Peer Community In Forest & Wood Sciences

Recommendation of an interesting analysis of ontogenic and adaptive variations in local wood properties in European Beech (*Fagus sylvatica* L.)

Erwin Dreyer *based on peer reviews by* ***Régis Fichot*** *and 1 anonymous reviewer*

ALMERAS Tancrède, JULLIEN Delphine, LIU Shengquan, LOUP Caroline, GRIL Joseph, THIBAUT Bernard (2025) The diversity of radial variations of wood properties in European beech reveals the plastic nature of juvenile wood. HAL, ver. 6, peer-reviewed and recommended by Peer Community in Forest and Wood Sciences.
https://hal.science/hal-04133248

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The mechanics of wood as a material for construction, furniture, pulp and other uses have been addressed in a very large number of papers and are a well-established field for both research and technical applications (for example among many others, see Pöhler et al., 2006 for beechwood). In addition to such approaches that derive from material sciences, further developments based on similar physical concepts addressed the questions raised by the biomechanics of the standing and the growing tree which requires some degree of postural control and sensing of specific signals (gravity, movements...; see for instance Fournier et al. 2013; Dlouha et al., 2025). Within this field of research, the question of the correlation of wood anatomy (diameter of xylem tracheids or vessels, fibre content and angles, vessel wall thickness...) and biomechanical properties is of prime importance, and specific responses of wood and bark components have been identified over the last decades. In particular the occurrence of reaction wood generates local strains and contributes to the postural control (Ruelle, 2014).

In this preprint, Almeras et al. address a complementary question related to the properties of juvenile wood in trees. During the first years of the growth of young trees, the annual tree rings display quite specific properties (large tree rings, less dense wood, ...) that gradually change with age and dimensions of the trees

until reaching a range of values typical for adult trees. During the first years, the interannual changes might follow an ontogenetic trajectory mainly related to age (and dimensions) while in later stages, they appear to be strongly controlled by environment (wind, soil fertility, site index, irradiance, water availability, ...). All these changes result in radial profiles along tree rings (from the pith to the bark) of three main features that govern the biomechanical properties of wood, namely the width of the annual tree ring, the local specific gravity (wood density), and the specific modulus which contributes with density to the local modulus of elasticity (Fournier et al. 2013). Such gradients of local wood properties within stems have been analysed and synthesised in the last years (Lachenbruch et al. 2011, Meinzer et al. 2014).

Here, the authors address the question of local variations of such properties within tree stems as a function of the distance to the pith (inversely related to the age of the trees when the ring was formed) in a broadleaved species, European Beech (*Fagus sylvatica* L.). They checked whether ring width, specific gravity and specific modulus display systematic trends from pith to bark across tree stems, and whether these trends enable the detection of a general ontogenic (age-related) effect with very similar patterns in juvenile wood of different individuals, or whether adaptive factors (modulated by the environment and by the mechanical constraints induced by the postural control of growth) dominate already in juvenile wood, like it does at later stages. Such questions were already analysed in the wood of some coniferous species (softwood with tracheids), but less frequently in hardwood species (angiosperms, like Beech with its diffuse porous wood anatomy).

Before starting the analysis of age-related tree ring properties in juvenile wood, the authors addressed the potential impact of duraminisation, which affects the oldest tree rings in the inner wood (that is those formed during the juvenile growth stages). Duraminisation results from local deposition of a number of secondary metabolites and results in the build-up of heartwood; in the case of beech however, reddish heartwood is less present than in other species (Knoke, 2003). Almeras et al showed here that the occurrence of reddish wood did only marginally affect the mechanical properties and contributed only marginally to the observed variations among trees

The very solid experimental design enabled the authors to clearly assign a fraction of the observed variation in the three parameters to (i) the site where trees had grown, (ii) to the individuals within these sites and (iii) to the position of the ring within the stem. The intraindividual component of the variation was much larger than the former. However, the observed asymmetry in the patterns of ring properties in juvenile wood, and the large variability in these patterns among trees led the authors conclude that the ontogenic juvenility effects, visible in ring width were largely dominated by other effects influenced by the local environment. In this respect, the results differ from those that were recorded earlier with *Pinus taeda* L. in a plantation (i.e., trees of the same age and homogenous spatial distribution, Bendtsen and Senft, 1986).

