Our replies to all comments are shown in blue and the original editor's comments are shown in black.

EC1: 'Comment on egusphere-2025-3542', Olivier Evrard, 24 Nov 2025

This review manuscript provides a synthesis on data published regarding soil erosion in Mediterranean olive groves. Overall, the text is rather concise, well written and of interest to the international research community.

We thank the Editor for these suggestions to improve the paper's reach and context.

In my opinion, the database compiled by the authors should be made accessible in open access (I apologize if it is; then it means that I missed the link).

We will upload the full dataset to a repository (e.g., Zenodo) and provide the DOI in the "Data Availability" statement.

The manuscript would also gain from further contextualization (i.e., about what is considered as 'Mediterranean' whether the climate or the region is investigated; about the surface covered by olive groves in the area under investigation; about the implementation of conservation techniques under olive groves – e.g. are there agricultural statistics available?)

We agree that "Mediterranean" can be ambiguous. We define the study scope as regions with a Mediterranean climate (Köppen Csa/Csb), primarily focusing on the Mediterranean basin where >95% of olive production occurs.

We agree that providing data on the adoption rates of conservation practices adds crucial context. While harmonized statistics for the entire Mediterranean basin are scarce, national data from major producers like Spain indicate that adoption remains low despite the known benefits. We will add a sentence in the Introduction citing recent agricultural statistics (from the Spanish Ministry of Agriculture). We explicitly state that while conservation agriculture is promoted, over 50% of the olive growing area in Spain does not have a vegetation cover.

It would also gain from a general bibliometric analysis: what was searched for in the literature? Using which tools and relying on which queries? General information about the study locations (a map would be useful), the journals in which data was published, etc. would also be useful.

We will include a map showing the location of the reviewed studies.

The literature search targeted studies on soil erosion processes in olive-growing systems published between 1985 and 2024. The analysis utilized two complementary databases, Scopus and CAB Abstracts. The search relied on Boolean queries that combined three key components: general soil erosion terms, olive-specific terminology (e.g., "olive orchard", "olive grove", "Olea europaea"), and a comprehensive list of specific erosion processes (e.g., "water erosion", "tillage erosion", "soil loss"). We will add an explanation of this analysis in the revised manuscript.

Detailed comments

LL.53-60: could these erosion rates be converted into equivalent soil depth loss by erosion to further evaluate whether they are meaningful?

We have opted to retain mass-based units rather than converting to depth (mm) to avoid misinterpretation. Mediterranean erosion is often driven by concentrated flow (rills/gullies), making an "average depth" physically misleading. Furthermore, conversion introduces uncertainty regarding bulk density, and retaining mass units ensures direct comparability with the European tolerable soil loss thresholds cited in the manuscript.

LL.92-100 this text is interesting but does it rely on any reference?

We will add the following references:

de Vente, J., Poesen, J., 2005. Predicting soil erosion and sediment yield at the basin scale: Scale issues and semi-quantitative models. Earth-Science Reviews 71, 95-125. https://doi.org/10.1016/j.earscirev.2005.02.002

Boix-Fayos, C., Martínez-Mena, M., Arnau-Rosalén, E., Calvo-Cases, A., Castillo, V., Albaladejo, J., 2006. Measuring soil erosion by field plots: Understanding the sources of variation. Earth-Science Reviews 78, 267-285 https://doi.org/10.1016/j.earscirev.2006.05.005

L.145 a map of all study sites would be helpful (maybe all regions of Spain are not equally covered?) – a general bibliometric evaluation would be useful as well.

We agree, see above.

Table 2; is it all data available from the literature or did you make a selection? If so, based on which criteria?

The dataset derives from a systematic review of 1,385 records retrieved from Scopus and CAB Abstracts. Selection was not arbitrary but followed a rigorous screening protocol based on three key criteria:

1. Studies reporting specific erosion rates rather than qualitative descriptions.
2. articles providing essential environmental variables (slope, texture, vegetation cover) required for the regression analysis.
3. Primary field or modelling research conducted in Mediterranean olive orchards.

As mentioned above we will add an explanation to the revised manuscript.

L.176 about ‘tolerable soil loss’: maybe this should be further discussed in your manuscript (in the final thoughts?) given you are making strong suggestions to go further towards sustainability.

We fully agree that the concept of tolerable soil loss is the necessary quantitative benchmark for defining "sustainability." Without this reference point, terms like "high" or "severe" erosion remain subjective.

We will highlight that even the "non-alarmist" average gross soil loss rates measured in runoff plots (5.5 t/ha/y) exceed the upper limit of tolerable loss by nearly 400%. This quantitative comparison provides the necessary justification for our strong recommendations: conservation practices are not merely an optional improvement but a fundamental requirement to prevent irreversible soil depletion.

L.195… is there always a validation in the modelling studies compiled? If not, what proportion of studies do include a validation? Are there studies simulating scenarios before having conducted such a validation beforehand?

