

Individual-tree genetic modeling to assess adaptive responses to local environment conditions - implications for the European scale

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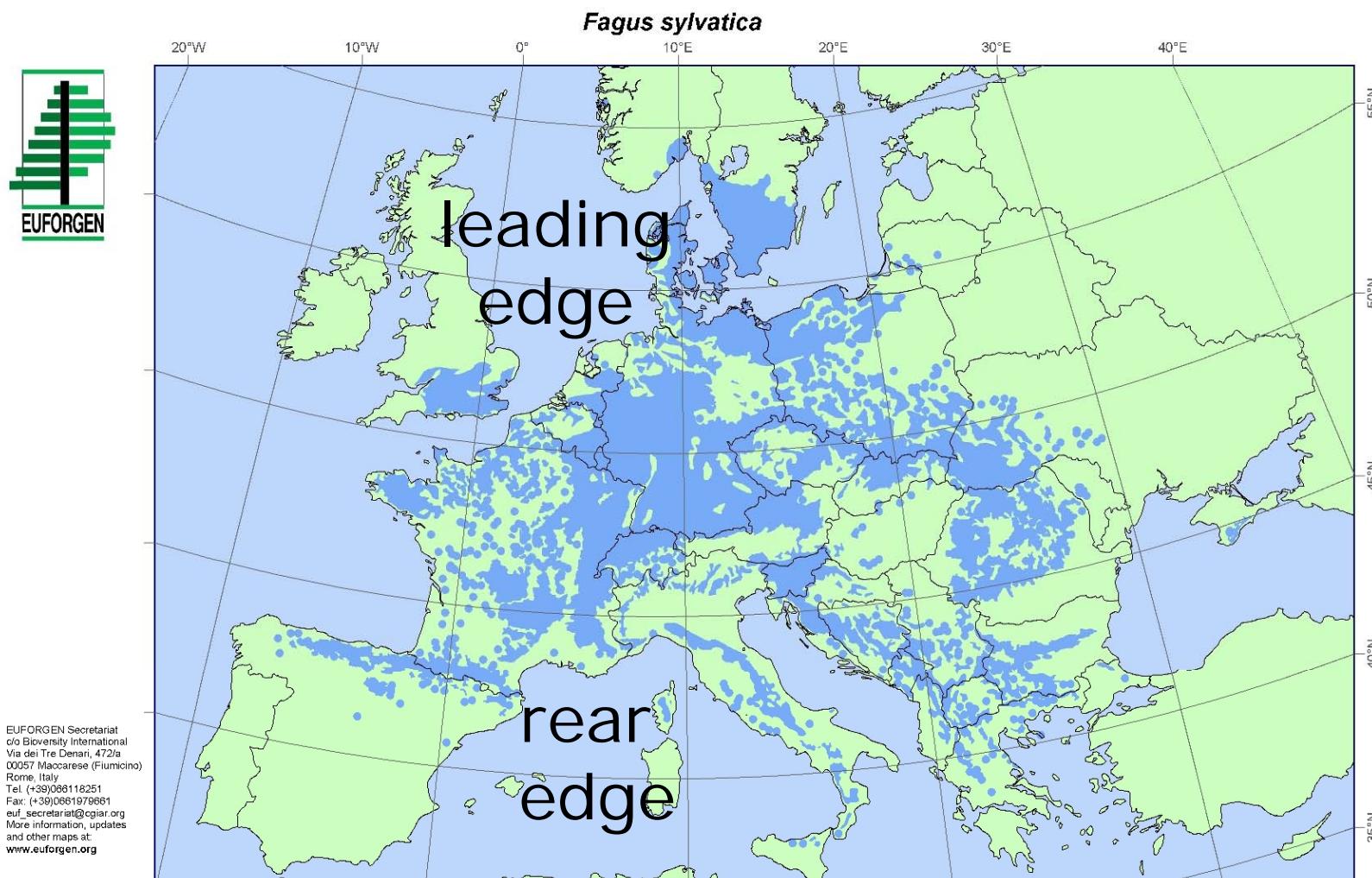
Final meeting Eberswalde 13-15 April 2016



COST is supported by the
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Why genetic modelling?



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and other maps at:
www.euforgen.org

This distribution map, showing the natural distribution area of *Fagus sylvatica* was compiled by members of the EUFORGEN Networks based on an earlier map published in:
Pott R. (2000) Palaeoclimate and vegetation - long-term vegetation dynamics in central Europe with particular reference to beech. *Phytocoenologia* 30(3-4): 285-333

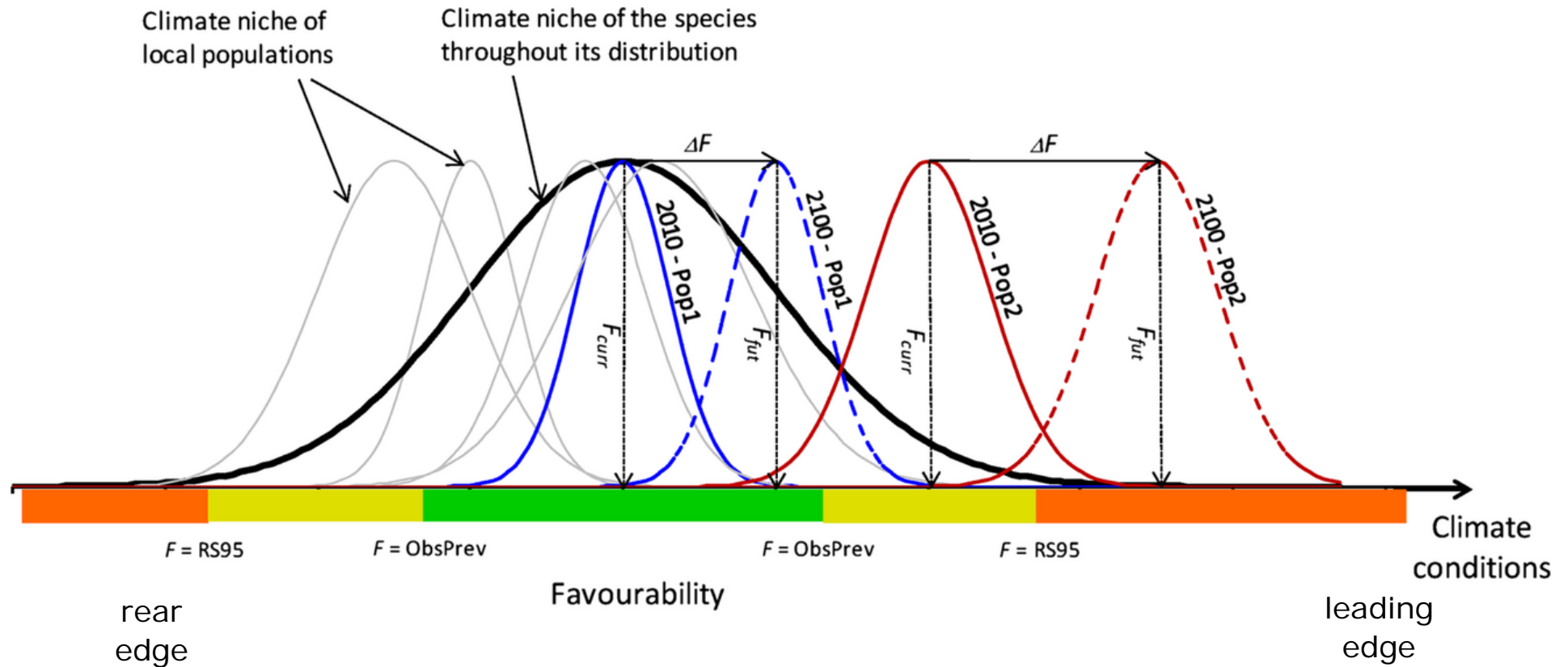
Citation: Distribution map of Beech (*Fagus sylvatica*) EUFORGEN 2009, www.euforgen.org.

