

The study presents measurements of nitric oxide (NO), ammonia (NH₃), carbon monoxide (CO), hydrogen (H₂), volatile organic compounds (VOCs), CO₂, methane (CH₄), and nitrous oxide (N₂O) from control and ERW-treated soils collected from arable, grassland, broadleaf forest, and conifer forest field trials in the UK. Overall, the effects of ERW on trace gas fluxes varied among gases and soil types, with no consistent response across all sites. Significant treatment effects included lower CO₂ emissions in both forest soils, greater CH₄ uptake in broadleaf forest soil, higher NO emissions in grassland soil, and changes in CO and hydrocarbon fluxes in forest soils. NH₃ and H₂ showed no significant treatment effects, and no individual VOC remained significant after correction for multiple testing.

I enjoyed reading the manuscript. One of its main strengths is the broad range of gases considered, beyond the greenhouse gases that are more commonly measured in ERW studies. The results also show that trace gas responses to ERW can be quite variable among land uses and gas species. I agree with the authors that longer-term field measurements, together with more detailed soil and microbial characterization, will be important for understanding how these responses develop as the applied material continues to weather. The authors also acknowledge several important limitations, including the snapshot nature of the measurements and differences among sites in application history and trial duration. I have the following comments that I hope will help improve the manuscript.

We thank the reviewer for their time reading the manuscript and are very grateful for these constructive comments.

Line 106–107: Please clarify why soil subsamples from the three field subplots were pooled into a single composite sample for each treatment. The same issue also applies to the grassland and forest soils. Once the field replicates are pooled, the subsequently prepared laboratory chambers are subsamples of the same composite sample rather than independent field replicates. How was this accounted for in the statistical analysis? It would also be helpful to clarify whether the treatment comparisons should be interpreted as comparisons between composite samples rather than replicated field-level treatment effects.

Subsamples from field subplots were pooled into composite samples because we wanted to consider the field sites as a whole rather than look at variability between subplots, especially since the soils are being manipulated considerably from their original field condition (through sieving, drying, rewetting). We wanted to capture the variability in soil gas fluxes as this can be high even in composite replicates (e.g. Abis et al., 2018). The treatment comparisons are comparisons between composite samples- we will add additional clarification for this in section 2.6 Data analysis.

Line 243–244: Please check the definition of the boxplot whiskers, also in the other figure captions. The caption states that the whiskers extend by one interquartile range (IQR) from Q1 or Q3, whereas the conventional Tukey boxplot uses $1.5 \times \text{IQR}$. Please confirm which definition was actually used in the plotting code and revise the caption if needed.

Thank you for highlighting this error in the captions for boxplots – the conventional 1.5 x IQR was indeed used for the plotting. The relevant figure captions have now been updated to say ‘whiskers show quartile 1 or 3 plus or minus 1.5 x interquartile range’.

Line 307–308: I am not sure that “hydrocarbon uptake was greater under ERW, particularly in conifer soils ($p < 0.05$)” is consistent with Table S3. For conifer soil, the significant difference appears to be in net hydrocarbon flux ($p = 0.014$), while the uptake component itself is not significant ($p = 0.211$). Should “uptake” be replaced by “net flux” here? The following statement on higher hydrocarbon emissions in broadleaf control soils is supported by Table S3 ($p = 0.028$), although both treatments show net hydrocarbon uptake in Figure 5.

Thank you for highlighting this. We agree that the statement is not consistent and have updated the sentence for accuracy and clarity:

‘The principal exception was in forest soils, where net hydrocarbon uptake was greater under ERW in conifer soils ($p < 0.05$), while hydrocarbon emissions were significantly higher in broadleaf control soils ($p < 0.05$).’

Line 441–442: Please check the statement that naphthalene emission increased with increasing soil pH. ERW increased soil pH, but naphthalene emissions were lower in the ERW-treated forest soils. If higher pH reduces naphthalene sorption, one would instead expect this to increase its potential emission. I suspect that “increasing emission” may need to be “decreasing emission.” This would also be consistent with the explanation given in the next sentence, where increased microbial degradation at higher pH is suggested as a reason for lower naphthalene emissions.