We will add a brief comment on the validation % of the reviewed modelling studies

Table 3: I would add the number of studies related to each method in the table; I guess some general information about the spatial scale/temporal scale under investigation should also be calculated and added?

We will try to add all this information to the table if the table does not get too populated and hard to read. Otherwise, we will add an additional table in the Appendix.

L.230 ‘heighten uncertainty’: please rephrase

We will rephrase it:

Additionally, the small number and limited duration of FG studies limit the representativeness of the results, especially in Mediterranean landscapes with highly variable rainfall regimes.

L.245… the associated data would be super helpful

We will upload the data into Zenodo as mentioned above

Section 3.3.2 and beyond about the ‘vegetation cover’: what is considered by the authors (the main trees, their canopy, understory vegetation, both the trees and understory vegetation?)

Vegetation cover between trees. We will clarify this in the text

L.308 is ‘compelling’ the right term to use here?

We will rephrase the sentence: The results from runoff plot (RP) studies provide further evidence of this protective effect.

L.349 I guess that this sentence is unclear and should be rephrased.

We will simplify this paragraph: By applying a log transformation, the conclusion remains the same, that higher rainfall intensity leads to more soil loss, but now nearly 50% of the variability in the log of soil loss per mm of rain can now be explained by rainfall intensity.

L.354 is ‘dislodges’ the right term here?

We will rephrase this sentence: Higher intensity rainfall has significantly more kinetic energy, resulting in the detachment of a greater volume of soil particles, a process known as splash erosion.

LL.360-361 this sentence is somewhat disconnected from the main text.

We will remove this sentence

L.372 low in organic matter >> depleted in organic matter?

We will replace it

L.388 I would avoid the use of terms such as “seemingly”

We will remove it

L.401 I guess that these studies do not miss these events, they integrate and cumulate all of them, which is different.

This sentence is confusing. We wanted to explain that gully erosion is not captured by ST. We will correct it.

L.408 ‘before it can exit the catchment’ >> before it is exported from the catchment?

We will correct it

L.416 “models, when properly calibrated…” >> do you have this important information from your database?

We will include information about the % of studies where models where calibrated

L.416 another technique that may connect all the scales would be the use of sediment fingerprinting; is it something that you think may be useful/encouraged?

Thank you for the suggestion. Sediment fingerprinting could indeed offer a potential way to connect processes across different scales and to identify sediment sources within a catchment. We will include this idea in the discussion section of the manuscript as a possible approach, while noting that its applicability remains uncertain.

Our main concern is its suitability for long-term assessments in landscapes affected by active gully erosion, particularly in Mediterranean regions where sediment deposits in water bodies are often limited due to the dry climate. Although footslopes or sediment fans might serve as alternative sediment archives, they are susceptible to re-erosion by gullies or tillage.

Moreover, when fallout radionuclides (FRNs) are used, gully erosion can introduce subsoil material with little or no FRN activity. The mixing of FRN-poor subsoil with FRN-rich surface soil in depositional areas may lead to misleading interpretations of soil loss rates, sediment sources and transport processes.

LL.426-433 I don't really understand this suggestion of study 'in areas close to the catchment limit'

We mean upslope areas, where contributing areas are small and deposition minimal. We will further explain this in the text.

L.440 is data available on olive yields to support this statement?

We will add a reference to support this.

Infante-Amate, J., González de Molina, M., Vanwalleghem, T., Soto Fernández, D., Gómez, J.A., 2013. Erosion in the Mediterranean: The Case of Olive Groves in the South of Spain (1752–2000). Environmental History 18 (2), 360–385. https://doi.org/10.1093/envhis/emt001

LL.460-485 instead of incentives only, we may also think about another political approach, which is the one of 'cross-compliance': if farmers do not implement good practices, they are not eligible to public support. This section could also benefit from relying more on data from your compilation.

This is a very relevant policy instrument, especially in the EU context (CAP). We will add a sentence in the Conclusion/Implications section specifically mentioning "cross-compliance mechanisms" (such as GAEC standards in the EU) as a critical lever for enforcing minimum soil cover requirements.

Conclusions

L.487 'diverse body of research': maybe this could be further contextualized in the text

We will rephrase the sentence: This literature review has synthesized a broad spectrum of research spanning from plot-scale field experiments to catchment-level monitoring and long-term soil truncation estimates.

L.504 I do not think that this statement on connectivity is supported by data provided/compiled in this research, is it?

We agree, we will remove this from the conclusions

L.513 see my comment above on which is considered as 'vegetation cover'

We will explain this, as mentioned above

LL.526-530 this is interesting but it reads as an advocacy, do you think that it is appropriate?

We will soften the language in the "Final Thoughts" section. Instead of "The path... is clear... must be driven by," we now write, "Current evidence suggests that shifting towards permanent ground cover is a viable strategy for sustainability," focusing on the scientific conclusions rather than prescriptive advocacy.