First published online on 30 August 2006 - Updated on 23 July 2008

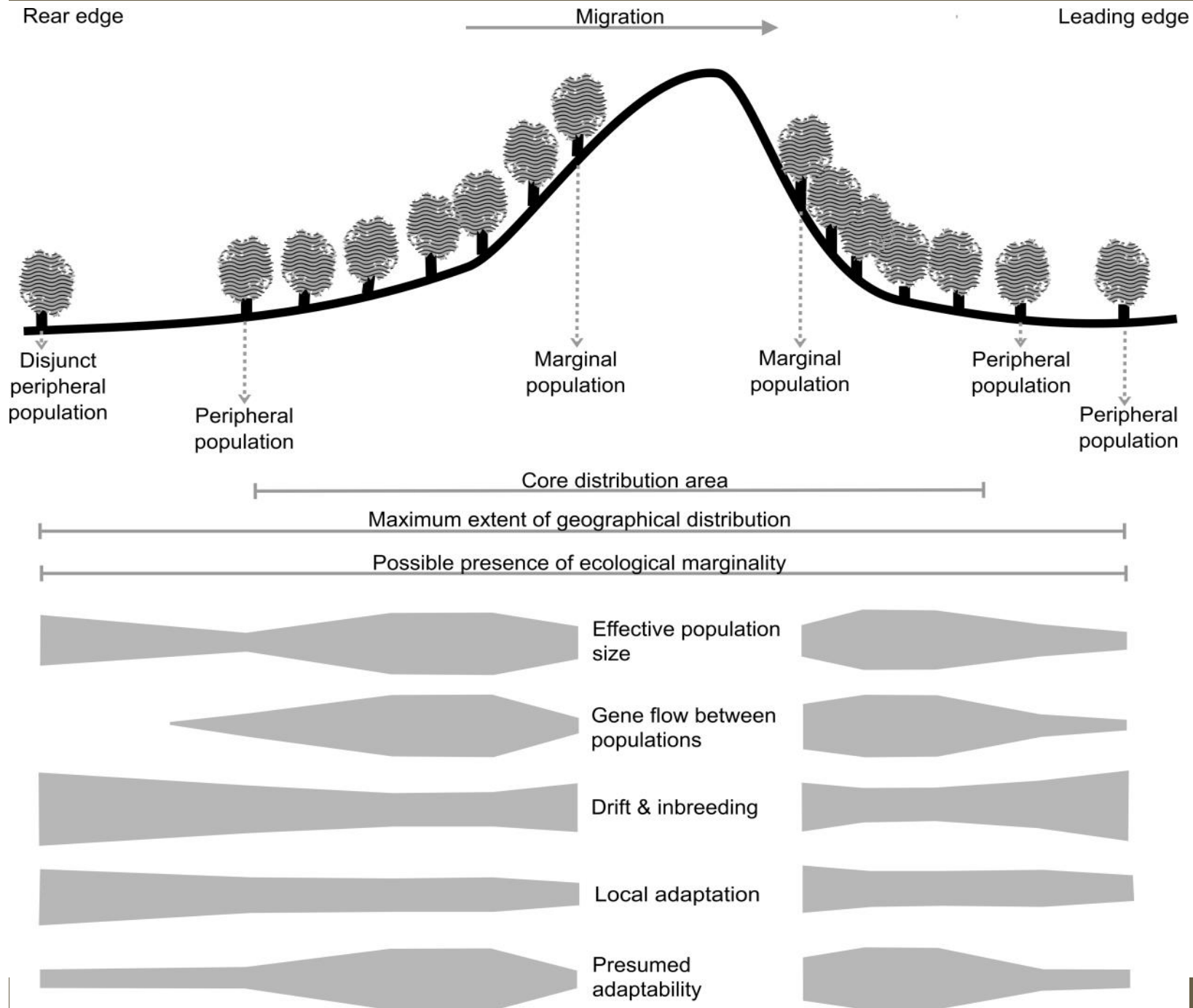
0 250 500 1,000 Km

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HNOLOGY

climate niches - local vs whole distribution

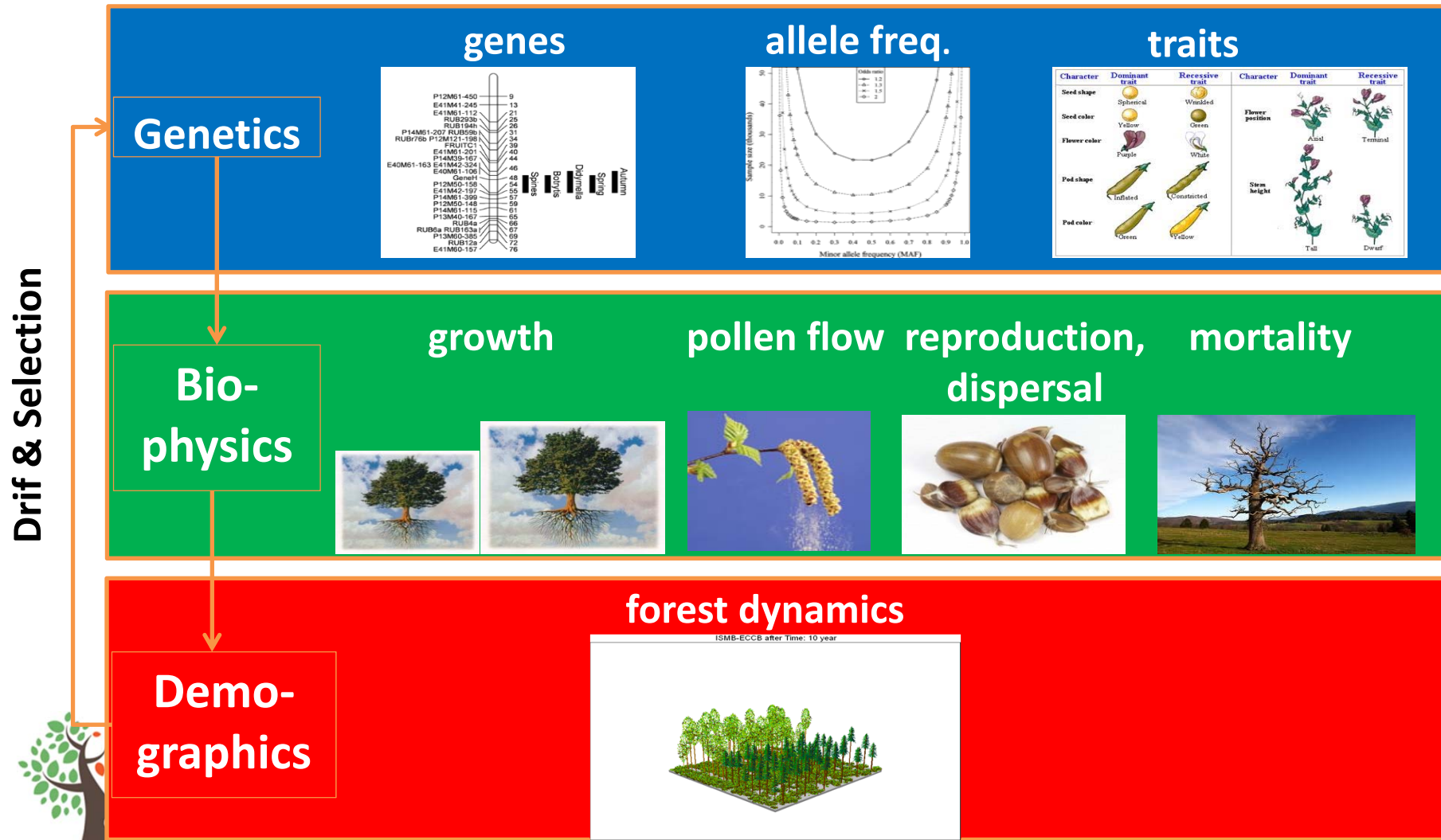


