



photo Igor Míchal

# ROTATION OF FIR AND BEECH IN CARPATHIANS – DEVELOPMENTAL CYCLE OR LINEAR TREND?

The question for the nature conservation practice

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## Structure of contribution

- „Classical“ hypothesis
- Long term field measurements and the results
- Historical development of Carpathian forests
- Synthesis

## location - „classical“ hypothesis

Where was it happened?



A topographic map of Europe showing the Czech Republic and the Carpathian Ecoregion. The Czech Republic is outlined in black and labeled with the text "Czech Republic". The Carpathian Ecoregion is outlined in white and labeled with the text "Carpathian Ecoregion". Two black lines point from the text labels to their respective geographical features on the map.

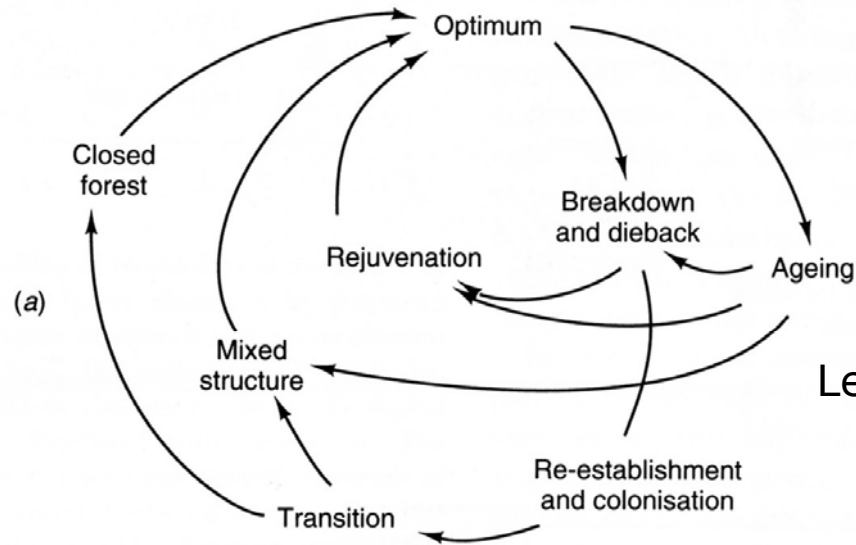
**Czech  
Republic**

**Carpathian  
Ecoregion**

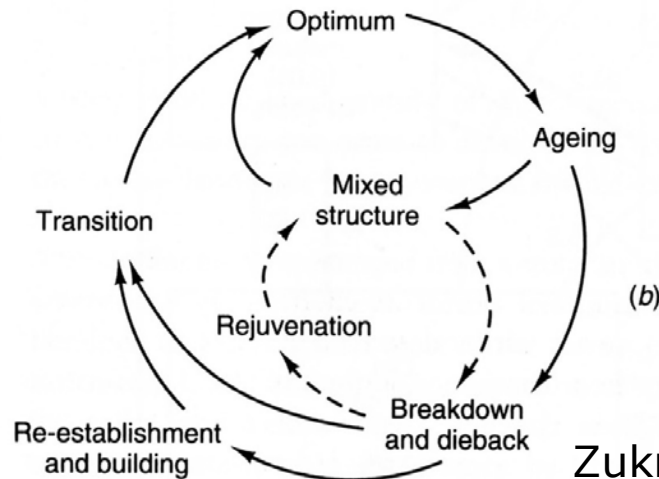


# „classical“ hypothesis

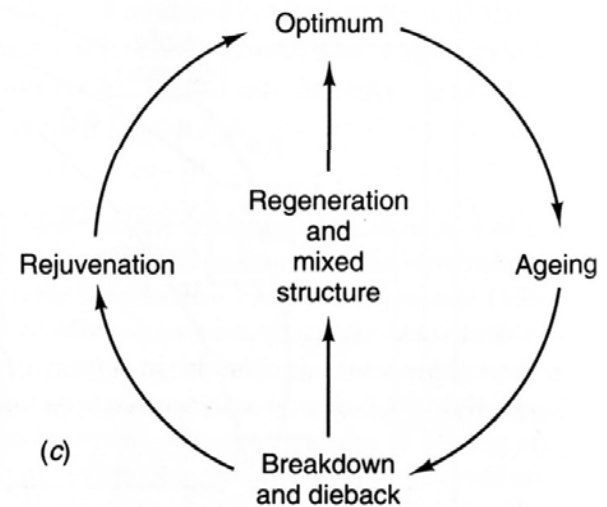
## developmental cycle of mixed temperate forests in Europe



