Review of manuscript submitted to Biogeosciences on "The European forest Carbon budget under future climate conditions and current management practices"

General comments

My review of the manuscript BG-2022-35 by Pilli et al. finds that the paper is of high scientific significance. It can be considered an important contribution to scientific progress in the field of forestry research and environmental policy as it provides a concept for combining different types of models for addressing urgent policy questions. The paper is of high scientific quality and to my knowledge includes the most recent and relevant literature on the topic. There are limitations to the approach and the study leaves open questions, e.g. on the interaction of forest management and natural disturbances, the effect of other disturbances beyond fire, the effect of management changes. However, the authors are not tempted to overload the study but focus on practicability of the approach. This has of course also limitations for the interpretation of the results for policy. 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 (https://doi.org/10.5194/bg-2022-35-AC1), "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.

Overall, the manuscript is well structured, the language clear and methodology and assumptions well-presented.

Specific comments

- Lines 205 ff: This explains… This is not clear to me: please more explicitly explain the geographical differentiation in the RC 2000-2015
- 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.
- Lines 245 ff/Fig 1: The labels of what the panels show are very small. I suggest adding "upper panel right:…" etc. to the figure caption for better readability.
- Lines 280 ff/Fig 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.
- Lines 289-291: At the European… The sentence is hard to understand. I suggest splitting it into two for more comprehensiveness.
- 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, …

- 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.

Technical corrections needed

- Line 65: so-called
- Line 79: combining
- Caption Figure 1S: LP-GUESSJ should be LPJ-GUESS
- Line 117: delete by year
- Line 155-157: Sentence starting "This is…" unclear, please revise.
- Line 160: Suggest naming the output variables after "output" again (Growth Multipliers and area burnt)
- Line 568: in Figure 8
- 570-573: language, consider splitting sentence into two