

Variations of earlywood vessel diameter of *Quercus petraea* Liebl in the French forests

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CONTEXT

- A new xylotheque of one hundred thousand of increment cores was established through the XyloDensMap project (Leban et al., 2017)
- This project aims at improving the forest information at the national level (tree sizes, volumes, locations and wood density)
- For each forest species we will describe the wood density variability and for some major species such as oaks, anatomical properties

QUESTIONS

What are the sources of variation of the sessile oak early wood vessel diameter ?
Altitude of the stands or tree size ?

MATERIALS AND METHODS

SAMPLING DESIGN

- The xylotheque was used for the stratified sampling
 - ◆ 3 DBH classes : 20 cm, 40 cm, 50 cm
 - ◆ 4 altitude classes : [0;200m], [200;400m], [400;600m], [600;1100m]
- 5 cores for each couple (Diameter, Altitude), 5*3*4=60 increment cores

The limited number of selected samples covers well a wide geographic area

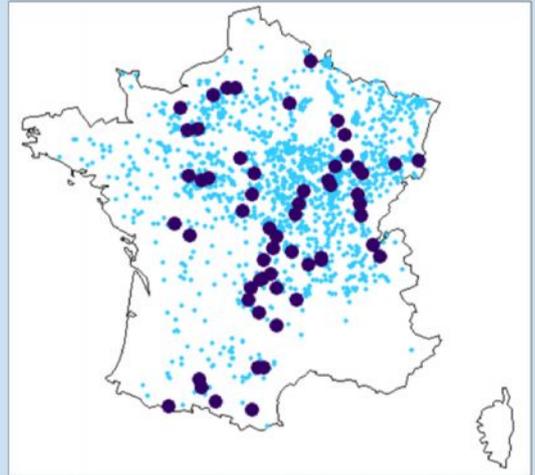
SAMPLE PREPARATION, IMAGE ACQUISITION

- On each core, cut a 2 cm long sample, starting at outer rings near the bark
- Gluing the sample on a wooden support for impregnation with PEG
- Surface preparation with a microtome and surface metallization
- SEM image acquisition, magnification x250
- Measurements of the vessel diameter for 5 rings per tree

RESULTS

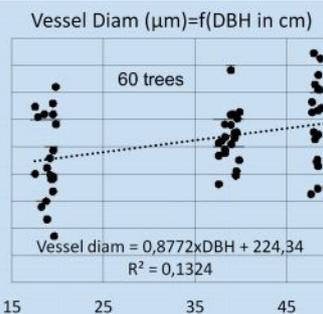
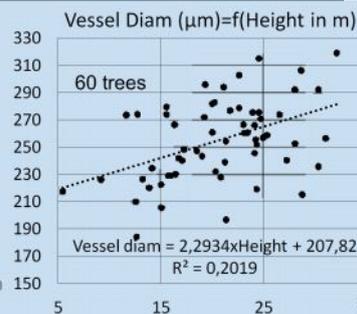
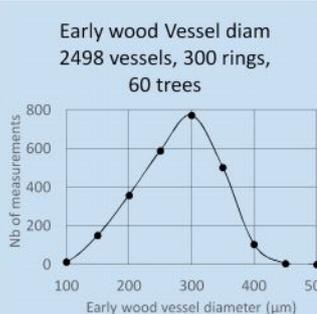
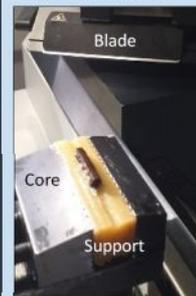
- The early wood vessel diameter varies from 100 microns up to 450 microns with an average value of 251 microns
- **Positive relationship between the vessel diameter and the tree dimensions**, in accordance with Poiseuille's law (Rungwattana & Hietz, 2018)
- The vessel diameter variations observed at the intra specific level are similar to those observed at the interspecific level (Martínez-Cabrera et al., 2011 for 200 angiosperms)
- **No significant relationship with altitude**
- **At the inter tree level, vessel diameter varies between 184 and 317 microns**
- **A linear multiple regression model explains 34% of the total variance,**
 $Vessel\ diameter = 112,82 * DBH + 1,01 * Tree\ Height - 0,26 * Tree\ age - 0,13 * Basic\ density + 293,76$

Sessile oaks in the French forests (5407 sampled trees, in blue and 60 selected samples, black)

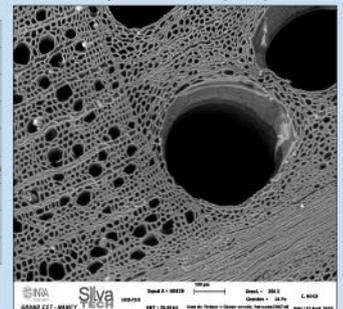


Microtome

Scanning Electron Microscope



Early wood vessels (x256)



CONCLUSION

- The use of the XyloDensMap xylotheque permits to obtain a well stratified sampling design with a limited number of increment cores covering a wide geographic area
- Early wood vessel diameter is mainly driven by tree dimensions, not by altitude (tree size decreases with altitude)
- The new multi linear regression equation can be used for the simulation of the vessel diameters of all the sessile oak samples the xylotheque

PERSPECTIVES

- Implementation of the new protocol for other oak species
- Measurements of other anatomical characteristics, latewood vessels, fibers etc.

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