



# Adaptive potentials: examples of increased vulnerability, and how we can support the forests potential for coping with such



Erik D. Kjær

*Danish Centre for Forest, Landscape and Planning,  
Faculty of Life Sciences, University of Copenhagen*





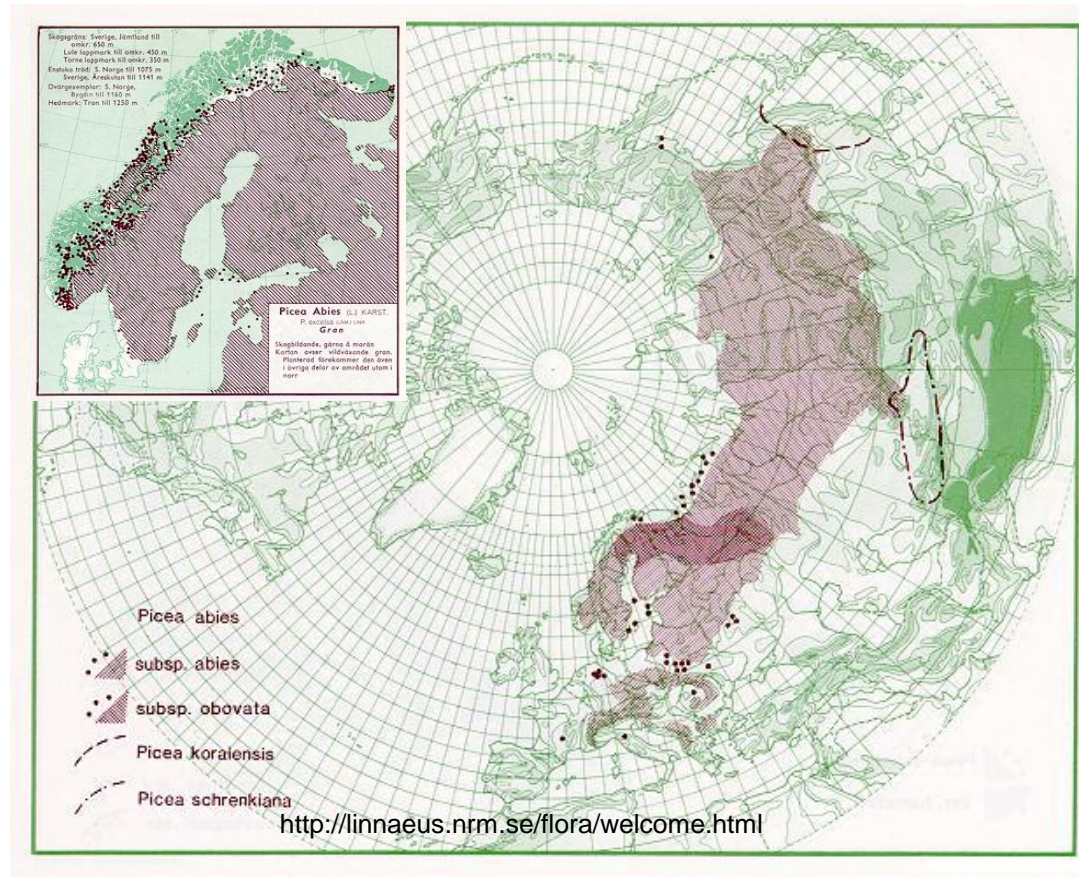
# Native species still fit?