Schueler, et al. 2014, GCB



Fady , et al.
in prep.

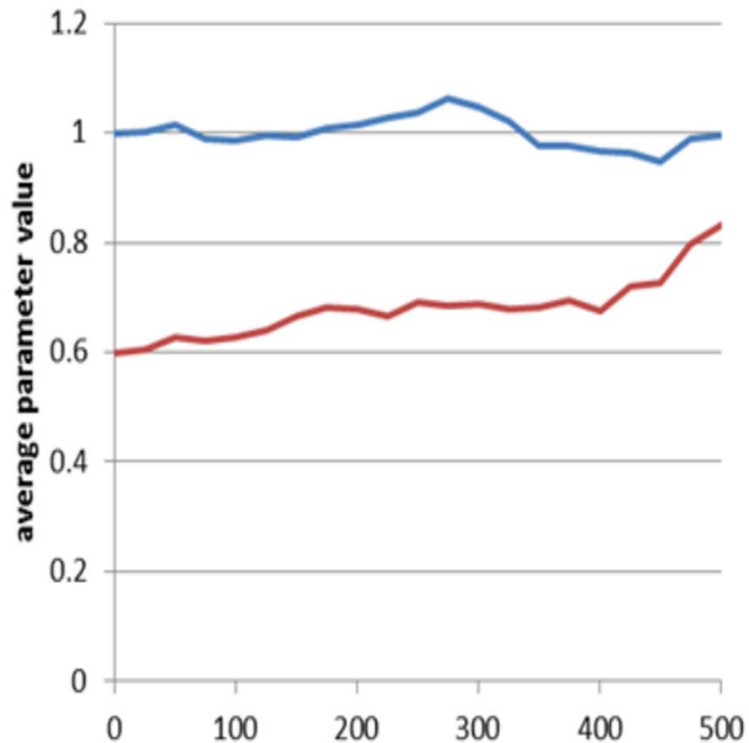
ForGEM model





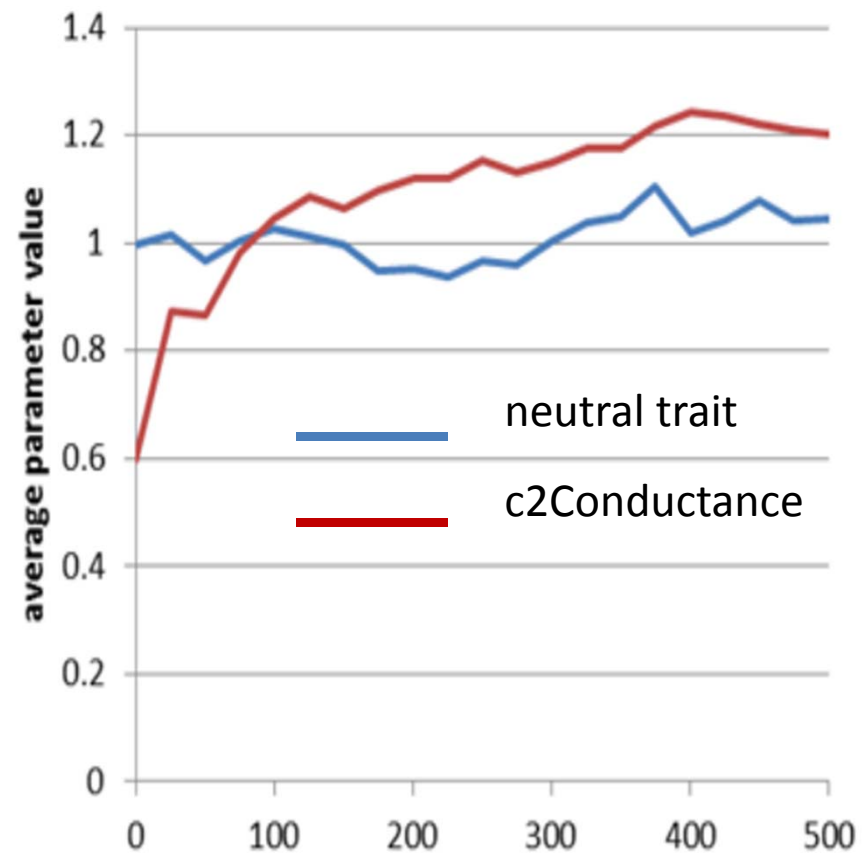
Example 1. Genetic adaptation of a model parameter related to stomatal conductance

