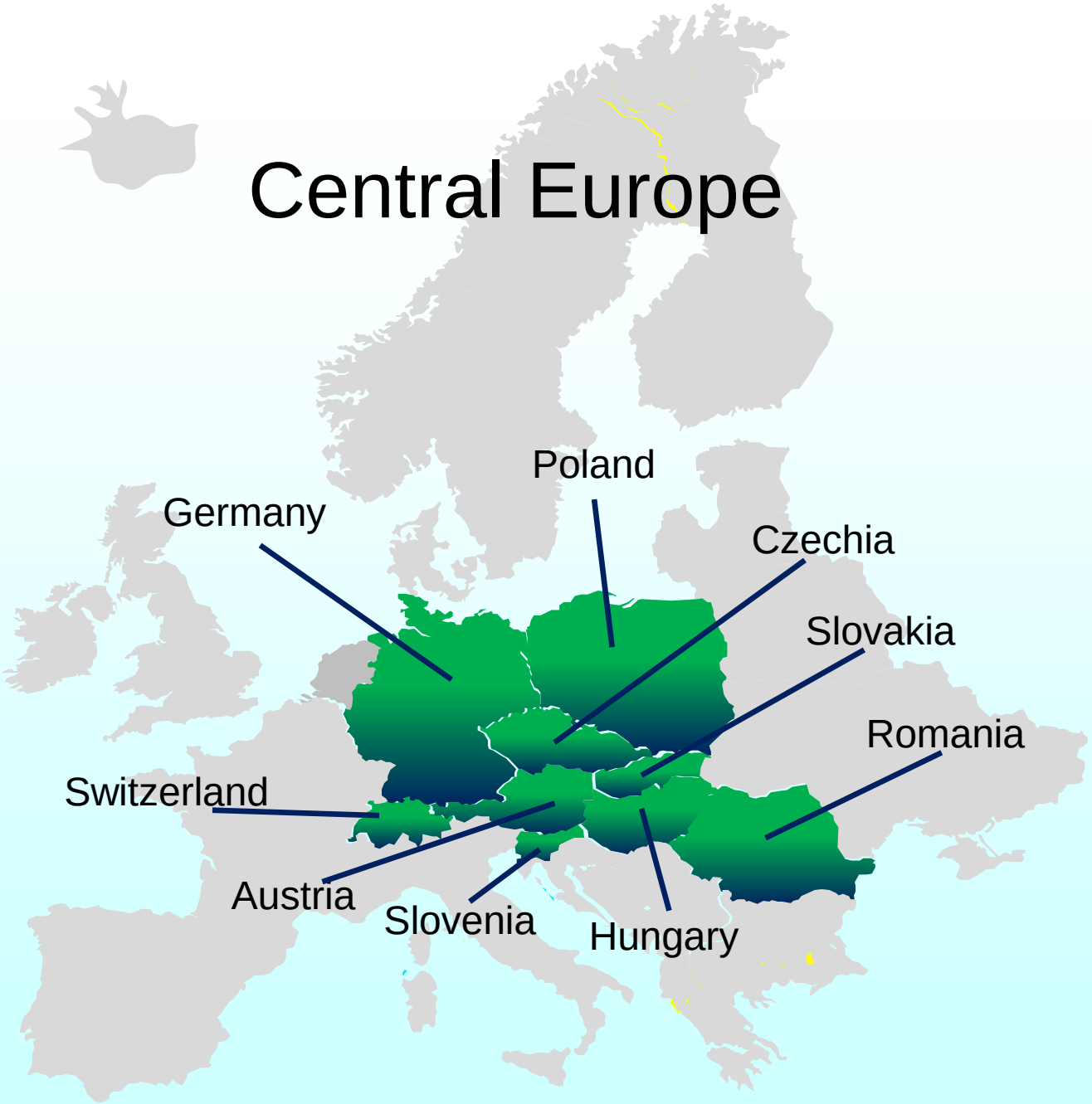
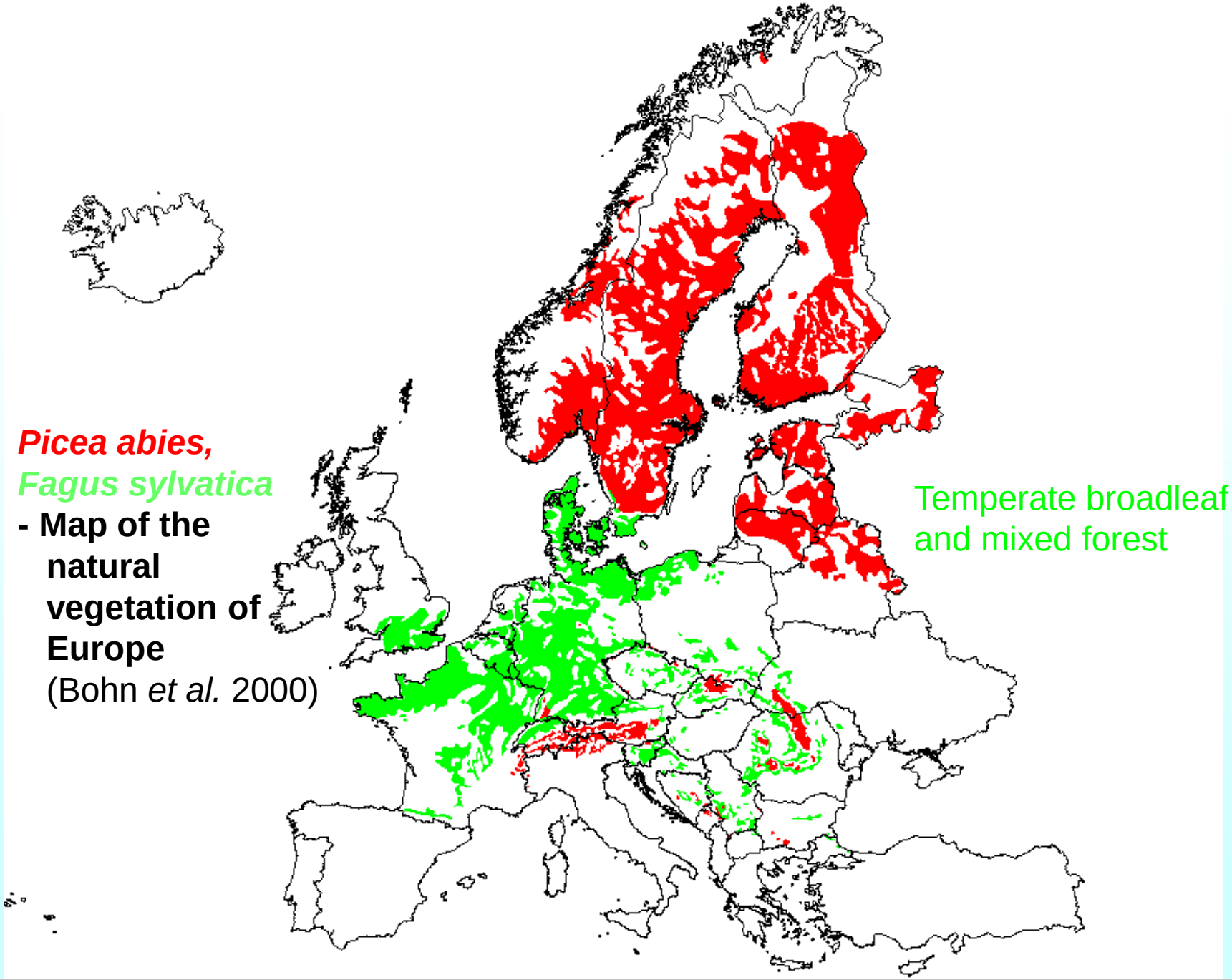
Central Europe:

