

Biogeosciences Discuss., author comment AC2
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Reply on RC2

Roberto Pilli et al.

Author comment on "The European forest carbon budget under future climate conditions and current management practices" by Roberto Pilli et al., Biogeosciences Discuss., <https://doi.org/10.5194/bg-2022-35-AC2>, 2022

Dear Reviewer,

Thank you for your positive review and for your useful and constructive suggestions. We will certainly take into considerations your comments when we revise the manuscript. Meantime, we take this opportunity to clarify some points.

- And here is my only criticism: in the paper the authors draw policy conclusions like the study "may constitute a first benchmark to set up specific management strategies". Due to the limitations of the modelling approach and the rather crude assumptions on the reference scenario conclusions on needed responses to revert the declining trend should not be drawn. As the authors mention in their response to Anonymous Referee #1 "the continuation of forest management (BAU) was chosen just to test our method, but this is not a policy scenario". In that sense the manuscript should more carefully draw conclusions on how to respond to the scenario results. Instead, the authors could provide requirements for making the results more policy relevant, e.g. by a more policy-oriented scenario design, sensitivity analyses regrading forest management options etc.

We understand the point highlighted by the Reviewer and, taking also into consideration the comments provided from Ref#1, we will certainly recall, both in the abstract and in our conclusions, the fact that our study does not aim to analyze a policy scenario. We also understand that some of our conclusions could be interpreted in such a way. For this reason, following your suggestion, we aim to rephrase the last statement of our conclusions (in particular between L. 699 and 702), highlighting that our methodological framework may help other studies to be more policy relevant. In this sense, further studies should certainly include, (i) a sensitivity analyses on different forest management options, and the consequent effects on the overall harvest levels, (ii) an assessment of the direct effect of these removals on the HWP net C sink and, possibly, (iii) even a first assessment of the possible indirect substitution benefits.

- Lines 205 ff: This explains... This is not clear to me: please more explicitly explain the geographical differentiation in the RC 2000-2015

Figure 1 reports, on the upper panels, the geographical distribution of the

average Net Growth estimated by CBM within the historical period 2000 – 2015 for broadleaved species, on the left side, and conifers, on the right side. Since the net growth represents the net biomass increment before losses from disturbances, these values are directly proportional to the Net Annual Increment (NAI) reported from NFI data. Despite the methodological differences between various European countries (Tomter et al., 2016), the NAI reported from Mediterranean countries and Northern European countries is generally lower than the NAI reported from central European countries (see for example Table 3.1-1, Lanz and Marchetti, 2020). Since the same NFI data are mostly used as input to initialize the CBM model, these differences – between the NAI of various regions - explains the lower Net Growth generally estimated for Mediterranean and Northern European countries and the higher values estimated for Central European regions. We will clarify this sentence within the revised version of the manuscript.

- Line 213 ff: This is... You attribute the reduction of NG “partially” to “ageing”. I think this needs to be verified and better supported by data. Also the “rejuvenation” might reduce NG if it moves the biomass stock of a stand below the maximum increment. That there is instead a saturation effect can be observed from Figure 13S. I suggest adding a sentence on these dynamics and refer to this figure at this point as the biomass stock/increment relations and dynamics cannot be observed from Fig 1.

We understand your point and we may certainly add a further reference to Figure 13S, after L 215, highlighting the saturation effect as can be observed from this figure.

- Lines 245 - 280 Fig 1 - 2: The labels of what the panels show are very small. I suggest adding “upper panel right:...” etc. to the figure caption for better readability

Thanks for your suggestion, we will increase the size of the labels and expand the caption.

- Lines 289-291: At the European... The sentence is hard to understand. I suggest splitting it into two for more comprehensiveness.

Thanks for your suggestion, the sentence will be rephrased as: *"At the European level, however, within the period 2016 – 2100 the overall NEP decreases from about 1.3 t C ha⁻¹ yr⁻¹ within the historical period to 0.97 t C ha⁻¹ yr⁻¹ in 2100 (i.e., -28%, see Figure 3 panel A). This is due to the larger share of forest land distributed in central and north European countries, where NEP is stable or decreasing, compared with the Mediterranean regions, where it is generally increasing."*

- Section 3.4. “Comparison with other studies, limitations, and uncertainty of the present study” is very long. It addresses different aspects that should rather be separated for more readability and clearer structure. Suggestions for additional sections are: Comparison of the reference period with other data sources, Assessing impacts of climate change, Assessing underlying trends of growth dynamics, Limitations of the model, ...

Thanks for your suggestion, the content of this section will be distributed in different subparagraph within the revised version of the manuscript.

- Lines 692-695: Due to the... The expected ranges for RCP 2.6 and 6.0 for 2050 are not clear from this sentence. Please revise it, e.g., by using the formulation in the abstract

where it is much clearer.

Thanks for your suggestion, the sentence will be rephrased as: "*Due to the uncertainty about the future evolution of environmental variables and the relative impact of these variables on forest growth and mortality, in 2050 the EU 27+UK forest net C sink may range from about -100 Mt CO₂e yr⁻¹ under RCP 2.6 and 6.0 to about -400 Mt CO₂e yr⁻¹ and -300 Mt CO₂e yr⁻¹, under RCP 2.6 and 6.0, respectively.*"

Many thanks also for your additional technical corrections, we will address them within the revised version of the manuscript.

Additional References

Tomter, S. M., Kuliešis, A., & Gschwantner, T. (2016). Annual volume increment of the European forests—description and evaluation of the national methods used. *Annals of Forest Science*, 73(4), 849-856.

Lanz, A, Marchetti, M. (2020). Criterion 3: Maintenance and Encouragement of Productive Functions of Forests (Wood and Non-Wood). In *FOREST EUROPE, 2020: State of Europe's Forests 2020*.