Workshop
Inform-prioritize-collaborate: cooperation of regions on innovation in forest management, use of wood and forest-related services
April 26th 2018

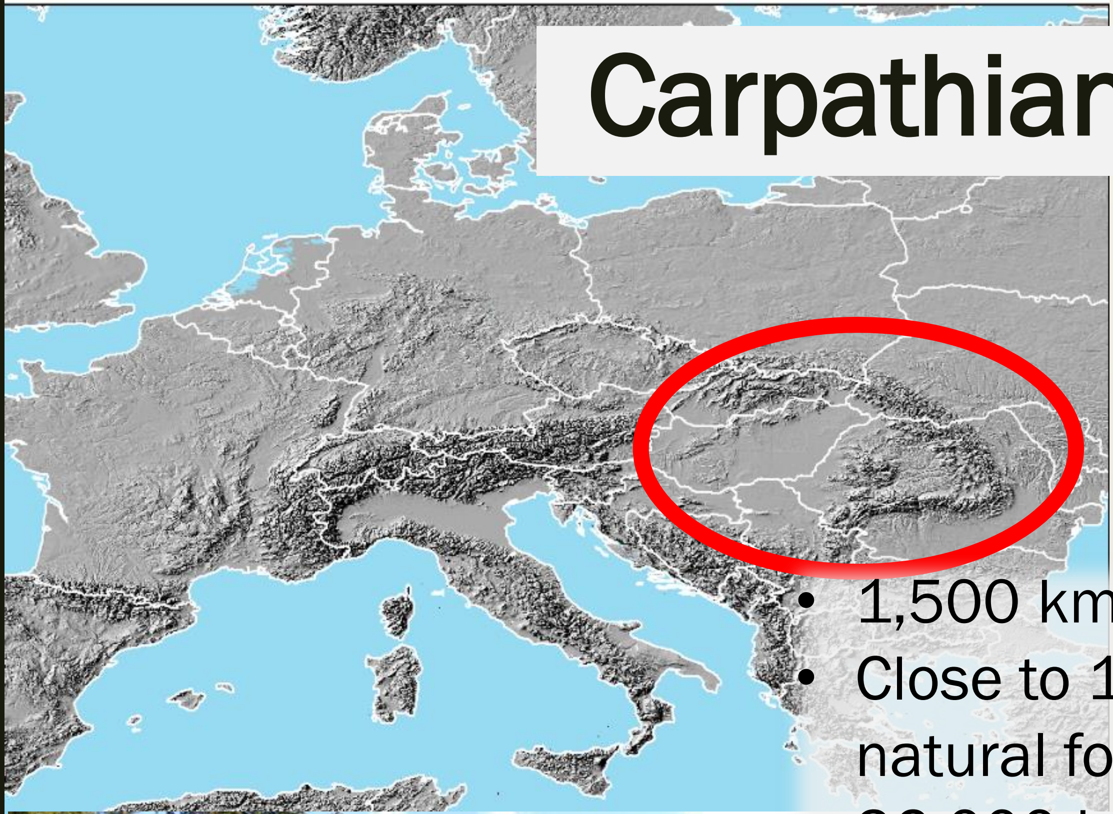
EUROPEAN SILVER FIR
SUSTAINABLE FOREST MANAGEMENT
CARPATHIAN FORESTS

Michal Bosela and Jozef Turok

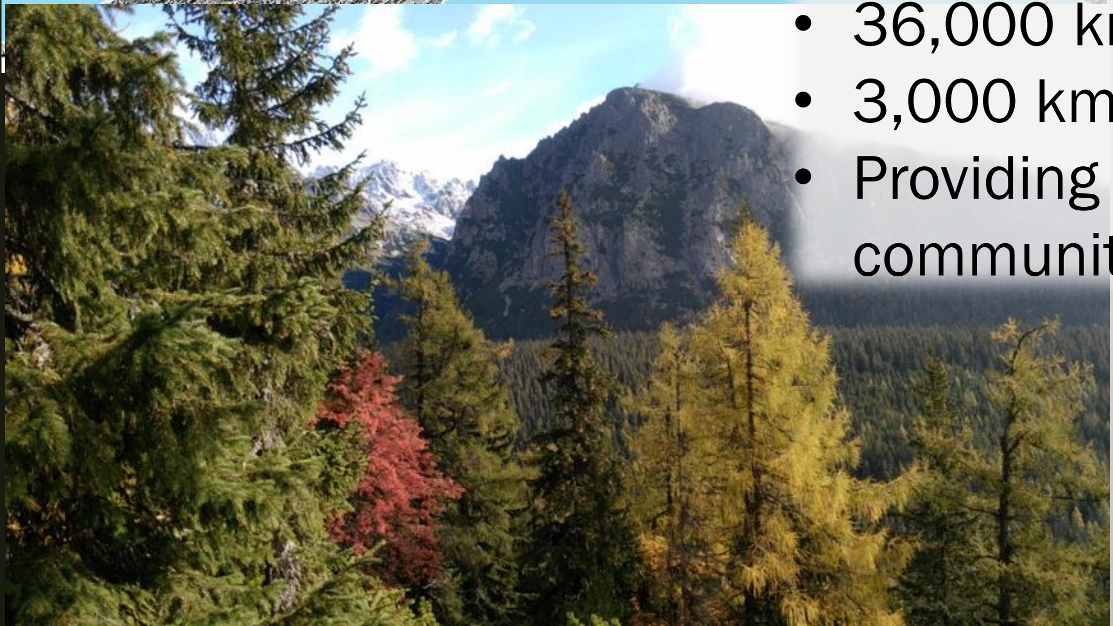
TECHNICAL UNIVERSITY IN ZVOLEN

Pictures and graphs: Michal Bosela

