



ALTERRA

WAGENINGEN UR

Microevolution of trees and climate change.

A simulation study bridging eco-physiology and quantitative genetics

Koen Kramer, Bert van der Werf, Wim de Winter

Alterra, Wageningen University and Research Centre, The Netherlands

Netherlands Annual Ecology Meeting 2013
6 February 2013

Conference Centre "De Werelt", Lunteren



www.fp7-forger.eu

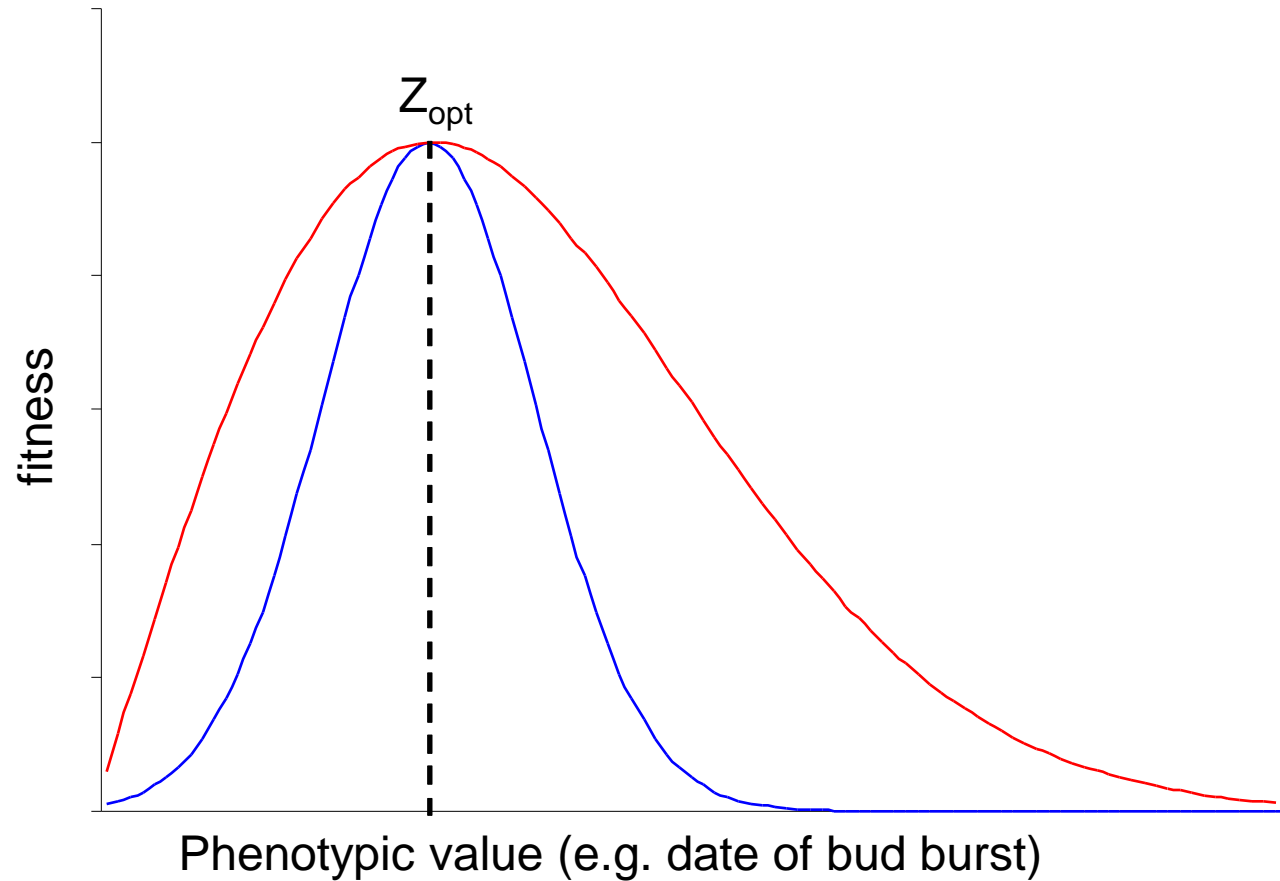
TOWARDS THE SUSTAINABLE MANAGEMENT
OF FOREST GENETIC RESOURCES IN EUROPE



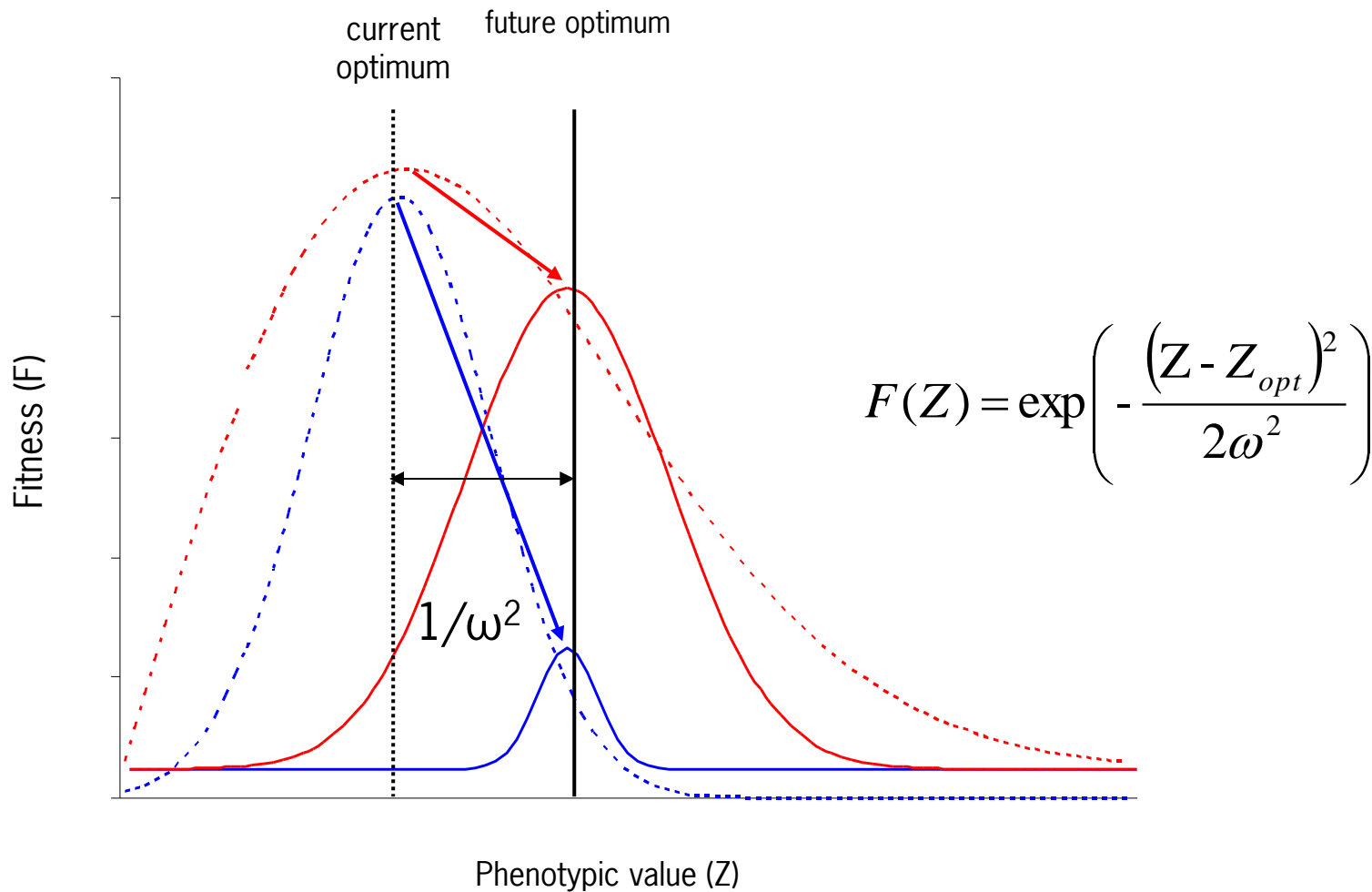
Structure of presentation

