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Interactive comment on “Effects of N and P fertilization on the greenhouse gas exchange in two nutrient-poor peatlands” by M. Lund et al.

Anonymous Referee #1

Received and published: 30 June 2009

General comments: The manuscript presents results from fertilization experiments where short term effects of added N and P on exchange of CO₂, CH₄ and N₂O have been measured. The southern study site, a temperate bog, Fäjemyr, has sevenfold N deposition in comparison to that of the northern (artic) bog, Storflaket. The layout and findings of the present study are not very novel or unexpected. However, it is a nice work and worth of publishing in Biogeosciences. Presentation of the results is not always clear (e.g. comparisons). Please, check the manuscript, especially the results-section, thoroughly for language, clarity and structure.

Spesific comments: Title: Could “...in two nutrient-poor peatlands” replaced with “...in two boreal peatlands with contrasting N deposition rates”? Then it would better raise up the differences between the two sites (which can also be seen in the results).

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Introduction p. 4806 row 5 and Discussion p. 4817 row 23: “Methanogenic bacteria “ should be “methanogenic archaea “ (in the past they were called archaebacteria, but due to their independent evolutionary history and biochemical differences from other forms of life they are now classified as a separate domain in the three-domain system (Archaea, Eukarya, Bacteria).

Introduction p. 4806 rows 12-16: Addition of nitrate can also inhibit methanogenesis e.g. by competition for hydrogen and or due to toxicity of denitrification products (see reviews by R. Conrad 1999 FEMS Microbiology 28, 193-202 and R. Conrad 2007 Advances in Agronomy 96, 261-323 and references in those).

Introduction p 4806 row 25: Please use term “net ecosystem exchange” (defined earlier) instead of “net primary production”

Introduction p 4807 row 2: I would replace “all greenhouse gases” with “three greenhouse gases” because CO₂, CH₄ and N₂O are not the only (although are the most important) greenhouse gases.

Introduction p 4807 rows 8-10. Were the hypotheses written before the study? They happen to be exactly the same than the received results. . . In the last paragraph I would rather point out the aim and originality of this study in comparison to existing knowledge e.g. from previous fertilization experiments conducted in boreal peatlands.

Materials and methods p.4808 chapter 2.3: Were fluxes measured before the fertilization experiments to see if control plots and treated plots were originally similar?

Materials and methods p.4808 row 24: Were the GHG fluxes in Storflaket measured in 2007?

Materials and methods p.4809 row 2: Replace “during” with “before” GHG flux measurements

Materials and methods p.4810 rows 17-19: How many headspace gas samples were taken during the measuring period? What is “significant” flux?

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Materials and methods p.4810 row 11: Requirement of r^2 value of 0.7 or higher can be problematic for N_2O fluxes. For small fluxes r^2 value is small, although the measurement has been successful. Thus, in the case of N_2O fluxes, r^2 limit of 0.7 can lead to a significant data reduction.

Materials and methods p.4810 row 16: Was the data always normally distributed within each test group? Was LN or some other transformation used to achieve the normality?

Materials and methods p.4811 rows 13-14: ANOVA was also used for N_2O fluxes (p.4812 row 25)? What about CH_4 ?

The Results section is not always clear, e.g. p. 4812 row 12-13: increase in what? Page 4812 row 13: “Respiration fluxes” could be replaced with “respiration”. Page 4812 rows 15-16: higher THAN (check the language).

Results p.4812 row 1: Has PFT been determined somewhere?

Results p.4812 row 21: Where (what treatment) and when were the mentioned N_2O peaks measured? Do you have any explanation for those peaks?

Results p.4813 row 6: Does “ CO_2 uptake” mean here both NEE and GPP?

Results p.4813 row 11: “There was a close to significant treatment effect for CH_4 fluxes. . . .” could be formulated more clearly, e.g. “Nitrogen and phosphorus alone slightly increased CH_4 emissions, while their combination decreased CH_4 emissions”.

Results p.4813 row 18: Were both sites always net sources of CH_4 ? If yes, “ CH_4 emission” would be more informative than “ CH_4 fluxes” (term “flux” does not tell the direction and is thus less informative). Methane emissions were surprisingly low, discuss the possible reasons.

Results p. 4814 rows 7-8: I don’t understand what does “average sums” mean here, averages? Are these values for Fäjämyr? Does the data presented in Fig 3 (positive NEE value- \rightarrow C source) include all seasons? That would explain the positive values

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in Fig 3, although in Table 2 (spring, summer and autumn) NEE is always negative (C sink).

Results p.4813 row 23: Temperature and respiration were always correlating. Was this taken account in the measurements (e.g. by randomizing the measurement order of the plots)?

Tables 1 and 2: The legends could be more informative, e.g. Fig.1 Effect of N and P fertilization treatment on CO₂ component fluxes. . .and Fig 2. Seasonal averages for CO₂ component fluxes. . .In table 2, I would prefer means and standard deviations instead of estimated marginal means (no p- values presented, thus RM-ANOVA is not needed here). Please, explain abbreviations and meaning of positive/negative sign as a footnote. Could table 1 and 2 to be merged?

Figure 1: Is this necessary? This map can be derived from the internet if needed.

Figures 1-3: Could the symbols/bars be made more clearly visible in black-and-white printout.

Figure 2. It is said here (not in materials and methods) that nutrients were added just before the GHG flux measurements were conducted on day 1. Can the peak on respiration during the first day (Storflaket) result from increased soil moisture content due to the irrigation? To me it seems that respiration has been induced also in the control plots of Storflaket.

Discussion p.4816 row 2: HAVE an additional

Discussion p.4816 row 4: . . .to CO₂ in the aerobic zone OF PEAT PROFILE.

Discussion p.4817 rows 24-25: “. . .strong possibility for increased N₂O emissions with increased N availability. Is this conclusion justified, because the N₂O fluxes were minor and there were no statistically significant differences between the treatments (p. 4812rows 20-25)?

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Conclusions p.4818 row 5: What do these complex and nonlinear responses in CH₄ exchange mean?

Reference list: When referring to Persson et al 2004 it is probably better to refer to www.smhi.se where the mentioned pdf can be found. The given internet address did not work.

Interactive comment on Biogeosciences Discuss., 6, 4803, 2009.

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6, C958–C962, 2009

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