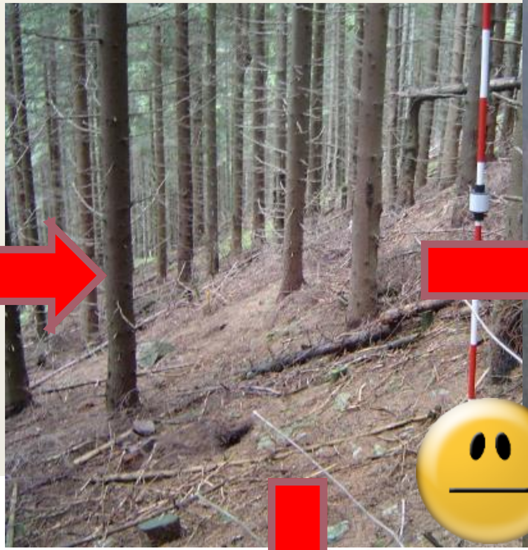
Carpathian mountains

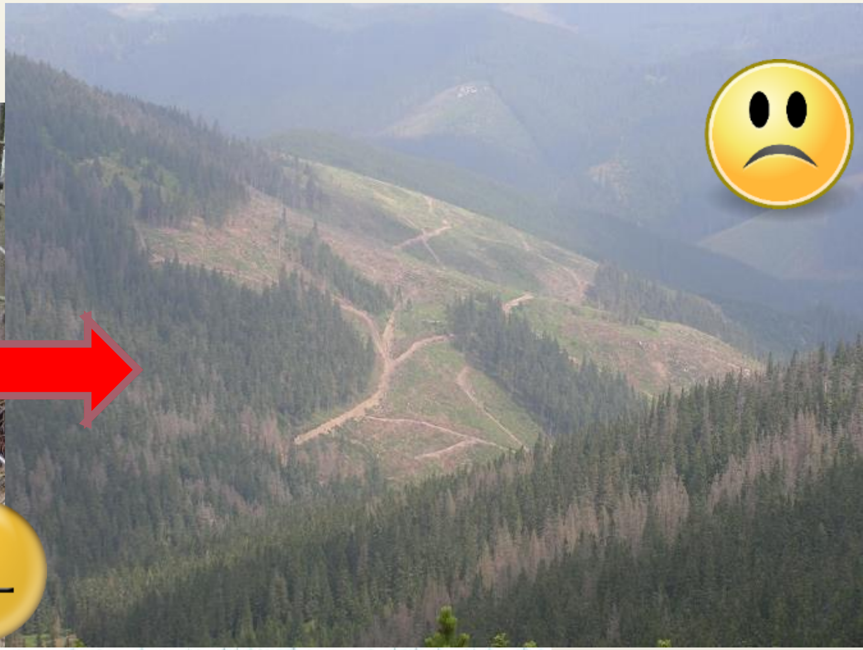


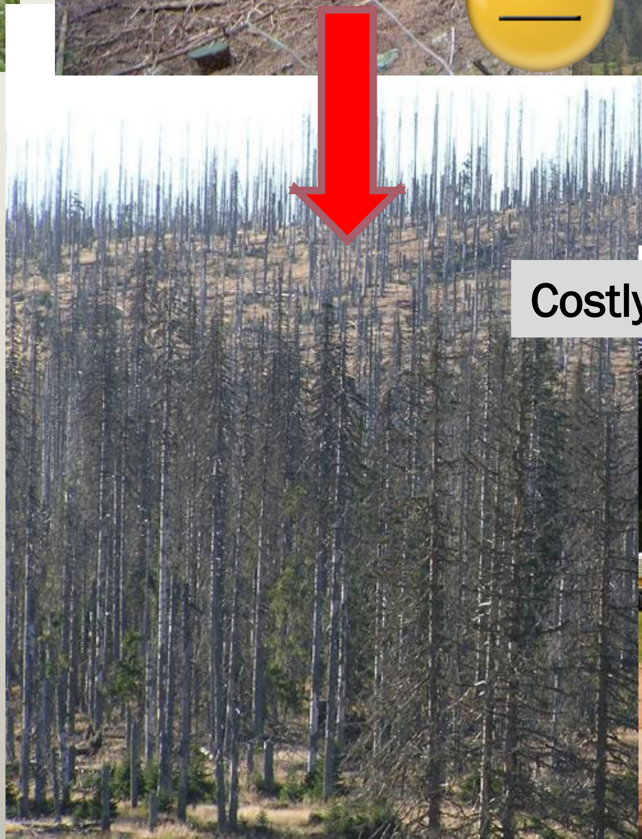
- 1,500 km long – the second longest chain
- Close to 100,000 km^2 of natural or semi-natural forests
- 36,000 km^2 of protected areas
- 3,000 km^2 of virgin forest
- Providing essential ecosystem services to communities in seven countries



Bad decisions in the past?