- Classical population genetic modeling
- Individual-based quantitative genetic modeling
- Examples simulated effects of climate change – forest management interactions on micro-evolutionary responses of European beech
- Conclusions

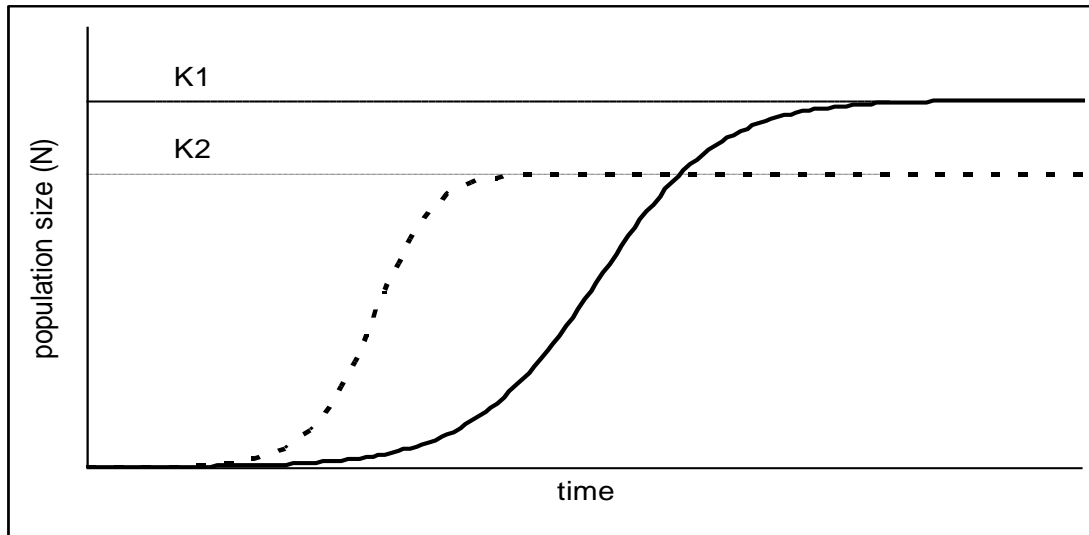
Classical population genetics



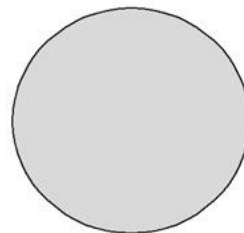
Classical population genetics



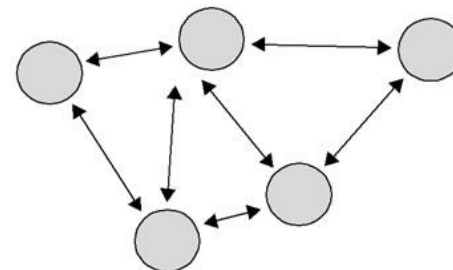
Classical population genetics



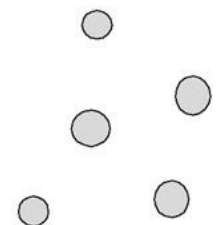
$$N_{t+1} = N_t + r \cdot N \cdot \left(\frac{K - N}{K} \right)$$



