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Interactive comment on "Carbon sequestration in managed temperate coniferous forests under climate change" *by* C. C. Dymond et al.

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Anonymous Referee #2 Received and published: 3 February 2016 This manuscript written by Dymond et al. aims to project future forest carbon dynamics within an area in north-central BC as a function of interactions of species composition, climate change, fire, and forest management. Simulations are conducted using the LANDIS-II forest landscape model. They developed a new LANDIS-II extension (ForCSv2) that aims to tract the Net Sector Productivity, a metric incorporating the Net Ecosystem Productivity and the emissions from wood products and disturbances.

Generally, the paper is very well-written and I did not find major flaws in the methods. The use of LANDIS-II is appropriate as it can readily incorporate disturbances and

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species-specific climate change impacts on growth in a spatially explicit framework. The development of the ForCSv2 extension in this context was therefore much needed and now greatly complements the existing LANDIS-II extension's library. I have very few comments and questions on the paper which are listed below.

Response: Thanks for your positive and constructive comments!

The authors simulated harvest and fire as disturbances. However, they did not included any insect disturbances, most notably mountain pine beetle (MPB) outbreaks. It's quite puzzling as current LANDIS extensions allow for such an integration. Furthermore, the most recent MPB outbreak had a tremendously high impact on the forest carbon dynamic of central BC. Clearly, the odds for a MPB outbreak as severe as the one that took place in the beginning of this century within the next 35 years (up to 2050) are small given the high mortality rate that was observed. However, several authors (Régnière and Bentz, Safranyik, Logan, : : :) reported that climate should become more suitable for MPB in the upcoming decades in this region. The authors should clearly state why they omit to simulate MPB outbreaks. Giving the uncertainty in future MPB outbreaks, it could be relevant to model the C dynamic with and without a MPB outbreak by 2050.

Response: We certainly agree with your comments on the importance of MPB outbreaks in BC and in the future. The omission was due to a number of compounding factors. First, the insect damage already affecting the area was taken into account in the starting inventory of 2012, although this area was not as badly impacted as areas to the east, likely due to topography limiting wind dispersal and stand complexity. Second, it is unclear what the likelihood will be of an outbreak within the 48 year simulation period, again, given the relatively low abundance of pine, the topography and stand complexity. Further complicating the modelling is that the Biological Disturbance Agent extension to LANDIS-II simulates all of the impact of an outbreak (perhaps 10 years long) in a single timestep, whereas the focus of this paper is on annual carbon fluxes. We made the decision to postpone integrating MPB into the landscape until the second

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phase of this project (already started) which will run out to 2100. We will be happy to clarify in the text.

I would like to have a little bit more information about the 144 future climate projections that were used for this study. Which GCM, RCM were used, which anthropogenic forcing? No need to list them all of course.

Response: A direct adjustment approach was used to create climate change scenarios from the selected historical climate data and global climate model (GCM) predictions for the study region (Nitschke et al. 2012). Monthly outputs from five GCMs were obtained from the Pacific Climate Impacts Consortium (PCIC, 2012). The GCMs and emission scenarios selected were: Hadley GEM-A1B; Hadley CM3-A1B; MIROC HIRES-A1B, GISS AOM- A1B; and, Canadian GCM3-A2. Climate change is projected to increase the study area's mean annual temperature by 1 to 3.5 degrees C by the 2041-70 period, depending on the global climate models (PCIC, 2012). Mean annual precipitation projections are more variable with models showing increasing, decreasing or unchanging precipitation.

The 144 model simulations mentioned in the original text were 10 annual years of daily data per ecoregion (n = 5) multiplied by 4 time periods (Historical, 20s, 50s, 80s) multiplied by 5 GCMS. However, this was not clear and we will remove mention of it in the text.

This paper is all about carbon dynamic. As such, authors should drop sections that refer only to changes in species range/biomass unless there is a direct link with the carbon dynamic. In this context, the last paragraph of section 4.1 should be dropped as it stands right now.

Response: Thanks for identifying an opportunity to shorten the paper.

Interactive comment on Biogeosciences Discuss., 12, 20283, 2015.