A largely and precociously artificial forest

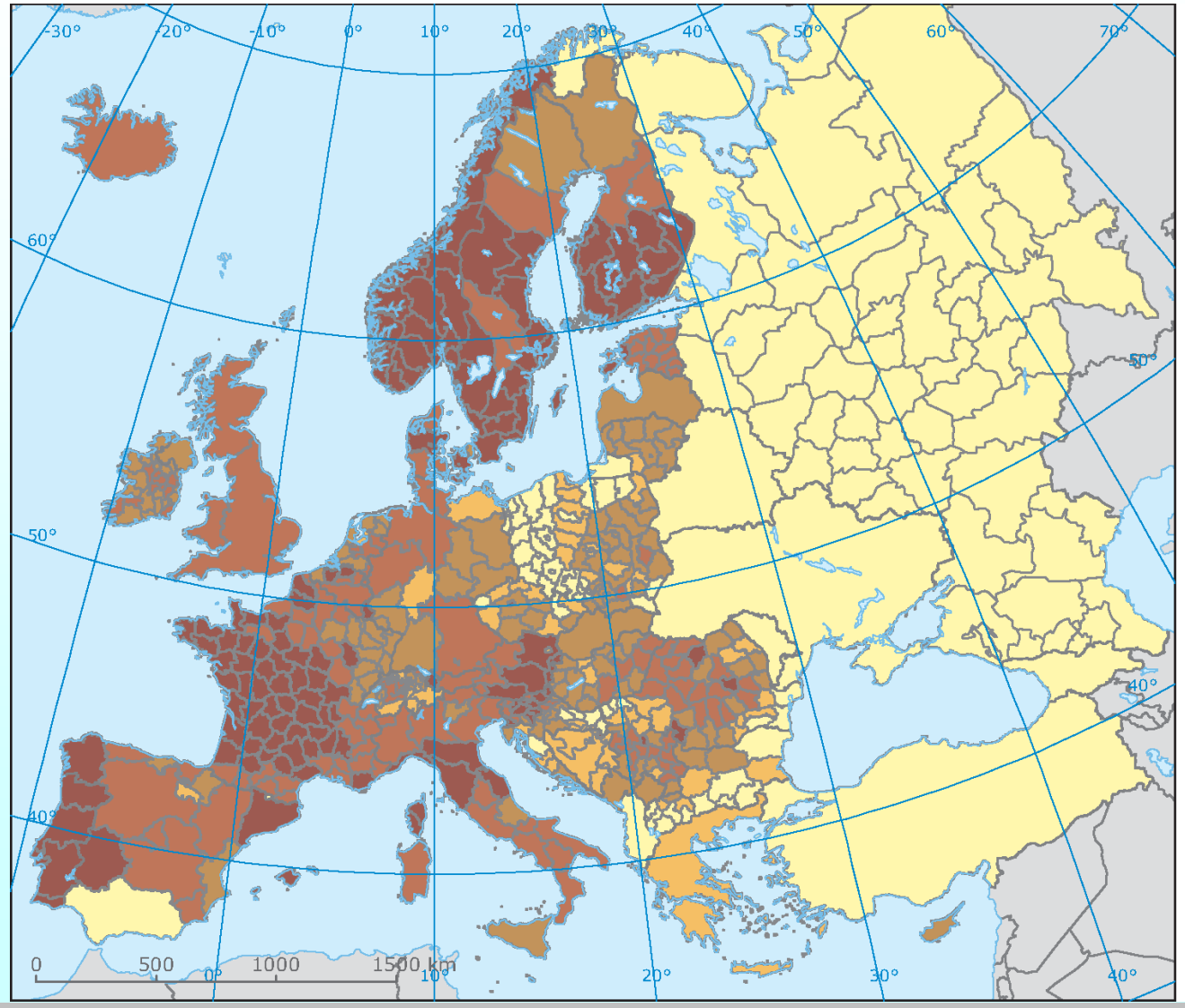
Central Europe

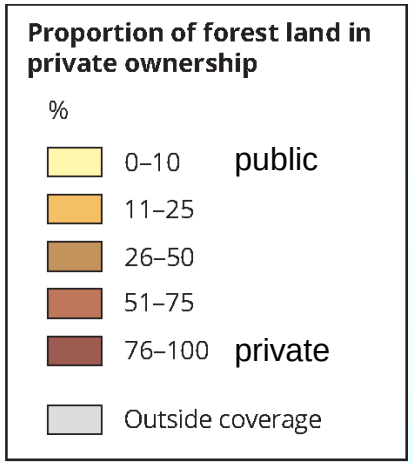



Picea abies,
Fagus sylvatica
- Map of the natural vegetation of Europe
(Bohn et al. 2000)
Temperate broadleaf and mixed forest

Forest ownership

Area of privately owned forest as percent of total forest





In EU:
40% public
60% private

“diversity of ownership”.

source : Pulla et al. 2013

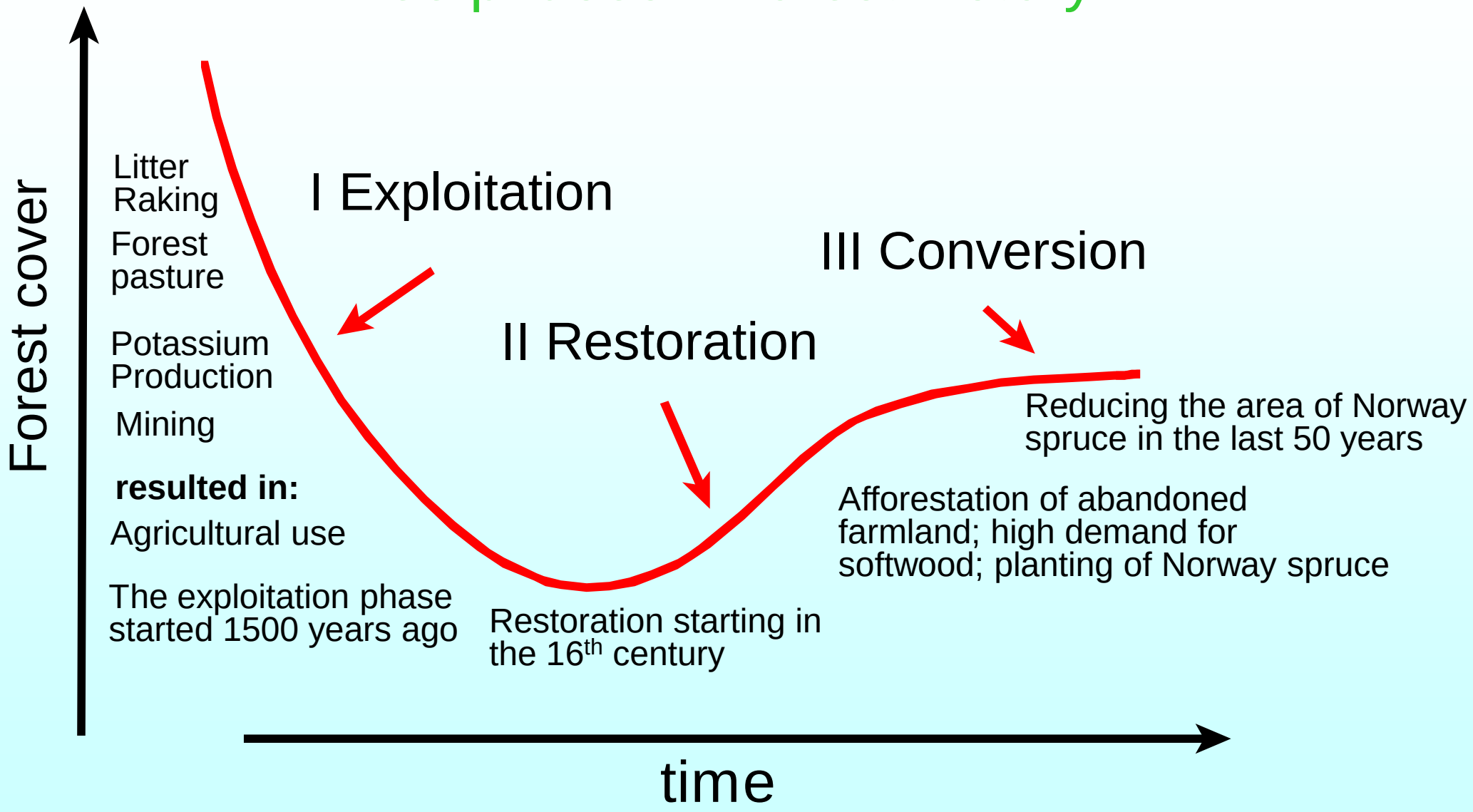
Since centuries forests in Central Europe have been shaped by people.

Therefore, state of the forests reflects past economic and social conditions.

These conditions changed over time.

More recently, in addition, changes in environmental conditions modified these forests and their use.

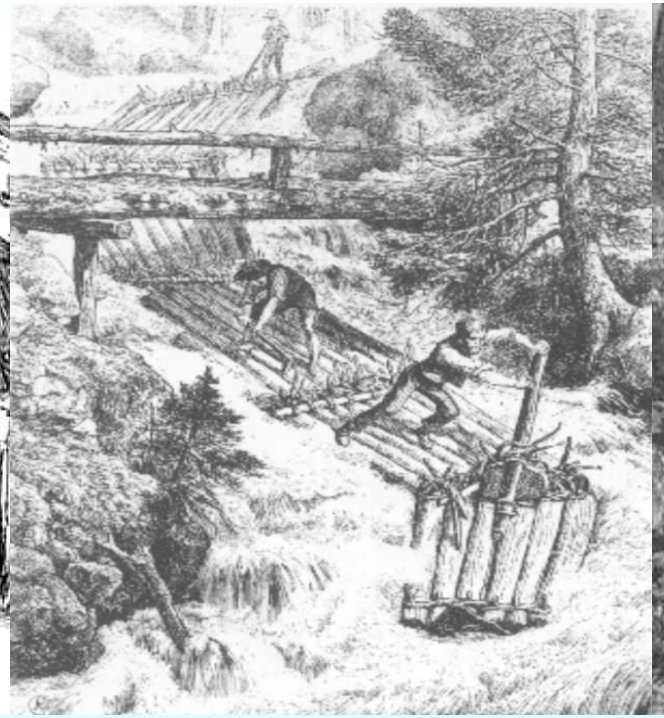
Three phases in forest history



Phase I: Exploitation

Albrecht Dürrer 1483
Wood engraving

Historical copperplate: Charcoal production in the Black Forest in the 19th century



Wood rafting; wood engraving 19th century

Litter raking (beech leaves) in Switzerland; reproduced in Brockmann-Jerosch 1928/30

Phase I: Exploitation

Historical use of the forests

- Agricultural uses such as:

  litter raking, forest pasture, pollarding, shifting cultivation, etc.

- Use of wood
  - Fuelwood
  - Mining
  - Glassworks
  - Salt production
  - Construction

- non-wood forest products
  - Resin collection
  - Bark collection, etc.

Caspar David Friedrich, 1822, “lonely tree”, Germany

Phase II: Restoration

In 1713, the leading official of a Saxon coal mine, Hanns Carl von Carlowitz, had exhorted the "sustainable use of the forests" in the opus Sylvicultura Oeconomica.

310 years sustainable use of forests

Phase II: Restoration

Forest restoration to meet the needs of the people at that time: Increasing quantity and quality of wood production sustainably.

Phase II: Restoration

Selection of tree species for restoration

Operational aspects:

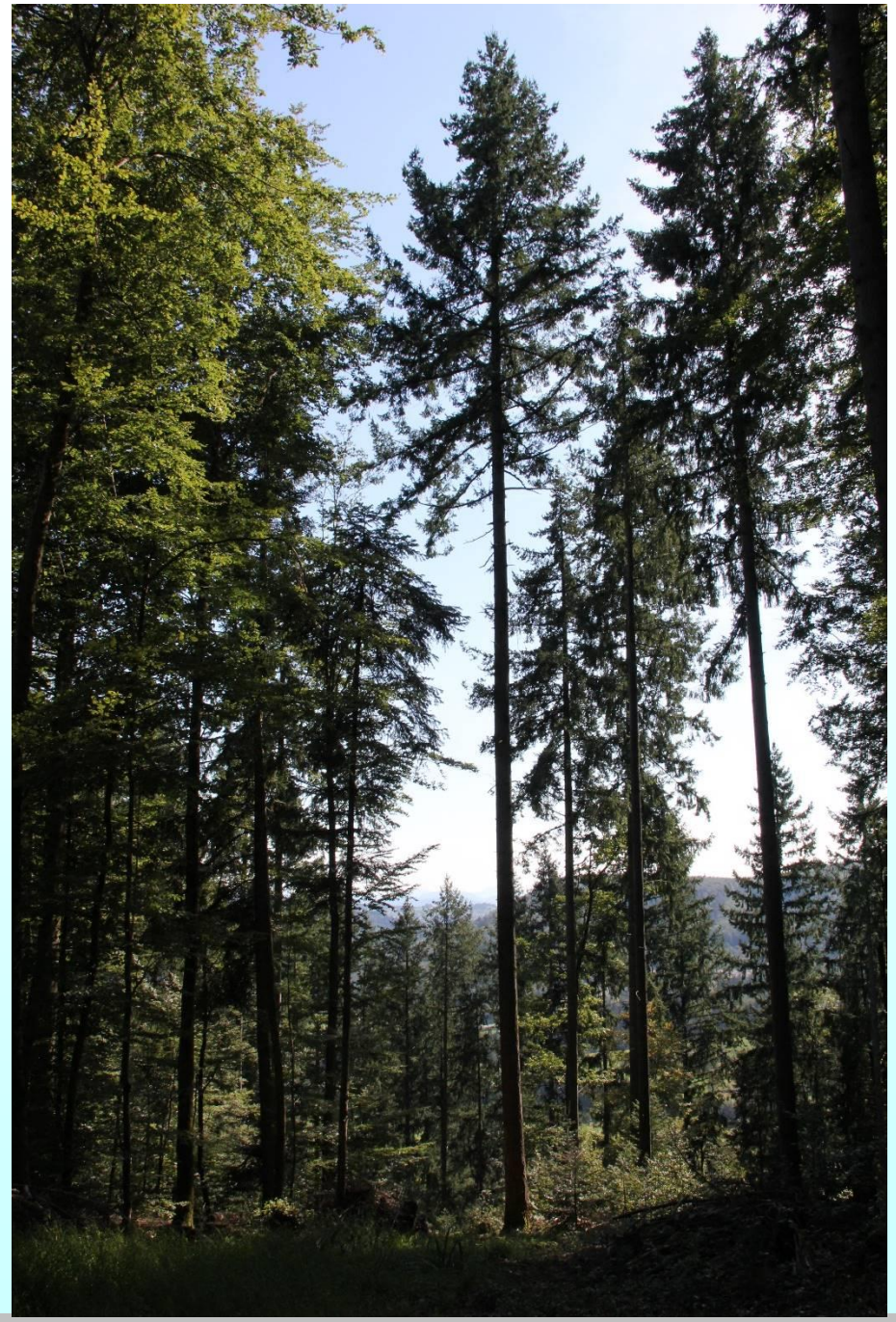
- easy to regenerate (planting on depleted land)
- seedlings available
- knowledge and experience available

