**The tracheogram method – linkage between wood formation and wood quality**

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Size and distribution of vessels in diffuse porous tree species are mainly controlled by the physiology, which is ultimately triggered by environment factors, i.e. water availability and climate. In this study, the variation in vessel sizes due to changes of water availability was studied. Changing vessel sizes alter wood density, which inevitably affects wood quality traits such as drying behaviour, glueability, paintability, or workability.

To study environmental effects on vessel size and distribution the tracheidogram method according to Vaganov (1990) for softwoods was adapted to the diffuse-porous hardwood structure of poplar (Schume et al. 2004). The method provided continuous measurements of vessel sizes, independent of vessel numbers present on radii across tree-rings. Thus, intra-annual changes of vessel sizes in trees growing on the same site, or on different growth sites can be assessed, to draw also conclusions on various aspects of wood quality.

Within this study we found sharp shifts in vessel sizes as a response of dropping horizons in the groundwater system that obviously disconnected trees from water supply. In spring with reduced evaporative demand due to sufficiently available water the trees usually formed larger and regularly shaped vessels. Mid-season vessel sizes were more prone to environmental influences with groundwater availability and precipitation playing a key role. Our data explain the sometimes observed semi diffuse-porous ring structure of poplar, including wood density shifts that also affect wood quality.

References

Vaganov EA. 1990. The tracheidogram method in tree-ring analysis and its application. In: Cook ER, Kairiukstis LA, eds. Methods of dendrochronology – applications in the environmental sciences . Dordrecht, The Netherlands/Boston, USA/London, UK: Kluwer Academic Publishers, 63–76.

Schume, H., Grabner, M., Eckmüllner, O. 2004. The influence of an altered groundwater regime on vessel properties of hybrid poplar. Trees 18: 184-194.

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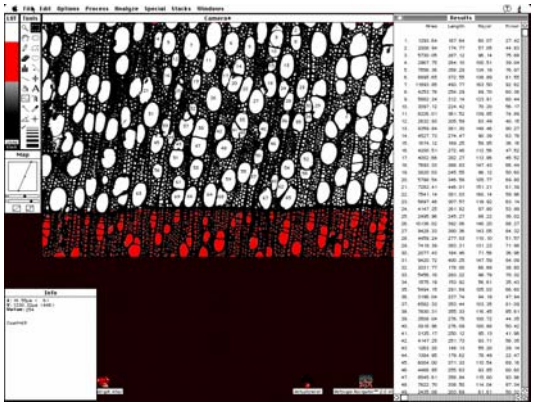
## Introduction

Size and distribution of vessels in diffuse porous tree species are mainly controlled by the physiology, which is ultimately triggered by environment factors, i.e. water availability and climate. In this study, the variation in vessel sizes due to changes of water availability was studied. Changing vessel sizes alter wood density, which inevitably affects wood quality traits such as drying behaviour, glueability, paintability, or workability.

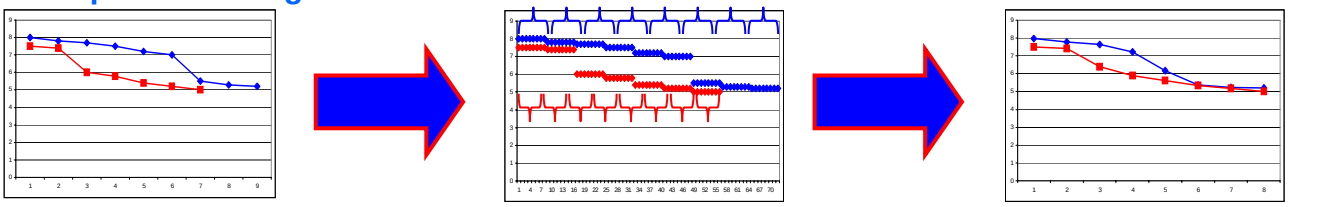
## Material and Methods

To study environmental effects on vessel size and distribution the tracheidogram method according to Vaganov (1990) for softwoods was adapted to the diffuse-porous hardwood structure of poplar (Schume et al. 2004). The method provided continuous measurements of vessel sizes, independent of vessel numbers present on radii across tree-rings. Thus, intra-annual changes of vessel sizes in trees growing on the same site, or on different growth sites can be assessed, to draw also conclusions on various aspects of wood quality.



Measurement of vessel area, -density and –size using NIH-Image

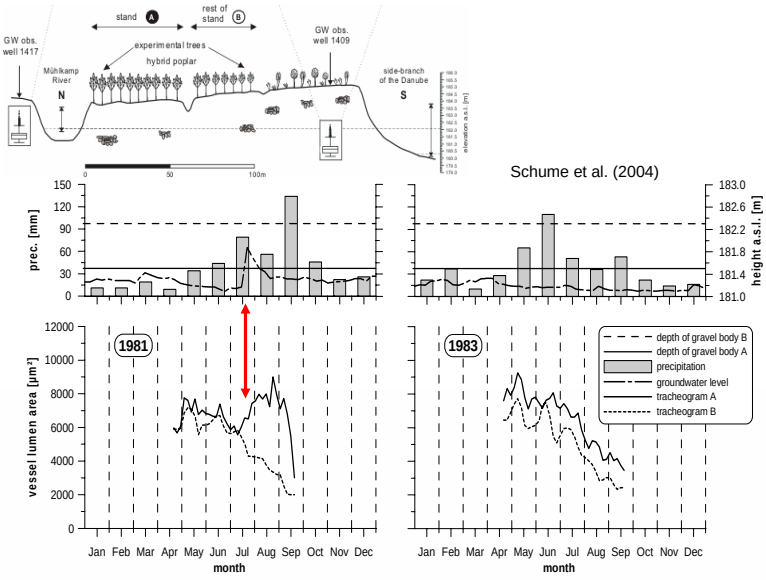
## The concept of tracheograms



Tree A – 9 values
Tree B – 7 values
Overall mean = 8 values per tree-ring

Tree A – value 8 times → mean of 9 values (brackets)
Tree B – value 8 times → mean of 7 values (brackets)

Tree A – standardized to 8 values
Tree B – standardized to 8 values




## Results

Within this study we found sharp shifts in vessel sizes as a response of dropping horizons in the groundwater system that obviously disconnected trees from water supply. In spring with reduced evaporative demand due to sufficiently available water the trees usually formed larger and regularly shaped vessels. Mid-season vessel sizes were more prone to environmental influences with groundwater availability and precipitation playing a key role. Our data explain the sometimes observed semi diffuse-porous ring structure of poplar, including wood density shifts that also affect wood quality.

References
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