

Dear Editor,

We would like to thank you for the feedback and support throughout the reviewing process. We have considered the points suggested by the reviewer and revised the manuscript accordingly. Please find our detailed point-by-point responses below. The original comments are in black and our response is in blue. The line numbers refer to the manuscript without tracked changes.

In addition to these changes, we noticed a small mistake in the caption for Table S4 which is now corrected in the revised Supplement.

Best regards,

Justine Trémeau and the co-authors

The authors have done a great job with the revision and the manuscript has clearly improved. I only have a few minor points.

I would still provide a short comparison of average growing season in-situ fluxes (standardized to a common light and temperature level) to support your model-derived annual CO₂ balance comparison which is quite uncertain. I understand that the measurements are sparse but there is value in confirming your findings related to the differences between lawns and meadows in this way too.

We thank the reviewer for the feedback and the suggestion! We included additional estimates for mean daily gross primary productivity (GPP) for the intensive sites. The approach involved calculating this metric over two consecutive weeks, specifically during periods when high-quality measurements were obtained across all intensive sites. The estimates were derived by utilizing the mean of the fitted light response parameters for each site, coupled with the observed photosynthetically active radiation (PAR) values over the two-week intervals. This analysis spanned nine such distinct two-week periods, spanning from May to early August in 2021-2022. The calculation of the mean respiration involved considering all observed respiration rates within the May to August timeframe. We encountered challenges in normalizing these rates using factors such as temperature or leaf area index, as the observed values did not exhibit a clear dependence on any of these individual drivers alone.

Consequently, the ranking of mean daily photosynthesis (GPP) across the nine distinct two-week periods in various intensive sites aligned closely with the order established through ecosystem modelling. Remarkably, the distribution between daily and seasonal photosynthesis exhibited substantial similarity across the sites, providing additional affirmation for the estimated photosynthetic production in these distinct test areas. Conversely, the sequence of momentary TER diverged from the patterns observed in annual means, reinforcing the notion that TER estimates carry higher levels of uncertainty. However, we exercise caution in asserting that the mean observed values are inherently more reliable than the ones by ecosystem modelling, given the limited number of replicates and the variability in environmental factors such as temperature, moisture conditions, and plant activity levels. These variables are acknowledged to fluctuate significantly, some even within a day, thereby potentially introducing bias into the resulting TER.

Additional paragraphs about this exercise can be found at the end of sections 2.2.3 (Methods, L273-277) and 3.2.1 (Results, L459-462) and in the first and especially second paragraph in section 4.1 (L604-609).

In the abstract and discussion, I would also state clearly that the modelled annual balances are quite uncertain and TER might be underestimated (and thus net uptake overestimated), to make sure that the reader does not simply take the annual estimates without considering its uncertainties.

We modified the abstract by removing the actual NEE values to avoid the indicated scenario and instead, added the order of the GPP estimates that are more certain. Now, the revised part reads as follows (L26-30),

“The mean photosynthetic production (GPP) of the irrigated lawn and mesic meadow was the highest in this study, whereas the dry meadow had the lowest GPP. The studied lawns were stronger C sinks, compared to the meadows. However, the net exchange values were uncertain as the soils were not in equilibrium with the vegetation at all sites, which is common for urban habitats, and modeling the heterotrophic emissions was therefore challenging.”

In the discussion, we already had a sentence about the uncertainty in the NEE estimates but to make it more clear, we highlighted it a bit more (602) and together with the new exercise considering TER uncertainty (L604-609), we find it very clear for the reader that the NEE values are uncertain too.

I would also add some discussion about CH₄ and N₂O fluxes to the manuscript – right now these results are not really interpreted.

As recommended, we have incorporated additional discussion on N₂O and CH₄ fluxes in the manuscript. The previous version had a relatively brief discussion on this matter, and we have extended it in response to the feedback received. It can be found on the lines 656-674 in the revised manuscript.

I would recommend the authors to carefully check the language of the manuscript once more. There are some sentences that could be improved (e.g. line 213 “total” mentioned three times, sometimes past tense, sometimes present in the methods/results).

We have carefully checked the language and revised the tense where necessary. Now, all methods and the results of this study are in the past tense, as well as the site descriptions which were earlier in the present tense. During the language check, we also smoothed the mentioned sentence and dropped 2/3 of the occurrences of “total”.

I would also consider being careful with the text related to species richness or biodiversity (because you are not studying that here anymore) and using words like shifting vegetation types instead.

We thoroughly reviewed all sections where we used the phrases species richness or biodiversity. We found that whenever we referred to our results, these terms were not used but more appropriate ones such as vegetation types. These terms were used when framing the study, such as the need to increase biodiversity where transforming meadows to lawns is one possibility. However, we changed most of these and used terms like *species and ecosystems* for biodiversity, *vegetation* for species richness and *environmental degradation* for biodiversity loss. Most of the changes took place in the abstract, first paragraph of the introduction and conclusions. In addition, we further clarified the terminology in the related research and discussion sections 3.5 and 4.3.

L26: Unclear what the two annual C balances refer to – different years?

Those values referred to the different lawns and meadows studied but as a response to the previous comment about the uncertainty in estimated NEE (“in the abstract and discussion...”), we removed the values from the revised manuscript. It is noteworthy that these values were included in the

abstract based on the comments during the first review round but now, in our opinion, it seems better not to include them there due to their overall uncertainty also raised during this round of comments.