Economic aspects:

- fast growth
- potential for producing valuable timber
- demand on the market

For restoration very few tree species were used:

- most importantly **Norway spruce and Scots pine**



Why are coniferous species economically attractive?

Coniferous trees:

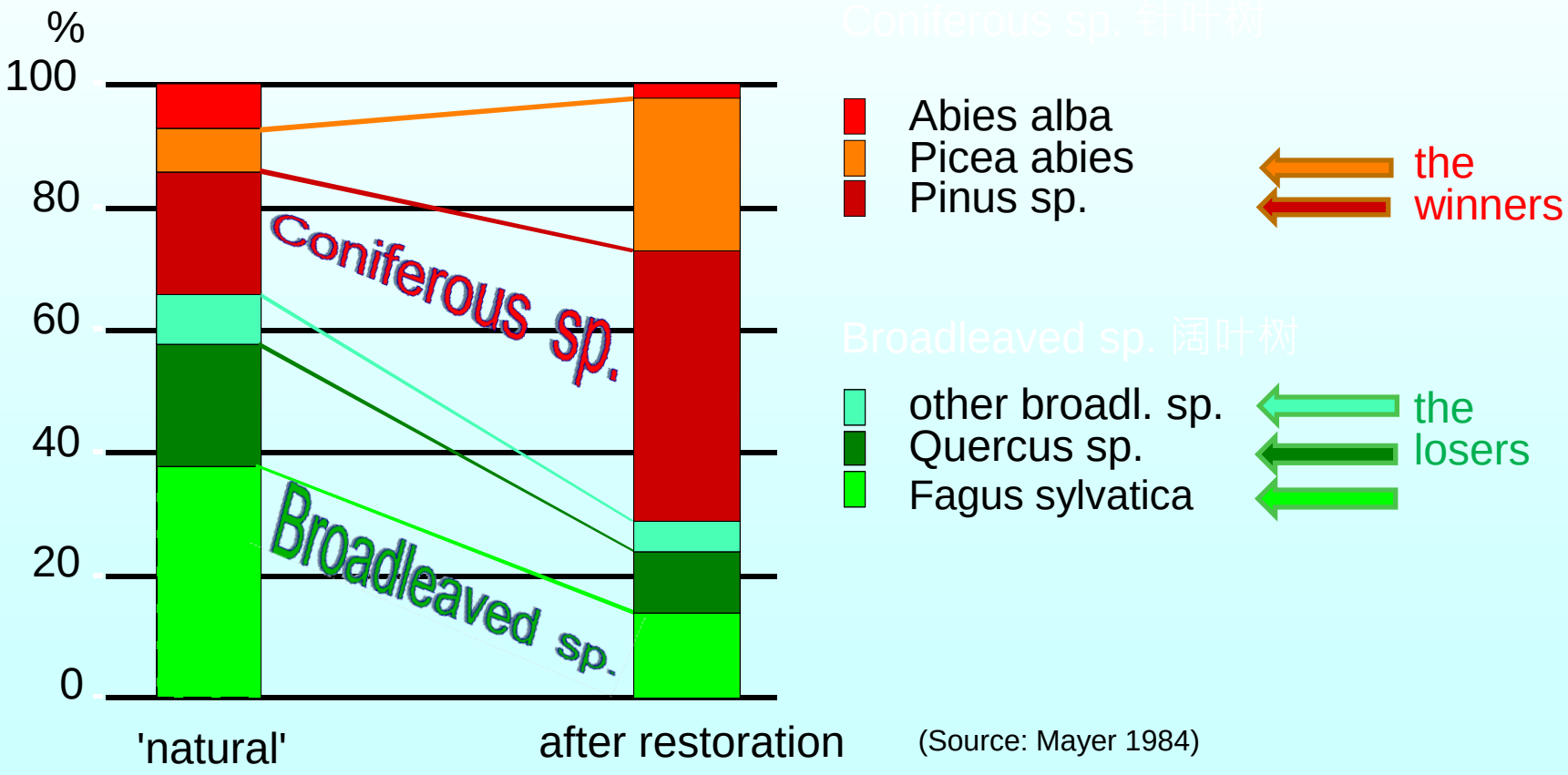
Percentage of wood to be used for timber: **70-80 %**

Broadleaved trees:

Percentage of wood to be used for timber: **20-30 %**

Phase II: Restoration

Changes in tree species composition driven by the needs of the people



(Source: Mayer 1984)

Natural range of Norway spruce

The natural range of Norway spruce in Central Europe is rather small; Norway spruce is growing naturally at high elevation adjacent to moist areas.

Norway spruce in Central Europe:

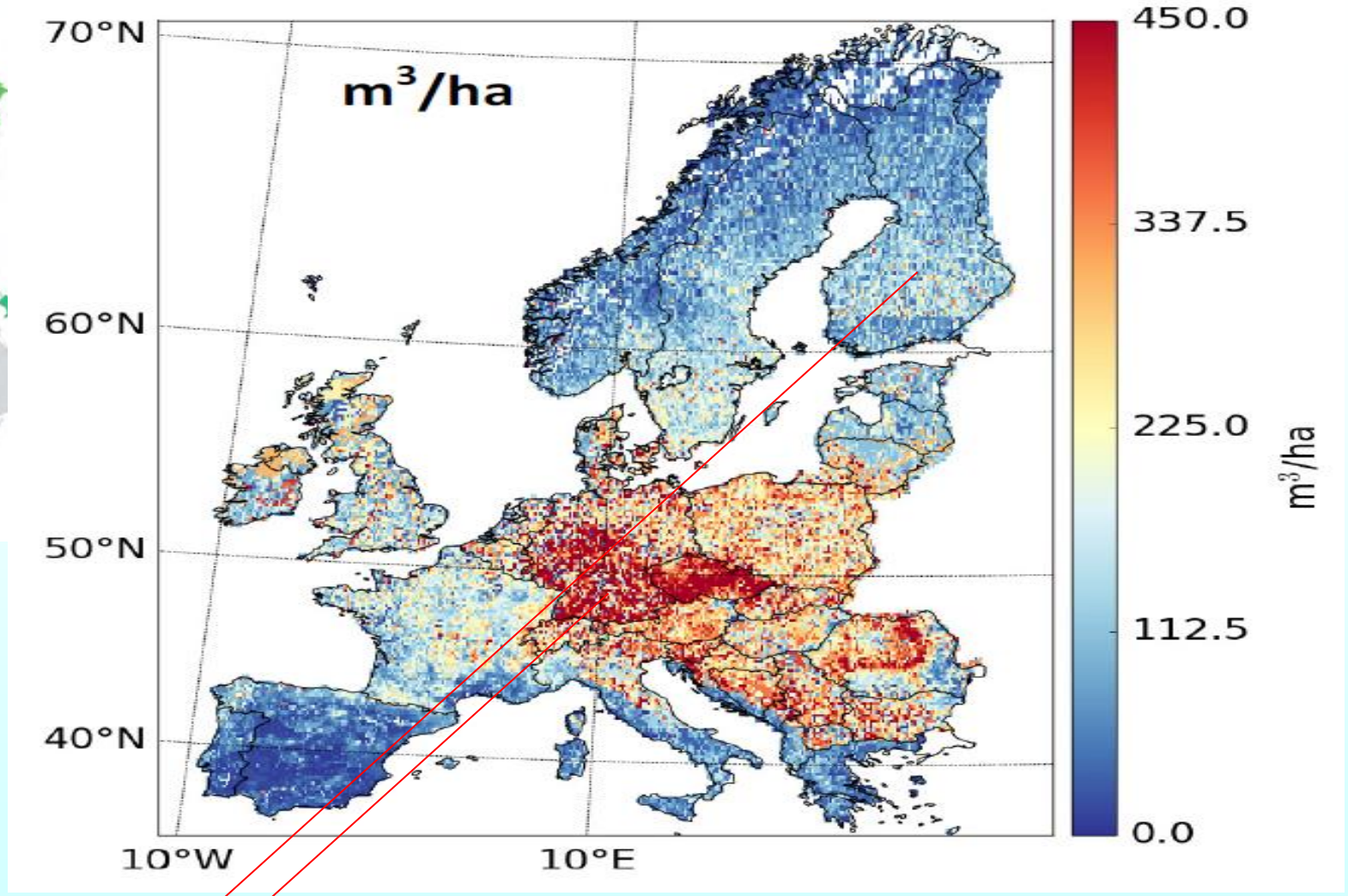
……. the economically most important tree species!

coniferous sp.

broadleaves sp.