Leibundgut, 1959



Zukrigl, 1963



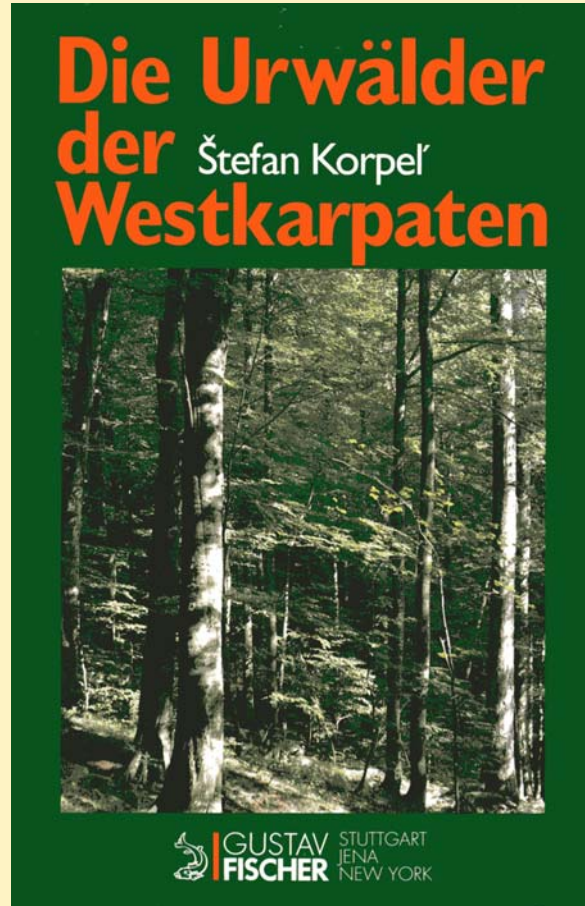
Mueller-Dombois, 1987

# „classical“ hypothesis

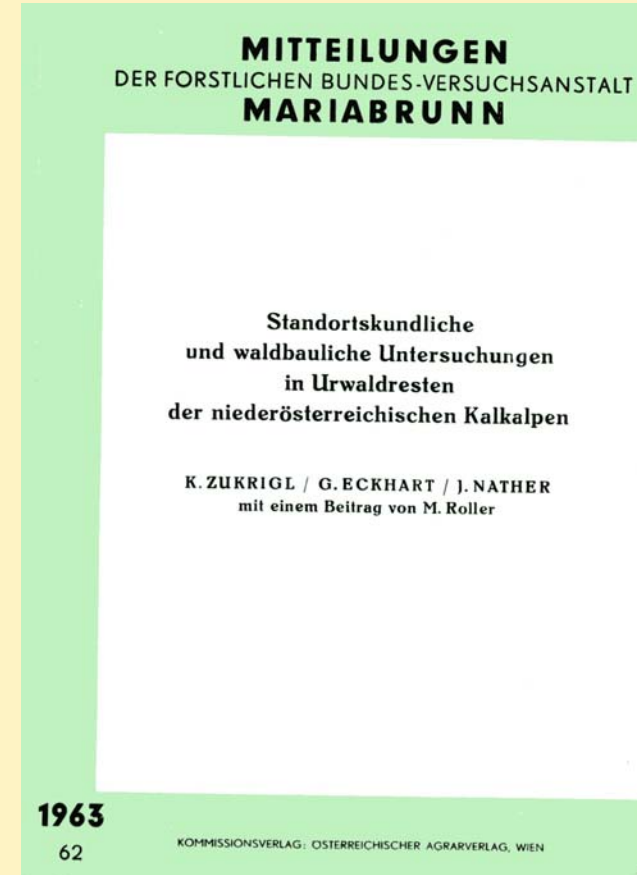
Hans Leibundgut  
50s-80s



Štefan Korpel'  
50s-90s



Kurt Zukrigl &  
Hannes Mayer  
60s-80s



## FACTS:

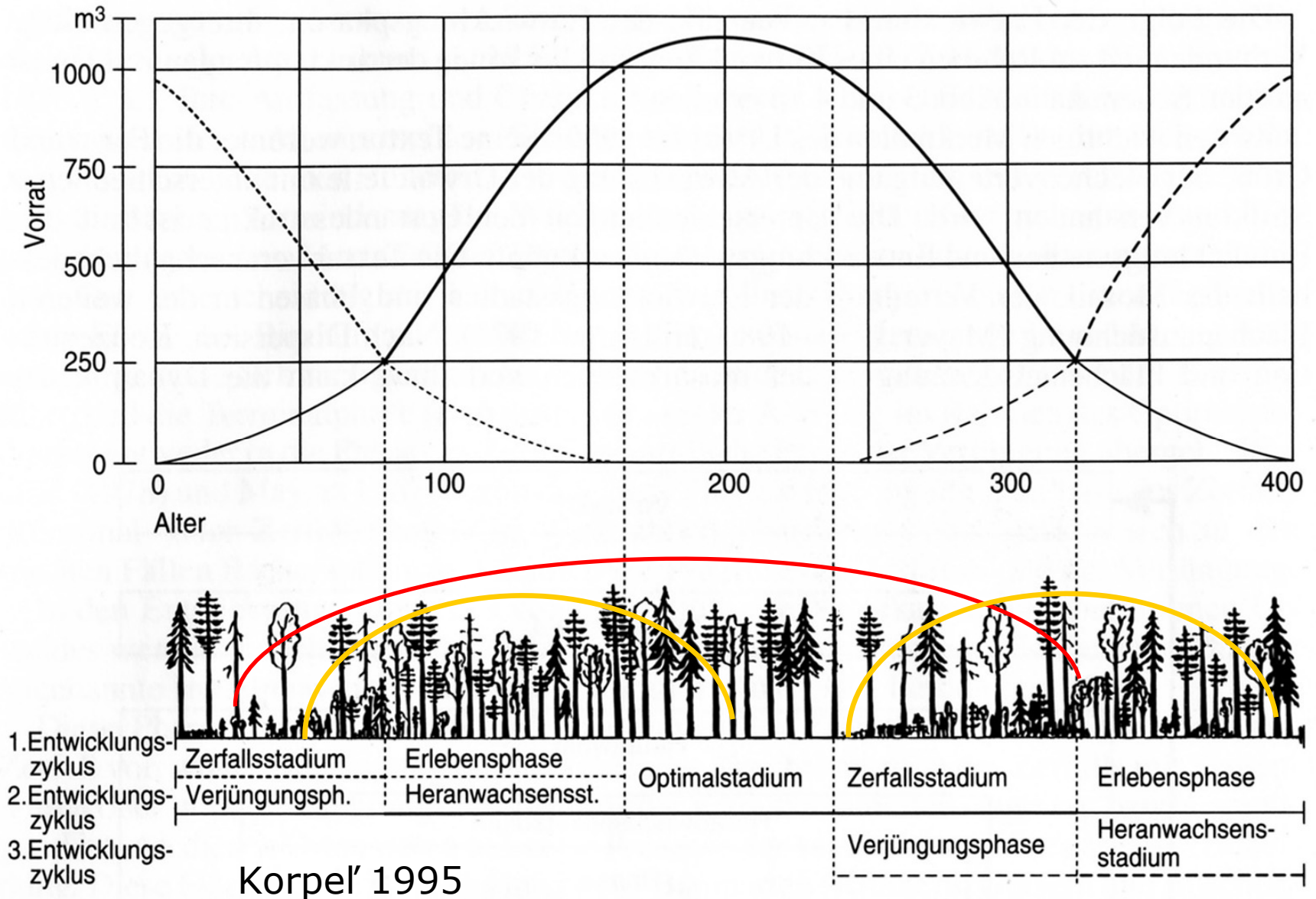
- European beech (*Fagus sylvatica* L.) is dominated tree species in mixed temperate forests in Europe
- Silver fir (*Abies alba* Mill.) is main mixture tree species in natural temperate forests of Central and Eastern Europe

## CLASSICAL hypothesis:

Silver fir and European beech are changing cyclically:  
during life of 1 silver fir generation are 2 European beech generations rotated