Cool and wet



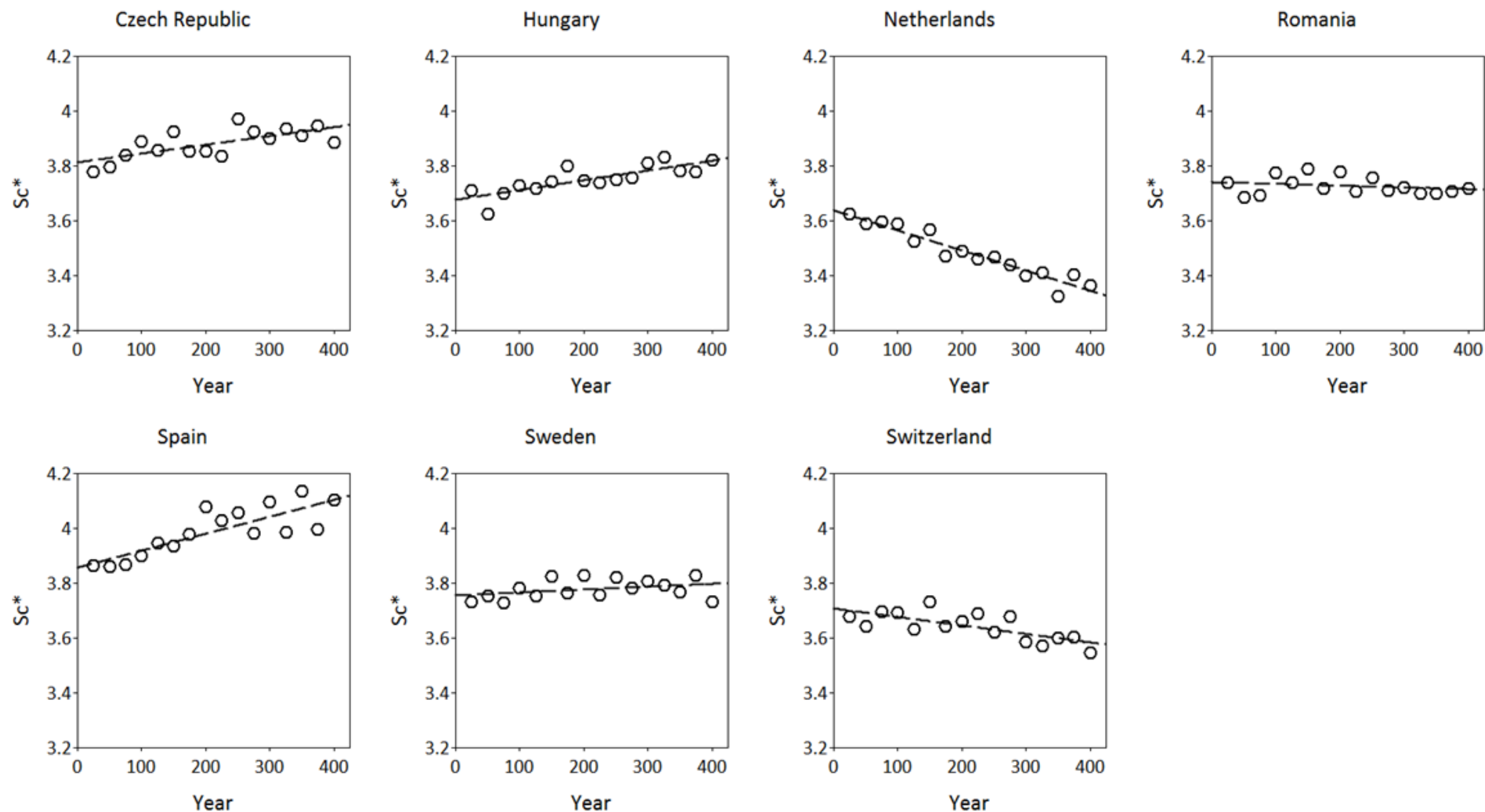
time (yr)

Warm and dry



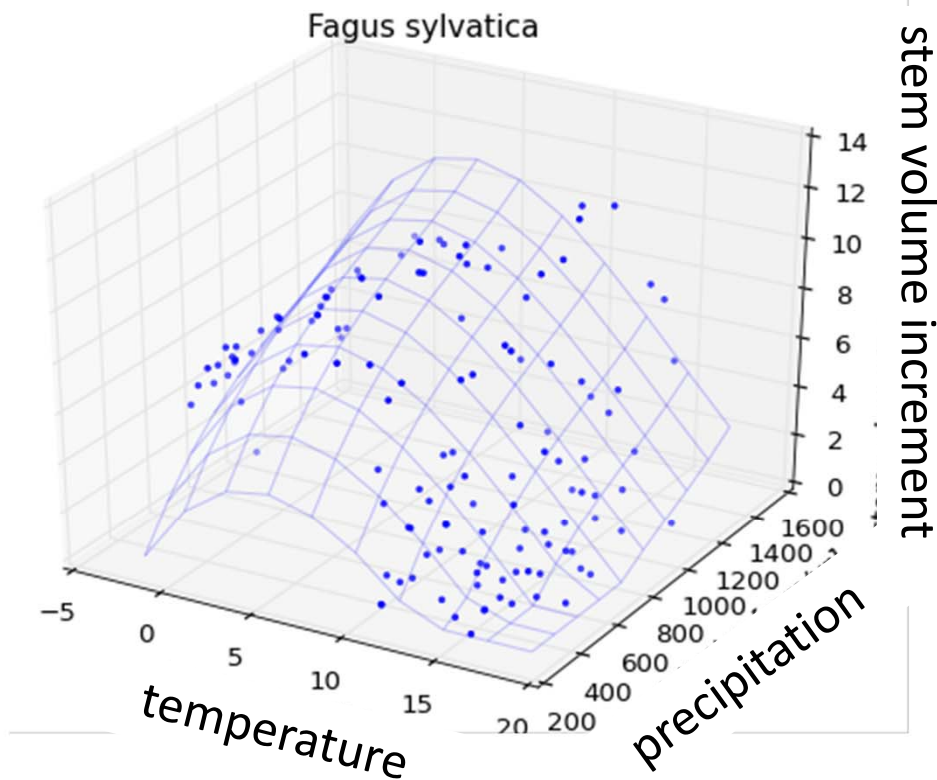
time (yr)