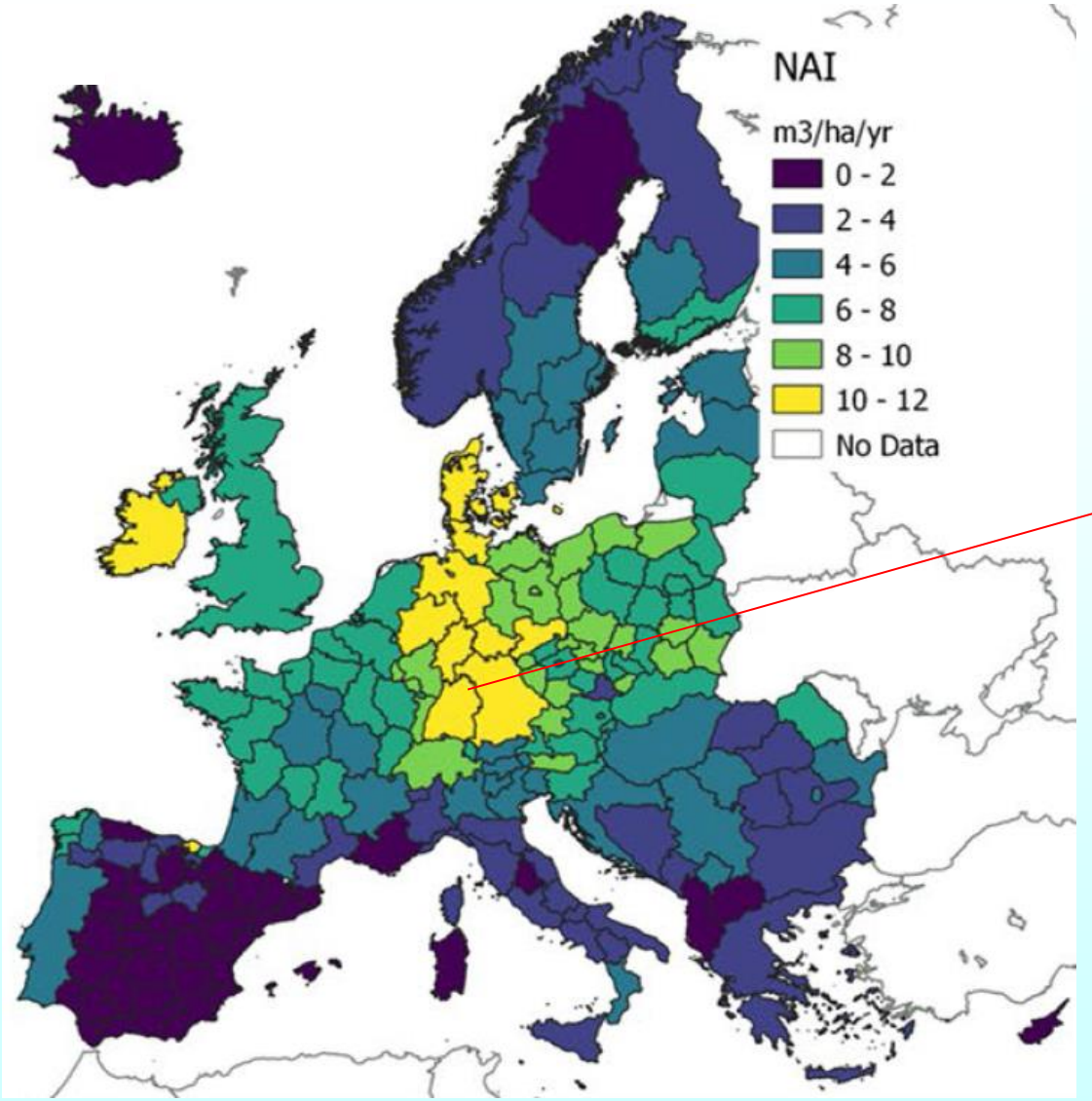
J. Marian 2018
based on ESA CCI 2015

source: European Commission Staff Working Document: Guidelines on Closer-to-Nature Forest Management 2023 (SWD(2023) 284 final)



source: A. Moreno, M. Neumann and H. Hasenauer 2017

- Growing stock in Finland: 109 $m^3\ ha^{-1}$ source: Korkonen et al. 2021
- Growing stock in Germany: 336 $m^3\ ha^{-1}$ source: BWI 3 2012

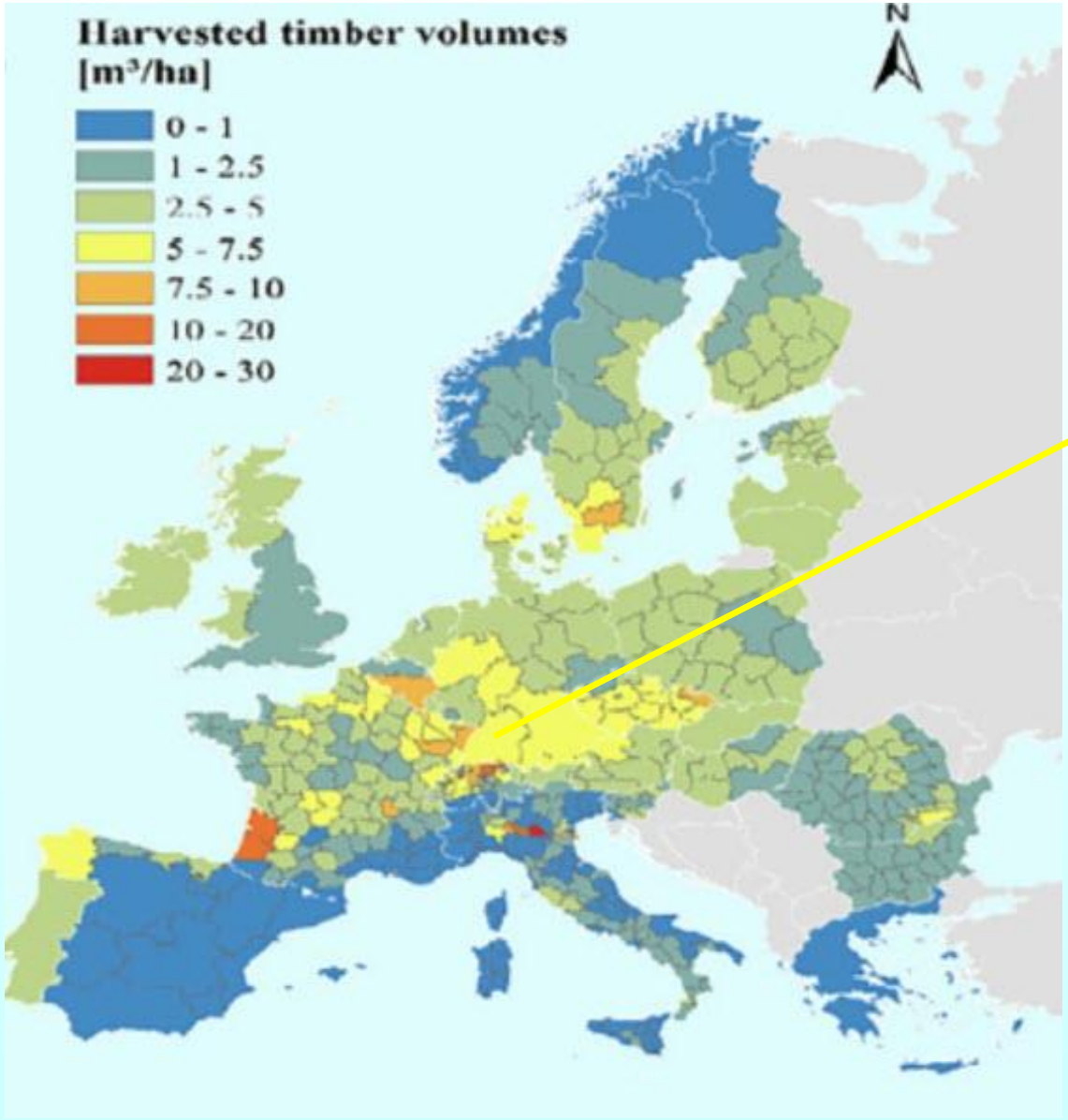


- net annual increment per ha > 10 m^3

Net annual increment per ha

source: Avitabile et al, 2024

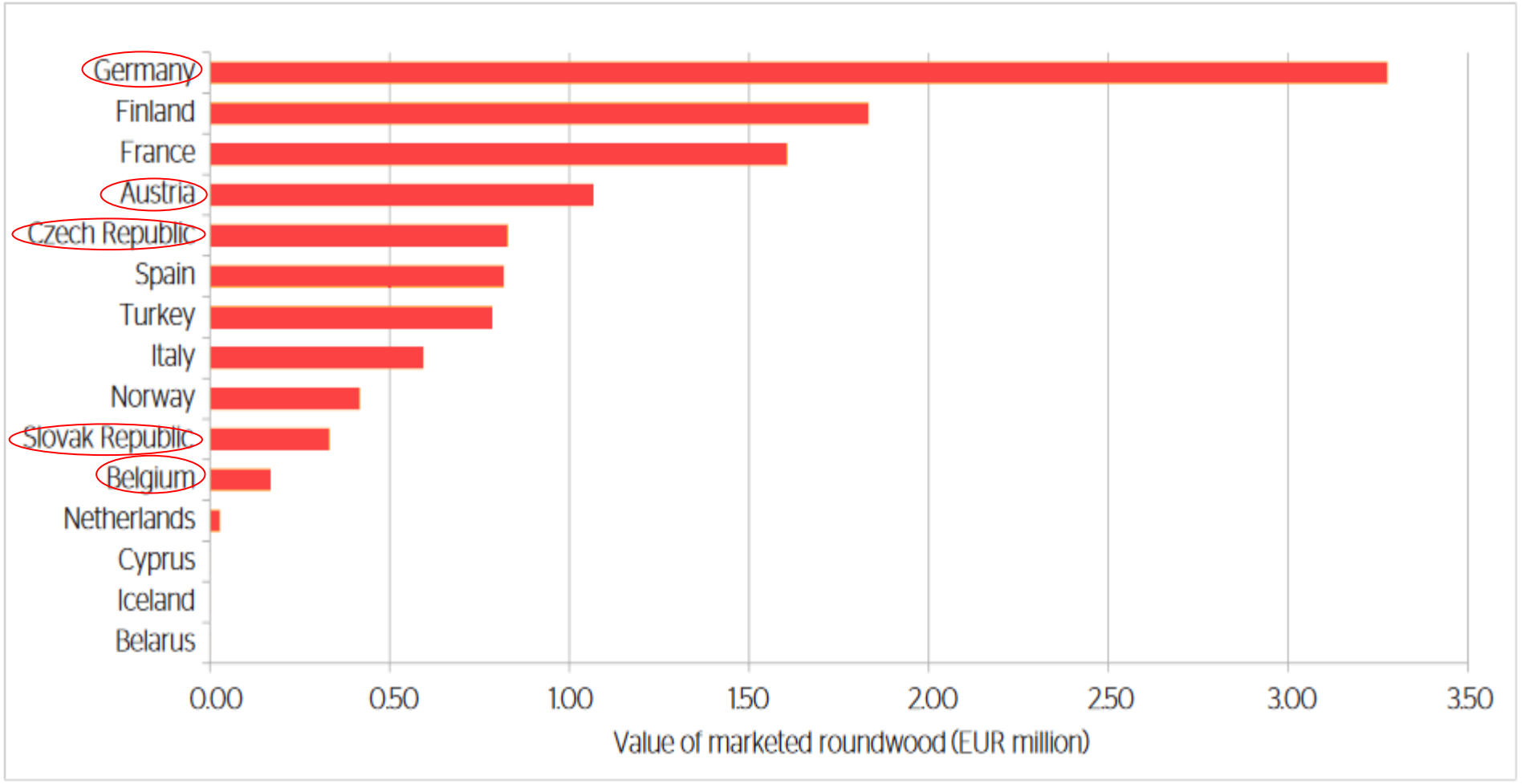
Harvested timber volumes [m³/ha] for the period 2000 – 2010



high wood volume increment [m³/ha]
high harvested timber volume [m³/ha]