# „classical“ hypothesis

## 1 silver fir generation – 2 European beech generations



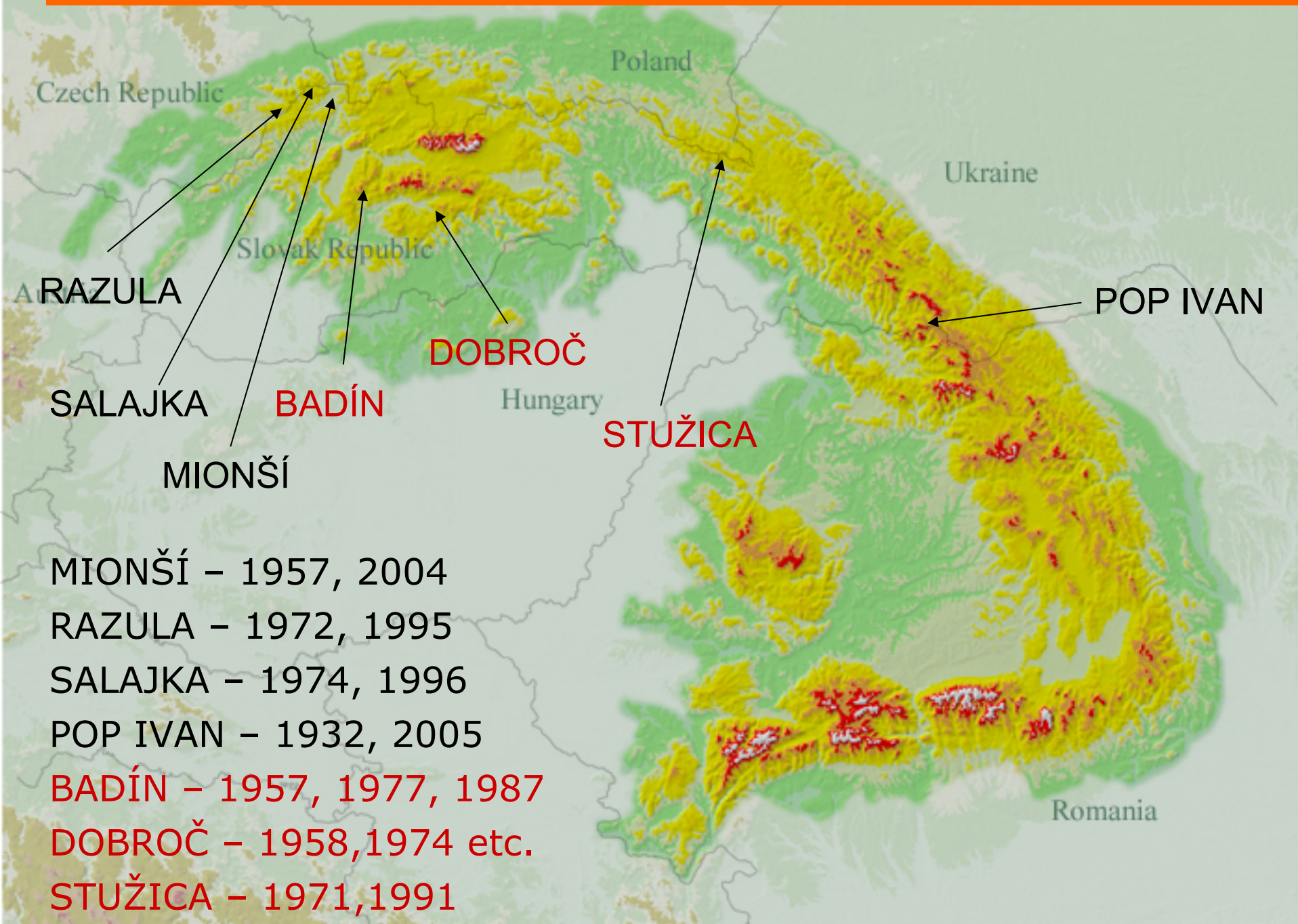
## WHAT WAS HAPPENED?

- We had different goals of our project (1994-2005)
- We found very similar developmental TRENDS in the best fir-beech carpathians forest reserves in the Czech Republic, Slovak Republic (UNESCO) and Ukraine
- We compared the data with the classical hypothesis
- It was not possible to apply

## WHY?



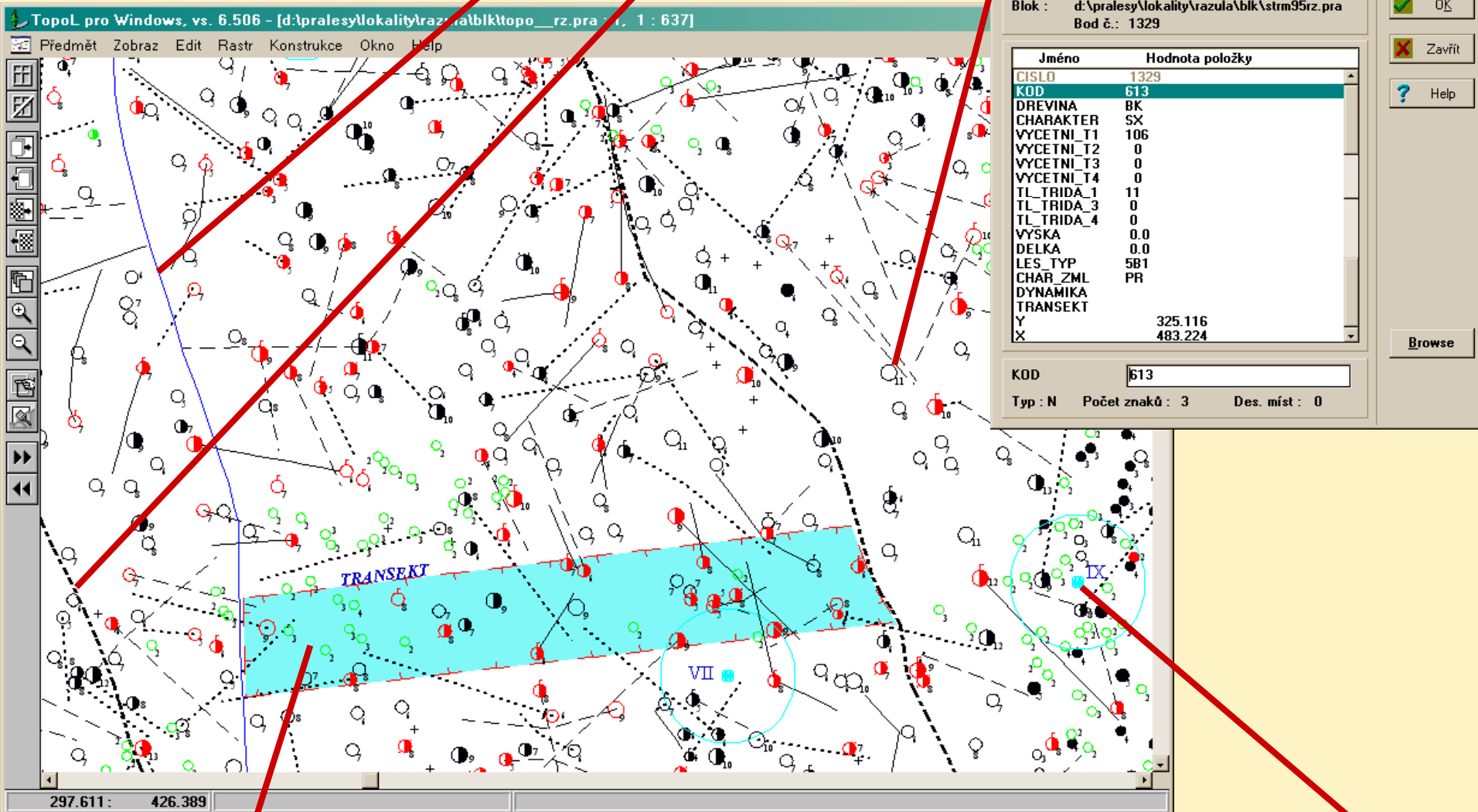
# Long-term field measurements and results