The recommended version of the preprint is very original as it shows how local (radial) variations of biomechanical wood properties can be addressed in a systematic way. This lead to novel approaches that share light on the processes governing wood formation in trees.

The first version of the preprint was submitted over a year ago. The recommended version differs in many respects from the initial one. The two rounds of reviews with external reviewers, and the additional one with the recommender resulted in an in-depth reorganisation of the statistical analysis and of the demonstration. This took some time, but shows also the benefits that may be gained during an open peer review process like the one developed by the Peer Community in....

References:

Bendtsen BA, Senft J. 1986. Mechanical and anatomical properties in individual growth rings of plantation-grown eastern cottonwood and loblolly pine. Wood Fiber Sci 18: 23-38.

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Lachenbruch, B., Moore, J.R., Evans, R. (2011). Radial Variation in wood structure and function in woodypPlants, and hypotheses for its occurrence. In: Meinzer, F., Lachenbruch, B., Dawson, T. (eds) Size- and age-related changes in tree structure and function. Tree Physiology, vol 4. Springer, Dordrecht. https://doi.org/10.1007/978-94-007-1242-3_5

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Pöhler E, Klingner R, Künniger T. 2006. Beech (Fagus sylvatica L.) - Technological properties, adhesion behaviour and colour stability with and without coatings of the red heartwood. Ann For Sci 63: 129-137. https://doi.org/10.1051/forest:2005105

Ruelle J. 2014. Morphology, anatomy and ultrastructure of reaction wood. In: Gardiner B, Barnett J, Saranpää P, Gril J (eds) The Biology of Reaction Wood. Springer Series in Wood Science. Springer, Berlin, Heidelberg. https://doi.org/10.1007/978-3-642-10814-3_2

Cite the recommended preprint:

Almeras Tancrède, Jullien Delphine, Liu Shengquan, Loup Caroline, Gril Joseph, Thibaut Bernard (2025) The diversity of radial variations of wood properties in European beech reveals the plastic nature of juvenile wood. HAL, ver.6 peer-reviewed and recommended by PCI Forest and Wood Sciences https://hal.science/hal-04133248

Reviews

Evaluation round #3

DOI or URL of the preprint: **https://hal.science/hal-04133248**
Version of the preprint: 4

Authors' reply, 15 January 2025

Dear Editor of PCI / Forest and wood science,

Thank you for your careful reading of the 3rd version of our paper on European beech:

Title: The diversity of radial variations of wood properties in European beech reveals the plastic nature of juvenile wood

Authors: ALMERAS Tancrède, JULLIEN Delphine, LIU Shengquan, LOUP Caroline, GRIL Joseph, THIBAUT Bernard

The 6th* version of the preprint uploaded in HAL corresponds to the 4th version now submitted to PCI. The attached file "PCI_Beech_v3_12nov2024_cor31dec.docx" indicates in blue the corrections directly proposed by

you, and in revision mode those resulting from your comments. When we disagreed or needed to discuss something, that was added to the comment. The docx is also available at:
https://seafile.lmgc.univ-montp2.fr/f/b0cd3458b9c54c5095cd/

The Excel file deposited in free access on the Zenodo platform (https://zenodo.org/records/14606666), containing the data and showing verious steps of analysis, is now clearly mentioned in a short Annex, as suggested.

We hope that this version will be considered as acceptable.

Best regards

For the co-authors

Joseph Gril

Download tracked changes file

Decision by Erwin Dreyer, posted 11 December 2024, validated 11 December 2024

This new version is largely improved with respect to the earlier one. It presents very clearly the very relevant research question, which is quire orifginal for a hardwood species, and the experimental procedure. The results are unambiguous, and quite solid. They demonstrate that the gradient of properties (ring with, wood density and specific modulus) across juvenil woods may vary among trees within populations, and that they probably reveal a predominant role of an ontogenetic juvenility driven by mechanical constraints.due to increased tree dimensions.

