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Interactive comment on “Carbon balance of a partially-harvested mixed conifer forest following mountain pine beetle attack and its comparison to a clearcut” by A. Mathys et al.

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Received and published: 11 June 2013

Response to Anonymous Referee #2

This manuscript documents aspects of the carbon balance and evapotranspiration from two sites in northern British Columbia representing sub-boreal forest subjected to mountain pine beetle infestation. The study, which lasted two years, examined a clear-cut and a partial cut site. The results demonstrate that partial removal of infested trees is more beneficial in terms of the recovering carbon balance than complete removal of the overstory. The measurements of fluxes and the basic meteorological variables were well done and carefully described. An open-path infrared gas analyzer (LI-7500,

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LI-COR) was used for carbon dioxide and vapour fluxes. The authors note that this instrument has proven problematic for winter measurements because of a possible self-heating error. They did not attempt any sort of correction. Rather they decided to reject all wintertime flux values when the net ecosystem exchange was <0 and the wind speed was <4 metres per second. The descriptions of methods are adequate with a couple of exceptions. There is a rather vague commentary about instrument calibration being performed in the lab prior to field deployment. Very scant or no further explanation is given and so correcting for calibration changes is implied rather than clearly demonstrated. Secondly, there is insufficient reason given for measuring precipitation at a height of 5 m in a canopy opening. I suspect that this height was chosen to allow for sufficient field of view above the gauge, but this is not explained.

Author response: We thank the referee for the constructive feedback. We have carefully addressed and responded to each of the comments below. We have adopted the suggested changes in the text to clarify our procedure of calibrating the infrared gas analyzer (IRGA). When the IRGA was replaced in 2011 its performance was checked upon return to the laboratory. The calibration was found to have changed very little and thus no corrections were applied to the dataset. We acknowledge the comment regarding the measurement height for precipitation and have provided an explanation in the text as suggested.

The authors correctly point out that increasing air temperature is a primary reason why the mountain pine beetle has been an increasingly serious problem in the pine forests in northern British Columbia. Where this is discussed (page 4930, lines 4 to 6) they note an increase in air temperature from 1895 to 1995 as the leading cause. However, it is the increase in winter air temperature in particular that is critical. It would be more useful to include winter temperature increases in the argument.

Author response: We agree that winter temperatures are particularly important in explaining the mountain pine beetle expansion in BC and have made changes to the text accordingly.

BGD

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The seasonal carbon and evapotranspiration characteristics of the two sites over the two years of measurement are exhaustively described with abundant numerical values of fluxes and good graphical displays. I found only one suspect description: NEP for the clear-cut site (MPB-09C) in June 2010 is given as -20 g C per square meter per month (page 4943, line 2), but the value is more like -15 (see Figure 10).

Author response: We thank the referee for pointing out this error and have changed the value in the text to -15 g C m⁻².

Table 1 documents the characteristics of the partial harvest site. It is unclear what the stated standard deviation of stand age means. It is more likely to be simply an estimate of the error in the estimate. Also there is no standard deviation in the thickness of the LFH horizon. Does this mean there was only one sample taken? It would be useful to know the number of samples for determination of mineral soil carbon and fine mineral soil bulk density.

Author response: The standard deviation associated with the stand age was calculated from the ages determined from 52 tree samples. Thus it represents the variation of tree age in the stand and is not an error estimate. We have added a foot note in Table 1 to clarify this. We have added both the number of samples and standard deviation of the LFH thickness to Table 1. As described in the Methods, the soil characteristics were determined from three National Forest Inventory ground plots established at the site.

It is not clear to me why the site map (Figure 1) designates different patches with different trail spacing. So far as I can tell the different trail spacing played no role in the argument.

Author response: Figure 1 was included to show how the partial harvesting was carried out at the study site and the location of the flux tower. While the variation in trail spacing may not have played a crucial role in this study, it provides an insight into how this harvesting method is undertaken in British Columbia. In the area within the footprint of the tower the spacing of the trails were operator selected to ensure that a

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large proportion of non-pine trees were retained in the stand. In the figure, we have added a photograph of the stand from the top of the flux tower to show the reader the appearance of the stand after partial harvesting.

The notion of the trees becoming more windfirm, and thus having fewer trees wind thrown, is interesting (Page 4946, line 29 to page 4947 line 2). It is not clear how “a significant fraction of trees in the stand were located close to the stand edge” and thus became more windfirm. This statement implies a very uneven spatial distribution of trees, something that was not made clear in the discussion.

Author response: We appreciate the referee’s comment regarding windfirm characteristics of the stand and have rephrased the sentence to make our explanation more clear. Nishio (2011) found that there was likely an increase in windfirmness of the stand before the MPB attack because it was located downwind of an open area where winds tend to be relatively high.

Editorial Corrections Page 4930, line 2: change “conditions” to “concentrations” Page 4946, line 3: change “10 yr” to “for 10 yr”

Author response: The suggested changes have been made.

Interactive comment on Biogeosciences Discuss., 10, 4927, 2013.

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