Example 2. Adaptive response of critical state of chilling

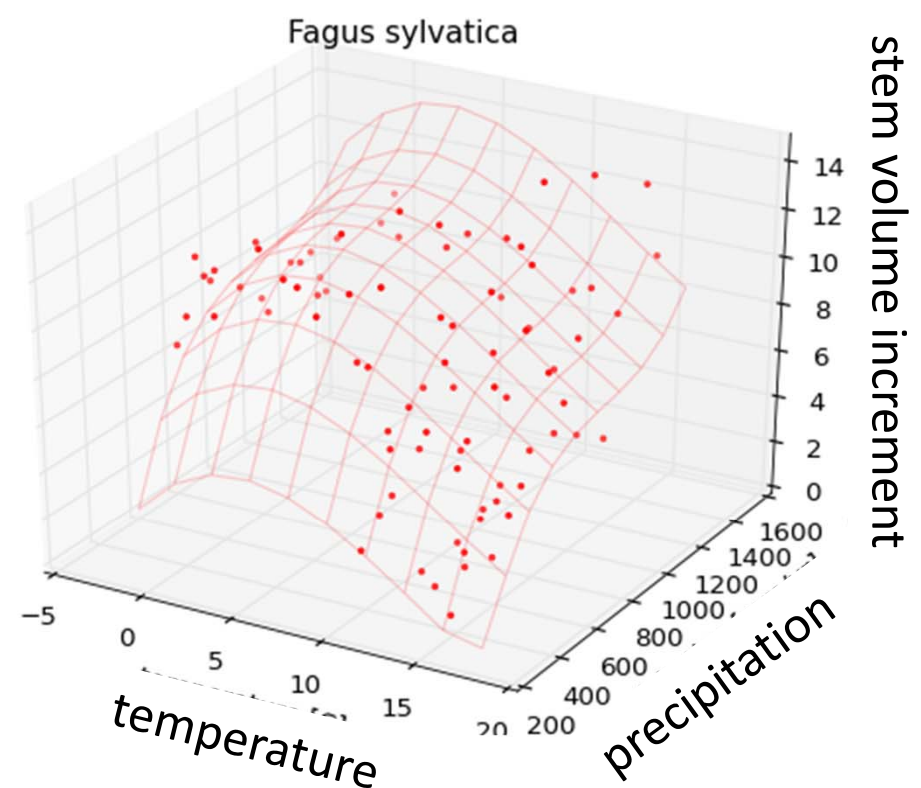


Consequences of adaptive response on stem volume increment - beech

No adaptation

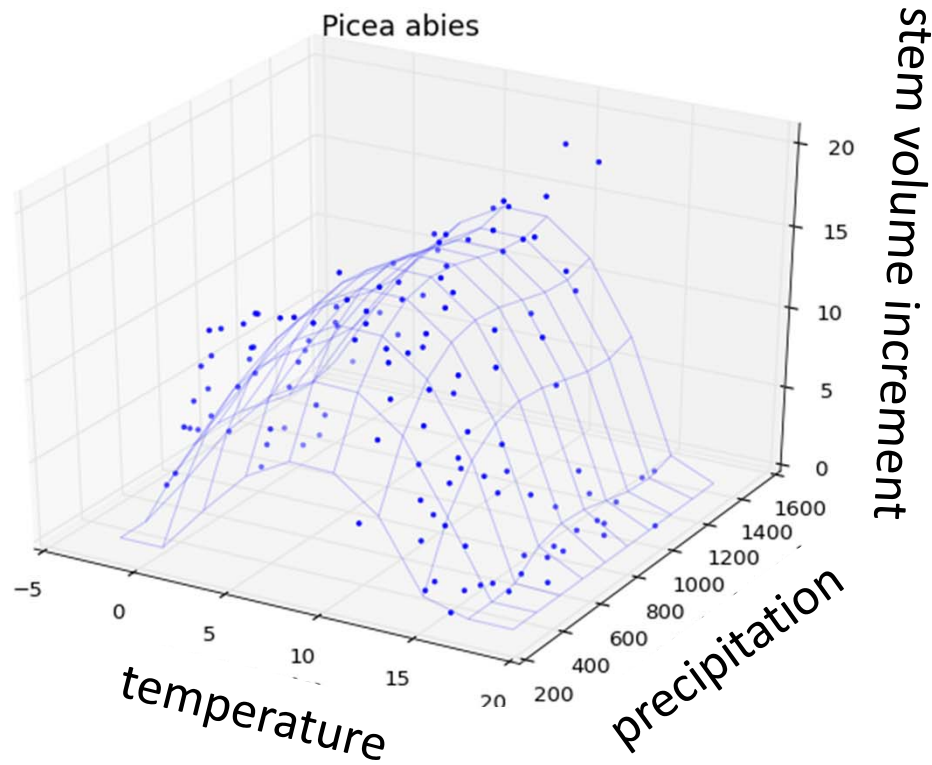


With adaptation

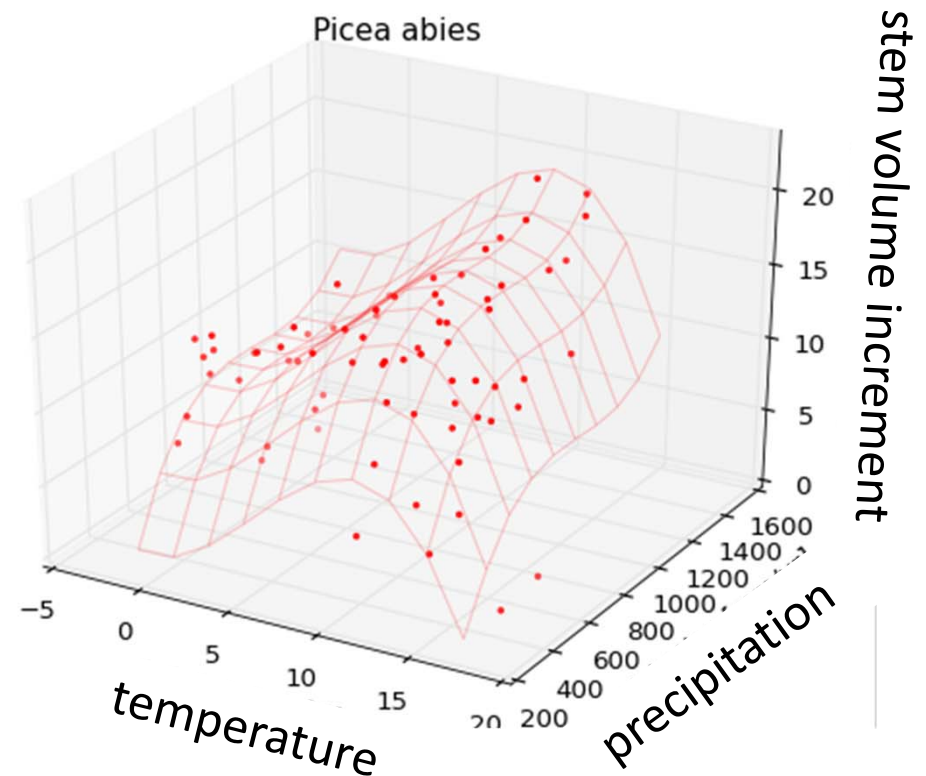


Consequences of adaptive response on stem volume increment – N.spruce