Source: Levers et al, 2014

Value of marketed roundwood for European countries in year 2010



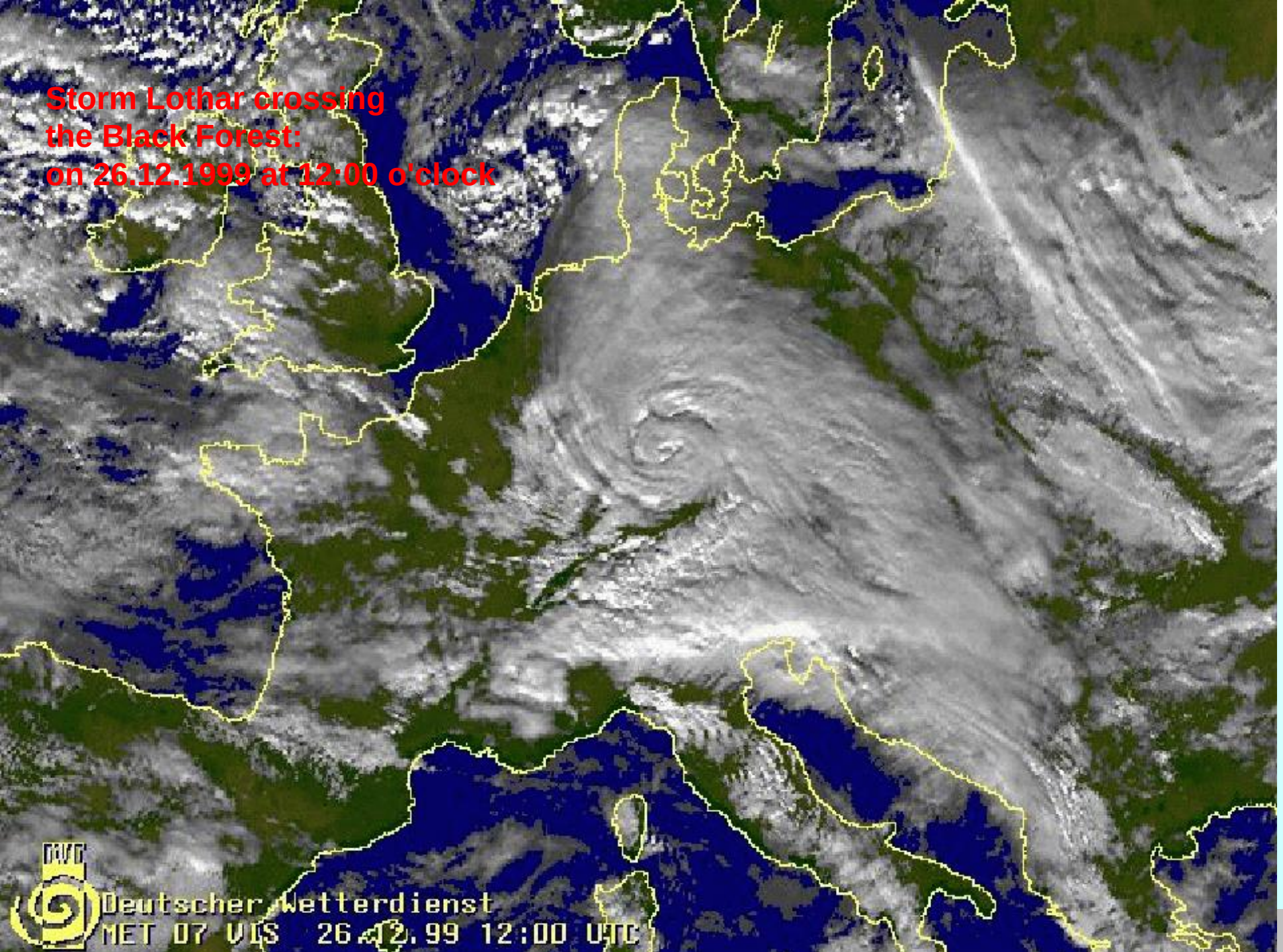
source: State of Europe´s forest 2015

Results of the restoration phase in Central Europe:

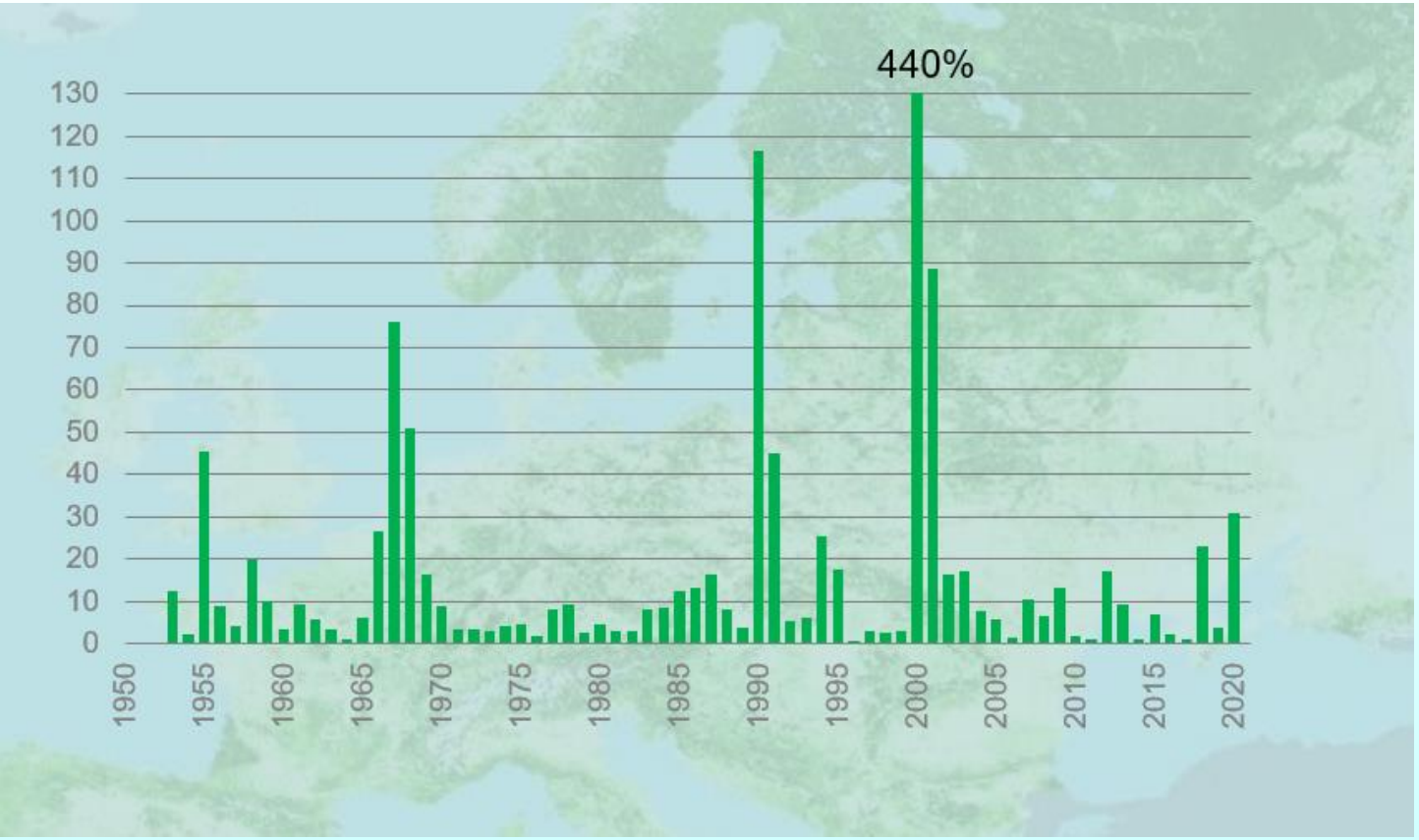
The achievements:

- the forest area has increased
- the wood volume production has increased
- the growing stock has increased
- the wood quality has increased
- the carbon stored in forests and wood products has increased

…. a success story!!!


Storm Lothar crossing
the Black Forest:
on 26.12.1999 at 12:00 o'clock
Deutscher Wetterdienst
MET 07 VIS 26.12.99 12:00 UTC

Salvage cut (storm) in % of allowable cut in the public forest of the Black Forest