The current version of the preprint is almost ready for final recommendation and publication in a journal. However, there are still numerous although minor changes that could improve clarity and readability of the preprint. A few general commentss follow, and most minor changes are suggested directly in the attached copy of the manuscript.

1. There is a need to provide more detailed captions for the figures and tables, with more details allowing to capture the content without refering to the main text;

2. Care should be taken to better take into account the differences in wood structure between conifers (”softwoods”) and angiosperms (hardwood, like the beech studied in this experiment). What applies to tracheids in softwood does not necessarily apply to the vessels in hardwoods. Moreover, hardwoods have less fibers and are not optimal for the pulp industry like conifers. This clarification requires to change a few sentences;

3. Overuse of abbreviations:there are many unjustified and useless abbreviations (lie SM, SG, RW, ...). Please spell out.

4. While the two possible drivers of the juvenility gradients (adaptive or ontogenetic juvenility) are clearly defined, there is a need to explicitely provide the experimental design used to discriminate them. This would enlighten the whole experimental procedure and make it easier to understand. The experiment bases on interindividual and inter-population variations, but this needs be better documentd and argued.

5. There is a reference to supplementary material int the M&M section with no reference to where to find it. A suggestion would be to integrate it into the body of the preprint as an appendix.

All other minor suggestions and comments are directly produced in the attached copy of the preprint.

Once these presentation details are settled, the preprint will deserve a very positive recommendationthat I am already preparing. **Download recommender’s annotations**

Evaluation round #2

DOI or URL of the preprint: https://hal.science/hal-04133248

Version of the preprint: 3

Authors' reply, 19 November 2024

Download author's reply

Decision by Erwin Dreyer, posted 30 September 2024, validated 01 October 2024

Dear authors

We have received two very detailed reviews from the same reviewers who attneded to the earlier version of this preprint. The two reviewers agreed that the manuscript was largely improved with respect to the earlier version, and that the current version is much more focused and more clearly organised. They however, believe that some further revision would help still improve the preprint and make it reach the quality for a recommendation by the PCI Forest&Wood Sciences.

Please do undertake this new revision, based on the very detailed and in depth comments provided by the two reviewers. I believe a positive recommendation should be possible after this last round of revision.

With best regards

Erwin Dreyer, recommender of the Peer Community in Forest&Wood Sciences

Reviewed by Régis Fichot, 30 September 2024

General

I already served as a reviewer on the previous version of the manuscript. The authors have completely reworked the paper and have taken into account, wherever applicable, most of my comments. The manuscript is now considerably shorter and easier to read, focusing only on the radial patterns of three main wood properties that is ring width, specific gravity and specific modulus. I still have a couple of minor comments (see below), hope this is useful to the authors.

- I feel the objectives still could be made clearer at the end of the introduction, with a couple of hypotheses based on the literature that would facilitate the reading and the analysis of the results regarding the main findings.
- The authors used the present tense most of the times for the writing; I suggest using the preterit to stick to standards.
- Regarding the decision rule to attribute UP, DOWN or FLAT radial patterns (Table 3 in the results section): it seems like the decision was made visually unless I am wrong. I think it would be better/less subjective if the decision was based on some kind of metric. Why not use the significance and the sign of spearman's rank correlation coefficient to decide? Or something else?
- Regarding the presentation of global mean radial patterns on L.242 to 247: I found it too vague and/or not exactly representative of what is drawn in figures. I would suggest rewording a bit these sentences so that it fits closer to the trends presented in the figures. For instance, what does mean "RW decreases regularly" L.242 while ring width clearly does not follow a linear trend and reaches a plateau after approx. 14/15 cm? Same comment for SG, it does not seem to "decrease thereafter" but it shows instead a more complex pattern. For SM, not sure the "then decreases regularly" is applicable, not sure the slight decrease can be considered actually significant.
- I think Fig. 9 is still not up to standard quality. Maybe remove the symbols so that the trends are more visible. A better choice of contrasting colours might also help.
- The discussion still might be a bit improved. I found the main findings directly gained from the data not clearly visible; as such, it rather feels like a sum of findings from the literature (with the exception of the last paragraph). This might be reworked without too much work.