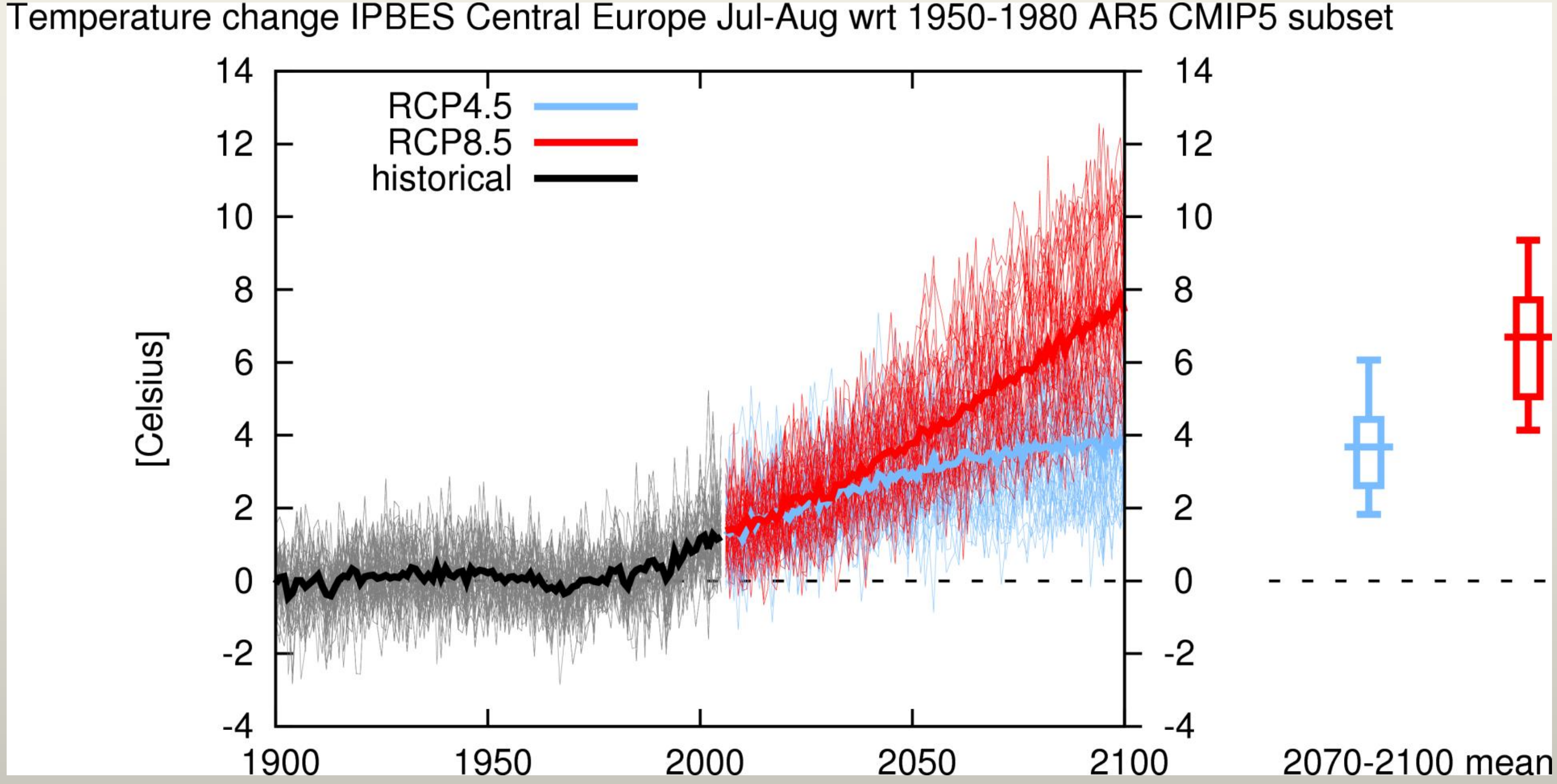
- Norway spruce replaced original beech and beech-fir forests across Europe (Spiecker *et al.* 2004)
- Spruce - susceptible to drought
- Increased frequency of devastating windstorms (Seidl *et al.* 2014)
- Bark beetle outbreaks in monospecific spruce ecosystems (Hlásny & Turčáni 2013)

Costly treatments required!!!

