

## ***Interactive comment on* “The greenhouse gas exchange responses of methane and nitrous oxide to forest change in Europe” by P. Gundersen et al.**

### **Anonymous Referee #1**

Received and published: 2 July 2012

Review of the manuscript “The greenhouse gas exchange responses of methane and nitrous oxide to forest change in Europe”, submitted to Biogeosciences Discussions

This paper compiles a comprehensive set of data on GHG flux measurements in different European forests emphasizing the change in GHG budgets upon simulated anthropogenic impacts and climatic changes. Although the strength and direction of responses in some cases were unexpected, the overall findings generally support our conceptual understanding of dominant regulators on GHG exchange in forest ecosystems, and it is interesting to learn that the concepts apply to a variety in ambient climatic and soil conditions as well as forest types. Thus, publication is recommended.

Generally, the paper reads well with a good organization in the data presentation, discussion and outlines. Concerning the experimental description and in particular the

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GHG measurement techniques, only little details are included, although references to primary articles are given. Nevertheless, I do think it would be helpful with a short description of uncertainties in the GHG flux observations. Clearly, the authors are aware the chamber based GHG flux observations have been / are subject to critical considerations. In Table 2 the number of concentrations measurements are indicated and flux calc. method is indicated, however no further comments on this information is given in the text. Does this imply that some dataset are more reliable than others? Please, specify in text. In addition to the GHG methodology, protocols for pH observations should be included (e.g. water or CaCl<sub>2</sub>), as different protocols per se will give different results, which might have influence on the current data-analysis. For the synthesis of data and discussion of GHG responses it might be helpful to convert the N<sub>2</sub>O and CH<sub>4</sub> responses into the common scale of Global Warming Potentials, expressed as CO<sub>2</sub> equivalents. This information will facilitate the intersite comparison both in terms of strength and direction. The information could be included in Table 3. The authors refer to internal drivers as being important for the GHG flux control, and in particular addresses N availability with focus on NO<sub>3</sub><sup>-</sup>. However, no data on NO<sub>3</sub><sup>-</sup> concentrations in the different sites are presented, only the indirect evidence in form of leaching observation from previous studies. In order to sustain the discussion on N<sub>2</sub>O increase (P6145) and CH<sub>4</sub> ox decrease (P6147), data on NO<sub>3</sub><sup>-</sup> / NH<sub>4</sub> should be included.

In addition to this, a number of specific comments need to be addressed by the authors.

Title: Consider to rephrase. Suggestion “The response of methane and nitrous oxide greenhouse gas exchange to forest change in Europe”

Introduction P6133, L15: I suggest leaving out Fig. 1. Most information in this figure is already in the text.

Methods P6134, L22: Be consistent when listing the site names, and not only use the abbreviations. P6135, L2: The pH values should be in Table 1 (or as is in Table 2), and not repeated in the text. Along this, there is no need to repeat information from Table 1

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e.g. on soil type. P6137, L10: Explain what is meant by stabilized ash. P6137, L15: As you do not consider results from the high ash treatment, there's no need to describe this in the text (e.g. line 10).

Results P6139, L10: Here, and in a couple of other places (e.g. L27), you refer to the direction of the correlation with reference to Table 4. But the direction is not apparent from R2; correlation coefficients ( $r$ ) need to be included. P6140, L10: Consider to re-make Fig. 4. It's confusing that data in Fig. 4 is on a positive scale when the majority of the fluxes are still negative. Perhaps this could be illustrated by using a sort of "stacked bar" indicating the control flux and treated flux with different shading. P6140, L20: According to Fig. 4 the wood ash addition was significant; correct in text.

Discussion P6141, L23 - P6142, L15: I suggest leaving out Fig. 5. It does not add information to the text; the length of the text-section could also be reduced. P6143, L13: It should be emphasized that low pH depresses overall denitrification, and thus not necessarily leads to increased N<sub>2</sub>O emission. (This is in fact mentioned later, P6145, L14-17). P6144, L16: Add a reference to the statement about relationship between soil moisture and pH. Table 1: MAT for Gardsjon is missing Table 2: Do not refer to unpublished material (Moldan et al)

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Interactive comment on Biogeosciences Discuss., 9, 6129, 2012.

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