Misc.

- The young modulus (MOE) appears in the Materials and methods section L.164 while it is not presented before in the introduction (only specific gravity and specific modulus are presented). Later on, MOE

is sometimes omitted (e.g. Table 2, Table 3, Fig. 5, Fig. 6) but sometimes presented (e.g. Table 4 to 7, Fig. 9). A couple of words on the usefulness and/or relevance of MOE, besides SM, would be welcome.

- Table 2: pls add the name of the parameters in the legend and indicate what the numbers from the ANOVA refer to.
- Table 2: consider changing the symbol for non-significant effects by ns to stick to standards.
- Table 4: it would be nice to have some kind of error (e.g. SE, confidence interval...) associated with the means presented.
- Fig.9: why not indicate specific gravity here, instead of density, since every other figure presents specific gravity?
- Table 6, 7 and 8: only two digits for correlation coefficients are enough. Pls also consider adding asterisks (corresponding to significance levels) next to coefficients instead of indicating the significance in the legend. Also, what kind of coefficients (Pearson's, Spearman's)? Pls indicate.
- L.327, TRP: pls consider recalling the meaning of TRP here at the beginning of the discussion.
- L.341-343: this seems out of context and should be incorporated somewhere in the discussion.

Reviewed by anonymous reviewer 1, 17 September 2024

Review: Radial variation of some wood properties in European beech

Authors stressed the topic of the paper on radial variations in beech wood properties that makes it more consistent and highlight better the originality of the study. However, some improvements in the presentation and analyses are to my opinion still necessary before publication. First, in the result section authors are jumping from the analysis of mean values and sources of its variation to analysis of radial variation patterns which results in redundancies. Result section should be streamlined and some figures removed. Figure style should be homogenized. Considering the analysis presented, some statistical assessments are missing, I do not think that visual assessments are sufficient. Further, discussion should concern all results or results that are not discussed should be removed from the paper.

Title: I think that the originality of the paper is to look at three different sources of the wood properties variability: stand site with different forest management, radial position and circumferential position. It would be nice if the title could better reflect these aspects.

Abstract

L15 First sentence is blurry, please rephrase.

L17 Objectives of the study should be introduced more clearly – analyze the variability of the radial pattern variation in function of the stand but also radius orientation?

L19 aspects of juvenility: Specify or rephrase

L23 more or less constant: I do no think we can accept this type of assessment, stick with statistical evaluation

L25 I am not sure we can assign the observed variability to differences in mechanical experienced by trees. It displays the plasticity of wood properties in relation with growth conditions in general and for sure mechanical environment of the tree is very important parameter. But to my opinion, data collected in the present paper do not allow mechanistic explanation of observed variations.

Introduction

L59 Authors present ring width as a mechanical wood trait which is not straightforward, please explicit the link, it would help the comprehension. However, can be really ring width introduced as a mechanical trait at the material level alongside with other wood properties?

L67 I am struggling with the definition of juvenility used in this paper: authors defined juvenility purely as an effect of cambial age while the origin of juvenile transition is widely discussed in the literature (presence/absence of living crown, age or diameter) and basically biological origin is not known.

I think in this paper authors basically discuss two possible origins of the radial variations of wood properties: the effect of cambial age per se (that is one possible definition of juvenility among others) with a mechanical functional definition of juvenile transition related to the tree diameter and experienced mechanical environment.

I think that wider definition of juvenility should be introduced and positioning of the paper clarified. Mechanical viewpoint is generic and may also explain the variations in properties around the tree circumference or between stands clearly pointing the limits of the juvenility based on the cambial age hypothesis.

L69 I think that reaction wood, its characteristics, location in the tree and impacts of sylviculture on its occurrence should be clearly introduced in this section. Further, forestry papers on this topic should be also cited alongside more theoretical studies (for example Dassot et al. 2015).

L94 I do not think the whole panels of figures is necessary for introduction, explanation of expected trends is sufficient. Figure presenting the relationship between the specific modulus and microfibril angle may be introduced in the material&methods section to justify the choice of measured parameters.

