Responses to comments on essd-2021-223 "A remote sensing-based dataset to characterize the ecosystem functioning and functional diversity of a Biosphere Reserve: Sierra Nevada (SE Spain)" by Beatriz P. Cazorla et al.

Kirsten Elger (Editor) Editor comment

Dear Beatriz Cazorla and co-authors, I have closed the discussion of your manuscript and am asking you for your revision. It would be great if you considered the suggestion of referee #2 and make the code available if possible. Many thanks in advance!

Dear Dr. Kirsten Elger,

Many thanks for your correspondence regarding our manuscript entitled "*A remote sensing-based dataset to characterize the ecosystem functioning and functional diversity of a Biosphere Reserve: Sierra Nevada (SE Spain)*". We also thank the two reviewers for their helpful comments that allowed us to improve our manuscript. We are now very pleased to send you a revised version where we have considered the comments and suggestions from the Reviewers. In the current version, according to the Editor and referee #2 suggestions:

> 1) We have made the code available to improve the reproducibility and transferability of the work.
> 2) We have made the changes that referees pointed out, and we have answered all the reviewers' questions in detail below.
> 3) We have removed the Subsection of results (5.1.1., 5.1.2, 5.1.3., 5.1.4.), as the referee#2 suggest, because it could be quite strange for a data descriptor. However, we would like to know the point of view of the journal's editor about this.
> 4)We have also checked and improved the English grammar.

In our response below, please find our point-by-point responses (indicated with "R") presenting, in detail, how we have addressed the Reviewer's comments and suggestions ("C"). The Reviewer's comments are reproduced in bold font and our responses are indicated in roman. We numbered each comment and reply for ease of reference and indicated the line(s) where the changes have been done in the manuscript. A new version of the paper has been uploaded.The line numbers indicated in the referee's comments are based on the referee's revision document. The line numbers of the responses are those of the new version with change control.

We sincerely hope you will find the revised manuscript appealing, meriting publication in Earth System Science Data.

With our best regards,
Beatriz P. Cazorla and co-authors

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RESPONSE TO COMMENTS FROM Referee #1

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Comments to the Author(s)

General comments:

*C1. - although the legend has been updated as indicated in the author's response, die figure (now) 3:still features the misleading description: Mean EVI (Area under the curve)

R1: Dear referee, we really appreciate your feedback. We have made the modifications you suggest. We will replace the misleading figure description EVI_mean "area under the curve" by Mean EVI (annual mean) (Annual primary production). Please find attached the modified figure in this reply (Fig. 1 in this response letter and Figure 3 in the manuscript).
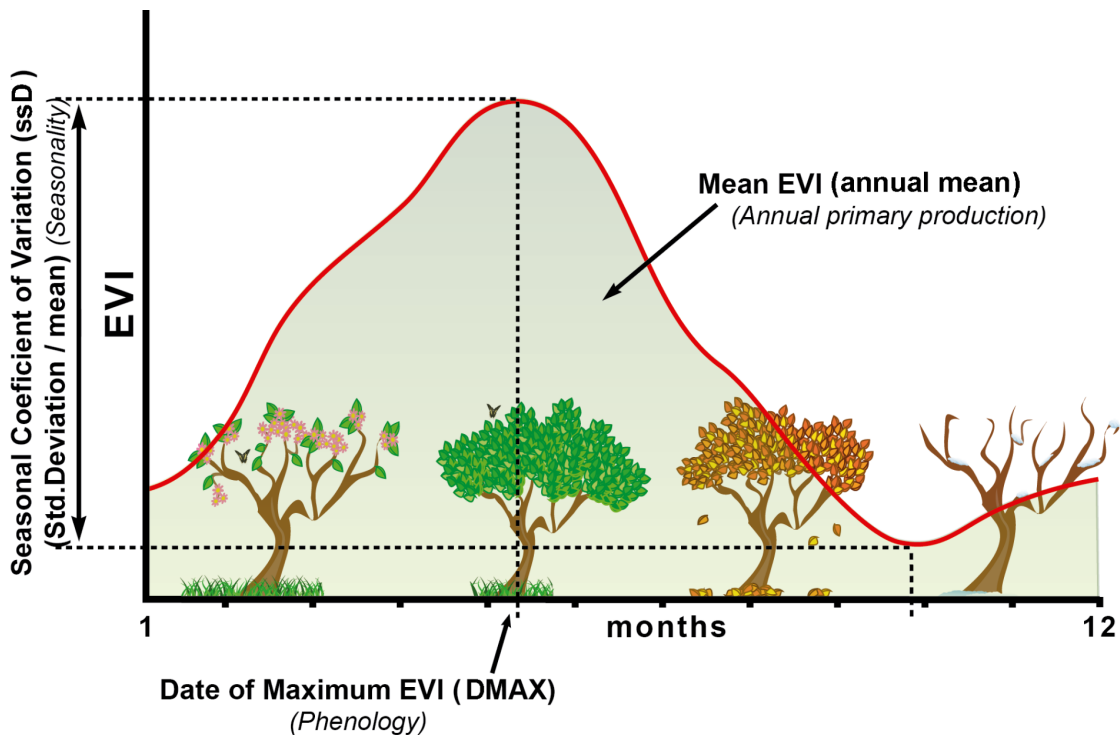
Fig. 1: Seasonal dynamics of Enhanced Vegetation Index (EVI) and EVI derived metrics or Ecosystem Functional Attributes (EFAs). The "X" axis corresponds to the months of the year and the "Y" axis to the EVI values. EFAs were: the annual mean of EVI, an estimator of annual primary production (EVI_mean); the EVI seasonal coefficient of variation, i.e. a descriptor of seasonality or the differences between the growing and non growing seasons (EVI_sSD), and the date of maximum EVI, a phenological indicator of the growing season (EVI_DMAX). We chose these three EVI metrics or EFAs since they capture most of the variance (96.5%) of the EVI seasonal dynamics in a Principal Component Analysis.

