

Authors

We truly appreciate the effort and time devoted by topic editor on our manuscript. We believe her comments have been very pertinent and that they have contributed to improving the manuscript. We have implemented all suggestions and accepted the proposed changes. These comments are shown below in black and our responses in blue.

1. Fig 5 — Correct the typed equation which should read 0.86 ± 0.09 . I would also suggest adding global “maximum observed” or similar to MAOC in this location, so that it is more clear.

Answer: Thank you for your observation. We have modified the equation in the figure according to your suggestion to make it clearer.

2. Lines 455-462 — Is it certain that MAOC accrual in the plateau of Fig. 3b is limited by the amount of C inputs, or is it driven by the broader environmental and climatic conditions? The fact that it plateaus as a function of SOC might suggest the latter, and this is also how the effective capacity is defined in Table 1 and Fig. 4 of Georgiou et al. 2025. In this case, reaching this effective capacity (although not technically MAOC saturation) may still act to limit accrual until the other limitations are relieved, and could be important to consider when planning management strategies.

Answer: We agree that our interpretation of the results in that section could be improved. We greatly appreciate your comment and the reflection it has prompted. We have modified the entire paragraph as follows:

“Carbon concentrations in the fine soil fraction (clay + silt) of the studied grasslands were well below the maximum C capacity observed in previous studies (Cotrufo et al., 2019a; Georgiou et al., 2022). However, we detected a certain limit to MAOC accumulation, as its content remained stable above SOC contents of 30 g/kg-1 and stayed below 20 g kg-1 even when SOC content exceeded 60 g kg-1, following a saturation curve (Fig. 3b). This result suggests that MAOC accrual in this system is mainly limited by environmental conditions rather than by the mineralogical capacity of the soil or the amount of inputs. In this sense, the maximum C content in the clay+silt fraction observed in this work (around 17 g C/kg clay+silt) likely represent the effective capacity of the ecosystem (sensu Georgiou et al., 2025) to stabilize C under current environmental conditions. Although this constraint may limit management opportunities to increase MAOC stocks through management, most plots had MAOC contents well below this effective capacity, indicating substantial room for improvement. Indeed, we observed significant management effects on the MAOC fraction. Importantly, management decisions should not rely solely on MAOC accumulation, as POC can also persist for long periods of time, acts as a precursor of MAOC, and has no known upper limit for accumulation (Angst et al., 2023).”

3. Consider expanding the conclusions slightly into a final paragraph, rather than three separate points/sentences as it is now.

Answer: We have followed your suggestion and merged those sentences and slightly expanded the conclusions as shown below:

“Implementing rotational grazing can increase both topsoil POC and MAOC stocks, whereas the abandonment of grazing may reduce the carbon storage capacity of Mediterranean grasslands. We found that most of these management effects were mediated by changes in soil nutrients stocks, microbial communities and vegetation morpho-chemical traits, which were, in turn, the main drivers of changes in SOC stocks and fractions. Specifically, more fertile soils with higher microbial biomass, lower Gram+/Gram- ratios, and more productive plant communities, with acquisitive traits and nitrogen-rich tissues, promoted the accrual of both POC and MAOC. In this regard, and as a novelty, this work has also proven the usefulness of plant functional traits as tools for the study of plant-soil interactions and SOC formation dynamics. Considering global change trends, our findings suggest a potential loss of soil carbon in the studied grasslands over the coming decades due to grazing abandonment and increasing temperatures. Selecting management approaches that mitigate or counteract these losses is vital to maintaining the fertility, productivity and functioning of semi-arid grasslands.”