Climate warming

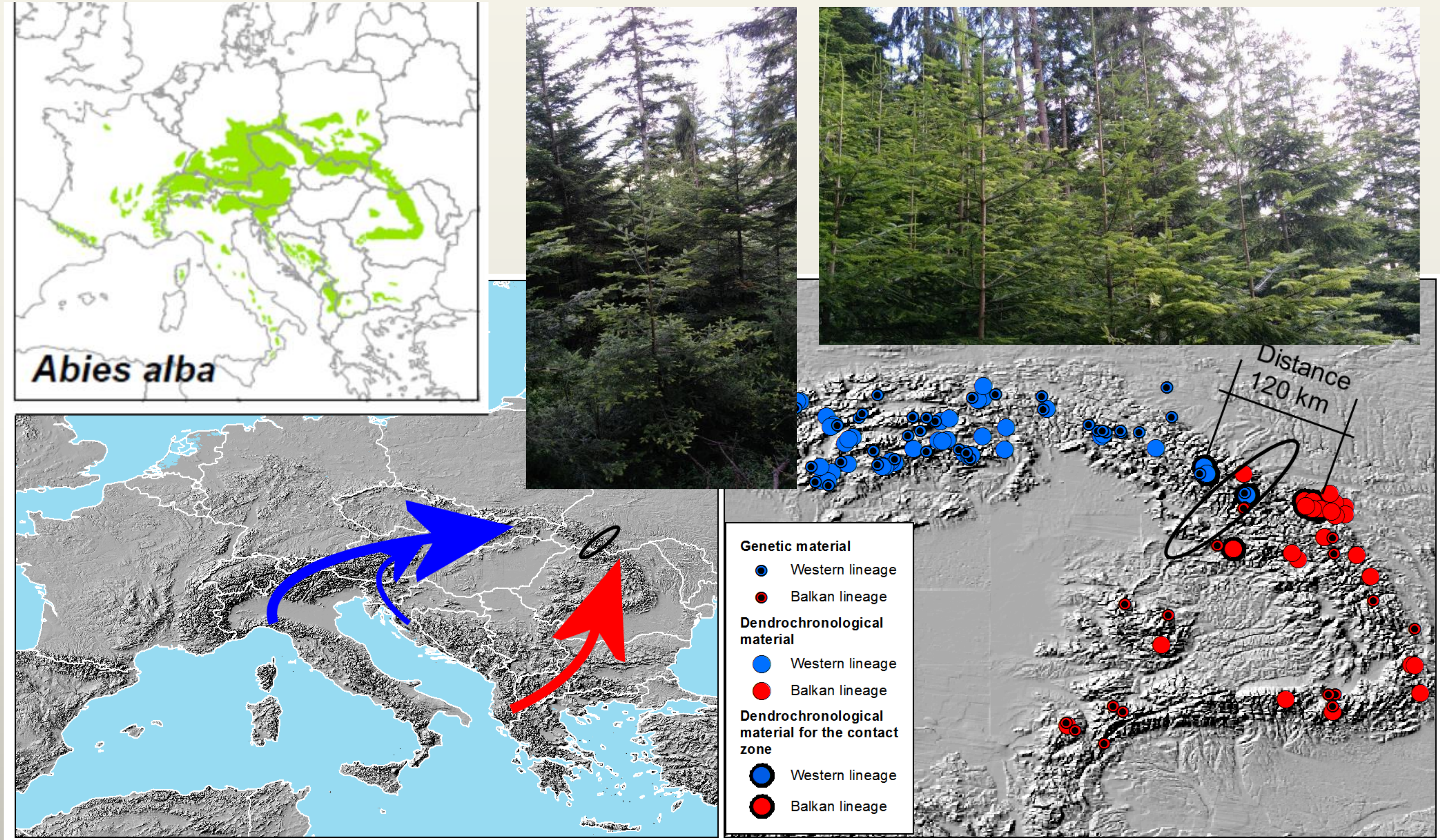
- Past
- Future

Norway spruce ecosystems will suffer from drought



Source: https://climexp.knmi.nl/start.cgi

WHAT ROLE CAN SILVER FIR PLAY?


Abies alba
Distance
120 km
Genetic material
Western lineage
Balkan lineage
Dendrochronological material
Western lineage
Balkan lineage
Dendrochronological material for the contact zone
Western lineage
Balkan lineage

Environmental Pollution 184 (2014) 211–221

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journal homepage: www.elsevier.com/locate/envpol

ELSEVIER

Possible causes of the recent rapid increase in the radial increment

Pajtík [a, b],

Journal of Ecology

Journal of Ecology 2016, 104, 1063–1075 doi: 10.1111/1365-2745.12575

Functional diversity enhances silver fir growth resilience to an extreme drought

Antonio Gazol and J. Julio Camarero*

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PAPER

menta

growth of *Abies alba* Mill

Mountains, north-eastern

Journal of Ecology

Journal of Ecology 2016, 104, 716–724 doi: 10.1111/1365-2745.12561

Effects of post-glacial phylogeny and genetic diversity on the growth variability and climate sensitivity of European silver fir

Michal Bosela[1,2]*, Ionel Popa[3], Dušan Gömöry[1], Roman Longauer[4,5], Brian Tobin[6], Josef Kyncl[7], Tomas Kyncl[7], Constantin Nechita[3], Rudolf Petráš[4], Cristian Gheorghe Sidor[3], Vladimír Šebeň[4] and Ulf Büntgen[8,9,10]

Global Change Biology

727–740, doi: 10.1111/gcb.13075

evolution of *Abies alba* forests in

rison of a dynamic vegetation model with

observations

RESEARCH COMMUNICATIONS RESEARCH COMMUNICATIONS

Placing unprecedented recent fir growth in a European-wide and Holocene-long context

Ulf Büntgen[1,2,3]*, Willy Tegel[4], Jed O Kaplan[5], Marcus Schaub[1], Frank Hagedorn[1], Matthias Bürgi[1], Rudolf Brázdil[3,6], Gerhard Helle[7], Marco Carrer[8], Karl-Uwe Heussner[9], Jutta Hofmann[10], Raymond Kontic[11], Tomáš Kyncl[12], Josef Kyncl[12], J Julio Camarero[13,14], Willy Tinner[2,15], Jan Esper[16], and Andrew Liebhold[17]

Forest decline played a pivotal role in motivating Europe's political focus on sustainability around 35 years ago. Silver fir (*Abies alba*) exhibited particularly severe dieback in the mid-1970s, but disentangling biotic from abiotic drivers remained challenging because both spatial and temporal data were lacking. Here, we analyze 14 136 samples from living trees and historical timbers, together with 356 pollen records, to evaluate recent fir growth from a continent-wide and Holocene-long perspective. Land use and climate change influenced forest growth over the past millennium, whereas anthropogenic emissions became important after about 1850. Pollution control since the 1980s, together with a warmer but not drier climate, have facilitated an unprecedented surge in productivity across Central European fir stands. Restricted fir distribution prior to the Mesolithic and again in the Modern Era, separated by a peak in abundance during the Bronze Age, is indicative of the long-term interplay of changing temperatures, shifts in the hydrological cycle, and human impacts that have shaped forest structure and productivity.