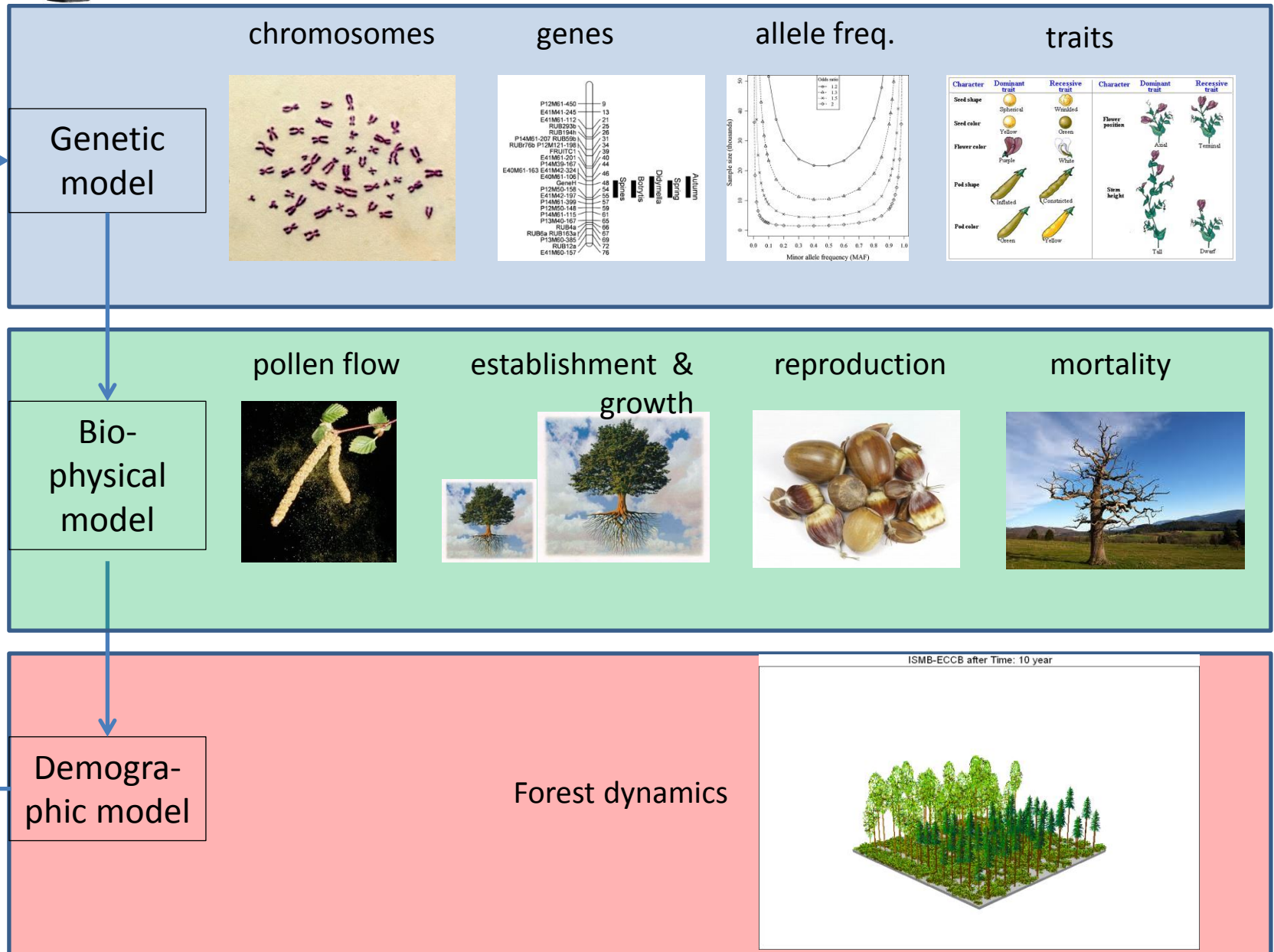
(a) No subdivision



(b) Intermediate subdivision



(c) Extreme subdivision

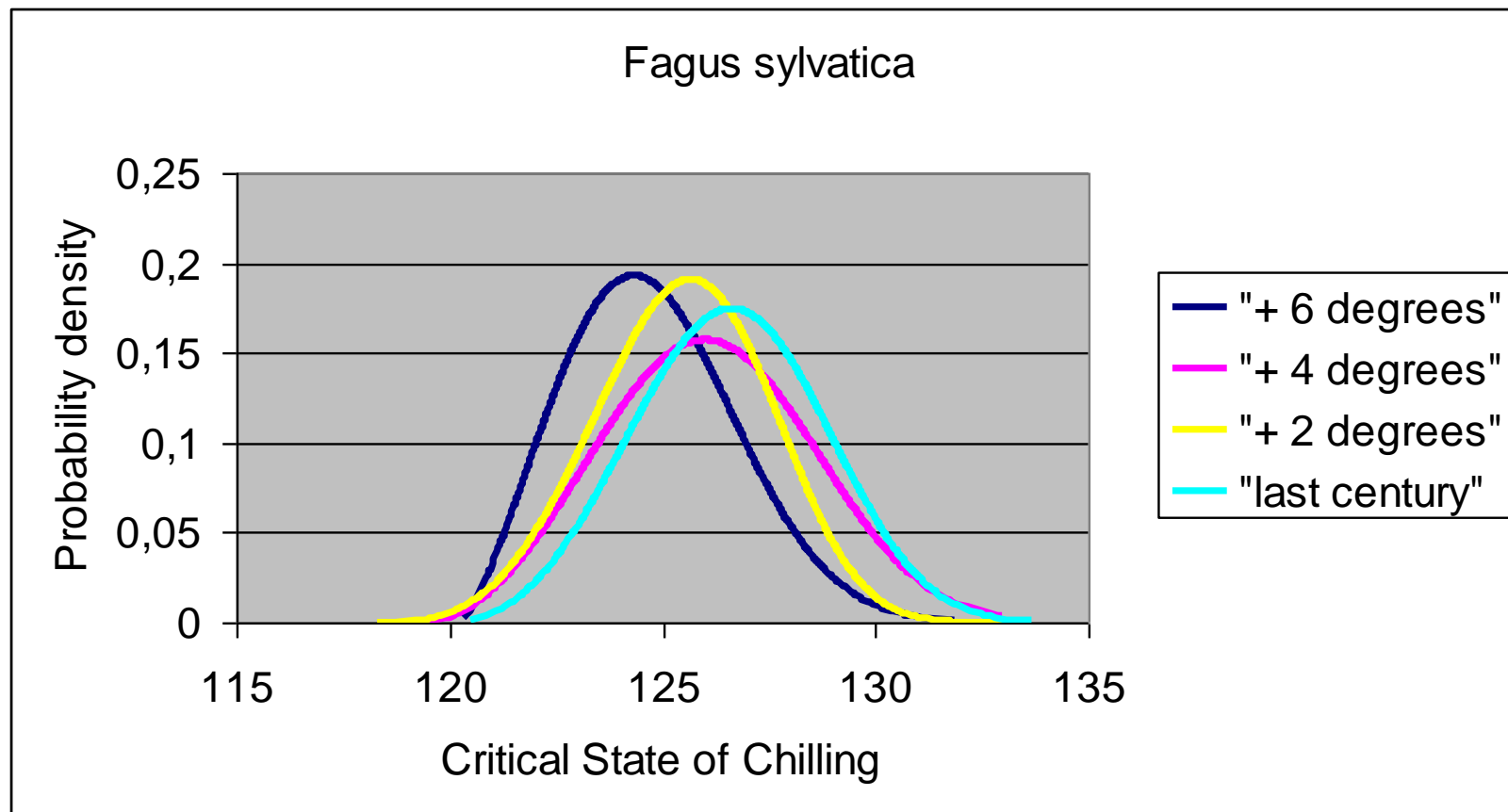


Examples

Simulated effect climate
change – forest
management
interactions on micro-
evolutionary responses
of European beech

