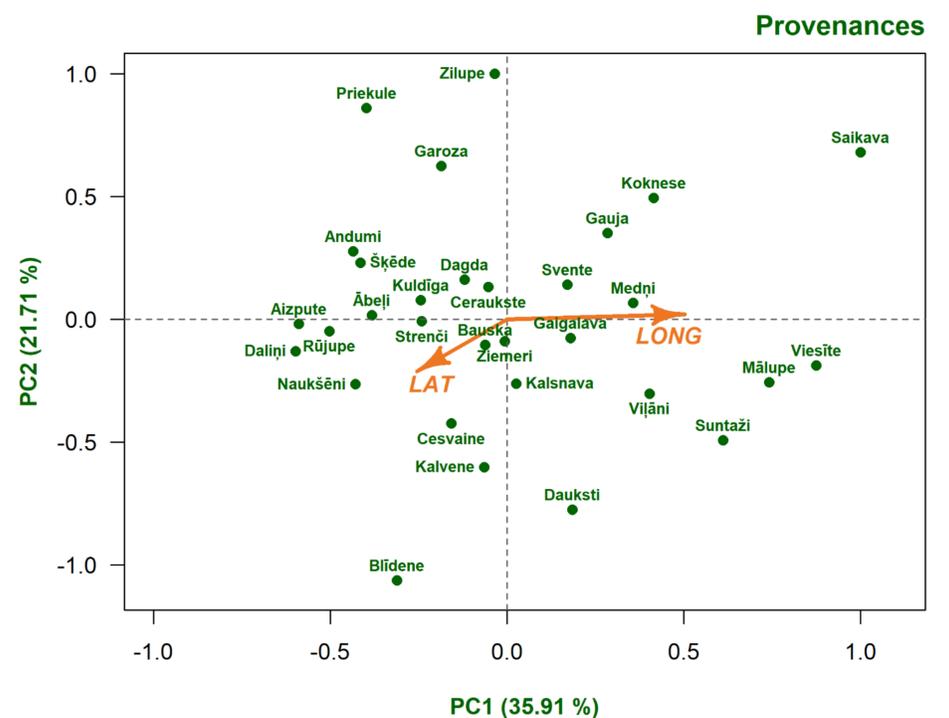
## RESULTS

- The first two PCs corresponded for 57.6 % of the total variance.
- The first PC related to the growth traits correlated with the longitude of origin of the provenances.
- Arbitrary division of eastern and western provenance regions according to scores of PCA.

The scores of the first PC of progenies overlain on their geographic locations. The dotted line indicates border of two arbitrarily distinguished provenance regions.



- The high genetic diversity within silver birch populations has favoured strong local specialization.
- Superior growth and higher heritability (0.41 - 0.61) in the more continental eastern provenance region.
- Moderate to high heritability for stem straightness, branch angle and overall stem quality for both regions.



## CONCLUSIONS

- Two provenance regions for silver birch in Latvia with respect to growth performance can be delineated.
- Better growth and higher heritability within the best provenances in more continental eastern region may constitute adaptable breeding population.
- Both provenance regions possess similarly high heritability for stemwood quality.

## REFERENCES

Zhuk A, Šķipars V, Veinberga I, Gailis A, Ruņģis D (2009). Assessment of genetic diversity in Latvian silver birch *Betula pendula* Roth populations. *Latvijas Veģetācija*. 18: 5–12.