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# A response to "*Trends in tropical tree growth: re-analysis confirms earlier findings*"

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We recently demonstrated that growth trends from tree rings from Van der Sleen et al. (2015) and Groenendijk et al. (2015) are affected by demographic biases. In particular, clustered age distributions led to a negative bias in their growth trends. In a response, they challenge our analysis and present an alternative correction approach. We here show that their arguments are incorrect and based on misunderstanding of our analysis, and that their alternative approach does not work.

Firstly, they argue that our correction methods result in spurious positive growth increases. This is a misinterpretation. Yes, in our test of the correction method we find positive growth trends (see SI Fig. 3), but they are not spurious as they are expected and of the correct magnitude. Our approach does not correct for all biases, and does not remove the effect of slow-grower survivorship bias (Brienen et al. 2012), as explained in Brienen et al. (2016). The authors misinterpreted the trend as a fault in the correction procedure, while in fact, it is confirmation that our methods work perfectly. Another point the authors raise with regard to our shuffling approach is that it would yield often insignificant results. However, we only establish a null model of expected growth trends arising from the irregular age distributions of their species, which is a valid, accepted approach.

Secondly, the authors claim we unnecessarily removed species. There is however clear logic behind this. To identify the effect of the non-uniform age bias on trends, those species affected by other biases had to be removed from the dataset. We thus first removed three species which were identified by the authors themselves to be biased by mortality biases (Groenendijk et al. 2015). We then tested the effect of the non-uniform age bias using two different correction procedures for all remaining nine species, including those with non-uniform age biases. As a final test, we also removed the three species with the most non-uniform age distributions to estimate growth trends over time for the remaining six species using the original method of Van der Sleen et al. (2015) which does not correct for any biases.

Finally, the authors propose to remove recent growth data from some species as an alternative correction approach. This procedure is flawed. Firstly, by removing recent growth data one cannot any longer test whether growth increased recently! Secondly, the approach erroneously assumes that the bias only occurs when there is a lack of recent

recruits. However, the problem not only arises because of the lack of recent recruits, and any non-uniform age distribution may result in biases, even if there are recent recruits (see Fig. 1). Finally, their sub-setting approach does not remove the effect of the non-uniform age bias as shown in Fig. 1, and thus is of no use for this problem.

We conclude that none of the points raised by Van der Sleen et al. (2016) are valid, and their tree data unfortunately still preclude detection of growth changes over the last decades.

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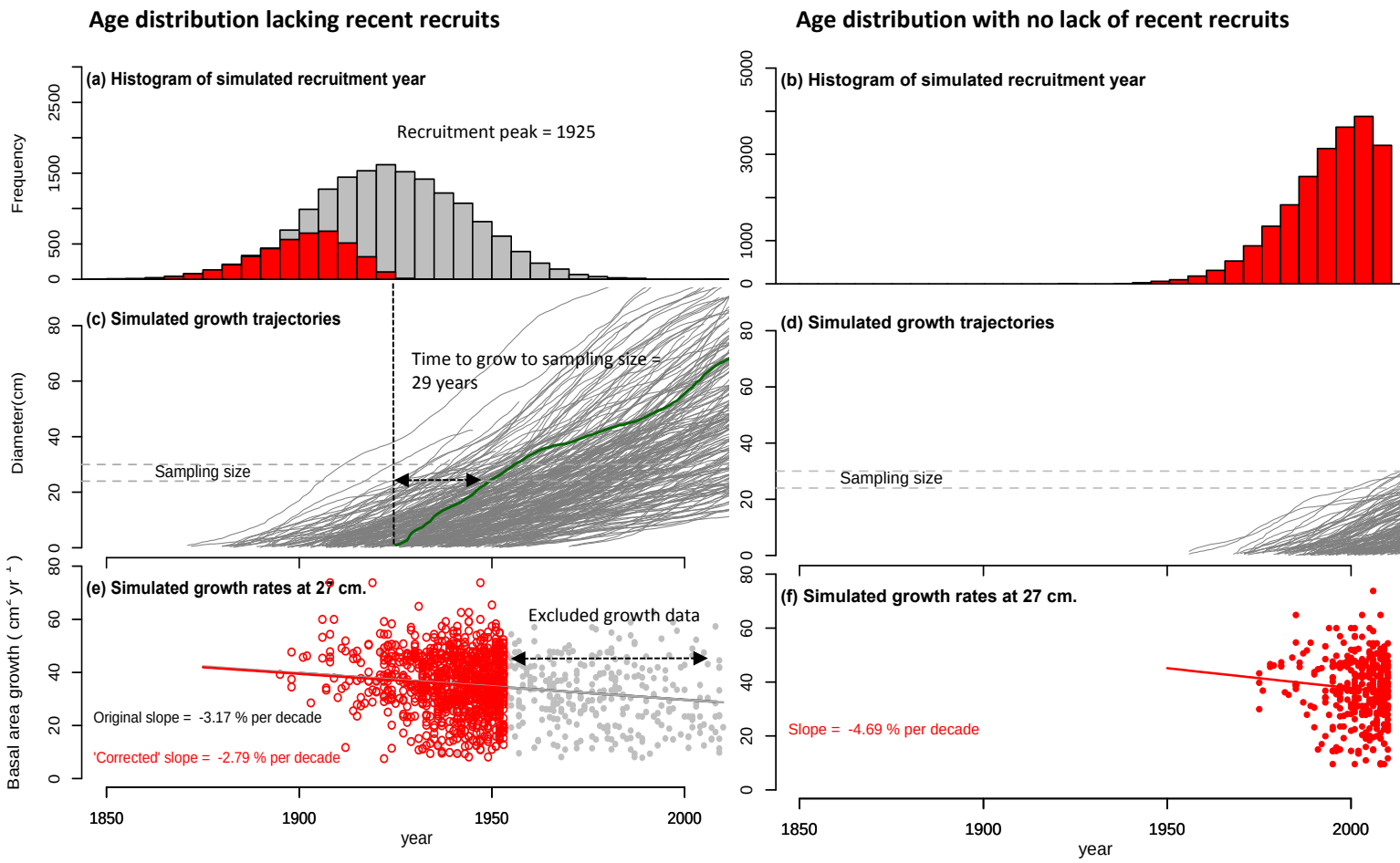


**Fig. 1. Illustration of the method proposed by Van der Sleen et al. (2016) to remove the effect of the non-uniform age bias from two different population age structures; one with a recruitment peak at 1925 (left panels), and one with no lack of recent recruits (right panels).** Their sub-setting procedure removes from the original dataset growth data from trees that recruited after the peak of the recruitment distribution (which is in 1925 in the left example). To calculate the first year for which data need to be left out, they added to the recruitment peak year, the number of years for the fastest grower in the dataset (green line) to reach the sampling size of 27 cm in diameter. Following this selection method, we removed from the left simulation all growth data after 1954 (1925+29), while for the simulation on the right there is no lack of recent recruits, and thus all growth points are included. As becomes clear from the left example, the age distribution of the subset of trees (i.e., red bars in panel a) is still non-uniform, and thus the sub-setting method does not remove the bias, still leading to negatively biased growth trend (red points and red trend line in panel e). The example on the right shows that the assertion by Van der Sleen et al. (2016) that age distributions that have no lack of recent recruits are not biased, is incorrect, as it still results in negative trends due to lack of historical recruits. These examples illustrate clearly that their proposed method does not remove the negative effect of the non-uniform age bias.