Some European examples



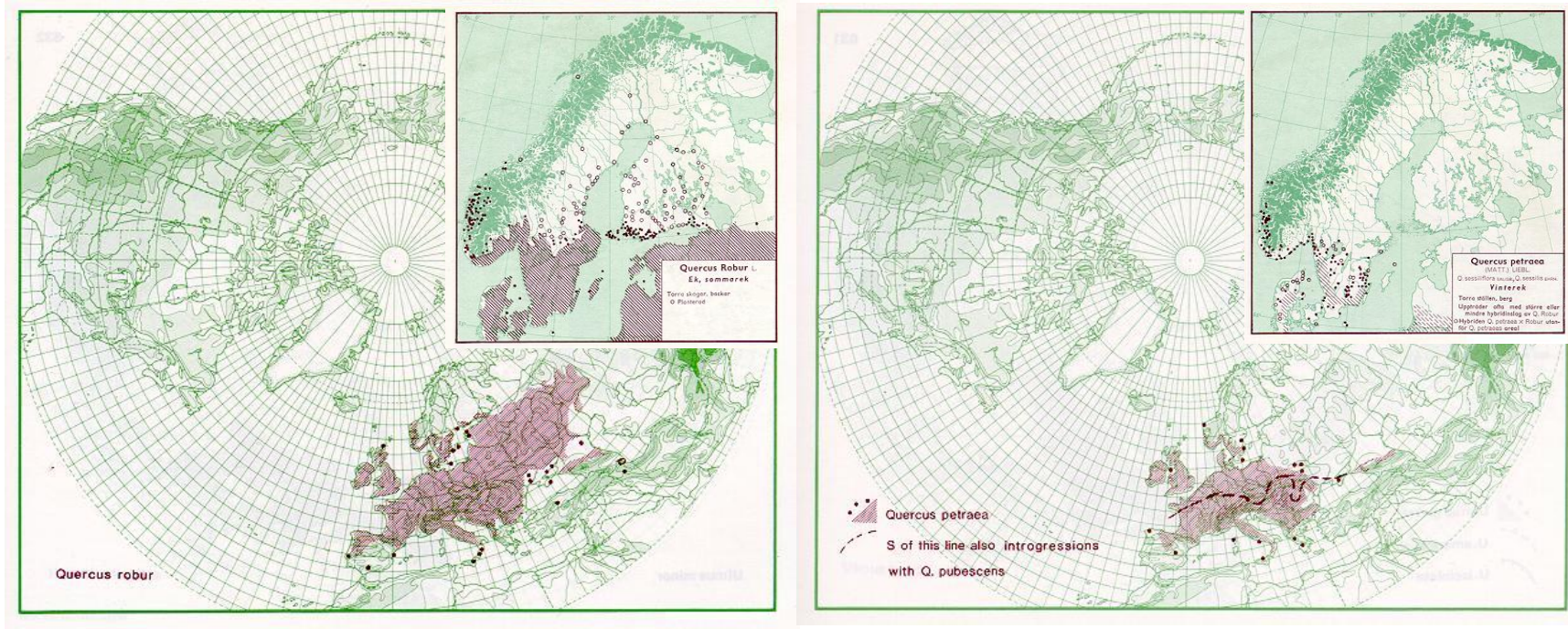


# *Picea abies*





# *Quercus robur* and *Q. petraea*

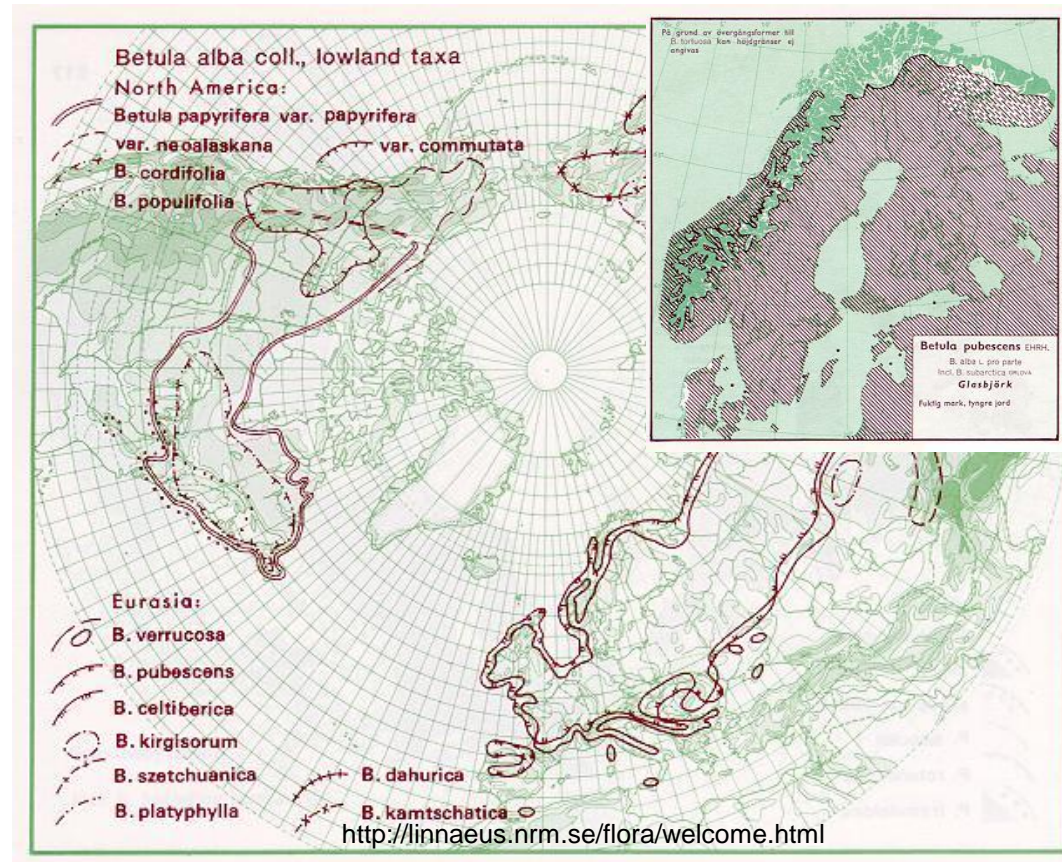