# long term field measurements and results

Boundary line of developmental stages and groups of natural regeneration

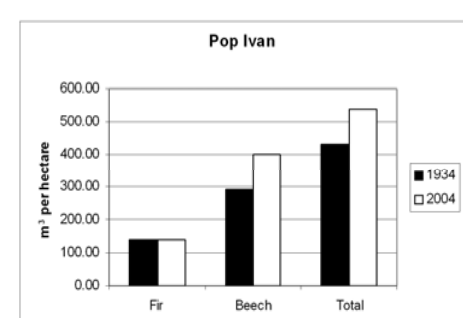
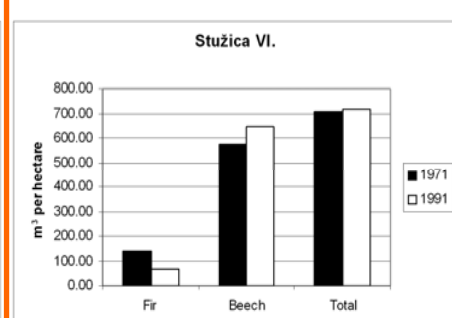
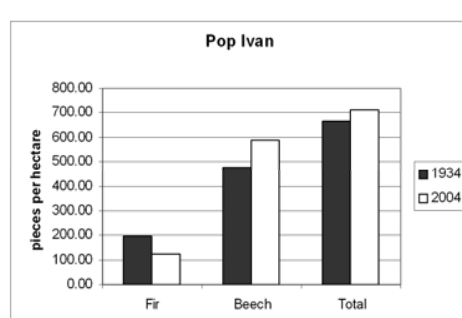
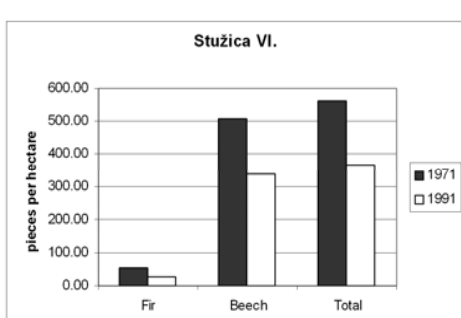
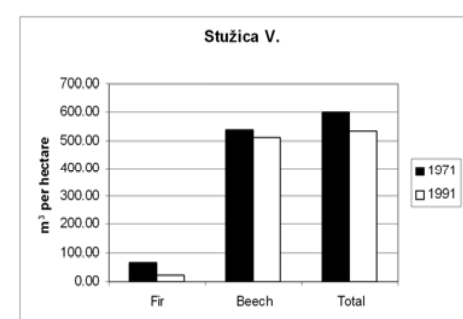
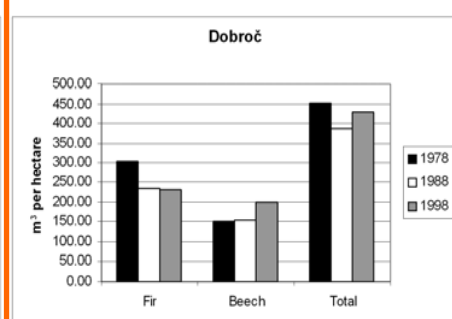
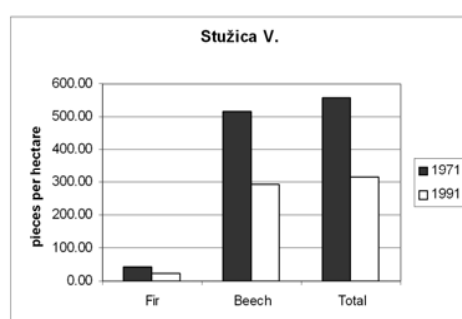
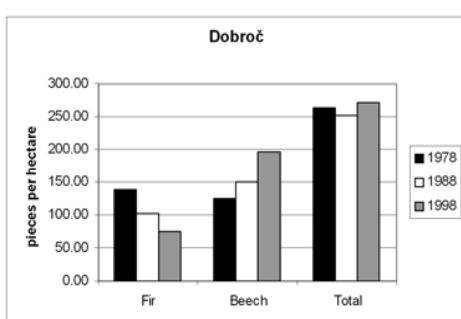
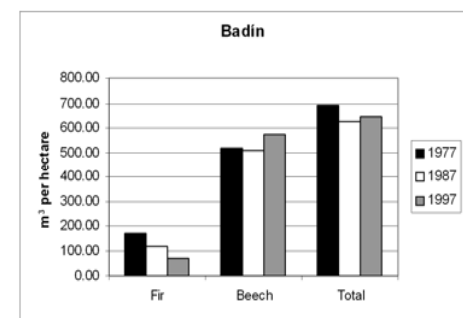
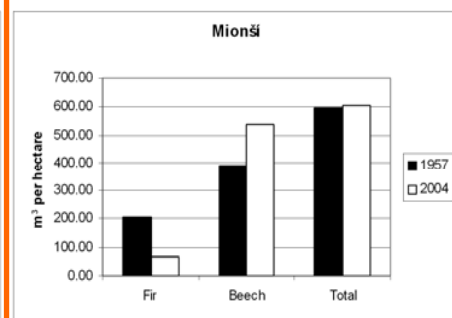
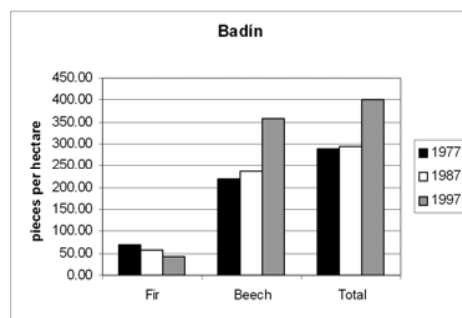
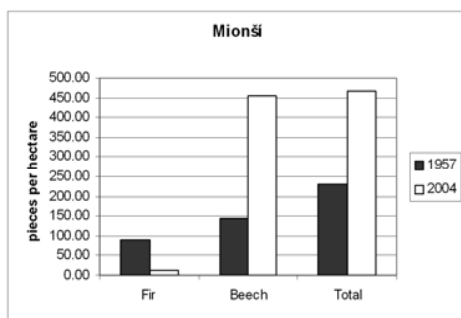
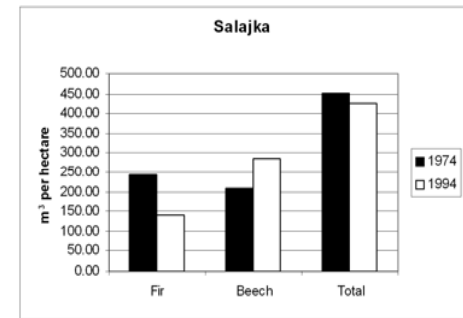
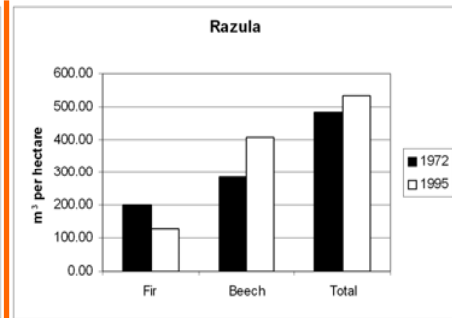
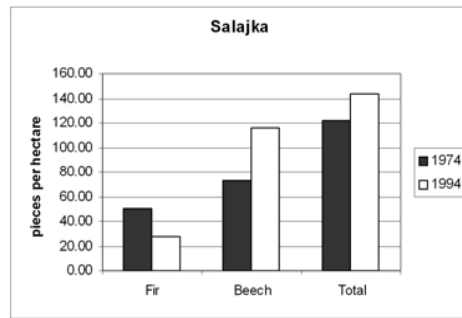
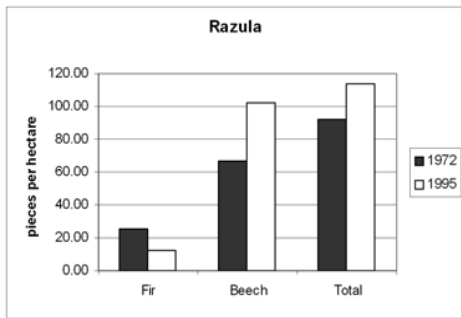
Trees database