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RESPONSE TO COMMENTS FROM Referee #2

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Comments to the Author(s)

General comments

*C2. - I am approaching this manuscript as a fresh reviewer. The work seems to have had a tricky passage through the discussion and review process to date. Although the comments from the two original reviewers were largely positive,the revision of the first version (https://essd.copernicus.org/preprints/essd-2019-198/) seems to have not been accepted. The current version has been under discussion since September 2021!

Overall, my impression is broadly positive, and I see no major flaws. I appreciate the effort by the authors to provide basic online visualization capabilities, and confirm that I could download the dataset and understand the contents of the various sub-directories (i.e. the metadata provided is generally sufficient).

R2: Thank you for the positive comments. As the referee#2 points out, this paper was already under review in ESSD (https://doi.org/10.5194/essd-2019-198) and had positive feedback from the reviewers (23Mar2020, 26Mar2020 and 15Apr2020). Unfortunately, it was not finally published. Since then, we have managed to work on the manuscript according to the feedback provided by the editor and the reviewers. Hence, we strongly believe that our manuscript and dataset now fulfill the high quality standards of ESSD, and we are very grateful to the referee#2 for his comments that allowed us to improve this version of the manuscript.

*C3. - However, numerous language improvements are still required. More substantively,

R3: Thanks to the referee#2 for the suggestions for language improvement. In the new version of the manuscript, English grammar has been revised and improved.

*C4. - I was slightly disappointed to that the authors did not provide the code they used to generate their datasets; this hinders the reproducibility and transferability of their work to a certain extent. If at all possible, even though the regulations of ESSD may not require it, I would ask them to consider providing the code so that others could apply the methods to other areas most efficiently.

R4: According to the Editor and referee #2 suggestions, we have made the code available to improve the reproducibility and transferability of the work. In the new version of the manuscript, we have added the link to Google Earth Engine EFTs code (lines 272-274).

*C5. - The authors should also ensure that high resolution figures are uploaded; in the present version, some aspects of the figures are hard to read.

R5: Thank you for pointing this out. In the new version, we have improved the quality of the figures to show them in high resolution.

*C6. - Finally, I am not sure if the detailed analysis and interpretation of the datasets that are presented as "results" is necessary / fits within the scope of a data descriptor; such material could arguably constitute or be expanded into a full novel research article, which simply cites the data descriptor.

R6: Thank you for the comment and for considering part of this work as a possible novel research article on its own. In the new version, we have removed the Subsection of results (5.1.1., 5.1.2, 5.1.3., 5.1.4.), as the referee#2 suggest, it could be quite strange for a data descriptor. However, we would like to know the point of view of the journal's editor.

