COMMENTS FOR THE AUTHOR(S)

The major contribution of your paper is a critical review of the cross-dating quality of north-western European oak chronologies in Roman times. This re-analysis is performed with your CDendro software and mainly based on publically available data. You point out several weak links in the long chronologies, most of them previously known. Your conclusion is that the dating of the entire Roman complex of NW-European oak chronologies depends entirely on the Becker chronology which, however, is not accessible for independent verification. You can neither verify nor solve this issue based on available data alone. Thus an important aspect of this manuscript must be a call for transparency concerning the European oak chronologies. Open data access, particularly to records which are claimed bridging gaps and depletions, will allow critical assessment of the chronology and thus rule out the existence, and hypotheses about, invented years in history.

Because of limited data access, you employ the northern Fennoscandian multi-millennial pine-chronologies in their attempt to assess and correct the oak chronology. This approach of cross-dating between species and over considerable distances is not without risk, and generally not recommended. Therefore, I have tried to replicate your computations. Although the story told in the manuscript is plausible, I unfortunately could not reproduce all parts of your results. I assume there are several reasons: For instance, I could not get hold of all data series used in the manuscript, and probably there are some differences in the computing algorithms used by CDendro and TSAP, and of course COFECHA. I do not think, though, that this has any major effect on the main conclusions concerning the oak data.

However, my re-analysis revealed weak points in the oak-pine relationship. Theoretically, there might be mechanisms which could explain such a teleconnection. But, the cross-dating between West-Denmark and northern Fennoscandia works in the most recent centuries only. As soon as I omit the last 500 years from the analysis, the match disappears. Thus this teleconnection is not time-stable. It then is difficult to justify that the oak-pine cross-dating should reappear in Roman times (and then vanish again in pre-Roman times). Furthermore, the oak-pine relationship in recent centuries (WestDK and SNorwayOakRecent *vs*. various pine chronologies) seems to be rather site-specific; some chronologies yield significant results whereas others not, and I do not see any obvious pattern. Another problematic issue is that there are periods during Roman times which are poorly replicated both in the northern pine and NW-European oak chronologies, potentially yielding unstable tree-ring signals and misleading matches. Actually, I could not find a temporally stabile pine-oak match at +218 years. The match seems to be limited to the last century of the proposed overlap. Finally, if concluding that the 218-year shift is correct, you must document cross-matches of between the Roman and recent oak chronologies at the new overlapping positions. So far, I could not find evidence that there are matches.

The conclusion that the Roman oak master might has to be moved by 218 years and that there might be a link with the northern tree-ring events of 330 BC and 536-542 AD, is intriguing. However, the results presented here are not sound enough to draw this drastic conclusion (invented years). I am afraid that the whole pine-oak aspect of the manuscript must be rejected at this stage. The question of the validity of the oak chronology first of all has to be demonstrated by oak data alone, particularly as we know that there is more data which can be used for this purpose.

Still, the decision about the publication of your manuscript in TRR may not depend on this fact alone. The main value of this work should be pointing out that the NW-European oak chronologies cannot be independently verified by outsiders. The question is whether the dendrochronological community and archaeologists relying on dating results based on NW-European oak chronologies should be satisfied with this situation. Scientific results shall be reproducible – the NW-European oak chronology obviously is not. This manuscript will be valuable if it stimulates/revives discussion about both the status of the oak chronology and not at least data availability in general.

I am not sure though, how the manuscript will appear without the attempt of cross-dating and teleconnecting pine

and oak, and after rejecting the 218-year shift. Generally, I would like the manuscript to give more information about chronology critics and Roman history and where, on a theoretically basis, invented years potentially could be hidden. The discussion should indicate the consequences of deleting, e.g., 218 years from the oak chronology. For instance, would this affect the chronology of NW-Europe, and specifically dendrochronologically dated oak objects, only, or also the Mediterranean region and our entire calendar?

Additional general comments:

1. importance and interest to the Tree-Ring Research's readers:
   Should be of high interest to open-minded scientists as a discussion article.

2. scientific soundness of the methods, arguments and interpretations:
   There is no specific methods chapter, and the authors use their own software. Though on the market for some years, I would encourage the authors to use the opportunity explaining how CDendro works and which routines/cross-dating parameters they specifically have applied here. The nature of the observed cross-dating statistics between oak and pine has not been explored in sufficient depth.

3. originality of the work:
   The work casts a critical view on previously published results. By the way, did projects such as ADVANCE-10K conclude on this matter or do we need a new European initiative?

4. degree to which conclusions are supported by the data:
   The validity of the proposed 218-year chronology shift unfortunately cannot be reproduced.

5. organization and clarity of the text and data presentation:
   I would suggest including a methods chapter. The discussion chapter is a continuation of the results chapter, and those should be combined. I propose expanding and transforming the conclusions to a discussion chapter. There already are a large number of tables and figure, but I would like to see a summary figure visualizing the data given in Table 7.

6. cohesiveness of the arguments:
   Basically, this would be well structured if it wasn't for the problems with the proposed oak-pine link and the 218-year shift, which of course is critical.

7. length relative to the number of new ideas and information:
   At present the length seems appropriate, but there should be additional room for methods and discussion. The final length will depend on how the oak-pine and 218-yr shift issues are dealt with.

8. conciseness and writing style:
   Good.

Specific problems and suggested changes (text, figures, tables)

1, Title: You might consider adding “NW-Europe” and/or “oak chronologies”.

9, links: Please specify which links you are referring to.

12, curves: Better terminology would be “chronology”, “series”, or “record”.

