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## ***Interactive comment on “Fate of N in a peatland, Whim bog: N immobilisation in the vegetation and peat, leakage into pore water and losses as N<sub>2</sub>O depend on the form of N” by L. J. Sheppard et al.***

### **Anonymous Referee #2**

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**General comments** The topic of this paper is important since nitrogen fallout is increasing in vast areas due to anthropogenic activities and many types of natural vegetation, like the ombrotrophic peatland ecosystem studied here, are naturally adapted to low nitrogen availability and therefore are vulnerable to increasing nitrogen load. The presented data is based on a long term realistic (reaching ten years at this point) experimental manipulation of a natural peatland system, which gives specific value to the dataset. The long term realistic datasets are necessary when calculations for the progress of global change are made and the data used for modeling purposes. The special novelty of the study is related to the manipulation of the system with different nitrogen forms. In general, the obtained results are significant and clearly presented.

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They clearly show that the peatland ecosystem responds differently depending on the form of the available nitrogen in the fallout and that the response is largely related to changes in vegetation. Furthermore the results indicate that all nitrogen forms as long term effect will compromise carbon sequestration by peatlands. This may have significant effects for the climate change mitigation potential of peatlands that are situated in areas with higher nitrogen fallout. The background of the topic is thoroughly presented, results are clear and the discussion part is extensive and mostly easy to follow. The manuscript is acceptable in its current form. However, I will mention some specific points that could be addressed to further improve the presentation.

Specific comments 1. Introduction, p 8145, last paragraph of intro: In the text you refer several times to an earlier publication (Sheppard et al. 2011) which is presenting data from the same experiment. I suggest that you explain in intro what has been published earlier and how the present data and paper differ from the earlier one (different years, different measurements?).

2. 2.2. s, p 8147, lines 5-6. Is the number of real replicates 4? This is not quite clear from the text.

3. 2.3., p 8148, lines 10-11. How was the area of Eriophorum “clumps” measured?

4. 2.3. p 8148, lines 17-18. What does “proportioned depending on the depth of the hummock” mean. Not quite clear.

5. 2.3. p 8149, lines 8-9. Were the static chambers inserted beforehand and the system allowed to stabilize before the sampling?

6. 3.1. The cover of several species declined. Did you make observations on the visible injuries preceding the death of the plants?

7. 4.2. p 8154, line 16. “accumulation of potentially toxic  $\text{NH}_4^+$  ions”. It would be nice to know something about the mechanisms behind the toxicity. A short addition of this, if possible.

8. 4.3. p8156, lines 3-5. The first sentence of the paragraph is somewhat confusing. I do not quite get the message , and suggest rephrasing this.

9. 4.3. p 8157, line 1. I suggest term “calculations” is missing after emissions.

10. Fig. 2. “slime” is mentioned in the fig and the caption. What does it mean?

11. Fig. 5. In the figure caption add the explanation of bars (%N?) and small squares (BD?)

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**BGD**

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