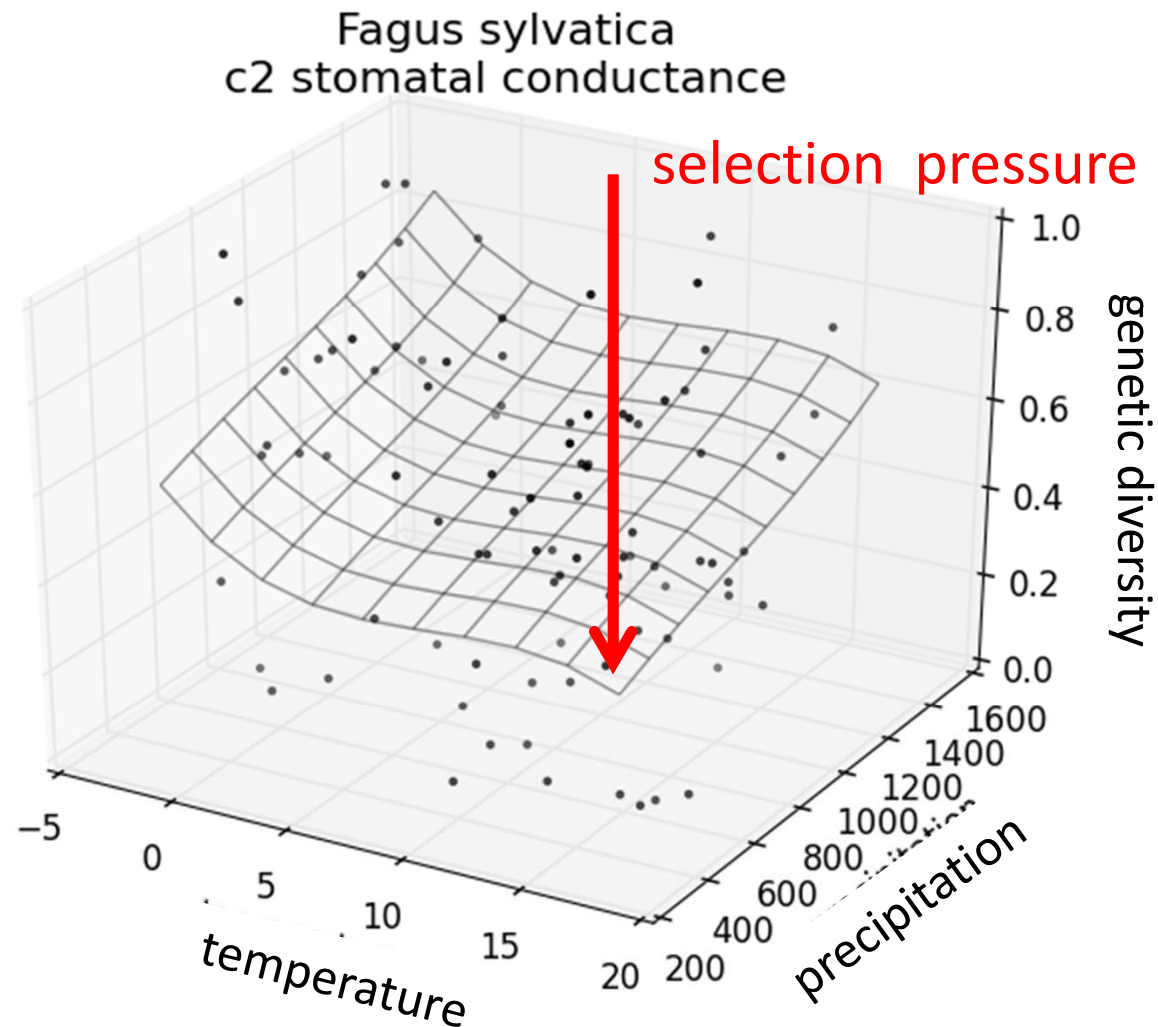
No adaptation



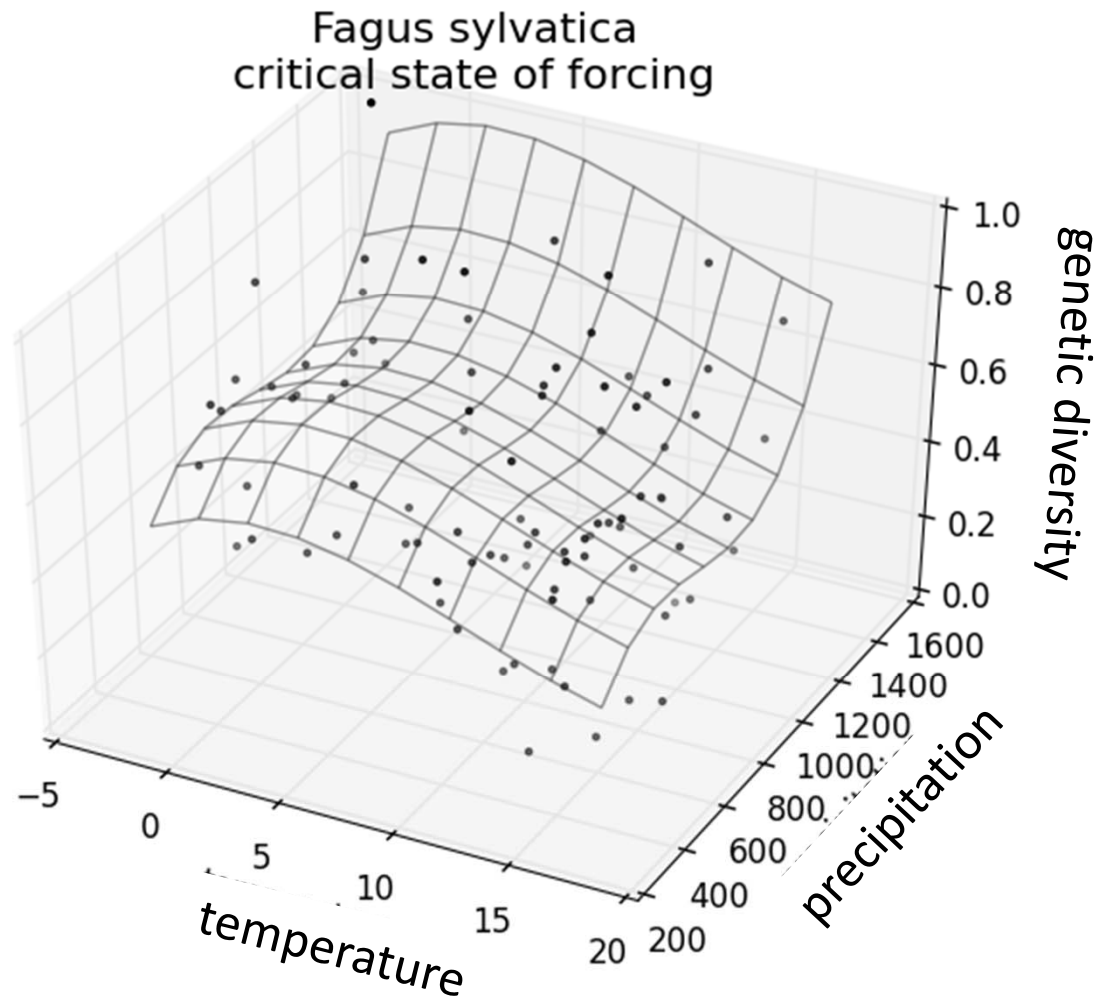
With adaptation



Consequences of adaptive response on genetic diversity - conductance



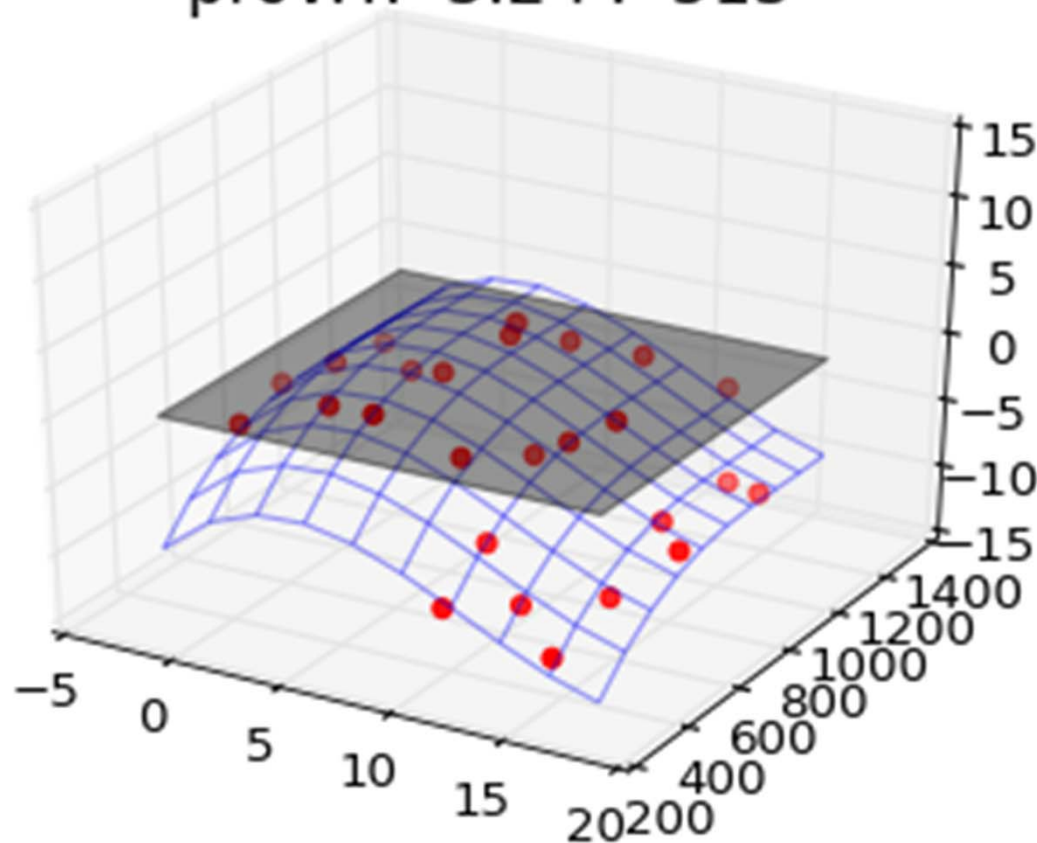
Consequences of adaptive response on genetic diversity - phenology