<http://linnaeus.nrm.se/flora/welcome.html>





# *Betula pendula* and *Betula pubescens*





# *Pinus sylvestris*



15.11.2003

Danish origin

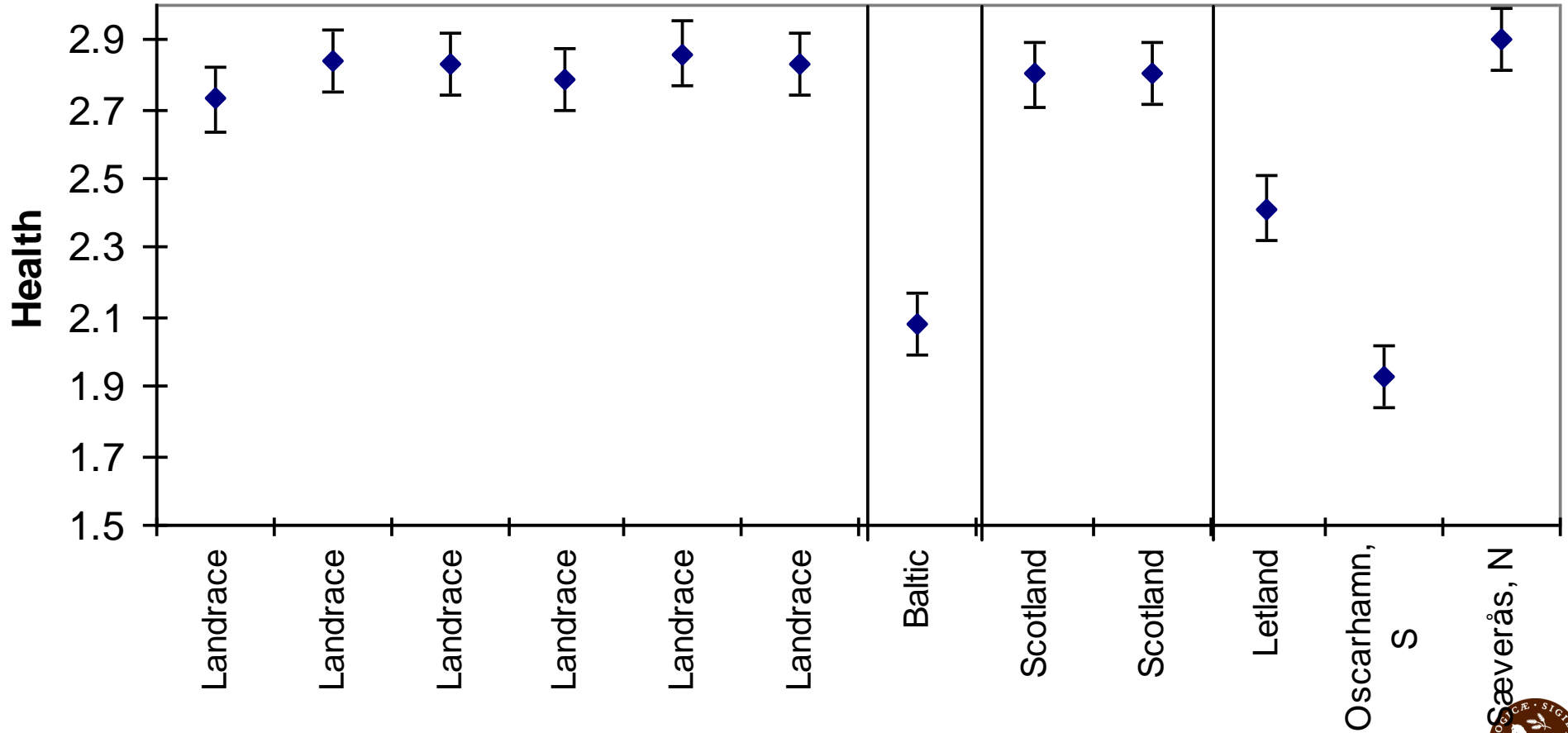