Front Ecol Environ 2013; doi:10.1890/130089

pectives on future

warming

,[1,2,3] Marco Steinacher,[2,4]

aro,[7] Marco Conedera,[8]

,[2] and Verushka Valsecchi[10]

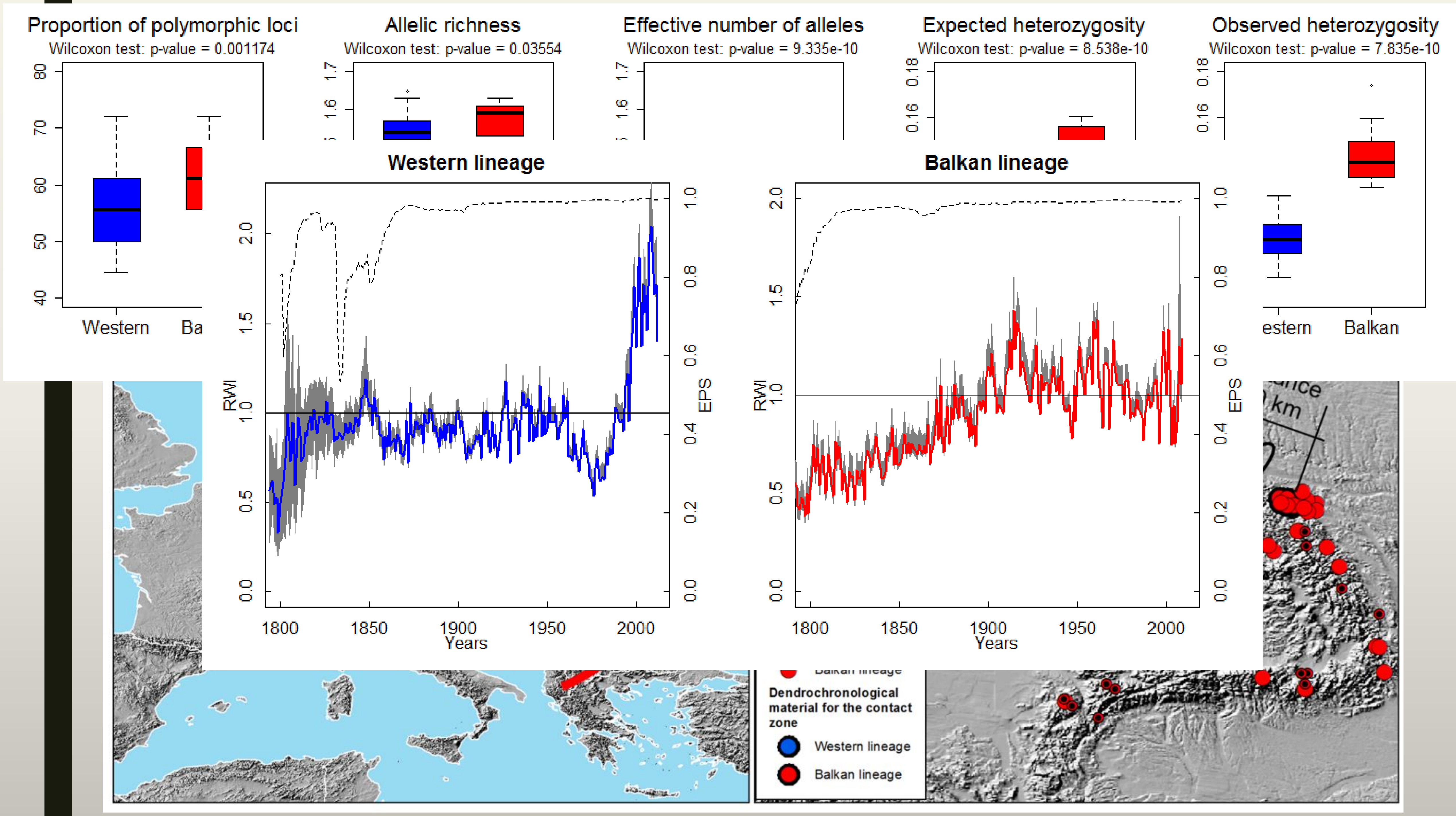
AL

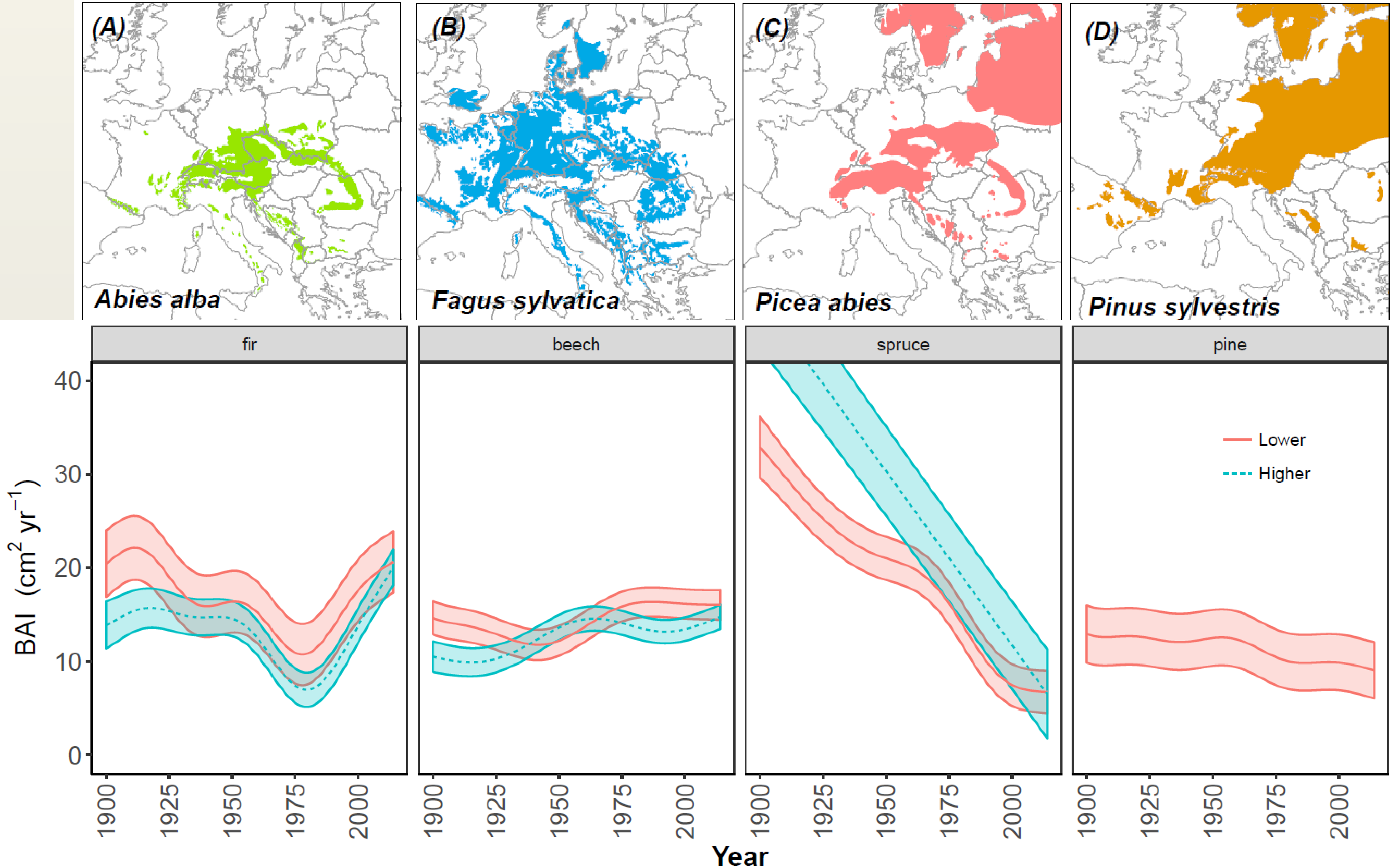
LE

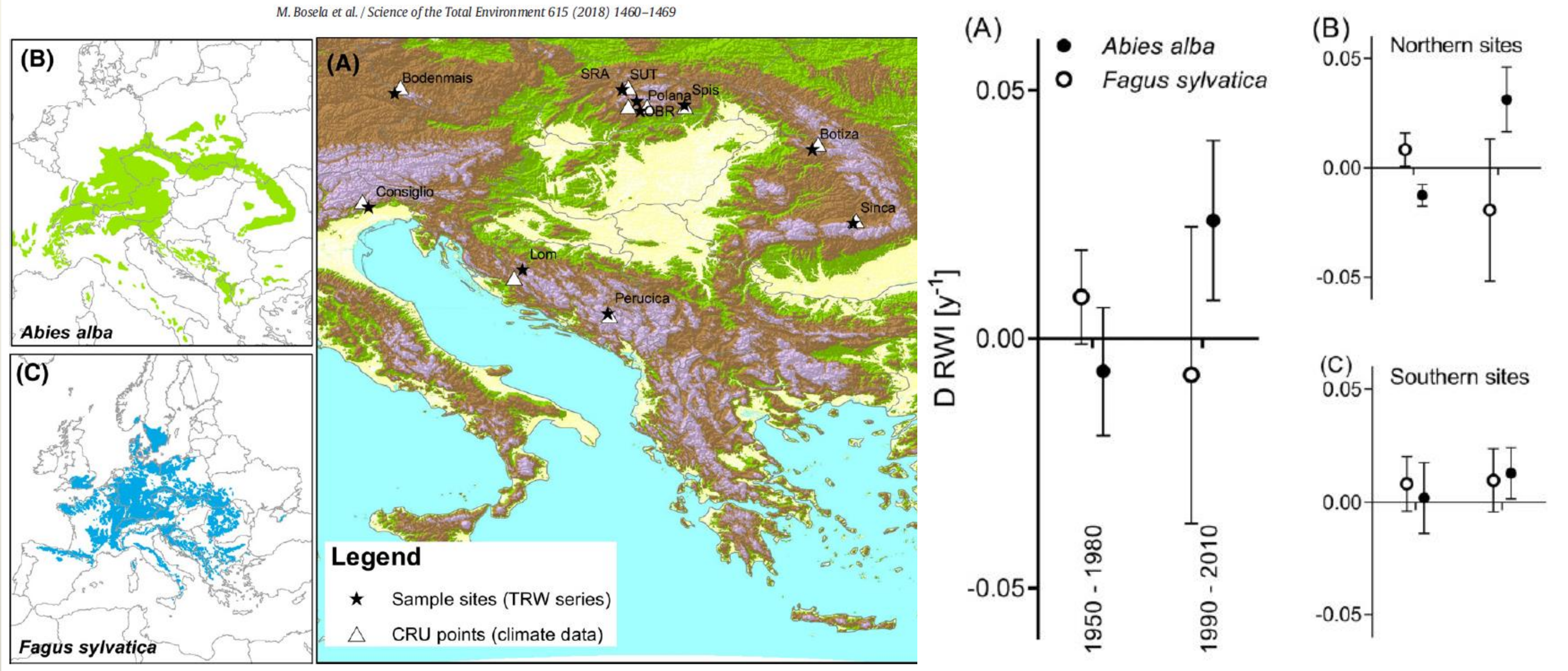
Distinct effects of climate warming on

populations of silver fir (*Abies alba*) across Europe

Antonio Gazol[1], J. Julio Camarero[1]*, Emilia Gutiérrez[2], Ionel Popa[3], Laia Andreu-Hayles[4,5], Renzo Motta[6], Paola Nola[7], Montserrat Ribas[2], Gabriel Sangüesa-Barreda[1], Carlo Urbinati[8] and Marco Carrer[9]


Proportion of polymorphic loci
Wilcoxon test: p-value = 0.001174