in silico provenance trial – Ex.1

difference in stem volume increment with local provenance

prov:T: 3.2 P: 513



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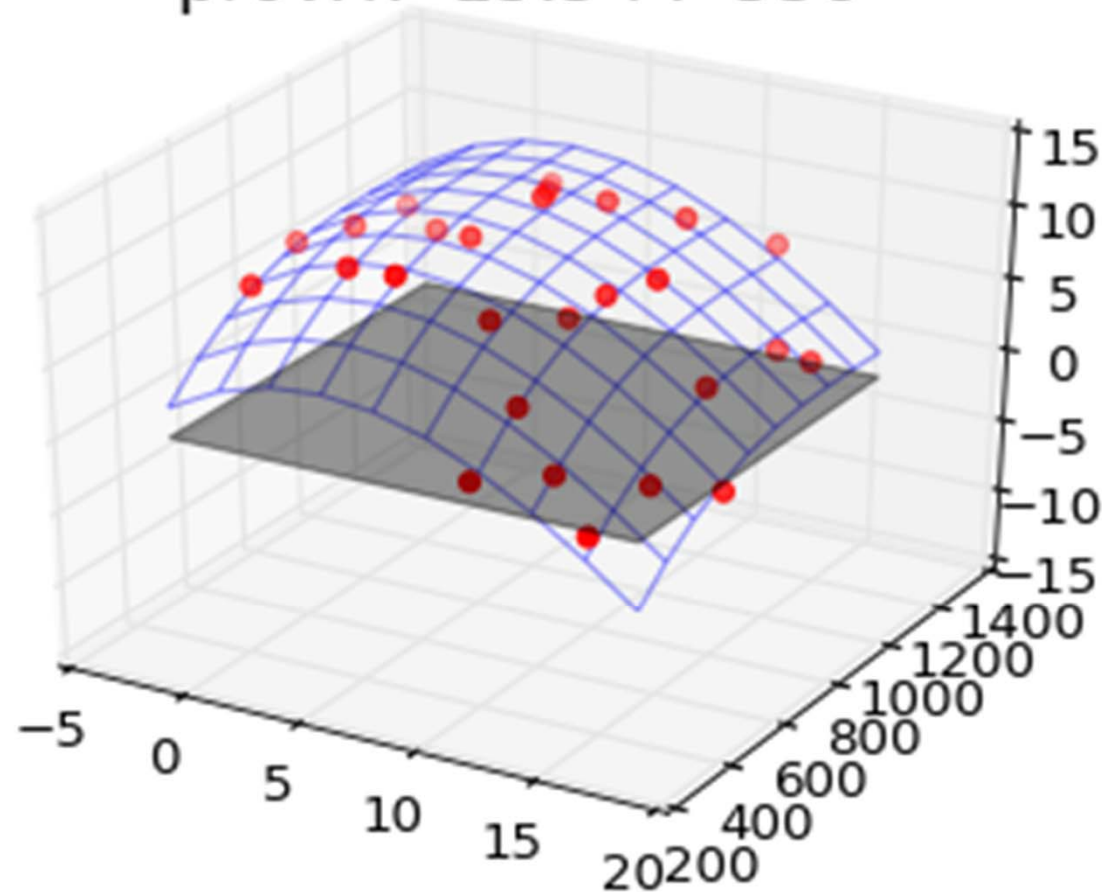
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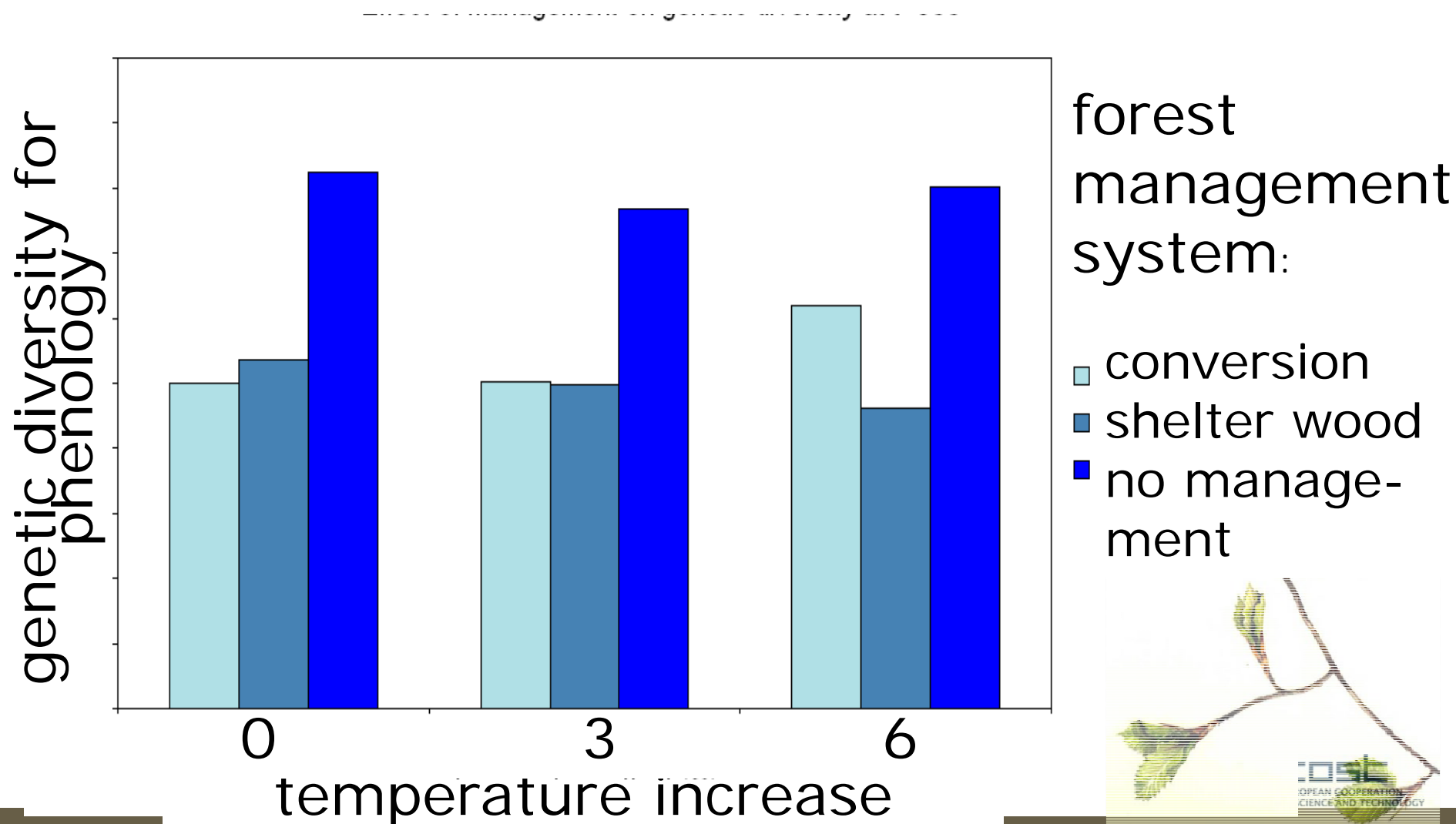
in silico provenance trial – Ex.2