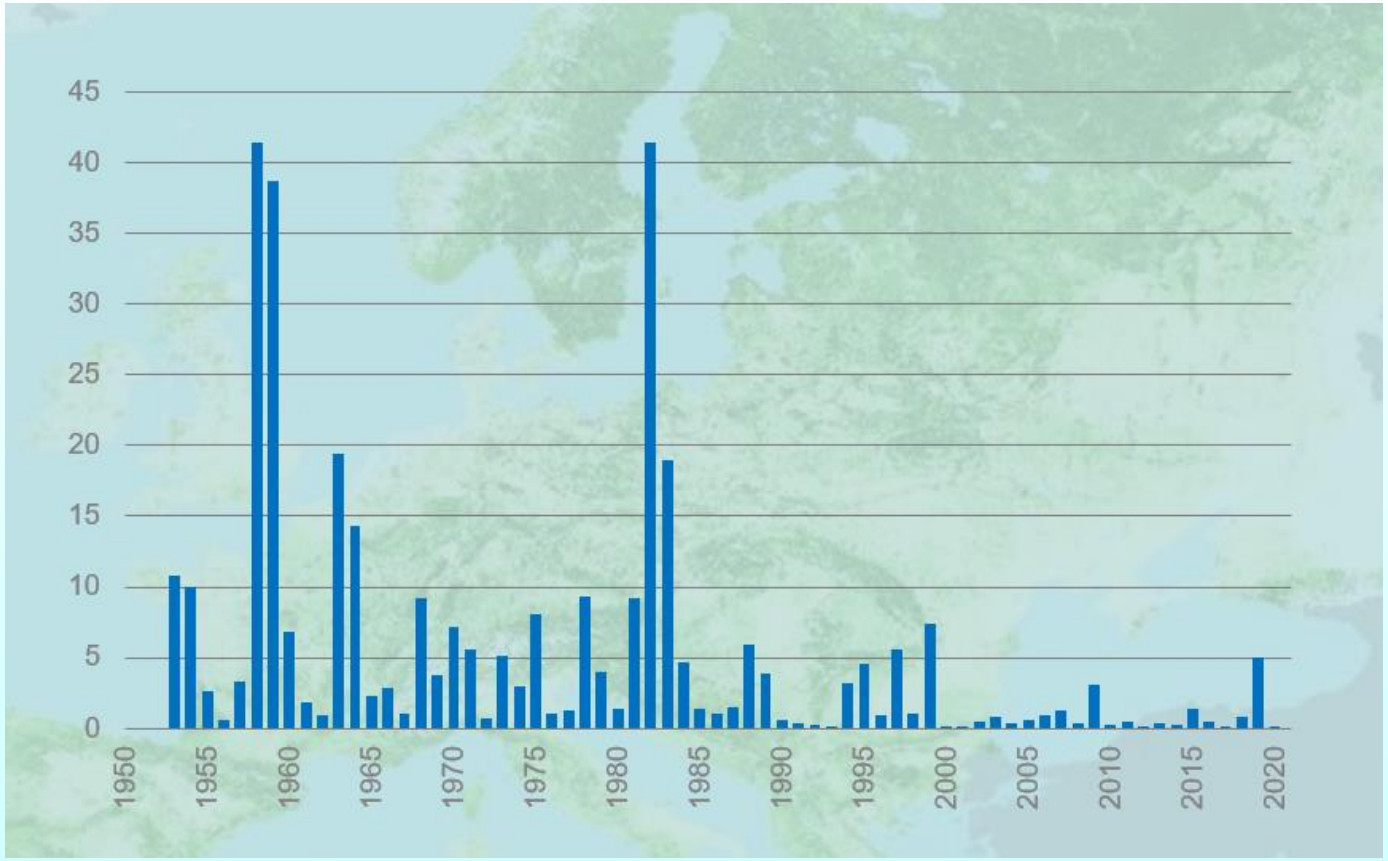
Average annual mortality in % of the allowable cut in the last 68 years in the Black Forest:

20.1 %

Trend: increasing

Spiecker unpublished

Salvage cut (snow & ice) in % of allowable cut in the public forest of the Black Forest



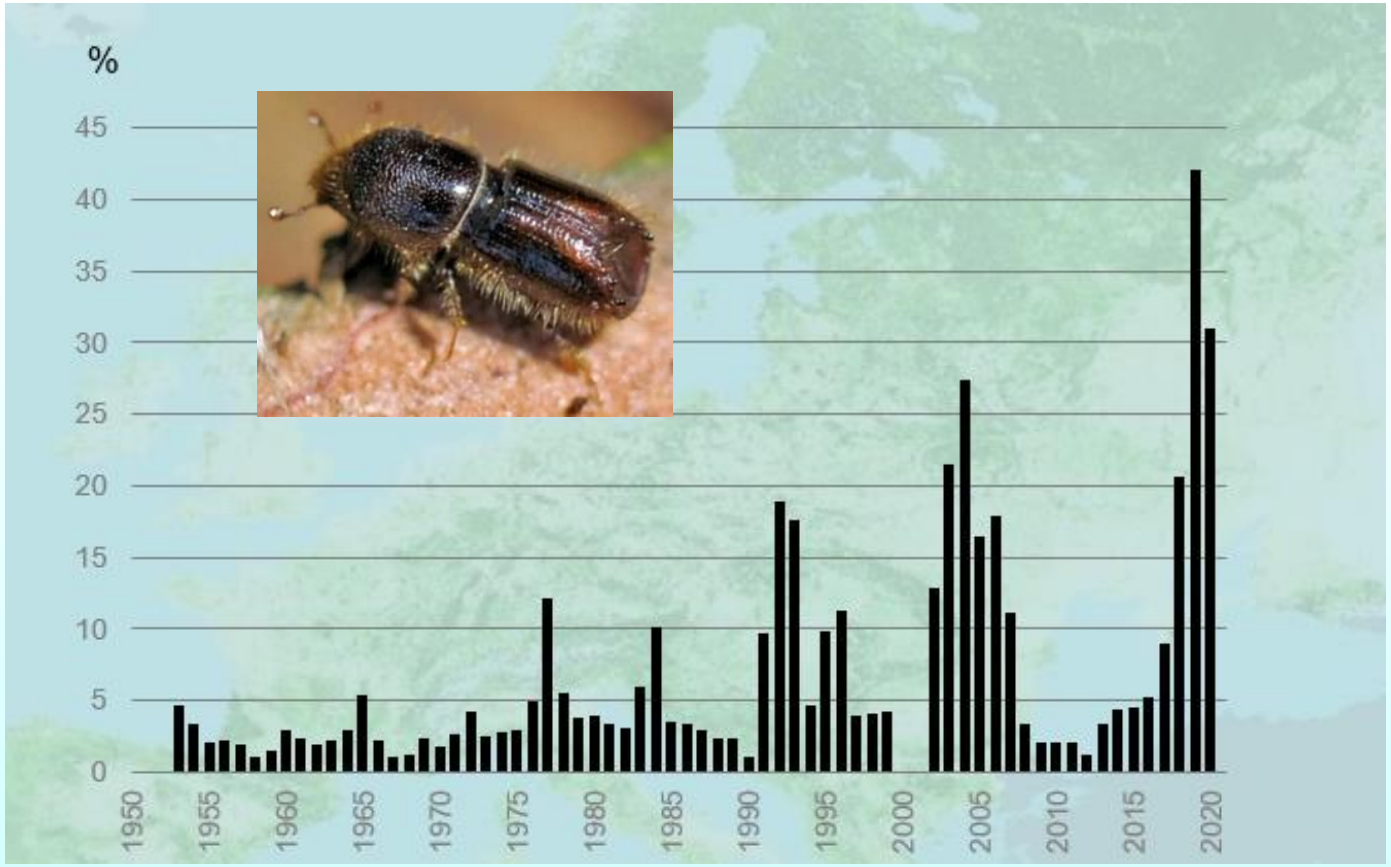
Average annual mortality in % of the allowable cut in the last 68 years in the Black Forest:

5.1 %

Trend: decreasing

Spiecker unpublished

Salvage cut (desiccated trees) in % of allowable cut in the public forest of the Black Forest



Average annual mortality in % of the allowable cut in the last 70 years in the Black Forest:

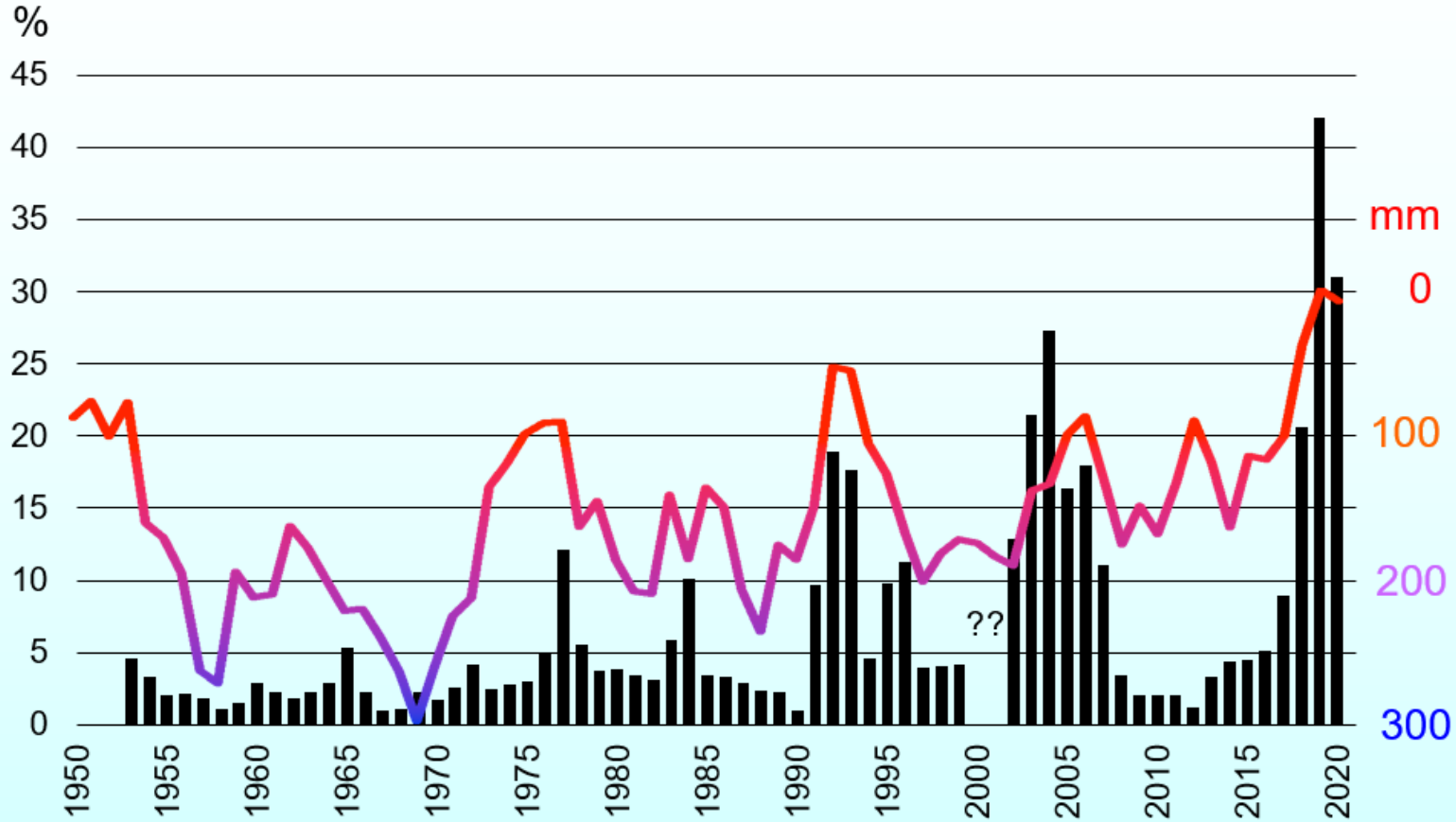
6.8 %

Trend: dramatically increasing

Moreover, **Forest fires** are becoming a problem in Germany caused of extreme heat waves and drought.