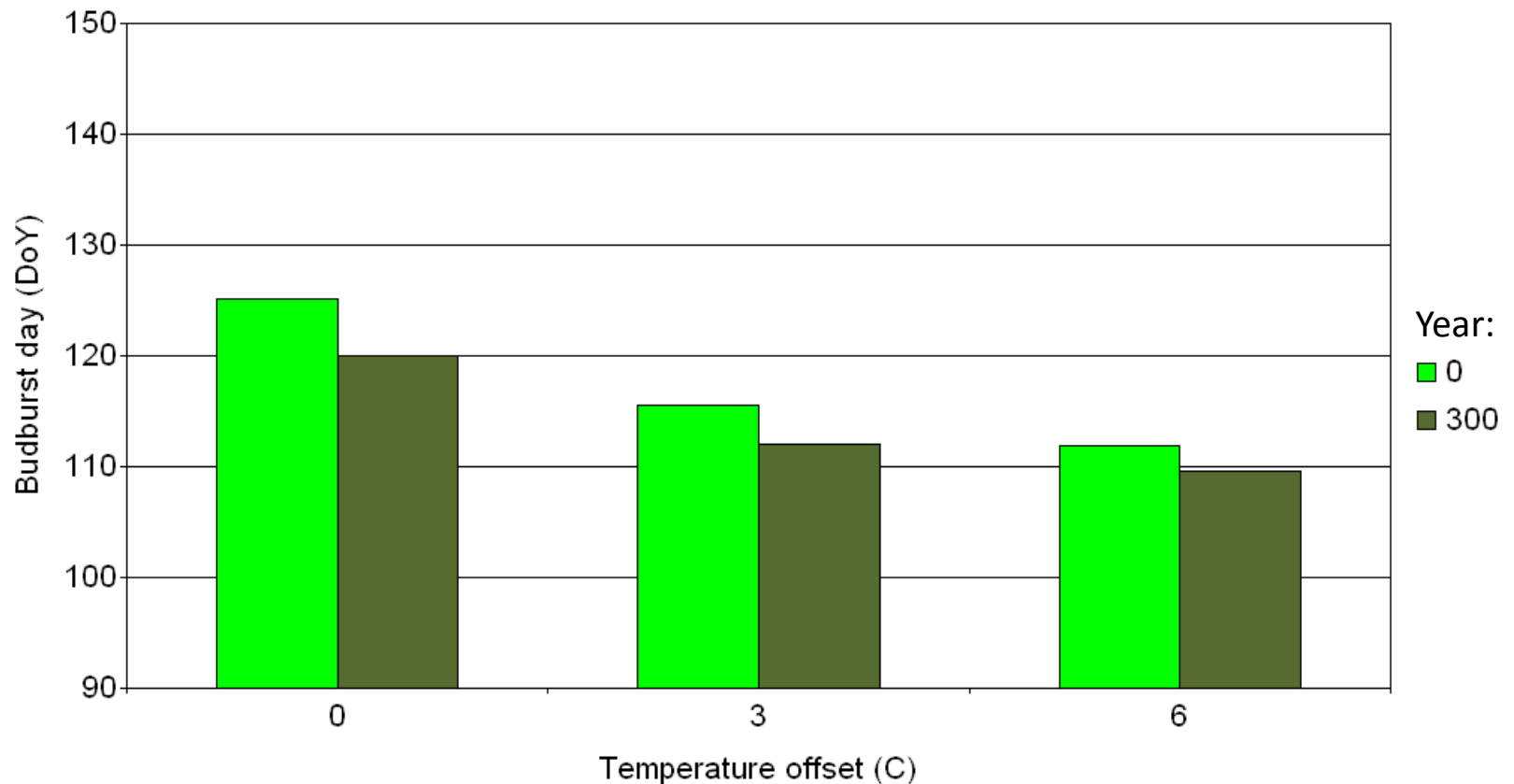


Adaptive response of chilling requirement



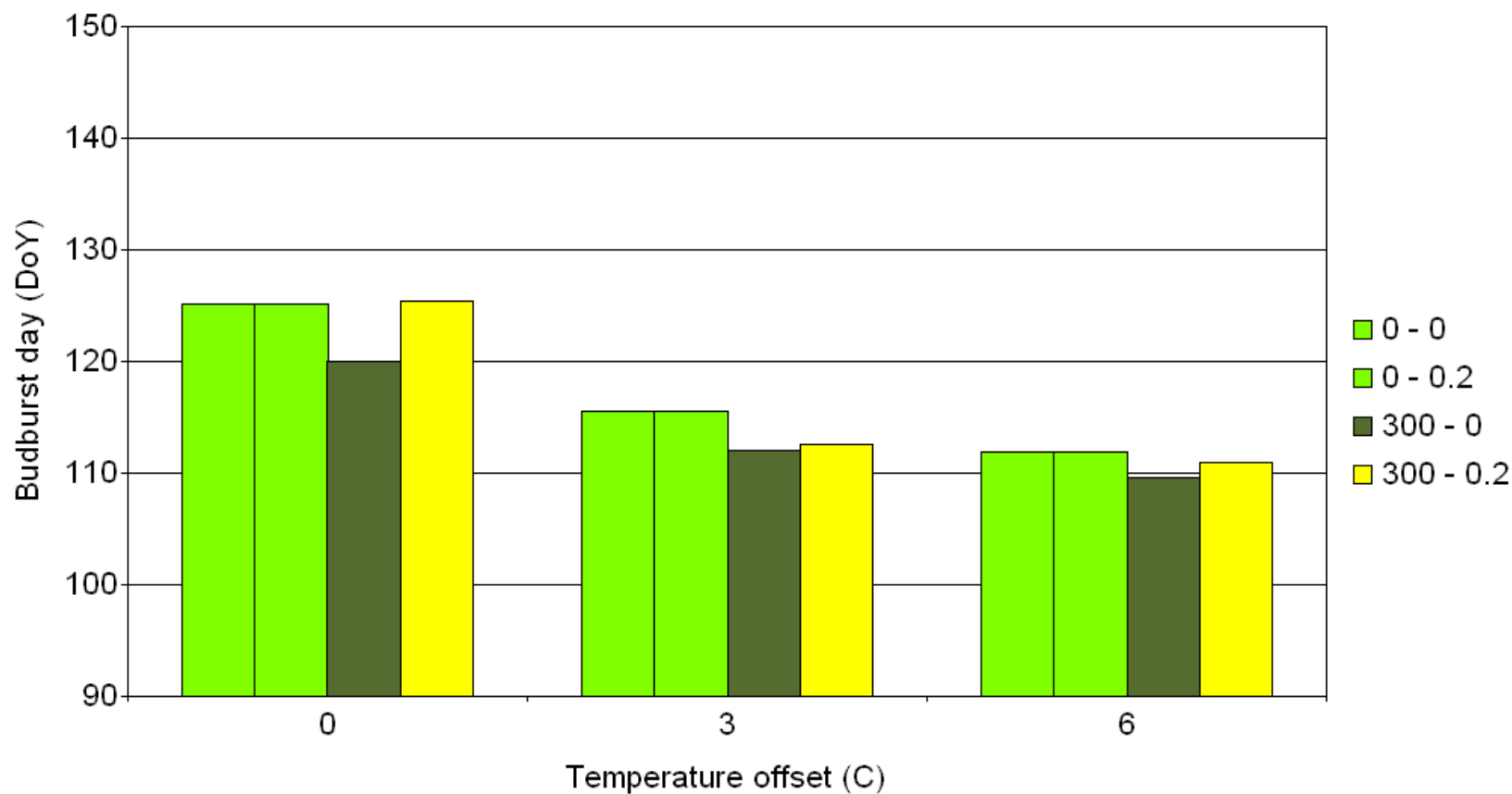
Response of bud burst to temperature

Phenotypic plastic response of bud burst to temperature at $t=0\text{yr}$ + adaptive response at $t=300\text{yr}$