*C7. - In summary, I recommend publication subject to these remarks, as well as the more specific (generally minor) comments in the attached PDF, being addressed.

R7: We are very gratefully to referee#2 for your useful comments and suggestions that allowed us to improve the new version of the manuscript.

Specific comments

Abstract

*C8. - Lines 25-26: Here in my view it should be made clearer that the EVI was calculated from the MODIS data / product. Also the abbreviation should be introduced thus: "the spectral Enhanced Vegetation Index (EVI)".
R8: We are very grateful to the reviewer for the indications to improve the language. All your suggestions have been considered and are indicated in the new version with tracked changes.

*C9. - Line 28: Seasonality of what? As currently written, it is not clear whether this is referring to something general or more specific like Carbon gains.
R9: To define EFTs we use three descriptors of the seasonal dynamics carbon gains as surrogate of primary production dynamics. EVI is a subrogate of the primary productivity since this index can be used to estimate the photosynthetically active radiation absorbed by vegetation, Monteith (1972). Throughout the manuscript we refer to the seasonality of carbon gains, obtained as the EVI seasonal Standard Deviation EVI_sSD, i.e., the differences between the growing and non-growing seasons.

*C10. - Line 30: This is confusing. Here you mean "previously mentioned" or "aforementioned"; please modify.
R10: Ok. We have rewritten it as follows: *"Finally, it provides inter-annual summaries for previously mentioned variables…".*

*C11. - Lines 33-34: Rephrase: "... provides scientists, environmental managers, and the general public with…".
R11: Done. The new phrase is *"The dataset provides scientists, environmental managers, and the public in general with valuable information ..."*

*C12. - Lines 36-37: Somewhere in the manuscript, it could be good to put the link to the DIEMS entry for this LTSER site. I think is this one; is that correct?
https://deims.org/e51cee43-dc12-4545-8e5b-dad35431e3f7

R12: Thank you for your suggestion. Yes, that link is the one for the DIEMS entry for Sierra Nevada LTSER site. In the new version of the manuscript, we have added the DEIMS link in Section "5.1 Case study", where we talk about Sierra Nevada LTER site. Lines 328-329 of the new version with the track changes.

Introduction

*C13. - Line 41: Please revise the language here "a set of essential variables for… is necessary" would be better.
R13: Ok. The sentence now appears as follows *"A set of essential variables for characterizing and monitoring ecosystem functioning is necessary to achieve this goal (Pereira et al., 2013). "*

*C14. - Lines 50-51: Are these examples where these variables have or have not been incorporated? If the former, consider writing "but see..".
R14: Thanks for the recommendation. In two examples these variables and have been incorporated, in the other two examples they have incorporated other variables, so we think it is better to use *"see Alcaraz-Segura et al., 2009; Fernández et al., 2010; Cabello et al., 2016; Skidmore et al., 2021".*

*C15. - Line 52: Perhaps this could be made clearer with an extra verb, e.g. "through monitoring functional traits" (or similar).
R15: Thank you for the suggestion, we have added "monitoring" in the sentence. Line 53 in the new version with track changes.

*C16. - Line 58: Perhaps it would be clearer if you rephrase this to say something like: "...models enable essential functional variables… to be estimated based on spectral indices derived from satellite images".
R16: Ok. The sentence have been changed as follows *"Theoretical and empirical models enable essential functional variables of ecosystems, such as primary production, evapotranspiration, surface temperature, or albedo to be estimated based on spectral indices derived from satellite images (e.g., Enhanced Vegetation Index; EVI) (Pettorelli et al., 2005; Fernández et al., 2010; Lee et al., 2013)".* Lines 58-63 new version with track changes.

*C17. - Line 59: the Enhanced Vegetation Index; EVI
R17: Changed. Line 61 in the new version with track changes.

*C18. - Line 64-65: "offers" is a strange word choice here in my view. How about something like "...provides a holistic indicator of ecosystem response to environmental changes…" or similar?
R18: Perfect. Thank you, we have changed this word following your suggestion. Line 67 new version.

