

Interactive comment on “Stand age and tree species affect N₂O and CH₄ exchange from afforested soils” by J. R. Christiansen and P. Gundersen

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Specific comments p. 5735, l. 15: It is true that the pressure effect can affect the diffusive flux. At least it has been shown for CO₂. For N₂O: the pressure effect on chamber headspace concentration should give rise to a non-linear development of gas concentrations because you would draw N₂O rich air out of the soil enriching the headspace more than diffusion alone would suggest (see Christiansen et al. 2011, Plant Soil, 343, p. 171–183). However, we did not observe this phenomena in our chambers and therefore do not attribute it to have a large effect in our case. Furthermore, the pressure effect by manual sampling has mostly been attributed to CO₂ with much higher fluxes.

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It might be the periodic depressurisation can cause mass flow, but the enrichment is too low to be detected in our system. I am reluctant to interpret my data against the supposed depressurisation for two reasons: 1) we did not observe concentration development that could be attributed to depressurisation and 2) we did not have pressure measurements in the headspace to confirm that it was actually taking place. However, I have added the following sentence at p. 5735, l. 21: “Pressure changes in a manually sampled chamber headspace has been reported to lead to overestimation of the estimated diffusive flux (Bekku et al. 1995), but we did not observe any changes in headspace concentrations that could be attributed to mass flow caused by depressurisation of the chamber headspace.” p. 5736, l. 2–6: The sentence with “depth segments” has been deleted p. 5736, l. 8–9: In principle we do not have a guarantee that N concentration did not change during storage in the refrigerator. However, two factors minimise the likelihood of transformations: 1) filtering through 0.45 µm filter effectively sterilises the sample because bacteria are caught and 2) the temperature of 4–5°C has earlier in our laboratory been shown in experiments to be sufficient for storage of extracts for periods of 1–2 days without the risk of transformation. p. 5737, l. 18: We log-transformed in order to fulfil the assumptions of the statistical method, repeated ANOVA. We obtained the same results with original data, albeit p-values were biased because original data violated the assumptions of the statistical method. I have added a sentence specifically stating why we log-transformed: “Data were log-transformed to comply with the assumptions of the statistical test, variance homogeneity between groups and normal distribution of residuals.” p. 5738, l. 16–20: done p. 5742, l. 19–20: “CH₄ uptake” has been replaced with “CH₄ fluxes” effectively meaning that CH₄ uptake increases with decreasing bulk density p. 5748, l. 22–23: this has been changed to: “However, in the period we measured, 15–17 years after planting N₂O emissions were low as well as the CH₄ oxidation rates.” p. 5748, l. 26–27: this has been clarified. p. 5749, l. 3–5: this has been removed from the conclusion and included in the discussion with references to support our view p. 5749, l. 6: done

Technical corrections p. 5730, l. 20: done p. 5730, l. 21: done p. 5733, l. 19–20:

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this has been corrected. Instead of writing pedunculate oak at every mentioning of this tree species I have only written oak. The scientific names are now also provided in the abstract as well as in the introduction. p. 5739, l. 9: done p. 5740, l. 23: done p. 5741, l. 2: done p. 5743, l. 26: done p. 5745, l. 2: done p. 5745, l. 6: done p. 5745, l. 8: This entire paragraph has been rewritten to reduce the discussion on the effect of C/N ratio p. 5748, l. 6: done p. 5749, l. 1-3: The sentence has been rephrased to: "Thus, we conclude that during the first four decades after planting because of 1) increased N availability in the soil due to lower N demand from trees after four decades since afforestation supports higher N₂O emission from the soil in both oak and Norway spruce and 2) the soil bulk density decreases with time under both forest types enhancing the exchange of N₂O to the atmosphere and oxidation of CH₄ in the soil."

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