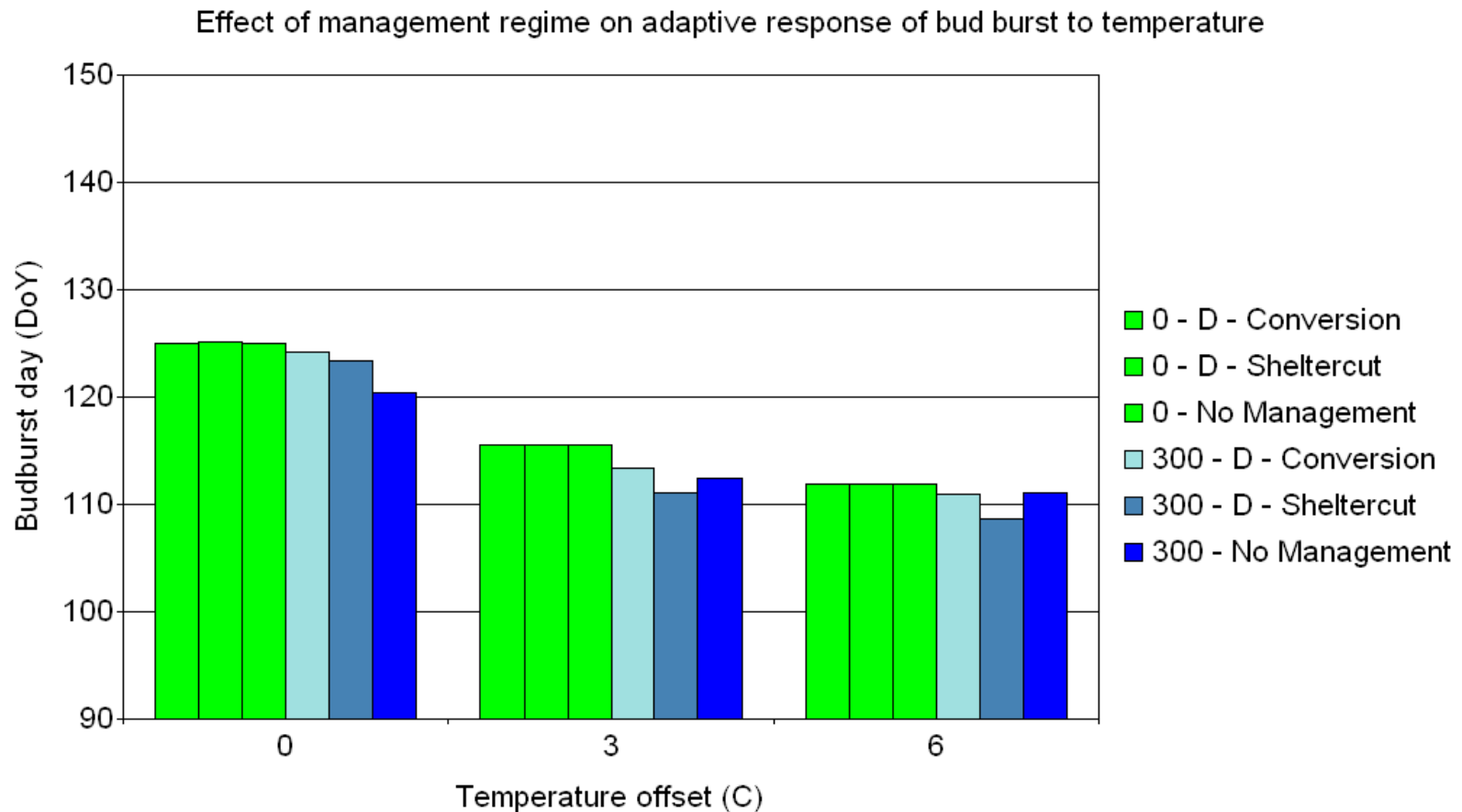


Interaction temperature - pollen flow

Effect of external pollen flow on adaptive response of bud burst to temperature