difference in stem volume increment with local provenance

prov:T: 15.5 P: 538



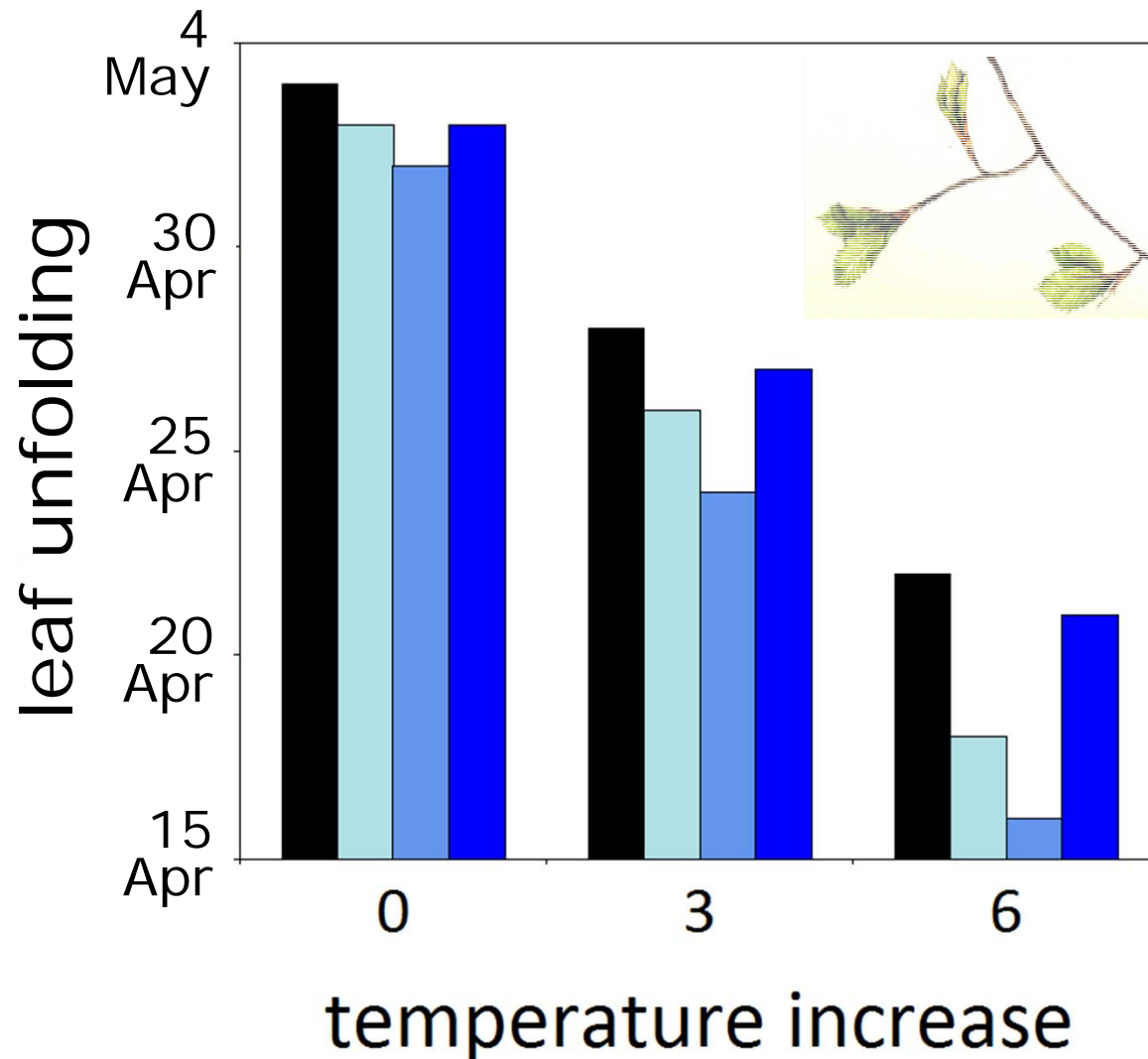
Genetic information for management: simulated impact management on adaptive capacity



simulated impact of management on rate of adaptation

forest
management
system:

- 1. No adaptation
- 2. Conversion
- 3. Shelter-wood
- 4. No management



Conclusions (1/2)

Genetic processes are important to take into account in climate change impact assessment:

- adaptive differences across distribution of tree species, local responses may differ from global responses
- selection intensity differs along environmental gradients, and differs between parameters / eco-physiological processes



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Conclusions (2/2)

Research needs:

- rates of adaptation vs environmental change
- genetic base of: adaptation – plasticity - acclimation
- assess functional – adaptive- diversity



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