Allelic richness
Wilcoxon test: p-value = 0.03554
Effective number of alleles
Wilcoxon test: p-value = 9.335e-10
Expected heterozygosity
Wilcoxon test: p-value = 8.538e-10
Observed heterozygosity
Wilcoxon test: p-value = 7.835e-10
Western
Balkan
Western lineage
Balkan lineage
RWI
EPS
Years
1800
1850
1900
1950
2000
Dendrochronological material for the contact zone
Western lineage
Balkan lineage


(A)
Abies alba
(B)
Fagus sylvatica
(C)
Picea abies
(D)
Pinus sylvestris
fir
beech
spruce
pine
Lower
Higher
BAI (cm² yr⁻¹)
0
10
20
30
40
1900
1925
1950
1975
2000
Year



- Silver fir has increased its growth across Europe since last decades
- Beech productivity increased till 1990 (see also Pretzsch et al. 2014), then stabilised or even decreased
- Pyrenees, Calabria populations as potential source of genetic material?

...to conclude current knowldge

- Increased and decreased growth rates found for both spruce and fir
  - *Differ accross Europe among geographic regions*

- Large uncertainty in predicitons of future growth and distribution of the species under climate change conditions

- Current data bank or published knowledge provides biased results and interpretations
  - *Selection of dominant trees for dendrochronological research*
  - *Publishing only significant results*

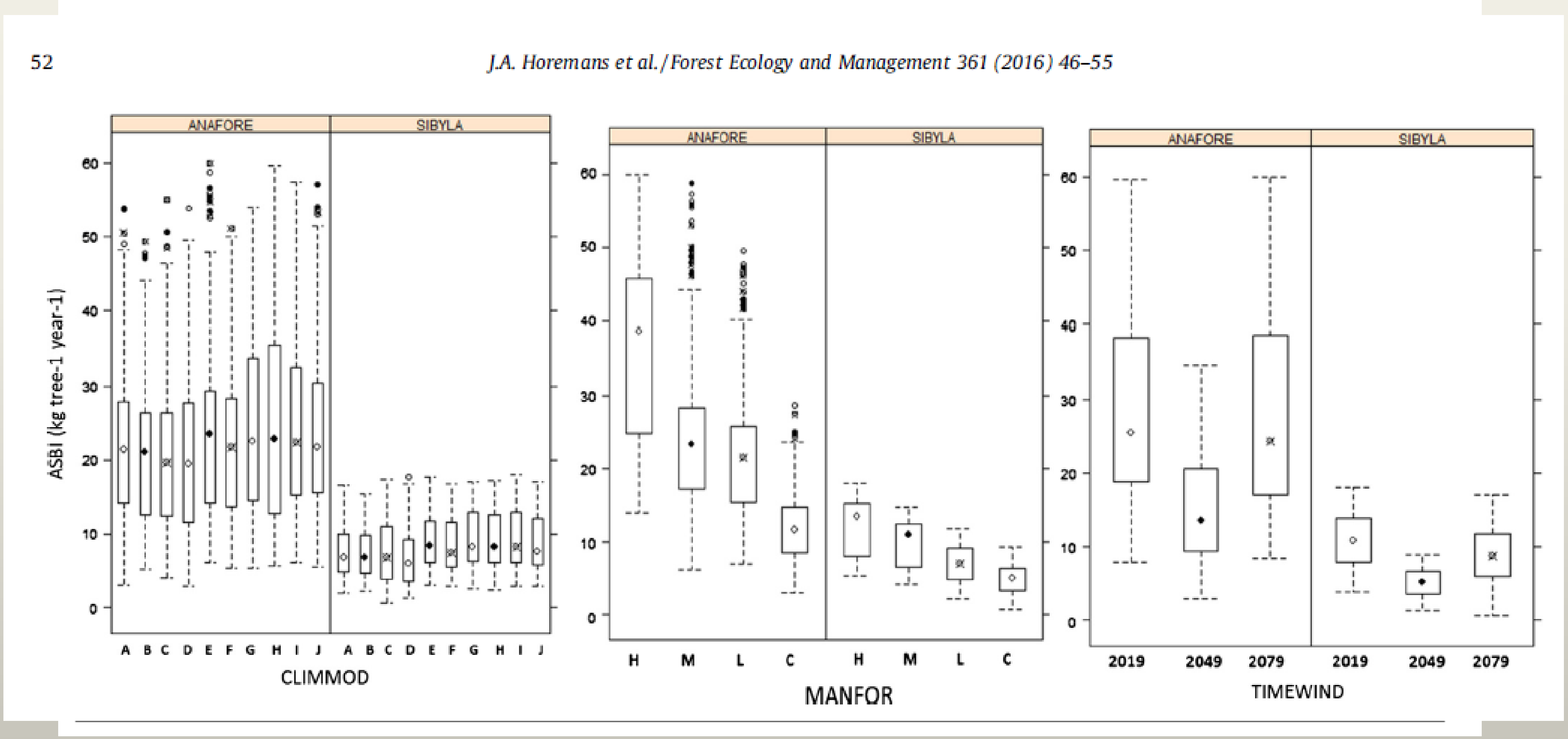
FURTHER RESEARCH?