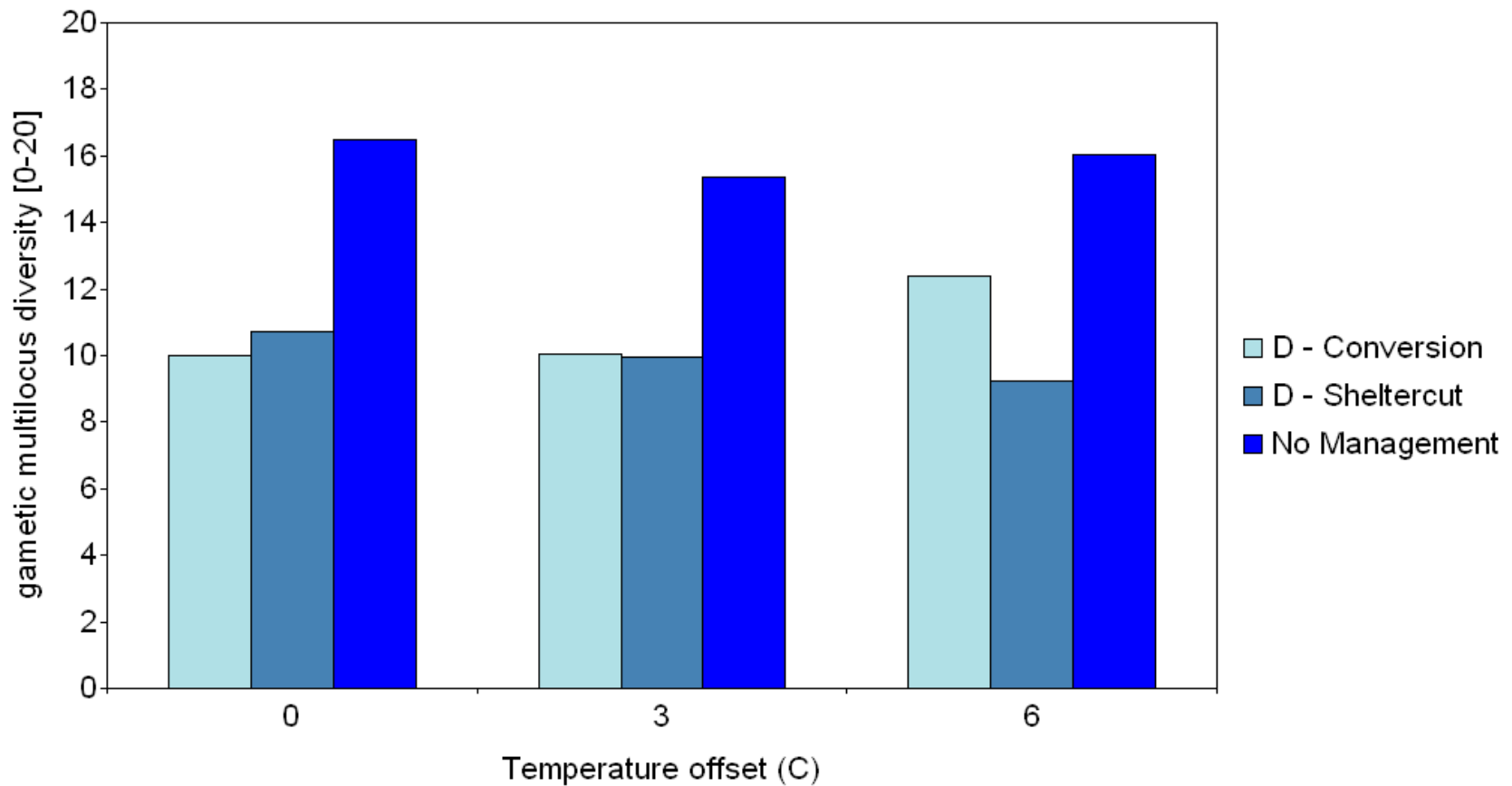


Interaction temperature – forest management



Management and genetic diversity

Effect of management on genetic diversity at t=300

