**Biogeosciences
Discussions**

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$_2$O depend on the form of N" *by* L. J. Sheppard et al.

Anonymous Referee #1

Received and published: 31 August 2012

The authors Sheppard, Leith, Leeson, van Dijk, Field and Levy present data from a unique experiment concerning nitrogen (N-) deposition in peatlands. Comparing the effects of different N-forms on vegetation and their N-retention potential is worth publishing. The lack of data on moisture availability to key species is a major concern to me. Judging from the vegetation it seems a rather dry example of bog vegetation. Secondly, conclusions based on bulk density data are questionable. Thirdly, I was wondering why nitrate and ammonium concentrations were substantially higher in the amm-treatment. The soil moisture N-concentration exceeded data from earlier studies applying similar N-loads. To what extend are loads comparable? The manuscript would benefit from a careful look through. The discussion is rather lengthy when touching the

few N-emission data. Methods are not complete. Graphs are a bit rough.

Minor remarks: p.8144 L18 – sentence not clear, awkward question (manuscript is later on more concerned about N-forms at high deposition rates rather than a neat gradient)

p.8148 L26 – For how many days were syringes left in the field? How was the oxidation of ammonium to nitrate in the syringe prevented when samples were left out for more than 2 days? p.8149 L8 – Information on soil extractions are missing. Most KCl methods are inferior to methods using Strontium chloride or Barium chloride when estimating total cations attach to (peat) soils. L17 – 8 times per year or in two years' time? p.8151 L1 - interesting finding that Sphagnum capillifolium capitula contained > 2% N in the Nitrate treatment while showing rather small differences in cover compared to the control. This finding is in contrast to many N-addition experiments in European bogs. Probably give it more attention as older experiments mostly used ammonium and nitrate combined (even in combination with sulphur) p.8151 L15 - bulk density of surface peats is an important variable for N-storage but difficult to draw conclusions from as it ingrates time-dependent processes. Bulk density is driven by litter burial and compaction following changes in hydraulic pressure and peat decomposition (see literature of Jonathan Price and others).

p.8153 L4 – Why would the authors expect an increase in vegetation cover at Whim bog with increasing N deposition: even in the controls N-availability is supposed to be rather higher due to desiccation of the surface peat (drainage) and N-deposition rates of some 10 kg N/ha/yr p.8154 L5-18 – The assumption that bog vegetation is a priori N-limited seems old-fashioned to me. There's growing evidence in the global literature that P-limitation is common not only at increased N-deposition rates > 10 kg N/ha/yr but also at rates as low as 2 kg N/ha/yr. I would strongly recommend to include this aspect in the discussion/introduction.

p.8157 L7-9 - Good point. Discussion from here on adds little to the article.

p.8159 L9 – also toxic to other bryophytes that are important for N-retention L13 –

spelling should read bypasses L18 – I can only partly agree with this conclusion. The data presented here showed a surprisingly low decrease in the cover of Sphagnum mosses – something like 30% to 20% of total cover. If 30% per cent is supposed to be 'healthy, vital …' why should 20% already be the dusk of carbon sequestration through Sphagnum mosses? Dry spells will probably impose an evenly high or higher stress on the mosses compared N-deposition. I'd like to see more thoughts in the paper questioning whether N-deposition rates are 'overrated' or likely to be overruled by N-form.

Figures: Fig. 1 – no error bars? Fig. 2 – tissue samples of Calluna before it disappeared from the amm-treatment? Fig. 3 – Graphs are difficult to read – make additional Y-axis for the amm-treatment. Or switch to log-scale. It should read amm rather than NH3 in the legend. Last sentence is a bit misleading sounds like 56 plots in the amm-treatment Fig. 4 – lower panel: Large error bars in water extractions raises concerns. What was the background NO3-concentration of the water used for extractions? Fig. 5 – How many samples taken to estimate bulk density of the amm-treatment? The graph doesn't show an error bar. As mentioned earlier, it's not that straightforward to draw conclusions from the upper 10 cm of peat as the base of these samples can vary greatly in age. Plots with reasonably high peat formation rates will reveal much younger compared to plots where vegetation forms peat at low rates.

Good luck amending the present manuscript.

———————————————————