L112 historical context – This wording may be misleading, please rephrase

L120 At the end of introduction, objectives and hypothesis tested in the study should be clearly introduced.

Material and Methods

L125 If available, it would be nice to have more information about the plots (rainfall, wind speed, soil type). Further, sampling of trees in the stand should be described – both, dominant and suppressed trees are considered or only dominant trees? Do they cover the whole range of presented diameters in the stand and if yes, what is the variability in diameters?

L131 20°C & 65RH in general yields equilibrium moisture content close to 12%?

L174 Does 'core' effect correspond to 'rod' effect?

Results

L193 I do not feel comfortable with this part of analysis based on visual observations. I think that the significance and importance of the slope should be assessed for each South or North profile and a clear limit for asymmetry should be given, of course the limit will be arbitrary but at least it is quantified and identical for all profiles. Further, extension of the variability in term of distance to pith would be interesting to model. It would help for quantitative discussion of these original results and would also improve the analysis at the stand level (Figure 9).

L203 Table – Percentage of symmetry are lacking for specific modulus?

L203 It is a bit surprising that the stand 2 located on mountain slopes does not represent a high asymmetry contrary to stand 8, how do you explain that?

L210 Authors are using both terms, specific gravity and density in the result section (Table 3 vs Table 4), please select one and use it throughout the text.

L217 There were no systematic difference between the Northern and Southern samples: how did you test it? On mean values or on trendlines? Please specify. I think it should be evaluated as a parameter affecting the trendline (in function of radial position) and considering that the symmetry ratio is of 70%, it would be surprising that the effect is not significant?

L232 no noteworthy difference could be observed – this statement is based on visual assessment? If yes, I would recommend to use a statistical test instead. Further, I do not think that Fig. 7 is necessary (or you can move it in annex), test on mean values will be sufficient for this point.

L251 Some strange characters in the figure legend.

L262 These plots are very interesting because they display variations of trendlines between stands however the figure is difficult to read. One option to improve could be to fit colors to the forest management type.

L265 Global results – the term global is not very precise. Some results from this section are already present before, the others should be incorporated in the section dealing with the variability sources before the results about trendlines as both deals with variability of mean values at the stand, tree or rod level.

L270: Data from Table 5 are already presented in Fig. 8, I don't think that this Table is necessary. Results on the coefficient of variation may be mentioned in the description of Fig. 8.

L284 tree dimension – number of trees?

L294 Table 8 deals with a relationship between measured properties with the idea about structure-function model which is not really introduced in the paper previously and not discussed neither. Explicit better or

remove.

L299 wood properties per tree – > per plot. These results are in the Figure 9 already, can be removed.

L310 Same comment as for Table 8. Correlation does not mean causality (L307). 0.1% level is not generally used for the significance of statistical tests, why to use this level?

Discussion

Results about the variance components are not discussed. Results about relationship between measured parameters neither.

L318 For softwoods…Please rephrase the sentence, it is not very clear.

L325 Plourde et al. (2015) reported the relation between the inner wood density and variation expected (increase, decrease or no variation), what is expected for a medium density wood as beech?

L333 I think the discussion about the interlocked grain trendline is out of scope or the relation should be explained.

L341 This is experimental choice and should be noted in material and methods section.

L346 (Germany, France) – Forgotten text?

L351 No information about thinning intensity is given in the study so it is difficult to related difference in the mean ring width at the plot level with the type of forest management. For example, soil properties or type of climate will be also important. Be less assertive.

L357 This result is not at the right place and should not end the discussion section.

Conclusion

I think that conclusion could be improved to fit better with results (please follow the same plan as for results and discussion above – mean values and partition of variation at first, radial variation patterns after) and discussion.

L368 This is not discussed in the previous section. Typical for intraspecific variations of MOE.

Evaluation round #1

DOI or URL of the preprint: https://hal.science/hal-04133248

Version of the preprint: 2

Authors' reply, 26 August 2024

Download author's reply

Decision by Erwin Dreyer, posted 03 September 2023, validated 04 September 2023

A careful and in depth reorganisation of the preprint is required before we might consider it for recommendation.