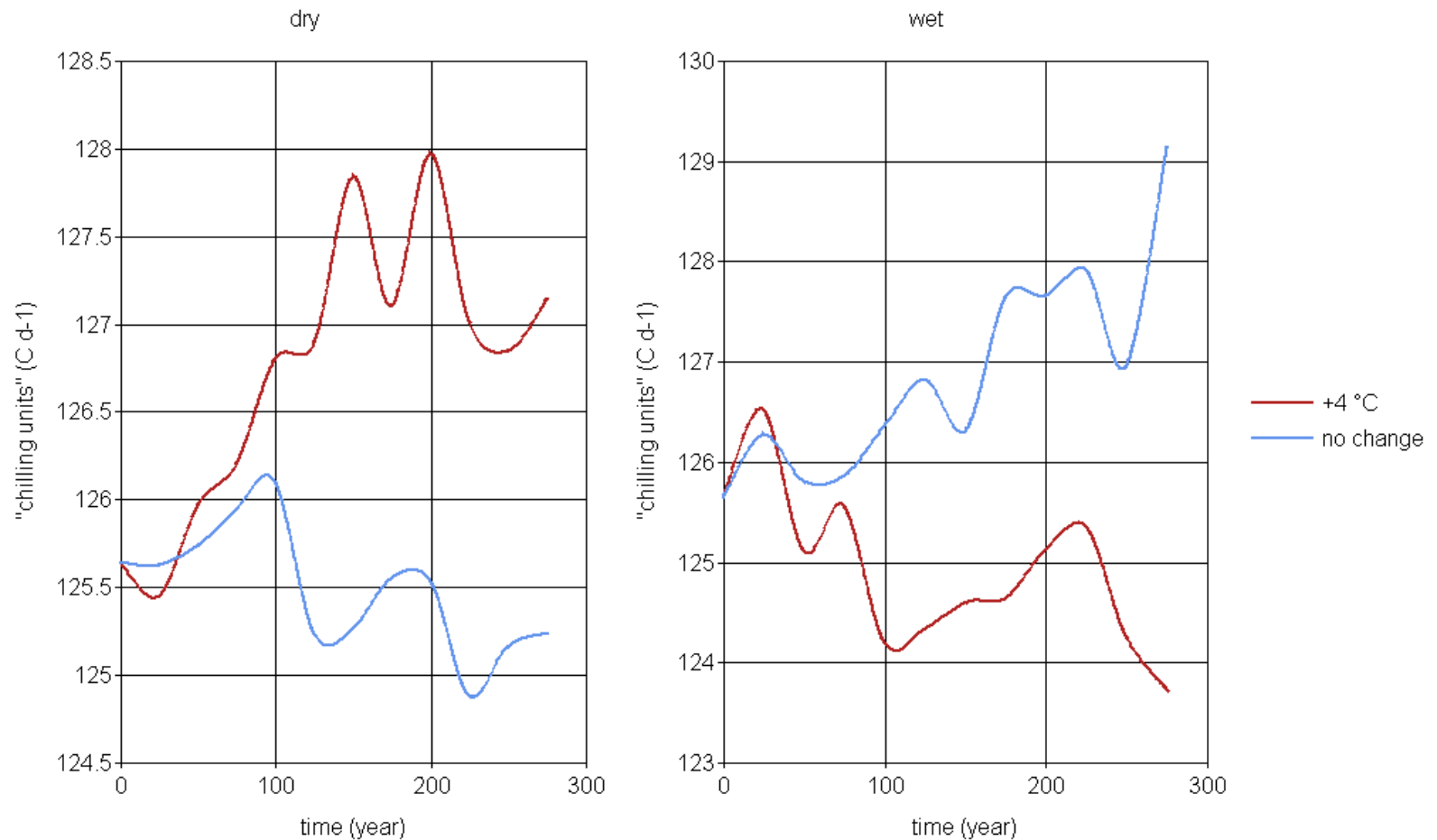


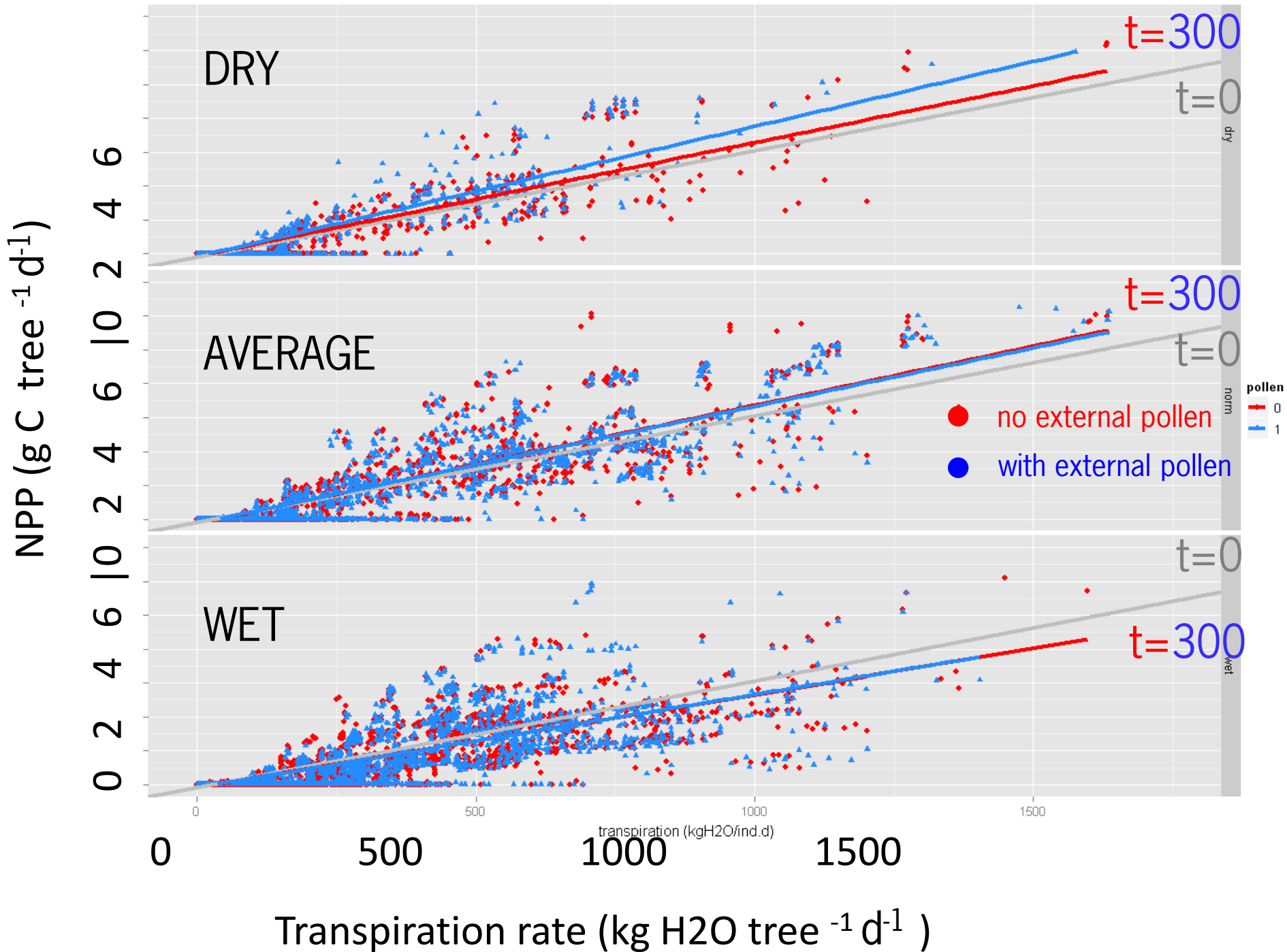
Adaptive response of European beech at southern limit of its distribution



