

Review of the doctoral thesis

Jan Tumajer: Quantitative vessel parameters of broadleaves as a tool for reconstruction of physical geographical processes

Doctoral thesis of Jan Tumajer deals with the response of vessel parameters to hydroclimate variability including extreme events in the case of *Quercus robur* and to various disturbances in the case of *Betula pendula*. Research into wood anatomical structure sensitivity to climate and mechanical damage is desirable with respect to climate change and recurring extremes such as floods or drought spells.

Doctoral thesis is compiled from four scientific papers and a common introduction, material and methods and conclusion. Jan Tumajer is the main author of all scientific papers with the author's contribution of at least 70%. Three papers have already been published and one of them is under review in a respected journal with impact factors.

The common introduction well describes the state of the art and the subsequent Material and Methods section presents the study area and methodology which is common for all studies. The main results are then presented in individual scientific papers. Finally, the Conclusion summarizes the main outputs resulting from the thesis. I have only several minor comments to this common section and some questions:

- Page 8 – “Fire events cannot be dated using dendrochronological and wood anatomical methods with sub-annual precision...” There are several publications which, on the contrary, present that fire event can be dated based on position of fire scars as dormant, earlywood or latewood scars (e.g. Schweingruber 1996 or Speer 2010)
- Page 9 – missing Latin name for cockchafer.
- 4.3. Tree species – Instead of *Quercus* sp. (indicates only one unknown species of *Quercus*) should be *Quercus* spp. (indicates all *Quercus* species). In my opinion, you should mention here that two ecotypes of *Quercus robur* exist and each of them grows in different conditions.

- Page 15, 4.4. Sample processing – Did you have any problems with thyloses when you measured earlywood vessels? Was usage of black ink and white chalk enough to eliminate presence of thyloses?
- Page 16 – If I understand well you did not measure tree-ring widths in the case of *Betula pendula*. Why? In the next sentences you say that anatomical parameters are not reliable for cross-dating, which is the first important step, and therefore you used tree-ring width. How did you cross-date the *Betula pendula* series?

Although the papers were already reviewed in the journals, I have also in this case a few comments and questions:

Paper 1 (Chapter 6.1):

- In my opinion, you should present supplementary files in your thesis as you did in the case of the fourth paper.
- Page 21, 2.1 Study area: You mention here the most extreme events for the CR. How are these events defined? Why did you extract these years from the paper Brázdil et al. 2015? In that paper, there are many other drought years mentioned e.g. 1947. Similarly, if you write about the whole area of the CR you should mention also floods in 1997.
- My main question in the case of the paper (related also to paper 2) is about sampling strategy. You write in the Introduction (mentioned also in 4.3.) that flooding-induced anomaly in vessel anatomy appears only in the flooded part of the stem. If you wanted to investigate the effect of historical floods on the vessel anatomy why did you take samples at breast height? You cannot know if the stem was flooded at breast height in the specific years. I think that it would be better to take additional samples in the lower part of the stem.
- The relationship between floods or drought years and climate could be assessed by some statistical methods e.g. logistic regression.
- You write in the results that events in 1941 and 1959 were not reflected in you chronologies. Do you think that trees could respond with one year lag as it could happen in the case of oak?

Paper 2 (Chapter 6.2):

- Do you think that temperature of the current September can have significant effect on tree-ring width? Did you know when cambial activity starts and finishes in such conditions? In the first paper (different area but similar conditions), you write that leaf yellowing starts during the second half of September.

Paper 3 (Chapter 6.3):

- I do not have any comments.

Paper 4 (Chapter 6.4):

- Given that this paper is under review I found there a few typesetting errors (e.g. line 95 – too many symbols “o” or line 221 – missing brackets)
- Do you think that there can be a difference in response of anatomical structure between real stem flooding and the simulation by aggrading deposits?
- Lines 341-342: “...longer experiment would probably be needed...” Are you going to continue with the research?
- You mentioned in the paper that quantitative wood anatomical series could be used as a palaeoclimatological proxy. In the study you used trees with the mean tree age of app. 15 years. Do you think the same response would be observed also in old trees (e.g. 100 years)? Do you think that the same responses as on *Betula pendula* can be observed also in other diffuse porous species, e.g. beech?

Overall assessment of the thesis

The doctoral thesis of Jan Tumajer fulfilled all of the main goals. Although I have several comments and questions, in my opinion, the doctoral thesis is of high quality, which is supported by four very well written scientific papers. The work is an important and significant scientific contribution and I recommend the thesis for the defence.

Brno, August 23, 2018

Ing. Tomáš Kolář, Ph.D.