13, a long…curve: Please specify.

21-28: Please add references.

25, long: Multi-millennial.

33, dendrochronology: Suggestion “available dendrochronological data”.

33, where: Better “whether or not”?

34, wood: Insert “oak”.

34, existence: Suggestion “hypothesis of…”

33-35, main subject: You might specify that you focus on NW-Europe.

36: Please, insert a Methods and Materials chapter here, describing data acquisition (lines 38-41) and CDendro routines. For instance, how is CDendro dealing with gaps in tree-ring series.

37: Insert header “Results and Discussion”

37, Europe: There are other long chronologies elsewhere in Europe that you don’t mention.

42-50: I suggest moving this paragraph to the Introduction chapter.

46, where there was actually: Remove and replace by, for instance, “These joint efforts revealed…”.

54, Köln and Hoffenheim: Please add reference and length.

55, is nothing we…: Suggestion “this cannot be verified by us”.

63, years: Correction “year”.

64, corr.: According to the information given in brackets, I assume that the correlation coefficient refers to correlations after the Hollstein transformation. Please include this in a methods chapter.

67, 100 years: The minimum series (and overlap?) length varies throughout the manuscript. Please include in methods chapter and explain why differences occur.

72-74, Rhine bridge: It would be interesting if you found a solution for this error and commented on this later on.

77, by a long way: Suggestion “by far”.

79, The Becker…: Move this sentence to the figure caption.

82, line diagram: Suggestion “bar graph”.

87, sortkey: Refer to CDendro and maybe the methods chapter.

91, same samples: The effect of common samples would depend on the sample depth. Could you add any information on this?

92, forming: Insert “supposed to…”

93, dated correctly: Are those floating chronologies which cross-dating with each other, or are they properly anchored in the Becker or Hollstein master chronologies?

107, correlation coefficient 0.35: This value differs from above (0.40). Why do you use a different threshold here?

116-122, gap 2400 BC: This paragraph is not relevant for this manuscript, and could be omitted.

117, not mentioned: Does this gap not appear in Brown and Baillie because you were more restrictive when selecting individual series?

144, t=4.7: Is this a t-value according to Hollstein or Baillie-Pilcher? I assume that the Belfast lab would use the Irish t_{BP}. You computed a t_H-value of 2.8 (my computation $t_H = 3.0$).

146, Q10705M, Garry Bog 2: This is one of the cross-datings that I could not verify due to lack of data.

159, included sapwood: This should not represent a problem for dating. Are you that you used the correct term?

161, drastic unparalleled: From my experience it is rather usual removing tree-ring sequences which you suspect not being representative for the common tree-ring signal, e.g., reaction wood. Without seeing the wood, it might not be easy understanding why rings were excluded in this case.

191, new master: Is this the FranceAbsoluteAD chronology?

197, All sample identifiers…: This information/sentence is not required and might be omitted.

210: This is the crucial point of the manuscript – Becker's data are not publically available, i.e. his chronology and thus the framework for the dating of Roman oak cannot be verified independently.

219, centuries: Insert "and millennia".

223, somewhat: Omit this word.

230-231, correlation coefficient: Is this computed from Hollstein-transformed series, and how long is the overlap? I would prefer referring to t-values.

234, above: Better "beyond"?

234, recent: Delete this word.

236, site members: Unfortunately, you don't give details on which series you selected (IDs, series length, cross-dating criteria?). Thus I was not able to reproduce your calculations exactly.

237, according to: Rather place "Table 4" in brackets.

245, t=6.7: My t-values (TSAP) between WestDK and Northern Finland and Torneträsk are about 0.5 lower than yours (5.5 and 6.0, respectively). Still, the difference to the next-best match is quite convincing. This difference is even stronger if applying SNorwayOakRecent. However – and this is crucial: This relationship seems to be valid during the last 500 years only. If you divide the WestDK chronology into sub-sections and run them independently against the northern pine chronologies, only the segments after about AD 1500 do cross-date at the proper position. Before 1500 this relationship disappears.

256, Table 5: I came to slightly different results. How are gaps (here in FranceAbsoluteAll) treated by CDendro?

259, An attempt to date European oak…: In the light of the temporal and spatial instability of the pine-oak relationship, I unfortunately must regard the remaining results as occurring purely by chance.

275, block analysis: I cannot reproduce this statement. For simplicity, I computed 500-year blocks, which should give even better results compared to your 350-year blocks. However, I found only a non-significant correlation (t_H 3.5) for the first 500-year window and a moderate match (t_H 4.5) for the last 500-year window – unfortunately nothing in between. Please support your findings by a Table or Figure.

295, Discussion: This chapter does not really differ from, and rather is a continuation of, the Results chapter.

301, confirm: There is no need to employ the observed correlation between pine and oak chronologies as evidence for the correctness of the oak chronologies. More important is the fact that the oak chronologies are anchored in time by living trees.

303, significant: This match is significant just for the most recent 75 years of the Roman oak complex. Because the start/end of chronologies tends to be poorer replicated, there might be a chance that this correlation occurs by chance alone.

318, 110 years: Why exactly this segment length? If I prolong the period to 150 years, the match disappears.

328, a site collection: Could you give more precise information? I did not find data to check this result.

329, Table 9: Should be combined with Table 8.

334, AD 536-542: An intriguing idea. However, this event does not seem to be dramatic – or even present – in the continuous oak chronologies. Thus, is it relevant for oak? I didn't see any sign of crisis in the oak chronologies around 330 BC either, regardless original or shifted position.

I hope that my comments are helpful for further developing your manuscript. Good luck!