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Interactive comment on "The European forest sector: past and future carbon budget and fluxes under different management scenarios" *by* Roberto Pilli et al.

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Many thanks for this critical and constructive review. As suggested, we may add a box-and-arrow figure (Figure 1 reported below), highlighting the annual fluxes between the pools and the annual stock change. This may certainly help the reader to summarize the net fluxes between the pools, including the difference between the Net Carbon Stock Change (i.e., -109.5 TgC, reported as C removals from the atmosphere) and the Net Sector Exchange, due to the HWP pool. Based on this figure, we see that "living biomass" and "felling" (including removals and harvest primary residues), have a positive net C balance. The negative balance reported for dead wood and litter is probably influenced by the (average) effect of the natural disturbances occurred during

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the period 2000 – 2012. These disturbances have moved part of the living biomass to DOM (through wind storms and fires) and to the atmosphere (through fires), but, through salvage logging after the main storms, they have also (indirectly) moved part of dead wood to the HWP pool. CBM estimates of soil C are assumed to include the belowground slow (i.e., humified organic matter in the mineral soil) and very fast (i.e., dead fine roots in the mineral soil, approximately < 5 mm diameter) pools to a depth of 1 meter (Kurz et al., 2009). Due to the short time frame considered by our study (12 yrs.), we could not highlight any significant variation of the soil C stock. Indeed, the slightly negative C stock change reported in the figure (-0.8 Tg C yr.) is mainly due to the effect of deforestation and, overall, the soil C stock is stable. But we agree that, the soils are presumably accumulating carbon as forests are getting older. The absolute total heterotrophic respiration (Rh) estimated by our study is 40% higher than the value reported by Karjalainen et al. (2003): i.e., 403 Tg C yr-1, against 245 Tg C yr-1. However, if we compare the relative emissions due to Rh with the total NPP, the estimates are not so different: 59% of the NPP is lost as heterotrophic respiration, according to Karjalainen et al., and 65% according to our study. This last amount is due to the specific assumptions made in the present study, based on a preliminary comparison between the model output and specific studies available at regional and country level (Pilli et al., 2013 and 2016). Similarly to other soil models, the results provided by CBM are also influenced by the uncertainty in model initialization. For the initialization of DOM pools (including soil), we assumed that the historic natural disturbance regime is a stand-replacing fire (or clear-cut) with a disturbance-return interval of 100-250 years (Kurz et al., 2009, Pilli et al., 2013). Therefore, the initialization assumption of the CBM model reflects changes in disturbance regime at the start of the simulation, relative to the historical conditions. However, the observed stocks may not be in equilibrium due to disturbances and very long turnover times of stable compounds (Wutzler and Reichstein, 2007). The soil C stock (including litter and dead wood) was initialized by Karjalainen et al. (2003) by setting the soil compartments to a “steady state” with the input of the period 1990-1995. The same authors, however, highlighted the lack of em-

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pirical data to estimate the C stock in the soil. Thank you for your specific comments on the text, they will be included in the revised version of the manuscript.

Additional references: Wutzler, T. and Reichstein, M. Soils apart from equilibrium - Consequences for soil carbon balance modelling. Biogeosciences 4, 125-136, DOI: 10.5194/bg-4-125-2007, 2007

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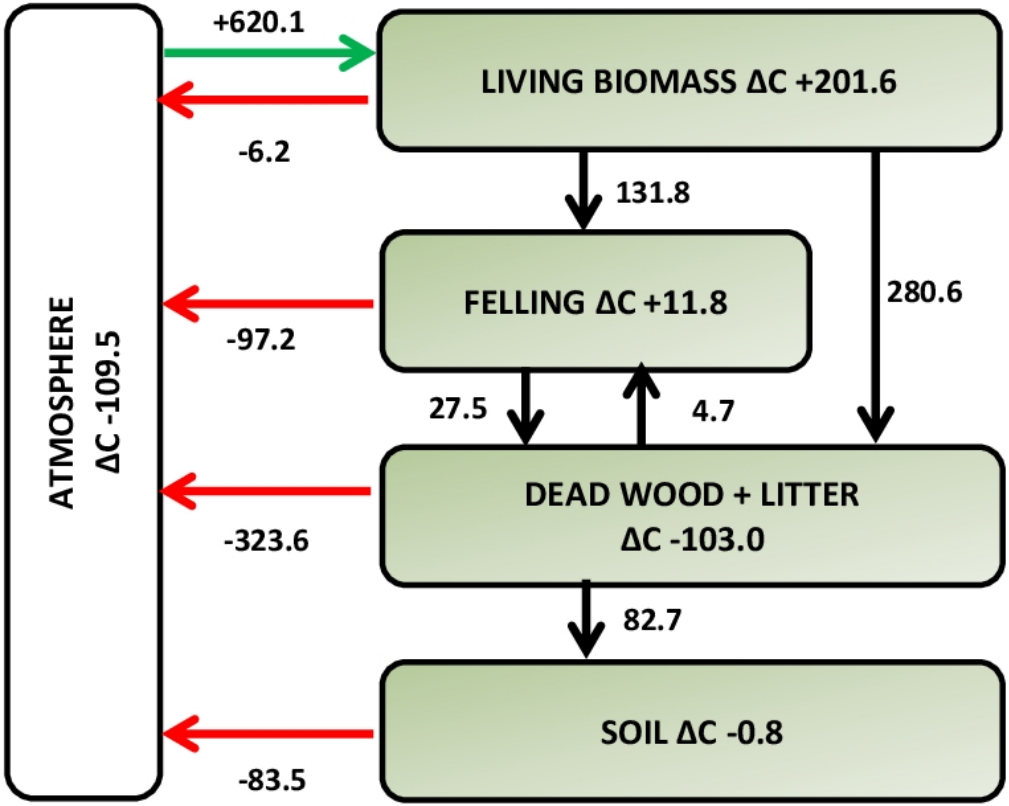

Fig. 1. Figure 1: summary of the average C increment and transfers between forest pools and with the atmosphere (in Tg C yr-1, for the historical period 2000 – 2012).

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