The submitted preprint addresses an important question in tree biomechanics, and more specifically on beech (Fagus sylvatica). However, as can be seen from the convergent reviews provided by two independent reviewers, the current version of the preprint still requires some important work, including an in depth reorganisation of the text. By the way, I strongly recommend to stick to the classical but efficient structure: "Introduction; Material and Methods; Results; Discussion; Conclusion" to avoid confusions. The introduction should end-up with a explicit set of research hypotheses".

Another issue raised by the referees is that the data stem from an earlier research and that the preprint follows an earlier publication. The current preprint should back on the existing information and concentrate on the new aspects that were not addressed in this earlier work. This was in particular stressed by reviewer 2.

I believe that the preprint has the potential to become a nice and interesting contribution to the literature about wood biomechanics. I however stress that taking into account all the comments and suggestions

provided by the referees is a prerequisite to potential recommendation. Once revised, the prerint would then be submitted to the same referees prior to any decision.

I warmly thank the authors for choosing to submit the preprint to the Peer Community in Forest & Wood Sciences, and do encourage them to undertake the revision required by the referees who did a nice job in reviewing this piece of work.

With best regards

Erwin Dreyer

Reviewed by Régis Fichot, 25 July 2023

Review of the paper 'Some aspects of beech biomechanics: juvenile wood properties, sapwood pre-stress and growth forces' by Jullien et al.

The manuscript investigates radial variation in a couple of wood traits mostly related to biomechanics (e.g. specific gravity, modulus of elasticity or specific modulus, maturation stress/strain) in trunks from 86 beech trees originating from 9 'natural' forests across 5 European countries. Overall, the authors report radial patterns typical of those commonly observed for planted trees and show that pre-stress is independent of growth, whereas posture control is not.

As a side note, I am not a specialist in wood biomechanics. Since I cannot comment specifically on the theory behind, my comments remain probably very general and are mostly related to manuscript structure and readability from my understanding of the paper. Hope this is still useful to the authors.

The paper has merit with measurements performed on more than 1000 wood rods sampled from wood logs obtained on 86 adult beech trees varying from 70 to 200 years spread across 9 forest in Europe. However, in its present form, I think the paper suffers from several limits that the authors should consider. I also think the paper would benefit from language editing and a table of abbreviations would probably be a good idea considering the large number of traits and abbreviations used.

I found the structure of the paper awkward in several instances. For instance, the introduction is very short while followed by, as written by the authors, a state of the art related to spatial variation in wood properties. Besides, the choice was made to merge results and discussion (although results are not discussed in this section and there are no references) while another section is later called discussion and conclusion (and there is actually no conclusion in this section). I would recommend reshaping the whole ms structure as I do not see any reason why not following a typical layout (intro / MM / results / discussion and conclusion) and I think it actually does not require that much work.

I think the relevance of the paper is not sufficiently well presented and the paper suffers from a lack of clear objectives. The state of the art feels a bit disconnected from the work, at least it does not lead up to clear objectives and a clear rationale as it should do. There is one hypothesis stated at the end of this section (L. 149 – 151) but the rationale is not easy to catch.

In my opinion, the paper also suffers from a lack of precision and statistics. There are numerous examples of sentences like 'There was a large majority of…' (L. 204) or 'Globally there were no noteworthy difference…' (L. 211) or 'Globally there is not significant difference…' (L. 230) or '… no clear difference could be observed…' (L. 242). The radial patterns observed between N/S directions, wood colour, trees or plots are not discussed in the light of statistical tests such that the affirmations above feel assertive without any proof. I guess there are tools available to compare patterns and/or trends that would strengthen the choices and comparisons made.

The number of figures is too high but this can be easily remedied by suppressing several unnecessary figures such as Fig. 2, 3 and 5. For Fig. 2 and 3, from my understanding these come from the literature; I think there is no need to keep them as long as patterns (and what they imply) are explained in the introduction. Fig. 5 serves as an example to illustrate N/S asymmetric patterns; I do not think this deserves necessarily a figure.