Abisco origin





# Health

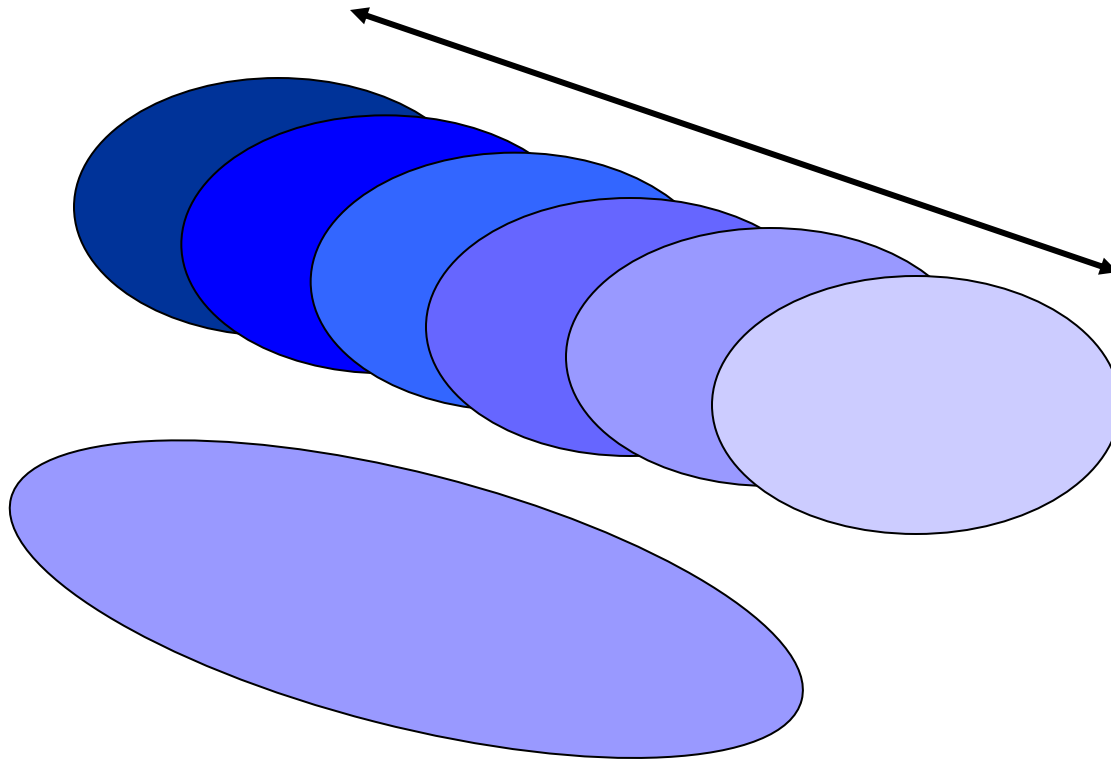


Danish field trial, NW Jutland.  
Source: Kjær og Barner 1998





