

## ***Interactive comment on “Comparative analysis of the influence of climate change and nitrogen deposition on carbon sequestration in forest ecosystems in European Russia: simulation modelling approach” by A. S. Komarov and V. N. Shanin***

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Received and published: 27 September 2012

General Comment: However, description of the simulation conditions is not sufficient for evaluation of the study and its results. For instance, initial conditions (soil, stand structure, tree species composition) and site type distribution in different regions is not clearly reported and citations are to reports that are far from easily available for international scientific community. Since simulations were done without management

C4314

(assuming that stands are conserved as forest reserves), limitations in the generalization of the results should be discussed.

Response: We extended the description of areas under study and provided the data on variation of environmental conditions among different forest types. We also added the description of generalization procedure used for preparation of initial data. Russian classification of forest types has been shortly described.

General Comment: Results of this study are, to large extend, in good agreement with earlier simulation studies on combined effects of N deposition and climate change (see e.g. one of the earliest papers on this topic Mäkipää et al. 1999 CanJForRes 29: 1490-1501). However, present study extend earlier analysis of N deposition and CC by providing simulations on different site conditions and by providing analysis on forest carbon sequestration potential on regional scale. Thus, the manuscript provides a new remarkable contribution on scientific knowledge. This new approach should be, however, more emphasized in the results and discussion chapters. In the current version, results and their interpretation are written in a way that could be outcome of the stand scale simulation.

Response: We focused more on Results and Discussion and extended these sections, adding more results, comments on these results, and comparison with other studies (including references provided by reviewer).

General Comment: Earlier studies have reported both positive and negative responses of soil carbon stock to changing climate. Here, effect of climate change is analyzed together with nitrogen deposition and observed increases in the soil carbon stock are in good agreement with stand scale simulations by Mäkipää et al (1999). However, both positive and negative responses to increased nitrogen supply have been reported (see e.g. Jonsson & Curtis 2001, Pussinen et al 2002, Prescott 1995, Knorr et al 2005). Thus, findings of this study gives further light to the ongoing discussion on effects of N deposition and CC to soil carbon and I strongly recommend authors to further compare

C4315

and link their findings to earlier studies.

Response: We extended the comparison with results from other studies and provided references to results both supporting and contradicting the outcomes from our study.

Specific comments:

Abstract - line 8, do you mean stable climate, i.e. climate without annual variation? or have you simulated stand development in ambient climate? Response: We meant an ambient climate, with annual variation but without clear trend in shifting of mean temperature or precipitation. We changed 'stable' to 'ambient', and also 'current' to 'ambient' for describing levels of nitrogen deposition elsewhere in the text.

- line 9, specify how many or which levels of nitrogen deposition were analyzed. Response: We added short description of scenarios of nitrogen deposition.

Introduction - first three lines are very generic without specific meaning; thus, can be deleted. Response: Deleted.

- lines 18-20, meaning of the second sentence is unclear. I mean that last part of it '...linked with nitrogen deposition from the atmosphere' is not meaningful here. Furthermore, some references to earlier and textbook type of publications would be fine, since finding that N is limiting factor is older than paper by Sutton et al. 2011. Response: Last part of sentence was deleted; and also earlier references were added.

- page 6831, line 4-5, repeating what is said elsewhere. Response: These lines were deleted. - page 6831, line 25, meaning of 'individual-based model' should be explained. Response: We added some explanations what 'individual-based model' means.

- objective should be more specific, e.g. is forest management accounted? Is mixed ecosystem? Moreover, do not include citations into objective chapter, since it should be understandable as such (do not require a reader to check other papers). Response: We added more specificity to the Objectives and removed the reference.

C4316

- In addition, a specified hypothesis should be included into objective chapter to help a reader to follow your study. Response: We stated a hypothesis which we follow in present study.

M&M - major problem in understanding M&M is lack of information on distribution of the site conditions. You have very general information on regions in chapter 2.4. but more detailed information on distribution of site parameters is needed. Response: We added two tables with description of environmental conditions in dependence of forest type.

- page 6833, line 14, how forest types were adjusted? Response: This was wrong formulation. We just meant that Russian classification is similar to Cajander's one. Detailed description of converting Russian classification into Finnish Cajander classification can be done to some extent but it takes a lot of text and we prefer to omit mentioning this possibility. Moreover model outputs do not depend on classification, it is a way to collect data from literature.

- page 6833, line 19, destructors?? Do you mean decomposers? Response: Yes, we meant decomposers. Corrected.

- page 6834, lines 16-23, more information on distribution of site conditions is necessary to understand the results and where they are relevant and can be generalized. Response: In addition to tables with description of environmental conditions, we added a description of the generalization algorithm which we used to prepare data for simulation.

- page 6835. lines 10-14 are not too informative (and repeats what is said in next paragraph), can be deleted. Response: These lines were deleted.

- how annual climatic variation was accounted or was it ignored? Response: We put some additional explanations to the corresponding chapter.

- page 6835, lines 26-29, not needed. Response: These lines were deleted.

C4317

Results - authors are using terms 'carbon balance' and 'total carbon balance', but it is unclear for a reader what they mean. Following the context they may mean either carbon stock or stock change over un-specified time period. Pls, clarify, and consider using other word. Use term carbon balance only for stock change for certain time period. Response: Since we meant the accumulation of carbon in the system, we changed this term to 'accumulation of carbon'.

- paragraphs started with sentences 'As seen from: : :', 'Figure 5 reveals: : :', ': : : are shown in Fig. 4.' should be modified to sentences that tell what is a result (don't expect a reader to work for that). Response: These sentences were corrected.

Discussion - discussion chapter would be more interesting if started by major result of the present study. Response: We changed the structure of this chapter, taking into account the reviewers' comments.

- In general, it was unclear what was considered as a main results and how they compared to current scientific knowledge. Pls, emphasize main results and compare them to earlier findings (from boreal and temperate forests) Response: We reconsidered the Discussion chapter and added some comparisons with data available from literature.

- page 6840, lines 15-19, this part is more like results. Response: We calculated the increment due to additional nitrogen income in terms of NEP to have the values comparable with these ones reported by Högberg but it looks more appropriate in Discussion.

- page 6840, line 22, do not expect that a reader knows what is reported by Högberg. Pls, tell in more details what he found and how that is relevant in comparison to the present study. Response: We added more details about what was reported in this paper and how our results related to the data reported earlier.

- how reported NPP, respiration and carbon stock changes compare to a range of reported values in the earlier publications from boreal and temperate forests. Response: We added some comparisons with data reported earlier.

C4318

- are the findings on soil carbon stock changes in agreement in earlier publications?  
Response: Yes, we added some comparisons with data reported earlier.

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Interactive comment on Biogeosciences Discuss., 9, 6829, 2012.

C4319