Still related to figure, I think Fig. 10 and 11 are not up to standard quality. I believe these figures can be improved through a different choice of symbols, lines, grids, etc…

The discussion is far too short considering the length of the results, with very few references. While the authors should streamline the results to be more to the point and aligned with statistics, I also think the authors should rework and strengthen the whole discussion so that findings are put in a broader literature context and the reader can see the relevance of the findings. Since the work seems to have benefited from a widespread network of forests across Europe, I actually expected the discussion to address underlying questions related to forest management, competition, climate, etc… Although this is noted at the beginning of the discussion, it is not discussed.

Specifics:

- L.42: (bud role). Pls consider changing to 'through bud activity' or something similar.
- L.43: (cambium role). Pls consider changing to 'through cambial activity' or something similar.
- L.43-45: I did not get the sentence, pls reword.
- L.56: unnecessary considering my comments above about reshaping the introduction section.
- L.59: secondary growth performed by living wood cells. What is meant here by living wood cells? Meristematic cells? I think the sentence should be reworded, as you probably mean cell differentiation endured by cambium derivatives instead of secondary growth, which in my opinion does not refer to the same process. Need to be more specific. In addition, programmed cell death does not apply to all secondary xylem cells (e.g. parenchyma ray cells).
- L.64: basic wood features are achieved. Such as what?
- L.69: basic growth descriptors. Pls remove the word 'basic'.
- L.71: Δr. Definition is missing.
- L.87: delete Savidge in the parentheses.
- L.89: …. Pls change to etc…
- L.101-107: I assume this whole paragraph would need one or several references.
- Fig.2 inset on specific modulus: there is a typo to specific (specidic).
- L.123: and so what?
- L.141: see data for poplar. What data? Do you mean Fig. 3?
- L.144: longitudinal shrinkage is a good parameter in case of reaction wood. A good parameter for what?
- L.149-151: besides I did not get the rationale for the hypothesis, one-sentence paragraphs should be avoided.
- L.154: such reference to projects should not be indicated in the text but kept for acknowledgements.
- L.158: from the 9 plots. Stick to the same terms (the plots are referred to forests before).
- L.219 and thereafter: the text switches to mainly present tense while past tense was generally used before.
- L.231 and elsewhere: allowable. Pls change to possible.
- Fig.7 inset on specific modulus: pls delete one parenthesis.
- L.254 and elsewhere: such description falls short considering there are no stats or indexes that come in support.
- L.266: I do not think comparing interindividual variation between traits based on standard deviation is incorrect since traits do not have the same units. In this case, relative variation such as coefficient of variation should be used.
- L.277: why is that interesting?
- L.341: GSI. Unless I am mistaken, the definition is missing.
- L.347: were gathered in the same sheet (maturation). This is probably related to the fact that I am not a specialist, but I did not get the sentence.
- L.351: Cirad 2015. Pls change to the authors of the report.
- Table 10: typos (probably due to pdf export) for αm, σm and ΔF.

Reviewed by anonymous reviewer 1, 22 August 2023

The sampling used in the present paper is the same as in the paper by Jullien et al. (2013) where the original biomechanical measurements (GSI distribution) in relation with the tree morphology were analysed. It seems to me that the present paper does not really bring new insights into the beech biomechanics, the hypothesis of the possible trade-off between the posture control and pre-stresses does not seem very relevant for such big trees with very low tilt angle (DBH of 60cm, 33m tall). The original data presented in the paper concern mainly the material properties and their variability. I would recommend to stress the paper to this focus and re-analyse the data as follows:

i) Partitioning of the variability (comparison of different sources of variability: plot vs tree vs radial position vs radial orientation) of different properties investigated ;

ii) Radial pattern analysis; relation with the tree morphology (data presented in the previous paper), growth speed (relation between figure 10 and 11) might be interesting as well to explain differences in the radial variation pattern in different plots;

Introduction and discussion should be revised to fit to this viewpoint and hypothesis clearly explicited. I would recommend an update of the literature refences concerning the radial variation patterns focusing more on hardwoods – works by Plourde et al., Bossu et al., Longuetaud et al., Purba et al. and likely others should be included.