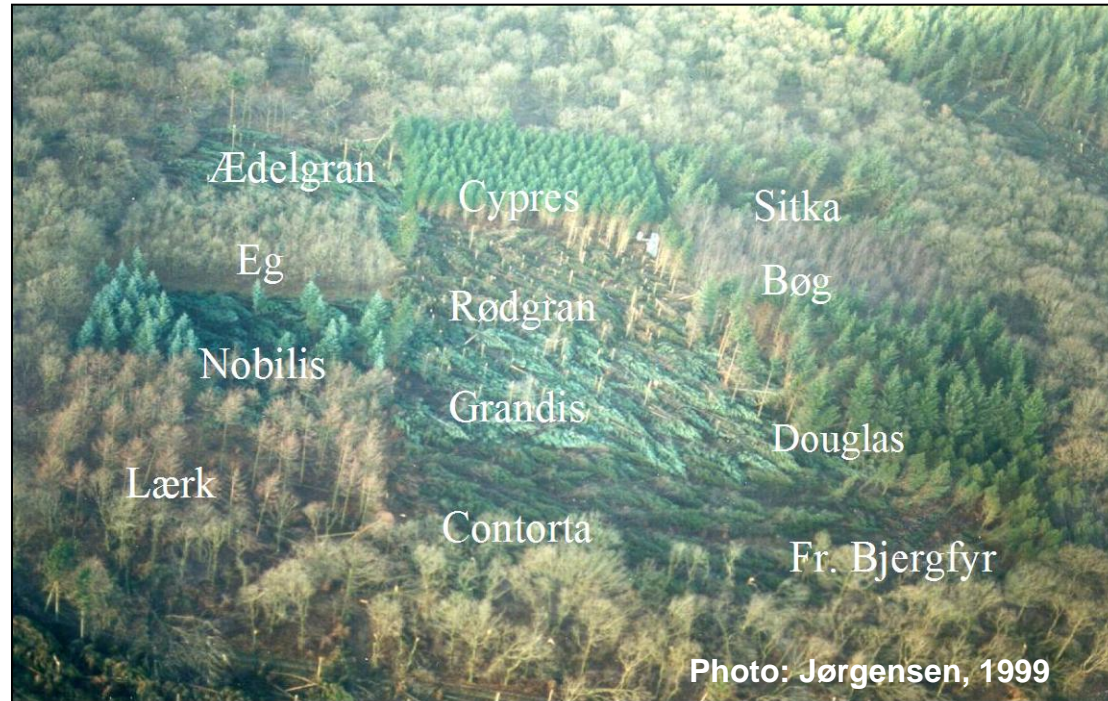
Hypothesis:  
Forest tree species accommodate large climatic variation by local adaptation rather than simple phenotypic plasticity







