Wood anatomy and different data to study the environmental signals registered in tree-rings – overview and example of beech (*Fagus sylvatica*)

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• cambium
• wood
• environmental information

• the “window” in the tree to receive and “archive” environmental signals

• Frankenstein, Eckstein, Schmitt, 2005
Conifers
Wood structure
Why does the same cambium initial produce so different cells?

Photosynthetic food

Hormones – auxin

January

Wood formation

December

• Larson …
False, double, multiple, missing rings…

Aleppo pine, *Pinus halepensis*
De Luis et al. In print

- Schweingruber, Grabner, Campelo, Gärtner, Tardif, De Luis…
Densitometry
330 articles in Bibliography of dendrochronology
Schweingruber et al. - 51 articles in Bibliography of dendrochronology

X-ray densitometry
High frequency densitometry
Neutron imaging
Blue light reflection
Image analysis - Wind Dendro

• Schweingruber, Grabner, Tardif, Wilson, Grudd …
Histometry, tracheidogram, image analysis

- Eckstein, Kirdyanov, Eilmann, Shashin, Grabner, Gärtner, Spiecker, Liang…
Resin canals RC

Without normal RC
Fir (*Abies*)
Juniper (*Juniperus*)

Normal RC present
Pine (*Pinus*)
Spruce (*Picea*)
Larch (*Larix*)

Traumatic RC –
wounding
defoliation
fire scars
geomorphic Processes

- Grabner, Levanič, Liang, De Luis …

All conifers
Dicotyledons

Oak (*Quercus*)

Beech (*Fagus*)

Mahogany (*Swietenia*)
Ash (*Fraxinus*)

- 1 year old
- Adult
- Young, affected by browsing

- Schweingruber, Eckstein, Fonti, Garcia Gonzalez, Sass-Klaassen, Wimmer-Grabner..
• Eckstein, Garcia Gonzalez, Fonti...
Beech (*Fagus sylvatica*)
Tree-rings
Wood formation
Beech (*Fagus sylvatica*), Slovenia

tree-ring chronologies
Response function analysis

Lowland 😞
Hot dry summers

High mountains
Warm summers
Wood formation 2006...

Panška reka
400 m a.s.l.

Menina planina
1200 m a.s.l.
Tree-rings
Climatic data

Phenology
Since 1960 (Environmental Agency)

Leaf unfolding  Leaf yellowing
1-Leaf unfolding (16 Apr)
2-Onset divisions in cambium (18-24 Apr)
5-Maximum cell production (29 May)
8-Cessation of cambium divisions (25 Jul-16 Aug)
9-Leaf yellowing (21 Oct)
DOY = day of the year 2006
DOY 234, 22 August
DOY 178, 27 June
DOY 157, 6 June
DOY 108, 18 April
Tree ring Width

DOY

Average (6 trees) with standard error bars

Vessel area

Average (6 trees) with standard error bars
THANK YOU!

http:\\www.wsl.ch
Bibliography of dendrochronology