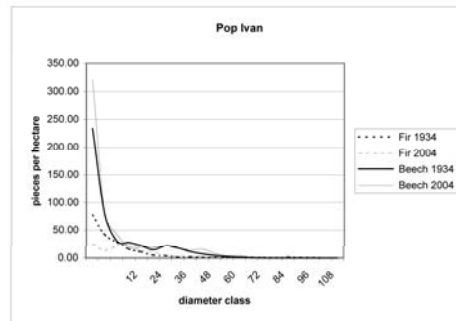
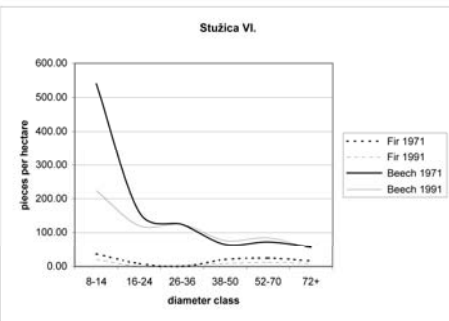
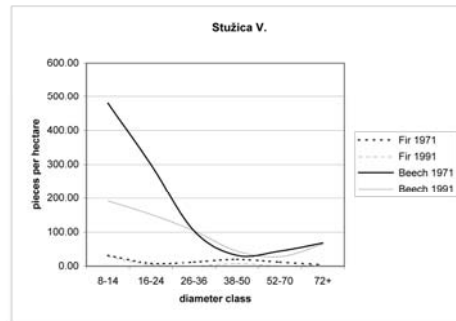
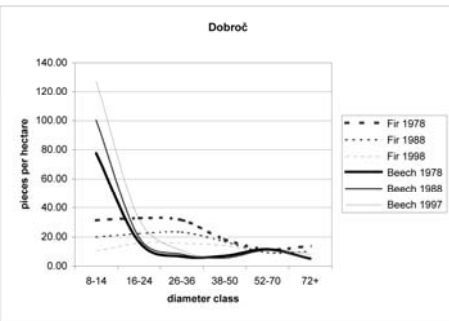
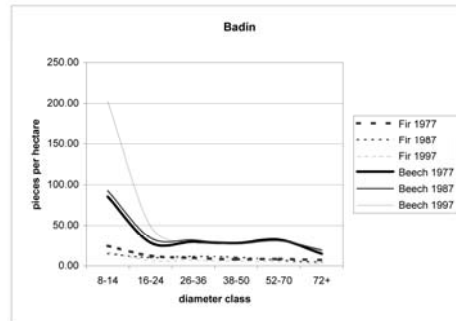
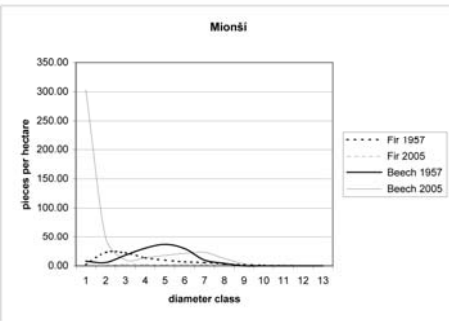
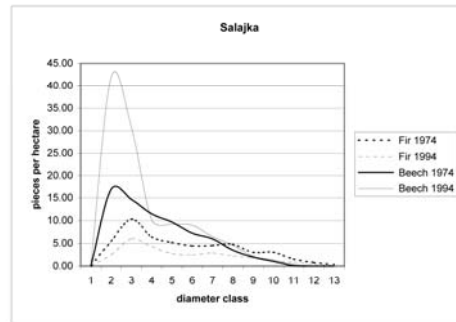
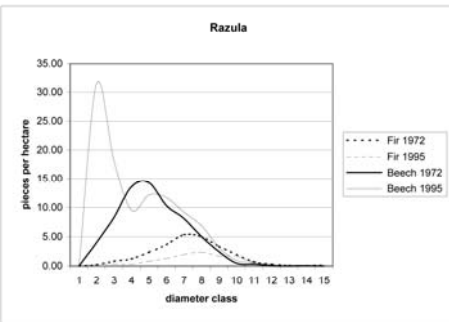
Stand profile

Phytocoenological relevé on circular plot and soil pit

# Long-term field measurements and results



# Long-term field measurements and results



Data ze slovenských lokalit byla převzata z publikací:

Badín – Korpel' 1995, Saniga 1999b

Dobroč – Saniga 1999a

Stužica – Korpel' 1995



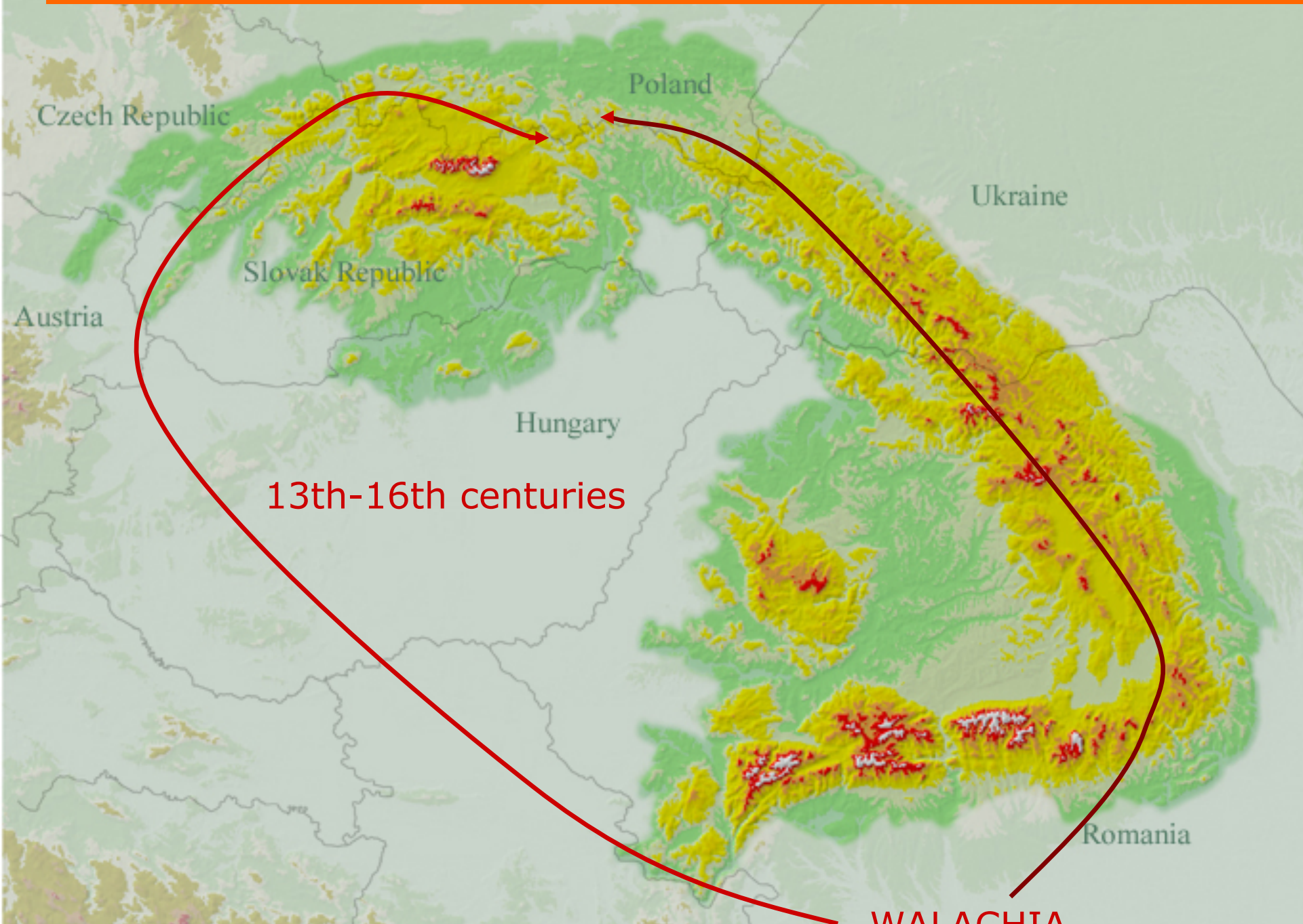
The same development in space and time - Slovak, Ukrainian and Czech forest reserves

- silver fir representation decreases in all forest reserves, changes of tree parameters are similar
- European beech representation increases, changes of tree parameters are similar

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The key is in history of settlement

# Historical development of Carpathian forests



## 14th - 16th century – Walachian colonization in the Western and Northern Carpathians

- Sheep grazing – preference of browsing on beech natural regeneration
- Litter gathering – worse conditions for humification (acidification)



**better conditions for silver fir natural regeneration**

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1756 – prohibition of forest grazing – Austrian-Hungarian

monarchy

**19th century** – real ending of forest grazing and litter gathering –  
**strong change of conditions**

### The end of the 19th and 20th century – expiration of the „grazing“ fir generation

- Growth of game stock (red deers mainly)
  - preference of browsing on fir natural regeneration
  - predators were hunted out
- Development of new litterfall layer (beech leaves)
  - beech seeds are large, fir seeds are small



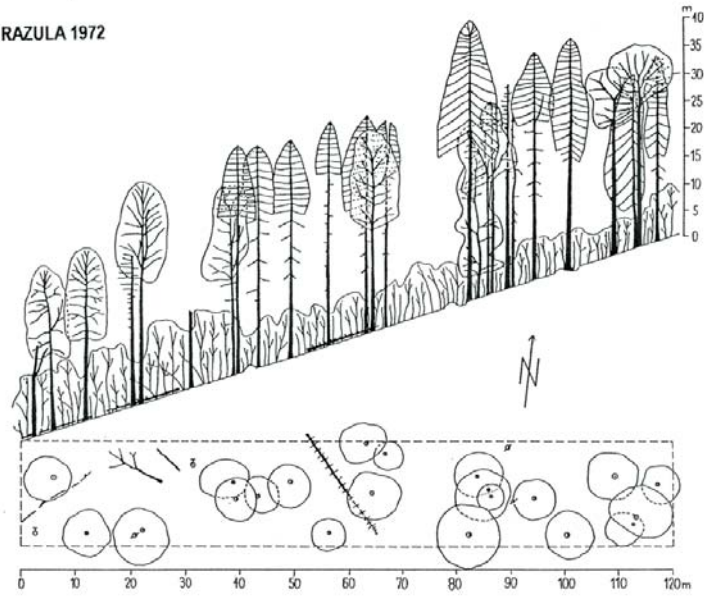
**better conditions for beech natural regeneration**