# Climatic extremes – not only average temperature and rain



Species trial after the storm in 3-12. 1999





# New pests and diseases

## Competition with new species



*An example*



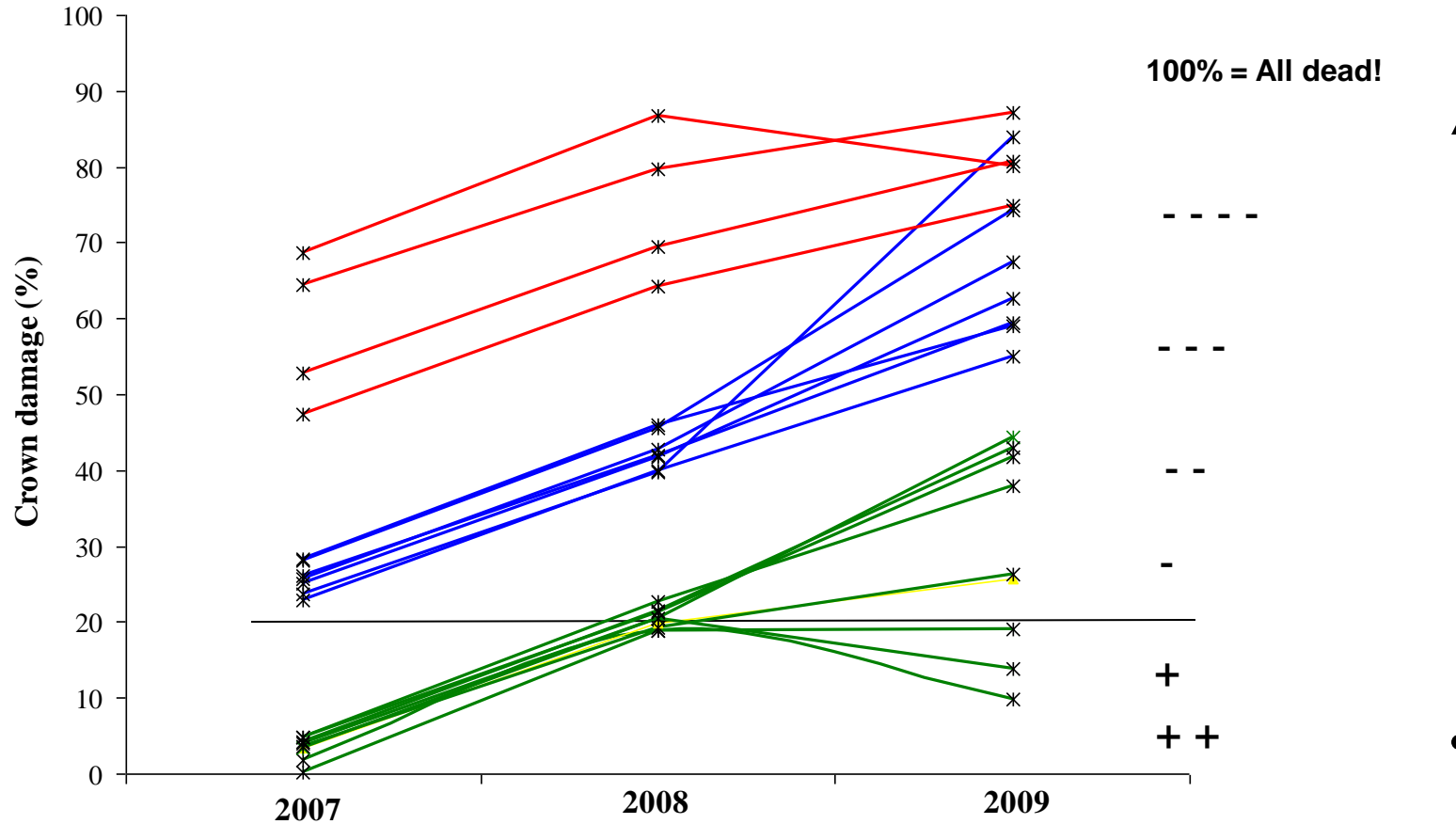
# Ash dieback



Photos: Iben Thomsen



# Genetic variation is present!



*Development 2007-2009, 40 clones, 25 replications, established 1998*





# Genetic variation is present!





# We need to support adaptation!

What and how?