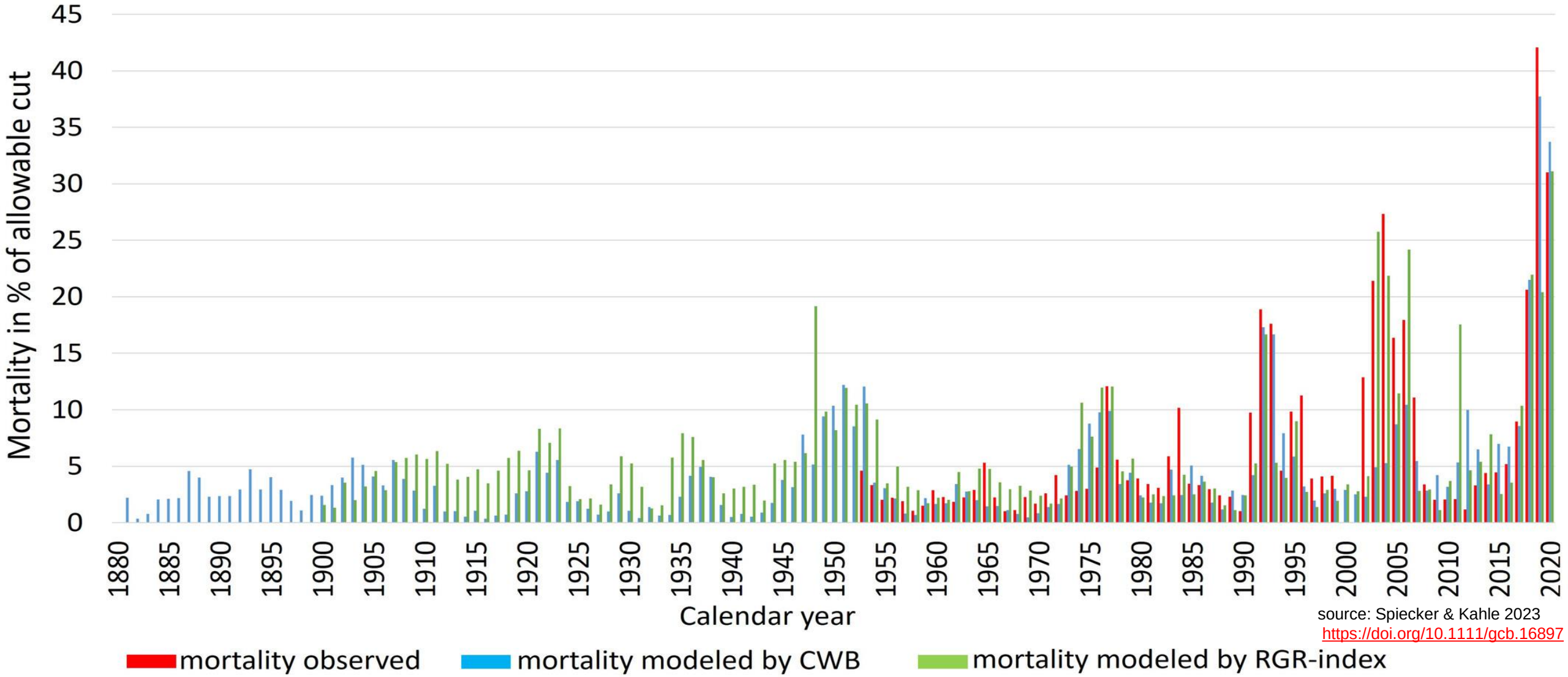
Spiecker unpublished

mortality and **climatic water balance** in the Black Forest



source: Spiecker & Kahle 2023: Global Change Biology, DOI: (10.1111/gcb.16897)

Climate-driven tree mortality in the Black Forest, Germany in the last 140 years, modelled and observed



source: Spiecker & Kahle 2023
https://doi.org/10.1111/gcb.16897

Exporting wood of trees killed by insects to China

Phase III: Conversion

Two major problems resulting from past restoration:

- Tree species were often not adapted to the site conditions

- Monocultures

Phase III: Conversion

To provide a solid base for answering the question of conversion various disciplines need to be involved!

History
Inventory
Ecology

Policy
Silviculture
Forest Operations
Economy

New drivers for forest management:

Changing ecological conditions

"climate change"

including extreme events (drought, storm, snow/ice etc.), invasive plants, insects, pests & diseases

Changing economic conditions

"increasing labor cost and relatively low wood prices"

In 1950: value of **1 m^3** of timber ~ **50 hours** of labor; in 2010: **1 m^3** of timber ~ **2 hours** of labor

Changing social environment

changing values and perceptions

Changes in values and perceptions:

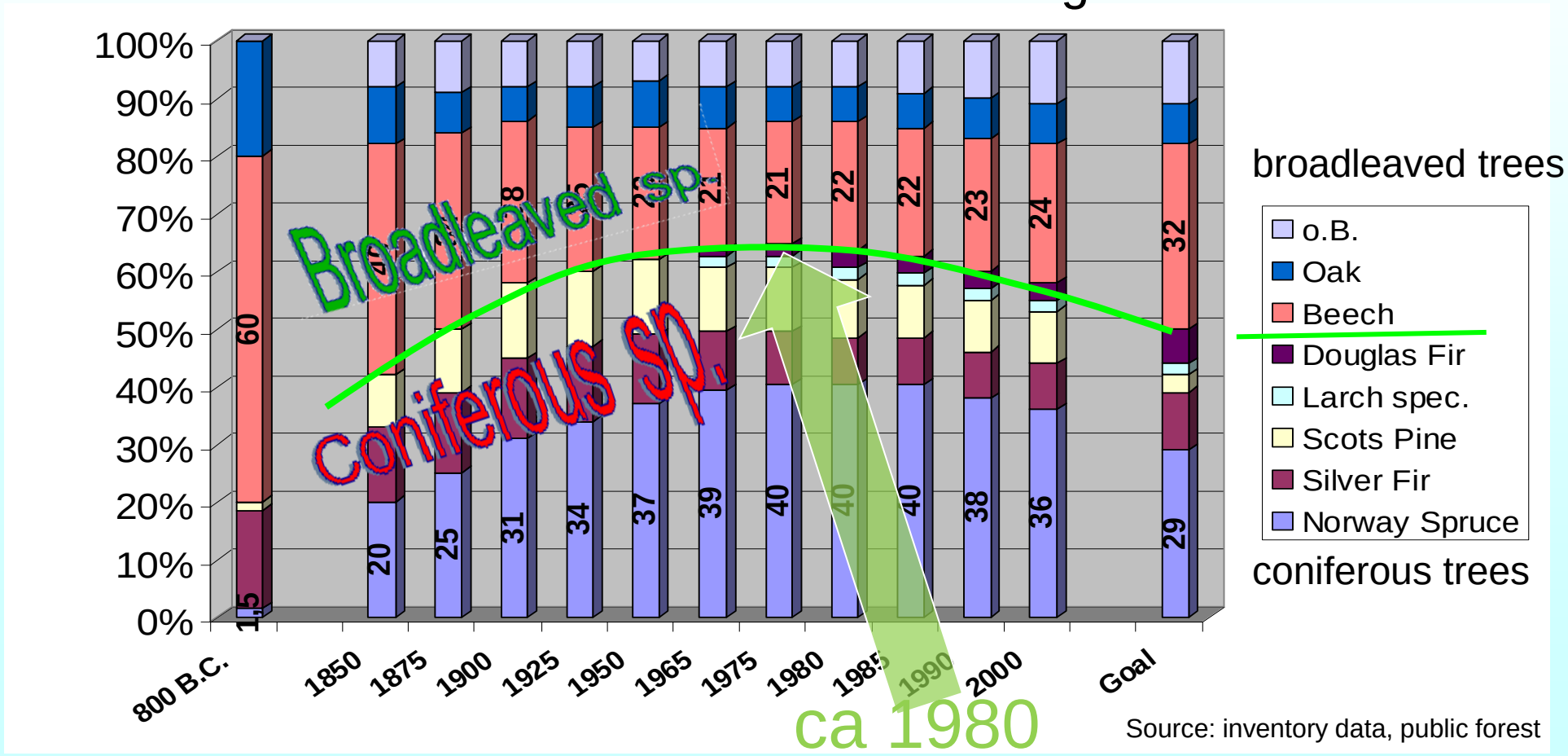
- **economic** interest in "*provisioning*" services of forests such as wood production decreased

- **ecological** interest in "*regulating*" services such as conserving biodiversity, water quality, climate protection increased

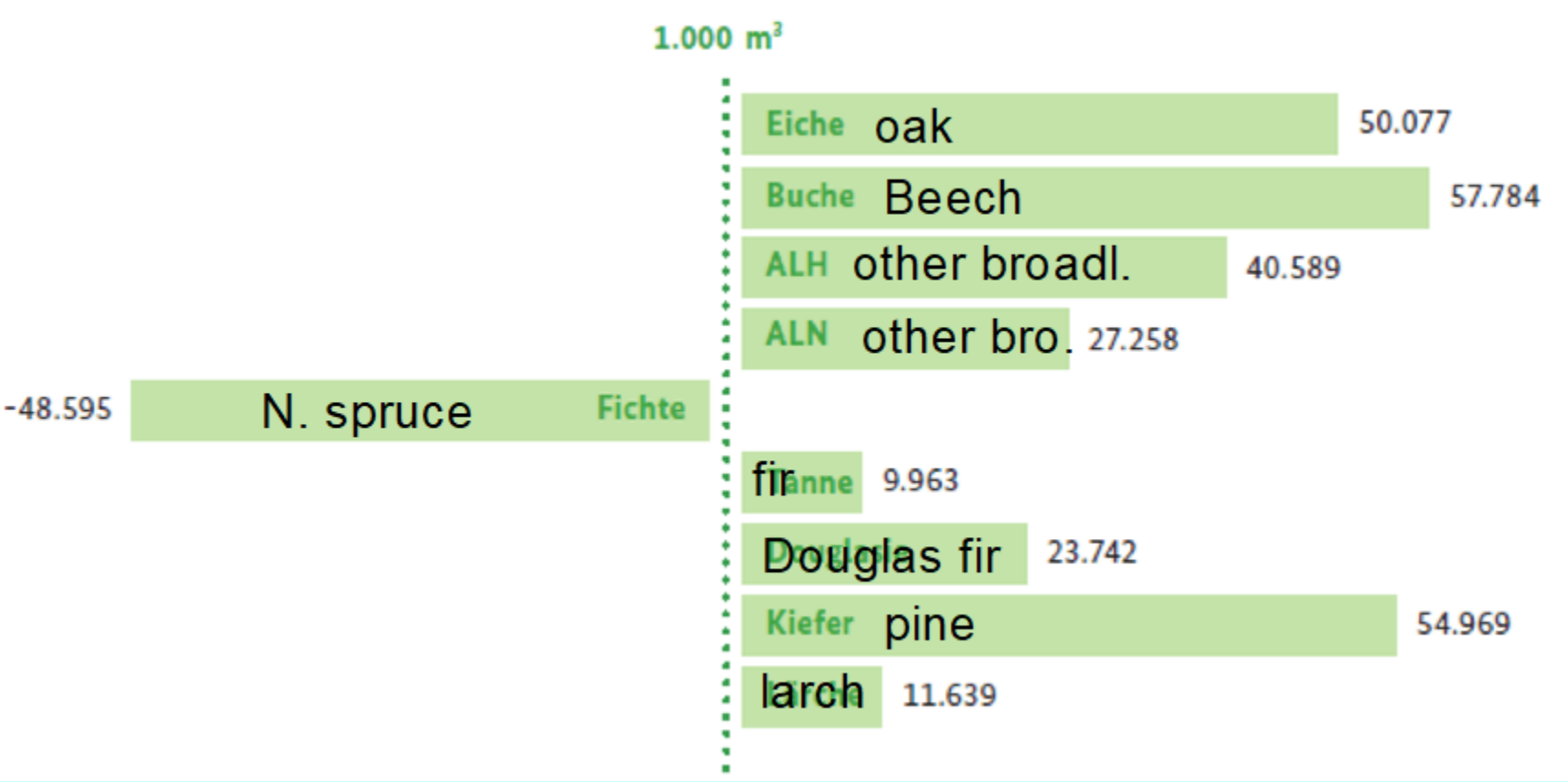
- **social** interest in "*cultural*" services such as recreational values increased

