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Interactive comment on "Ideas and perspectives: use of tree-ring width as an indicator of tree growth" *by* R. A. Hember et al.

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We thank the referees for helpful comments. The referees dismissed our central thesis and conclusions for a large number of reasons. Given the many disagreements and misunderstandings, we have decided to withdraw the Ideas and Perspectives article and potentially pursue a full research article that can expand on applied examples in more detail. Below we provide brief responses to some of the main criticisms by each referee.

Reply to Anonymous Referee

Our interpretation of the comments of the Anonymous referee (AR 2015) suggests to us that the main differences of opinion were (1) that we are proposing a new standard-

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ization technique, and (2) confusion around the use of ring-width as a climate proxy (which we are not doing) vs estimating magnitude and cause of trends in tree and forest production.

Criticism regarding: “The author’s cite a need to compare environmental sensitivities across studies of tree growth as the motivation for this new standardization technique, but the current methods of standardization already allow for comparison across sites and timer (sic) periods.” Our study did not propose a new standardization technique. Working with biomass instead of ring width does not circumvent the general need to "standardize" or “detrend” observations through statistical modelling.

With respect to comparison of environmental sensitivities, a relative effect (e.g., a relative temporal trend) in standardized ring-width index can only be compared across studies so long as the dimension of the variable in question (e.g., ring width) remains the same. The problems we point out are that (1) none of those studies will be representative of the relative trend in primary production and (2) the relative trend in standardized ring-width index should not be directly compared with the relative trend in standardized basal area increment, or standardized absolute growth rate of stemwood biomass, or the relative trend in net primary production predicted by a model, et cetera, because there is a difference in the dimension of the variables in question. Hence, our study may be of no relevance to the study of tree ring-based proxies of climate because all those studies universally work with ring width and there is little need for the proxy to be an unbiased estimator of primary production because a bias would have no bearing on the validity of the predicted climate variable. It does, however, confound studies in dendroecology where the intention is to estimate the effect of environmental treatments on primary productivity of trees and forests.

Comment regarding literature review: To the best of our knowledge, none of the studies in the recommended reading list make reference to the problem in question. They deal with the issue of standardizing ring widths, when the question under consideration is mainly the use of ring-widths as a proxy indicator of past climates (i.e. the ring width

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is the predictor variable). Here we are dealing with the issue of using ring-widths as a means to determine, as closely as possible, the primary productivity of trees and forests, and to determine the magnitude of environmental forcing of productivity caused by various climatic or global change factors. In other words, we are dealing with the case where tree growth (ring width or other metrics derived from ring with) are the dependent variable, not the independent variable.

Comment on Lopatin et al. (2008): We do not think AR2015 understood that we did in fact use tree-ring data.

Criticism regarding use of allometric equations: We agree with AR (2015) that a source of error is introduced by dimension conversion (i.e., use of allometric equations to convert measurements into AGR). This caveat was clearly stated in our article. The error introduced from conversion does not have any direct bearing on the thesis of our study.

Reply to referee Bouriaud

We interpret the comments of the 2nd reviewer, Bouriaud (2015), to suggest that the main differences were with respect to the novelty of the thesis of our commentary, and a disagreement with respect to the true magnitude of the bias.

Criticism regarding magnitude of the bias: "I disagree with the statement that "sensitivity of primary production indirectly inferred from analysis of w or BAI is significantly underestimated" and "The statement "significantly underestimated" seems an overstatement because, despite the lack of proportionality between the radial and the biomass increments, relative changes do nut (sic) suffer from the same discrepancy at inter-annual step."

The example that Bouriaud (2015) relies on to support the claim that we exaggerated the bias is correct, but the example would be of relevance only to a comparison of growth over one year. Here we are interested primarily in trends that occur over longer time periods. To be specific, the growth bias is independent of time scale, but Bouriaud

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(2015) correctly recognizes that the effect of the bias on yield compounds with time. Evaluating the effect of the bias on yield on an annual times scale is analogous to evaluating the bias after the first year of the 100-year time series described in Section 2 of our study. The study was approached from the perspective of assessing growth responses to long-term forcing.

Criticism: "About what happens on long term when using BAI, biomass increment, or forest carbon accumulation time series, a detailed analysis was already published by Babst et al. 2014a using a variety of sites and species for temperate forests." We acknowledged the study by Babst et al. (2014a). The closest relevant discussion made by Babst et al. (2014a) was, "Based upon the similar trends observed in BAI and biomass estimates one could argue for the use of either metric." Our study constructively builds on that discussion by pointing out one very specific reason why there ought to be differences between the variables in question, and pointing out that the differences would not be trivial in many applications. In so doing, our study suggests that the above argument by Babst et al. (2014a) is debatable. That said, Babst et al. are hardly the audience we sought to caution about this problem given that they already work with gravimetric units.

Criticism: "The problem is, many studies have already proven that the conversion from tree-ring width to biomass was an improvement when the aim is to obtain time-series of biomass or carbon uptake, and implemented such conversions for example to compare against modeled carbon balance or eddy covariance fluxes: e.g. Rocha et al. 2006, Babst et al. 2014b, Nehrbass-Ahles et al. 2014, Peichl et al.2010, Ramming et al. 2015." And they would not be alone. The vast majority of physical sciences, outside of dendroecology, work with the continuity equation and would approach this subject based on the system mass balance. In that regard, these recent studies fall into the fold. Various scientists in forestry and dendroecology would either be aware of, or would not be surprised by, the problem that we have investigated. Indeed, it is basic geometry so it should surprise nobody. Yet, to the best of our understanding, it has

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never been stated in any detail.

Criticism: "...while the title is very catchy, the subject is in fact very partially covered, since the focus is solely on the proportionality of the rate of growth for radial, BAI or biomass increment. The manuscript does not correspond to what is claimed in the title and brings little new knowledge to the topic." We are unsure how the title "Ideas and perspectives: Use of tree-ring width as an indicator of tree growth" could possibly be perceived as "catchy". There is no specific claim stated in the title.

Criticism: "The main limitation of using ring width series to produce biomass or carbon uptake series was indeed already documented in different studies based on more experimental evidences, and describing a variety of factors of stronger influence than the proportions." To be clear, our study did not investigate "limitations of using ring width to produce biomass", as there are really no limitations here (past diameters, used in allometric models to estimate biomass or wood volume, are easily reconstructed from ring width data). Our study focused on describing the difference in relative growth when it is derived from state variables of different dimension. The bias between relative growth inferred from biomass and ring width - in the order of 66 percent - was hardly trivial. It was not clear to us what the "factors of stronger influence" are and how they would compare in magnitude with the bias investigated here.

Thanks to both reviewers for constructive remarks.

Interactive comment on Biogeosciences Discuss., 12, 8341, 2015.