

Reply to anonymous referee #1

We sincerely thank the reviewer for the constructive evaluation of our manuscript and for recognising the relevance of developing these emission factors. We particularly appreciate the comments highlighting aspects of the manuscript that could benefit from improvement, especially by elaborating on data inclusion and quality control procedures. Our point-by-point responses to the reviewer's comments are provided below.

Comment by anonymous Referee #1	Author reply
The manuscript from Butlers et al. describes ghg-emission measurements from forests in the temperate climate zone especially for Latvia and surrounding countries. With the help from this collected data, the authors derived emission factors for organic soils under forests for Latvia. This emission factors are of high relevance of ghg reporting since these factors are missing for many countries. Of course, emission factors presented in this paper have to be improved, but it is a first step. Therefore, the topic of that paper is of high relevance for the readers of the journal. The authors also conclude correctly, that measurements and emissions factors for organic soils under forest for the temperate climate zone are missing.	We agree that improving emission factors is a continuous process as new measurements become available. We consider the present synthesis an important intermediate step toward moving from static emission factors towards more dynamic approaches for estimating soil GHG emissions that can better account for environmental conditions and site-specific variability.
The title of the manuscript does not describe the content well. It should contain that the manuscript is about to derive emission factors for organic soils under forest from ghg emission measurements. By reading the current title, readers may think it is about differences of ghg emissions in winter and summer or under changing climate.	We originally attempted a more engaging title rather than a generic descriptive one, but we agree that the current title may not sufficiently reflect the manuscript's main focus. We can therefore revise the title to make the derivation and synthesis of emission factors more explicit. Possible options are: • “Synthesis of greenhouse gas emission factors for forest organic soils in the Köppen–Geiger Dfb climate zone”

	• Or alternatively: “Synthesis of greenhouse gas emission factors for forest organic soils in the Köppen–Geiger Dfb climate zone with cold winters, warm summers and no dry season.”
Further the quality control of the used studies should be described in more detail.	We agree that the quality-control procedure can be described more explicitly: quality control followed the approach described by Jauhiainen et al. (2023), as the present synthesis builds substantially on the dataset compiled in that study where only peer-reviewed studies providing sufficient information to derive annual soil GHG flux estimates were considered. Where required, the originally reported fluxes were harmonised to annual soil GHG balances by applying supplementary procedures such as annualization of warm-season measurements, separation of heterotrophic from total soil respiration, or accounting for litter inputs. Detailed descriptions of these study-specific adjustments are provided by Jauhiainen et al. (2023), particularly in their Table S1. Individual estimates were weighted according to their relative reliability. A weight of 1.0 was assigned to estimates without major identified limitations, whereas a weight of 0.5 was used where uncertainty was considered higher, for example because of limited spatial replication or greater reliance on supplementary data when deriving the annual flux estimate. For annual and annualised flux data from Jauhiainen et al. (2023), the original reliability weights were retained. Additional studies compiled for the present synthesis were assigned a weight of 1.0 as the reported emission estimates were used directly without additional data manipulation. Therefore, no additional manipulation of the original data was performed within the scope of the present synthesis. We

	synthesised emission factors as reported in the published studies. At the time of preprint submission, part of the dataset was still unpublished and was therefore described as unpublished data. These data have since been published in a peer-reviewed article. Consequently, all emission factors included in the synthesis are now derived from peer-reviewed publications.
In line 60 the authors mention, that some of the studies have not described vegetation. The question is, if such studies can be used to derive emission factors for organic soils under forest.	We appreciate this comment, we can clarify this point in the revised manuscript. We did not consider the absence of information on vegetation (dominant tree species) to be sufficient reason to exclude a study if the site was clearly identified as forest land and the reported flux estimate was otherwise suitable for inclusion. However, we did not use such estimates when deriving tree-species-specific emission factors. We included them only in the synthesis of general forest-land emission factors, independent of tree species. This allowed us to retain relevant forest GHG data without introducing unsupported assumptions about vegetation composition.
Many studies did not give soil properties. How do deal with that? Where are the borders the authors decided not to take a study into calculation for emission factors? What quality requirements were applied to the measurement systems?	Soil-property measurements were not used as a mandatory inclusion criterion for the synthesis. Inclusion was instead based on the quality-assessment framework described by Jauhiainen et al. (2023), including whether the estimate could be clearly attributed to forest land, whether an annual estimate is provided, and whether soil nutrient status was indicated. We therefore did not exclude otherwise suitable emission estimates solely because detailed soil analytical data were not reported. We believe these concerns can be sufficiently addressed by the expanding description of the quality-control and study-inclusion procedure as described above.

Studies differ in length and frequency of measurements.	We can clarify in the manuscript that only annualised GHG flux estimates were included in the synthesis. We did not perform annualization in the present study. Where original studies reported only seasonal measurements, Jauhiainen et al. (2023) had already annualised them using peer-reviewed procedures and supporting data. Differences in study duration and temporal coverage were accounted for through the reliability weighting scheme described by Jauhiainen et al. (2023). We retained the weights originally assigned by Jauhiainen et al. (2023). For additional data included in the present synthesis, we assigned a weight of 1.0 because no data manipulation was required and the reported values represented annual net soil GHG fluxes.
The authors should explain, which standards were applied to the different studies.	The data processing applied to the original measurements, where required, is described in the Supplementary Material of Jauhiainen et al. (2023). In the present synthesis, we did not perform any additional manipulation of the underlying data; we used the published annualised GHG emission estimates as reported in the source studies. We believe we can address this issue by elaborating on the inclusion procedure described above.
Which flux type was considered for the CO ₂ fluxes? NEE or Reco?	The data obtained from the original sources represent net soil emissions, i.e. the soil CO ₂ balance (sum of heterotrophic respiration C losses and C input to soil by litter) rather than ecosystem-scale NEE. We can clarify this explicitly in the manuscript around line 55.
In line 220 the authors mention that varying study design of the different studies lead to biases within the results. The question which has to be answered is, is it better to include all studies or use	Only data meeting the specified inclusion and quality criteria were included in the synthesis, as described above. We believe this concern will be addressed by providing a more detailed description of the study-selection, inclusion, and

only the few studies which meets all quality criteria?	quality-control criteria in the revised manuscript as described above.
In units' year should be abbreviated with a.	To retain consistency with our previous articles published by Biogesociences, we would like to retain year ⁻¹ .
In line 133 hyphen is used instead of small - at -4,55. Line 318 there is an error with formatting. In the reference list gases should be subscripted (e.g., N ₂ O, CO ₂ ...). The reference Latvia's National Inventory Document in line 449 is not mentioned in the text.	Thank you for pointing out these issues. We can address them during revision of the manuscript.