Phase III: Conversion

Changes in tree species composition in the state of Baden-Württemberg

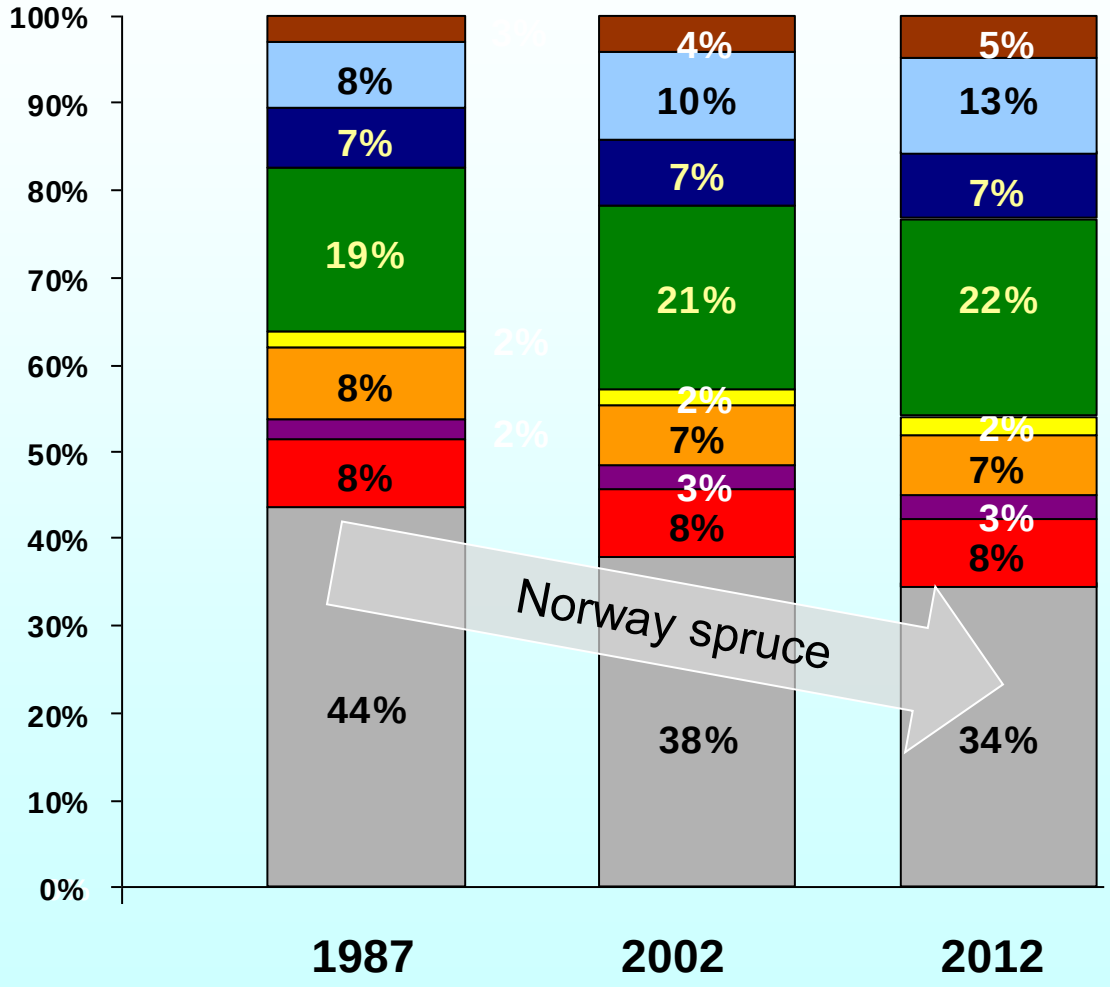


Change in Growing Stock in Germany 2002-2012
2002-2012



Phase III: Conversion

Change in tree species composition in Baden-Württemberg 1987- 2012 in % of the area

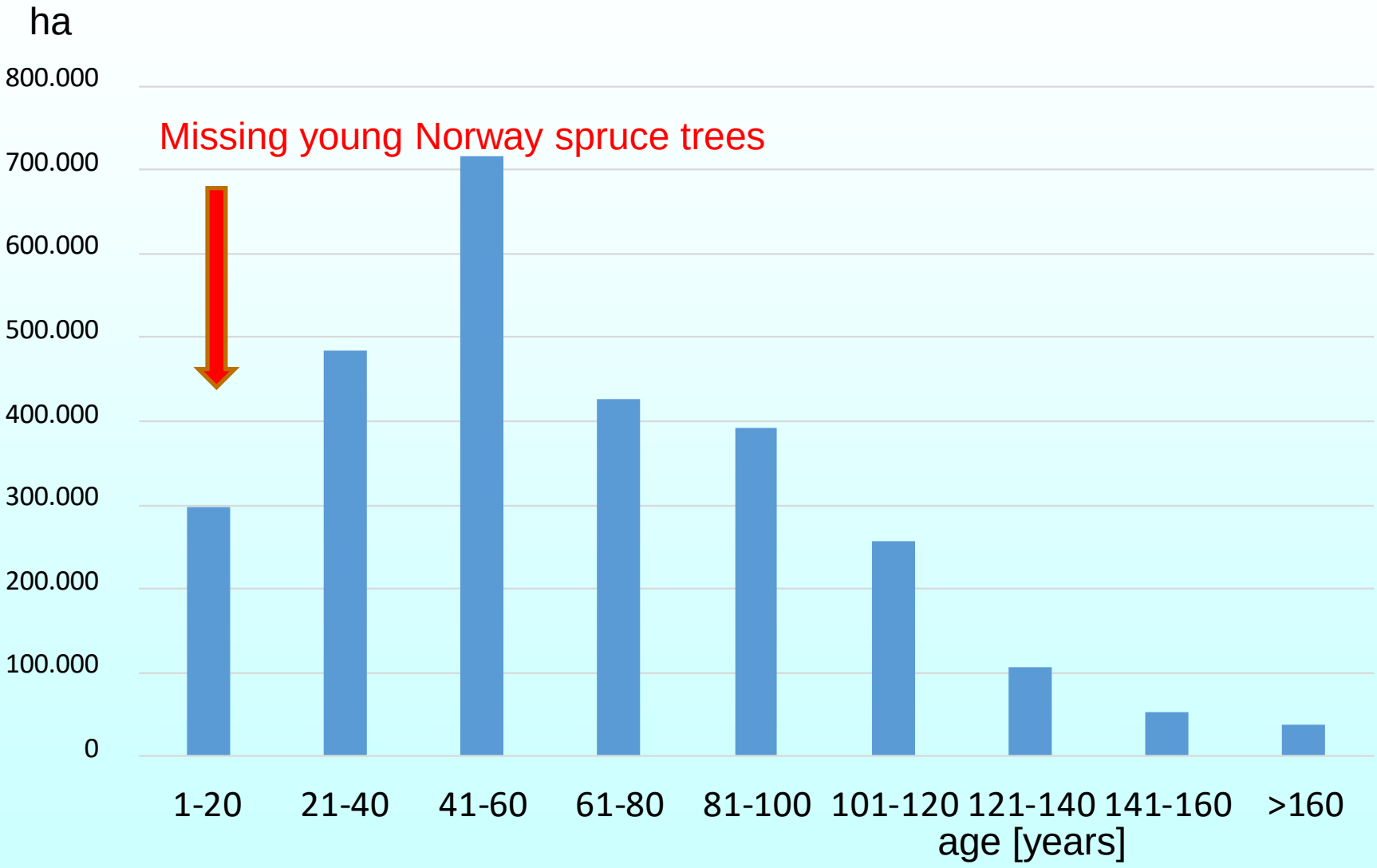


Norway spruce (N.Spr) outside its natural range:

…once the “star species” of Central-European forestry is losing its glory.

Source: Der Wald in Deutschland, ausgewählte Ergebnisse BWI III, 2016, Ba.-Wü.

Age class composition of Norway spruce 2012 in Germany



Phase III: Conversion

Aim settings for conversion

- Participation of different interest groups
- Forests as a source of income are losing interest
- Nature conservation is gaining importance
- Recreation is gaining importance

There is an increasing interest in “**close to nature forestry**” in Europe.

Making use of natural processes
- less labor input
- less interventions
- more natural regeneration
- less tending activities
- longer production cycles

even aged monoculture

Mixed forest with natural regeneration

Longer production cycles

Average age of the forests
in Germany 2008:

77 years

The age increased in 2002-2008 (7 years) by 4 years

The result of these changes:

Lower productivity (-)
Lower timber quality (-)
Less construction wood (-)
Lower management intensity (+)
More naturalness (+)
More resilience and resistance (+)
Less carbon sequestration (-)
Less renewable resources (-)

economic aspects

ecological aspects

How about the future of Central European Forests?

We will be faced with many uncertainties!

This means that the adaptive capacity of forests to changes has to be increased!

Diversity will increase the adaptive capacity of forests!

Ownership diversity, cultural diversity, diversity of site conditions, and biological diversity may help to increase the robustness of Central European Forests even so an optimal result related to one specific aim may not be reached.


Thank you for your attention!