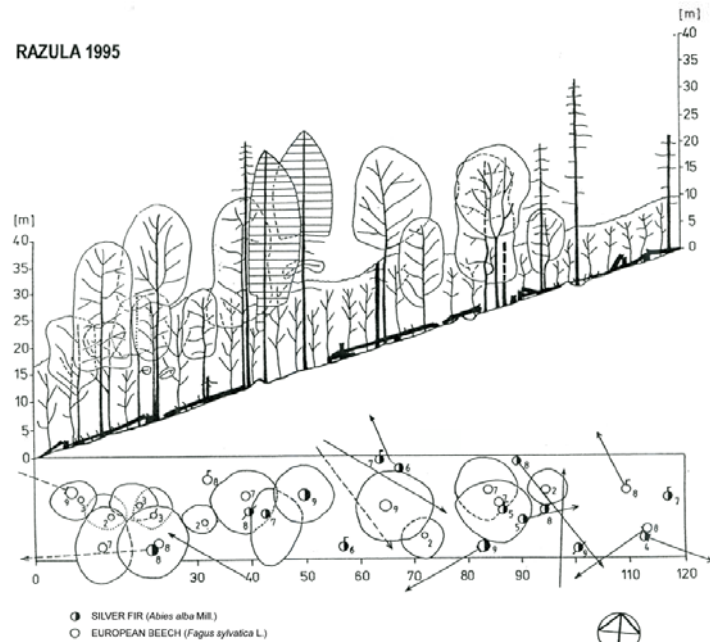


# Synthesis

RAZULA 1972



RAZULA 1995



# Carpathians in 50`s



photo Rudolf Janda

MAGFA 015 09



# Carpathians in 50` s

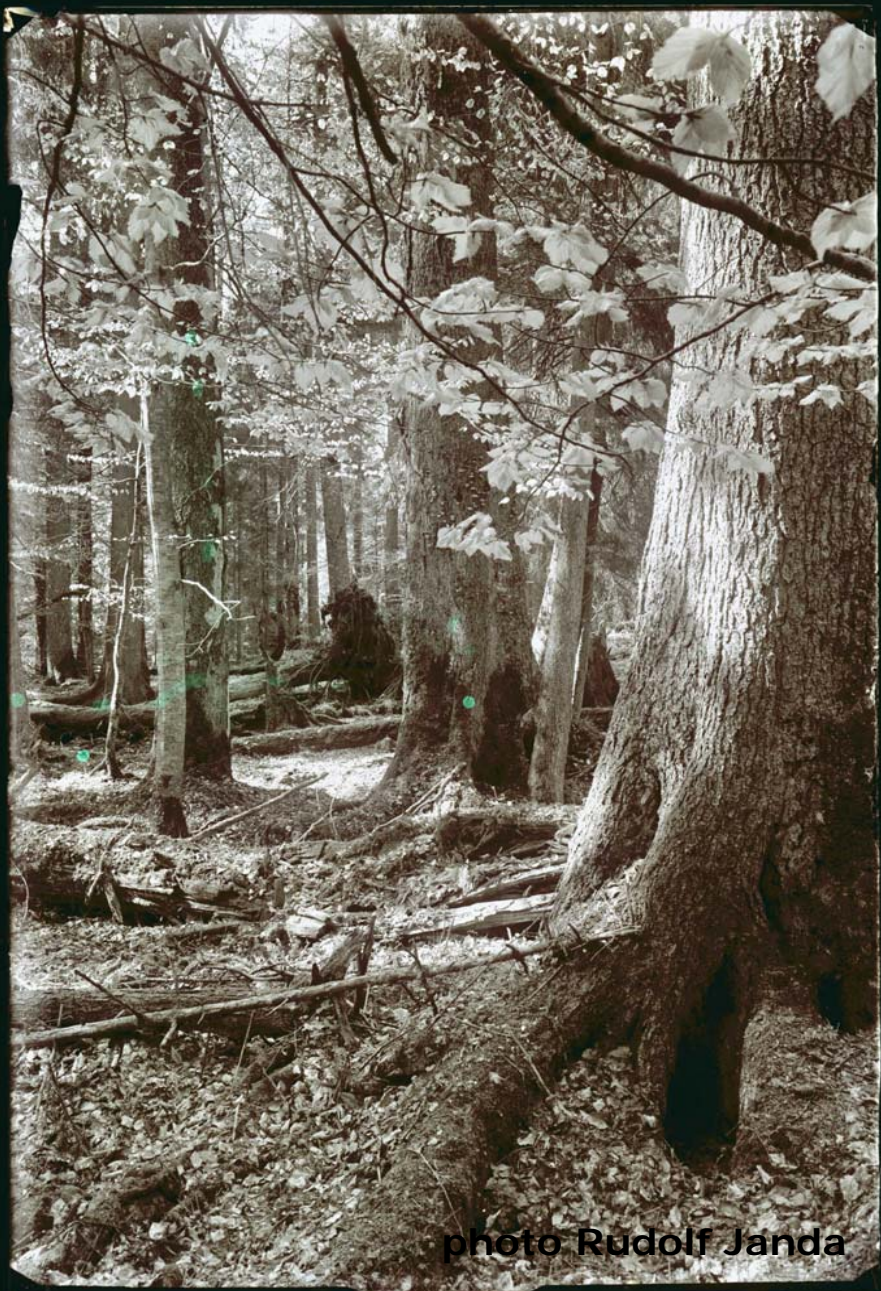


photo Rudolf Janda

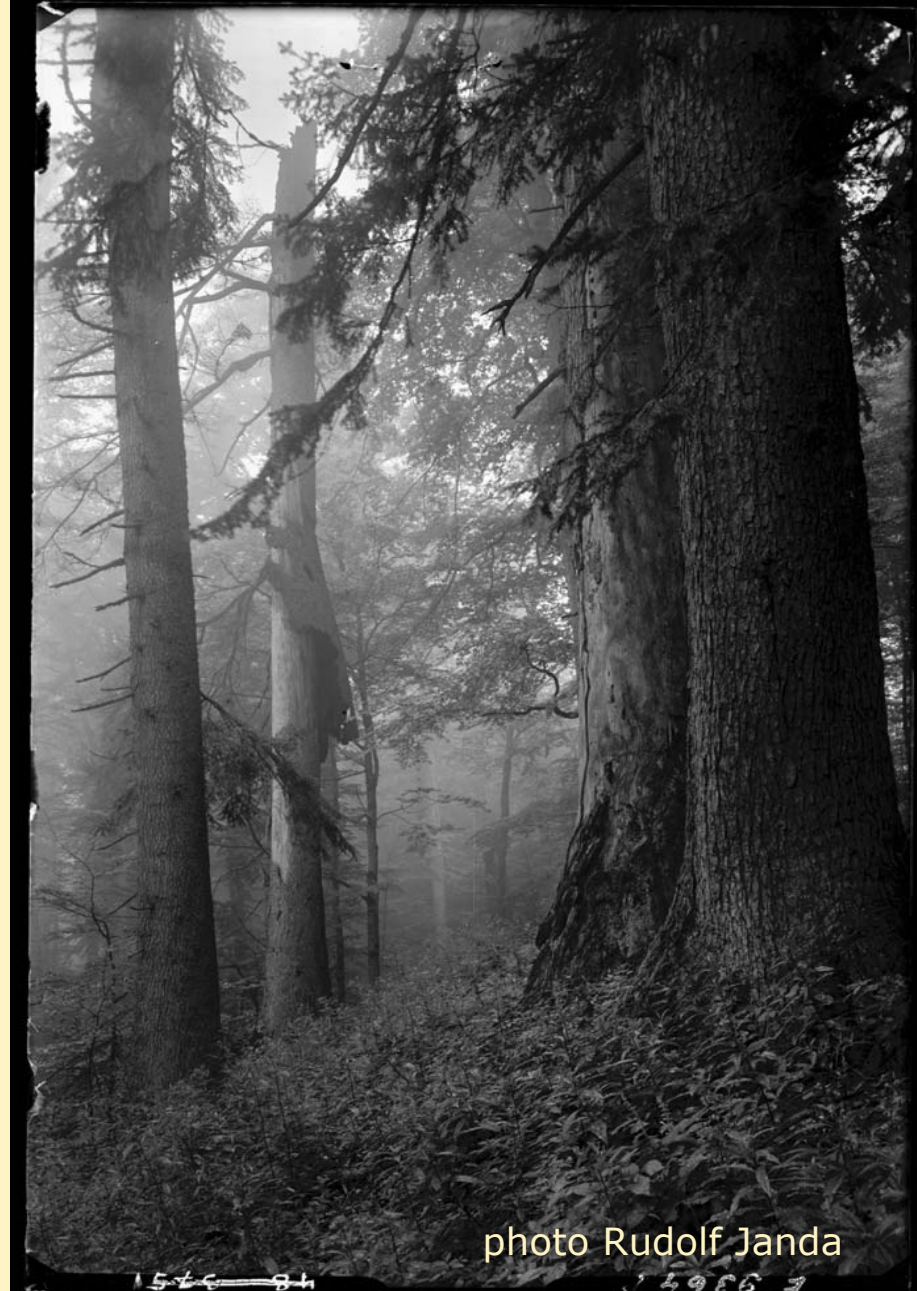
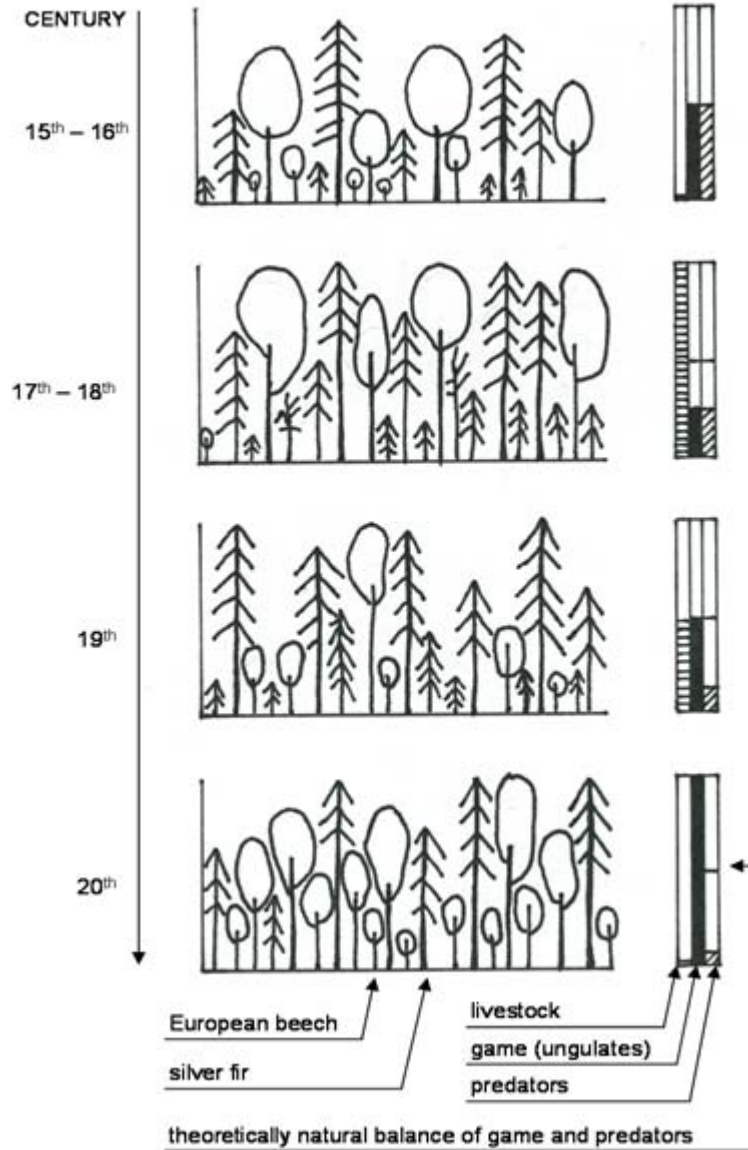


photo Rudolf Janda

# Synthesis





- Actual state of old-growth silver fir-European beech temperate forests is historically long-term affected due to human impact
- This influence was not accepted during last 50 years of research
- All strict forest reserves have the same state in time and space
  - i) silver fir representation decreases by:
  - ii) European beech representation increases by:

number of trees  
timber volume  
DBH distribution  
living to deadwood ratio  
etc.

Can we use the „classical“ hypothesis more?

**NO**

Actual development of silver fir and European beech in Carpathians is NOT ROTATION (not natural cyclical process)

- it is the TREND caused due to human impact

Measured localities are the best fir-beech natural forests in northern Carpathians.

The areas are from 23 ha to 200 ha.

They are the islands in the sea of cultural spruce dominated forests.

Wild game is concentrated in this localities because

- here are the sources of natural food
- here is the undisturbed space for life
- here is a lot of possibilities for safe shelter (deadwood)

Game stock blocks the growing of new silver fir generations, because to browse the terminals.

- i) If priority is seen in the spontaneous development of the ecosystem, which should proceed according to the model of potential natural vegetation after having been affected by humans, then secondary anthropogenic impacts (which the overpopulation of game doubtlessly is) should be prevented (protection of fir seedlings against browsing at the stages of optimum and growth, but not (!!!) their selection).
- ii) If we wish to monitor the development of this ecosystem under conditions altered by humans (as the current conditions certainly cannot be called "natural"), we have to be prepared for the variant without fir. If this occurs, then new and as yet unknown competitive linkages between these tree species may surprise us.