Thank you for finding this error – the statement was indeed meant to read ‘decreasing emission of naphthalene with an increased soil pH’ and has been corrected in the text.

Line 454–457: The two explanations proposed for the lower monoterpene emissions under ERW could be explained more clearly. Litter decomposition is itself largely mediated by microorganisms, so a decrease in litter decomposition with increasing pH may seem inconsistent with the next suggestion that increasing pH enhances microbial activity and monoterpene metabolism. These two mechanisms may involve different microbial groups or processes, but that distinction is not clear as currently written. Please clarify how these two explanations could operate, or provide additional support for them.

Thank you for pointing out this lack of clarity. We have added additional explanation and support to the litter decomposition process, and rephrased the monoterpene metabolism explanation to make it a more obviously distinct explanation.

‘This observation could, therefore, result from a decreased rate of litter decomposition with the increased soil pH leading to decreased volatilisation of the monoterpenes from the needle storage pools. Reductions in litter composition from increased soil pH due to liming and wollastonite addition have been observed (DeForest, 2019; McCay et al., 2013; Melvin et al., 2013; Yan et al., 2026), albeit inconsistently (Forey et al., 2015; Marschner and Waldemar Wilczynski, 1991). A suggested mechanism of this is the

increased availability of P reducing the need of microorganisms to acquire P through litter decomposition (DeForest, 2019). Alternatively, if there is increased microbial activity associated with the increased soil pH, there may be increased microbial metabolism of the monoterpenes which therefore decreases net emissions from the ERW samples.'

References:

Abis, L., Loubet, B., Ciuraru, R., Lafouge, F., Dequiedt, S., Houot, S., Maron, P. A., and Bourgeteau-Sadet, S.: Profiles of volatile organic compound emissions from soils amended with organic waste products, *Sci. Total Environ.*, 636, 1333–1343, <https://doi.org/10.1016/j.scitotenv.2018.04.232>, 2018.

DeForest, J. L.: Chronic phosphorus enrichment and elevated pH suppresses *Quercus* spp. leaf litter decomposition in a temperate forest, *Soil Biol. Biochem.*, 135, 206–212, <https://doi.org/10.1016/j.soilbio.2019.05.005>, 2019.

Forey, E., Trap, J., and Aubert, M.: Liming impacts *Fagus sylvatica* leaf traits and litter decomposition 25 years after amendment, *For. Ecol. Manag.*, 353, 67–76, <https://doi.org/10.1016/j.foreco.2015.03.050>, 2015.

Marschner, B. and Waldemar Wilczynski, A.: The effect of liming on quantity and chemical composition of soil organic matter in a pine forest in Berlin, Germany, *Plant Soil*, 137, 229–236, <https://doi.org/10.1007/BF00011201>, 1991.

McCay, T. S., Cardelús, C. L., and Neatrour, M. A.: Rate of litter decay and litter macroinvertebrates in limed and unlimed forests of the Adirondack Mountains, USA, *For. Ecol. Manag.*, 304, 254–260, <https://doi.org/10.1016/j.foreco.2013.05.010>, 2013.

Melvin, A. M., Lichstein, J. W., and Goodale, C. L.: Forest liming increases forest floor carbon and nitrogen stocks in a mixed hardwood forest, *Ecol. Appl.*, 23, 1962–1975, <https://doi.org/10.1890/13-0274.1>, 2013.

Yan, Y., Yin, L., Li, R., Deng, B., Yang, Q., Chen, L., Zhang, Z., Wang, S., and Zhang, W.: How does wollastonite addition influence litter decomposition in a subtropical forest? The role of litter quality and soil fauna, *Soil Biol. Biochem.*, 219, 110174, <https://doi.org/10.1016/j.soilbio.2026.110174>, 2026.