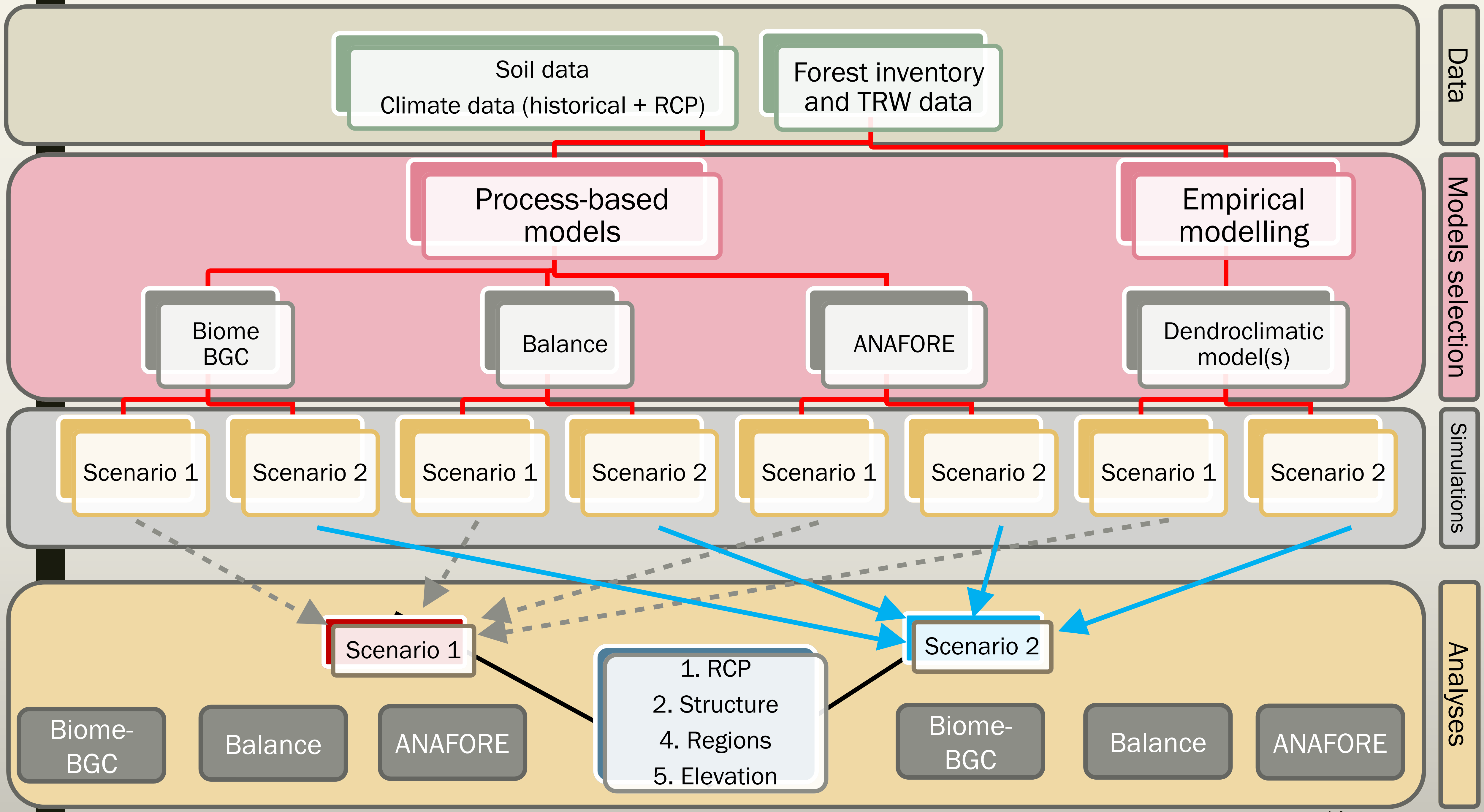
Representative network of trials to further investigate the effects of:

- Forest structure
- Species mixture
- Forest management
- Elevational gradient
- Nutritional gradient
- Species range (core and limits)

Growth modelling under future climate change conditions

Use of growth models to guide decisions, but…




Data
Soil data
Climate data (historical + RCP)
Forest inventory and TRW data
Models selection
Process-based models
Empirical modelling
Biome BGC
Balance
ANAFORE
Dendroclimatic model(s)
Simulations
Scenario 1
Scenario 2
Scenario 1
Scenario 2
Scenario 1
Scenario 2
Scenario 1
Scenario 2
Analyses
Scenario 1
Scenario 2
1. RCP
2. Structure
4. Regions
5. Elevation
Biome-BGC
Balance
ANAFORE
Biome-BGC
Balance
ANAFORE

THANK YOU FOR ATTENTION!