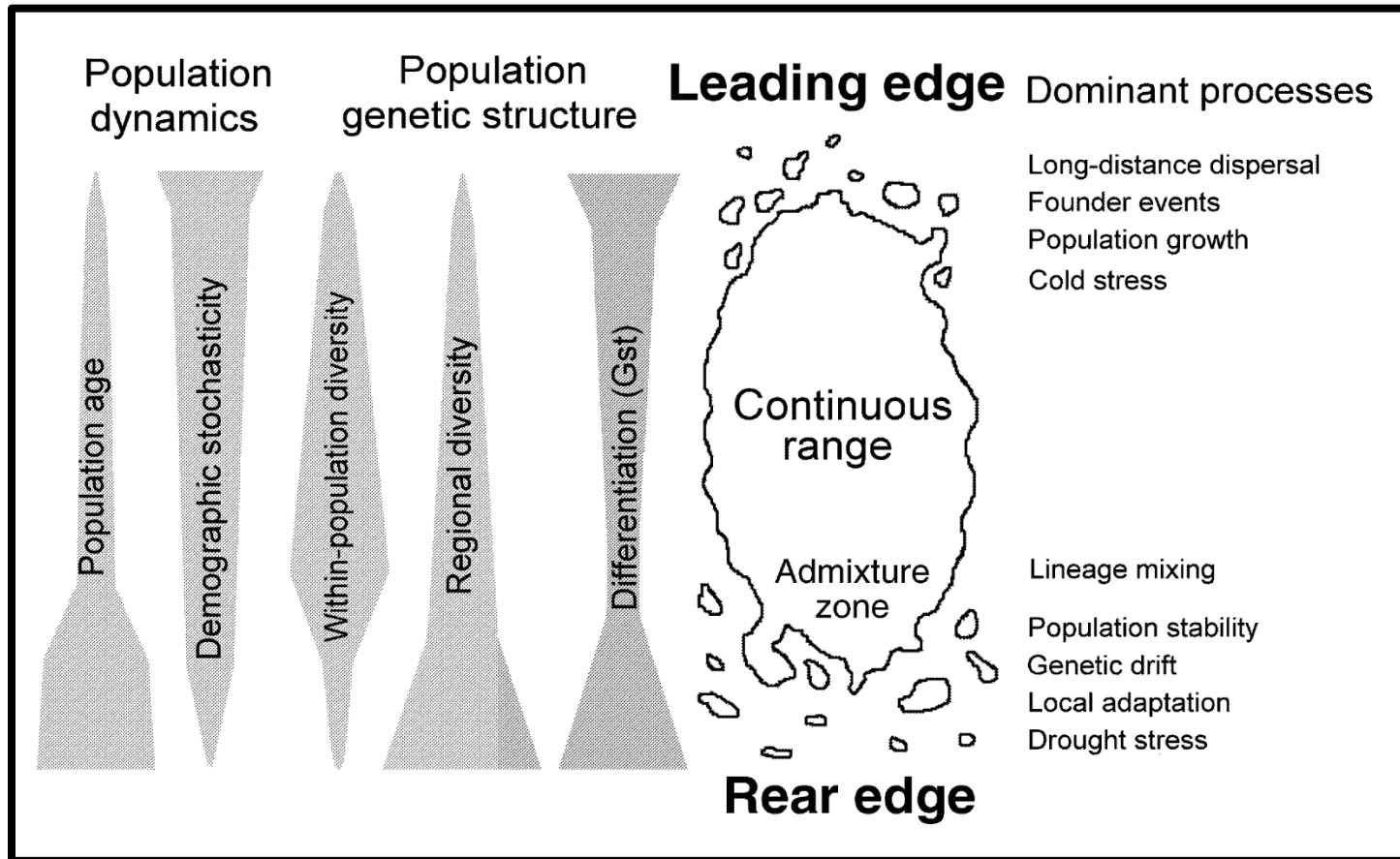
Adaptive response of European beech at southern limit of its distribution

Critical state of chilling





Micro-evolution of trees



Source: Hampe and Petit, 2005

Conclusions

- Classical population genetic modeling
- Individual-based quantitative genetic modeling
- Effects of climate change on micro-evolutionary responses of trees