Darwin, Wallace and the Red Queen...





# Darwin-Wallace: 'survival of the fittest based on natural selection'

'Species evolve to fit specific habitats through natural selection according to their fitness'

'Selection and isolation'





# The Red Queen Theory

Species must continuously evolve adapt to maintain their evolutionary relevance....





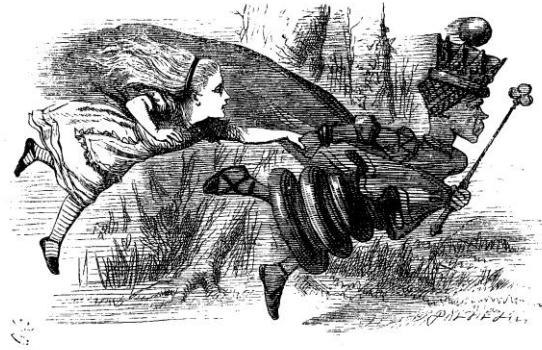


# The Red Queen Theory

LIVE FLOWERS.

41

wind whistling in Alice's ears, and almost blowing her hair off her head, she fancied.



“Now! Now!” cried the Queen. “Faster! Faster!” And they went so fast that at last they seemed to skim through the air, hardly touching the ground with their feet, till suddenly, just as Alice was getting quite exhausted, they stopped, and she found herself sitting on the ground, breathless and giddy.

The Queen propped her up against a tree, and said kindly, “You may rest a little now”

42

THE GARDEN OF

Alice looked round her in great surprise. “Why, I do believe we've been under this tree the whole time! Everything's just as it was!”

“Of course it is,” said the Queen: “what would you have it?”

“Well, in *our* country,” said Alice, still panting a little, “you'd generally get to somewhere else—if you ran very fast for a long time, as we've been doing.”

“A slow sort of country!” said the Queen.

“Now, *here*, you see, it takes all the running *you* can do, to keep in the same place. If you want to get somewhere else, you must run at least twice as fast as that!”

“I'd rather not try, please!” said Alice. “I'm quite content to stay here—only I *am* so hot and thirsty!”

“I know what *you'd* like!” the Queen said good-naturedly, taking a little box out of her pocket. “Have a biscuit?”

Alice thought it would not be civil to say “No,” though it wasn't at all what she wanted.



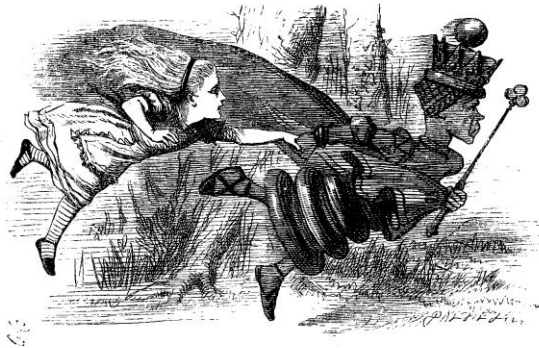


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# The Red Queen Theory

'It takes all the running you can do just to stay in the same place'

Species must continuously evolve adapt to maintain their evolutionary relevance....





# What we have learned so-far on the trees ability to 'run fast'

- Genetic patterns of differentiation are pronounced
- Potential for adaption seem large if management are based on sound genetic principles
- Many aspects are difficult to predict – especially new pests and pathogens





# Support continued adaptation- How?

- Effective natural selection –  
Level of **genetic diversity**, **Generation intervals**, **population sizes**, Ratio: regeneration/Mature trees
  - Gene flow and migration–  
Seed and pollen at the landscape level, **movement and testing of germplasm** (genetic pockets)
- ⇒ *Researchers*: we need to understand adaptation and the role of genetic diversity
- ⇒ *Managers*: we need to protect, support en encourage genetic processes
- ⇒ *Policy makers*: we need to apply a dynamic view of species and genetic origins





## *Acknowledgements*

