

Authors

First, we would like to thank the editor and referees for the time they have invested in this review. All comments and corrections have been truly useful in improving our manuscript.

Below, we respond to the comments made by referee #2 in this second round of review. We have included the referee's comments in black, followed immediately below by our response to each of them in blue.

Specific comments:

In the new version of the manuscript, the most important plant species in the sown mixtures (and the most common species already present in the grassland) has been listed, which gives a better understanding of the grassland ecosystem investigated. The point mentioned in the rebuttal, that the species in the sown mixtures have “relatively shallow root systems” would be beneficial to include in the manuscript (e.g., in line 166 after “... (Teixeira et al., 2015).”. This would help the reader to better understand the implication of the legume sowing in this study context and why the effects of legume sowing are assumed to mainly affect the upper topsoil layer. It would also help to justify the relatively shallow sampling depth.

Answer: We appreciate the suggestion and have included a mention of the 'relatively shallow root systems' in the proposed location (line 166 in the new version).

Lines 330-332. I agree with the comment of reviewer 1 on the first version of the manuscript, that it was not clearly described what was (the difference between) direct and indirect effects. This was shortly developed in the rebuttal by the authors but not inserted in the manuscript as far as I can see. The rebuttal was: “Lines 329-331 specify the direct and indirect (through effects on other variables) paths through which the effects of the variables can be transmitted.” For clarity it would benefit the manuscript if this rebuttal is incorporated into the manuscript to make it clear for the reader how direct and indirect effects are distinguished, e.g., in connection with line 330-332.”

Answer: Following your suggestion, we have reworded those lines of the manuscript as follows:

“These models assess the extent to which a defined structure of causal relationships between variables fits the actual correlations in the data. In this causal structure, direct effects describe the influence of one variable on another without intermediaries, whereas indirect effects occur when a variable affects another through its impact on a third variable.”

This paragraph is now found between lines 330–333.

Line 517-519: “However, rhizodeposition, which is closely linked to root biomass, has been shown to promote MAOC formation over POC (Berenstecher et al., 2023; Villarino et al., 2021).”. I appreciate the notion that rhizodeposition is an important driver of MAOC

formation. However, higher total root biomass does not guarantee an increase in rhizodeposition quantity, which depends on soil nutrient fertility and plant species identity and root traits (e.g., Mortensen et al., 2025b for grassland systems; Engedal et al., 2023 for cover crop mixtures). Therefore, I suggest rewording “linked to root biomass” to “linked to root growth and turnover”.

- Mortensen, E. Ø., Abalos, D. & Rasmussen, J. 2025b. Well-designed multi-species grassland mixtures enhance both soil C inputs and aboveground productivity. *Agriculture, Ecosystems and Environment* 385: 109578. DOI: 10.1016/j.agee.2025.109578.
- Engedal T., Magid J., Hansen V., Rasmussen J., Sorensen H., Stoumann Jensen L. 2023. Cover crop root morphology rather than quality controls the fate of root and rhizodeposition C into distinct soil C pools. *Global Change Biology* 29:5677-5690. DOI: 10.1111/gcb.16870.

Answer: Thank you for this observation. Following your suggestion, we have rewritten the sentence you indicated, now located between lines 519-521 of the new version. We have also added the reference to Engedal et al. (2023) at the end of that same sentence, as it is particularly relevant to the aspects discussed there.

Wording/typos:

- Line 20 and line 51: Change from “legumes sowing” to “legume sowing” to align with the rest of the manuscript.
- Line 35: Change from “Legume enrichment” to “legume sowing” to be consistent.
- Line 39-30: It may be a matter of taste, but I much prefer the original way of keeping (SOM) and (White, 2000) in two separate parentheses, since the citation (White, 2000) refers to the entire preceding sentence. It is clearer and more readable when it sits outside the parenthetical abbreviation (SOM).
- Line 110: As the verb relates back to vegetation characteristics (plural), change to “... have been shown to positively influence SOC stocks”
- Line 168: Correct spelling is: “Farmers sow...”
- Line 370: Do you mean “SOC, MAOC and POC stocks” (instead of “PC”)?
- Line 387: Move “higher” until after the last parenthesis, thus: “...15% (in the case of POC and MAOC) and 14% (for SOC stocks) higher than mean values...”
- Line 394: Change “continuous grazing” to “Ct” at least in this sentence to keep some consistency in terms of when the introduced abbreviations are used.
- Line 459: Please consider if “maximum capacity” is the adequate term here, or if “effective capacity” should be used, following Fig. 2 in Georgiou et al. (2025) cited earlier.
- Line 499: Likely you intend to write “on” here: “Part of the effects of plant traits on SOC”?
- Line 579: Delete “would” in “Our results would are in line...”.
- Line 595: Should this sub-heading have a number like the others, e.g., 4.6?

- Line 610-611: I am not following the meaning of “far from” in this context. As I read the sentence, the authors state that “abandoning of grazing is far from functioning as a tool for ecological restoration”. Is this really the intention, and if so, I think this is beyond the scope of the paper (ecological restoration in a broader sense has not been discussed in the paper). Do you mean “apart from”? Please make this clear – or simply delete this part of the sentence “; far from functioning as a tool for ecological restoration, ”.

Answer: We really appreciate the effort made by reviewer 2 in correcting the errors in this section. All the errors pointed out have been corrected in the new version of the manuscript.