

## ***Interactive comment on “Disturbance legacies have a stronger effect on future carbon exchange than climate in a temperate forest landscape” by Dominik Thom et al.***

### **Anonymous Referee #3**

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General comments : The research article named 'Disturbance legacies have a stronger effect on future carbon exchange than climate in a temperate forest landscape,' try to explore the effect of disturbance legacies and climate change in the projection of the forest carbon sequestration. In order to do that, they reconstruct a well documented historical scenario of an Austrian forest landscape with two disturbance events and one forest management shift. At the end of the paper, they encourage the scientific community to take into account the forest history when initializing the forest state before running projections of the forest dynamic. This is a nice attempt to promote the integration of disturbances and abrupt mortality in model development. I really appreciate the quality of the work done by the simulation experiment and the past reconstruction

C1

forest state with the new method of spin-up. I am convinced that this paper can be published without deep changes in the structure and the content. However, five points need to be clarified:

1) The results of the simulation experiment show that past forest management (absence or presence) is the main factor to explain the divergence between simulations. But this finding is not central to the paper! Instead of that, the authors define forest management as a human disturbance (that is perfectly true) and merged natural and human disturbances in one general disturbance term. This merging leads to a misinterpretation of the title and the conclusion because, for most of the ecologist and the forest manager, disturbance legacies always refer to an extreme event legacy like storms, beetles outbreaks, fires or droughts. My advice is to explicitly divide interpretation of the result into the natural and the human disturbance. For example, the title will become: "Human disturbance/forest management/human activity legacies have a stronger effect on future carbon exchange than climate in a temperate forest landscape."

2) the authors need to be careful with the last statement of the title: "than climate in a temperate forest landscape" because the authors only realized simulations with a medium climate change scenario (A1B). The strongest climate change scenario like the RCP 8.5 is most likely to happen, and it will have a stronger impact. In addition, the authors forget to take into account the indirect effect of CC on forest growth via the increase of the frequencies and the intensities of the extreme events. This partly due to the setup of the simulation experiment where disturbances are forced and disconnected to the mortality module of iland. But this interaction can be simulated in iland because the authors already developed abrupt mortality module into this model.

3) The way the authors display the results of the simulation experiment is very confusing. The figure 5 for example which display the difference between reference NEE and alternative NEE, starts to diverge from 2013 and not from 1905. The simulations without management should not be far from other simulation in 2013?

C2

4) In table 1, we can see a difference of about 40 tC ha between managed and unmanaged simulations. The strangest thing here is that in 2099 this difference disappears (compensation process?). This is interesting but the authors don't mention that in the discussion. Why? and why the figure 5 doesn't display that?

5) Did the two imposed disturbances have a different impact on the forest across simulations? If not, it means that the authors can't observe the legacy effect of one disturbance to another future one. It is maybe the reason why they don't observe a strong effect of natural disturbances. Due to this lack of interaction, the interesting questions like: - Can this forest have the capacity to absorb extreme events well enough to keep the same level of NEE if the intensity and the frequencies of natural disturbances will increase? Or - Are the forest management made between 1905 and 1997 is able to change disturbance impact on NEE in the future? cannot be tackled. It is a pity because it will strengthen the purpose of this paper.

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