*C19. - Line 68: Does the arrangement of these EFTs change through time, or are they stationary? I assume they are stationary, but you mention "dynamics", so there could be room for confusion. Also, do you actually end up with a map of these patches (EFTs)? Please clarify if possible.
R19: Line 71 track changes version. Paruelo and others (2001) and Alcaraz-Segura and others (2006, 2013) defined Ecosystem Functional Types (EFTs) as patches of the land surface that share similar dynamics of matter and energy exchanges between the biota and the physical environment. In practice, EFTs group ecosystems (at large scales) on the basis of shared ecosystem functioning

without prior knowledge of vegetation type or canopy architecture (Fernández and others 2010; Pérez-Hoyos and others 2014; Villarreal and others 2018). In other words, EFTs capture dynamics of ecosystem functioning, a different dimension to the structural vegetation types (Noss 1990).

Each pixel may have a different EFT each year, although it is not a common situation, but it could occur. To have a representative EFT map for the whole period, we use the most frequent EFT throughout the period (the mode) for each pixel and we assign that value to it. So, in the database we provide the EFTs yearly and the summary of the period (the mode of the EFTs across years).

*C20. - Line 85: Does the database really describe ecosystem functioning and functional diversity patterns, or rather key measures or aspects of them?
R20: Thank you for #referee2 appreciation. EFTs capture in a single map the spatial heterogeneity of key ecological processes such as the amount and timing of carbon gain dynamics. Therefore, as the #referee2 points out, the database describes key measures of ecosystem functioning. We have rewritten the sentences below to express it as follows:
Line 85-86: "*Here, we present a dataset that describes the spatial heterogeneity and temporal variability of a key measure of ecosystem functioning and ecosystem functional diversity patterns in the Sierra Nevada Biosphere Reserve, a protected area in south-east Spain (Fig. 1).*"
Line 265: "*Overall, the collection of datasets that we present here provides a characterization of ecosystem functioning, ecosystem functional diversity and inter-annual dynamics in Sierra Nevada Biosphere Reserve (SE Spain) through a key measure based on primary productivity derived from remote sensing.*"
Line 406-407: "*Overall, these data characterize the spatial and temporal patterns of a key measure of ecosystem functioning and ecosystem functional diversity.*"

*C21. - Line 87: I would suggest to remove this; this is a data descriptor, rather than a methods paper, and so the dataset shared is intrinsically linked to the study area. In fact, I would probably suggest introducing the study area in tine 84. e.g. "...in the Sierra Nevada Biosphere Reserve, a protected area in south-east Spain".
Line 90: Do you mean "we provide maps of three EFAs? Also the abbreviation EFA has already been introduced, so please use it directly here.
R21: Thank you for the comment. We have modified the paragraph according to the referee's suggestions as follows:
"*Here, we present a dataset that describes the spatial heterogeneity and temporal variability of a key measure of ecosystem functioning and ecosystem functional diversity patterns in the Sierra Nevada Biosphere Reserve, a protected area in south-east Spain (Fig. 1). We derived the dataset from the analysis of the intra- and inter-annual variation of vegetation greenness captured through the EVI spectral vegetation index, as a surrogate of primary production, during the 2001-2018 period. First, for each year, we provide maps of three EFAs: i) annual primary production, and ii) seasonality and iii) phenology of carbon gains, as well as their integration into synthetic mapping EFTs as discrete landscape functional units . Second, based on these units, we present two functional diversity metrics: EFT richness and EFT rarity. Finally, by considering the yearly maps, we calculated inter-annual summaries, i.e., inter-annual means and inter-annual variability, to show the average conditions and the stability of ecosystem functioning of the period (the workflow is provided in Fig. 2).*"
Lines 85 to 98 in the new version of the manuscript with track changes.

*C22. - Line 91: How are these two different, e.g. how are seasonality and phenology defined?

R22: We calculated three EFAs known to capture most of the variance of the seasonal curve or annual dynamics of vegetation indices (Paruelo et al., 2001; Alcaraz-Segura et al., 2006, 2009): the EVI annual mean (EVI_mean; an estimator of primary production), the EVI seasonal Standard Deviation (EVI_sSD; a descriptor of seasonality, i.e., the differences between the growing and non-growing seasons), and the date of maximum EVI (EVI_DMAX; a phenological indicator of the month with maximum EVI). In the manuscript, we include a figure to explain how were defined the different EFAs, please, see Fig. 1 of this response letter or Fig. 3 in the manuscript.

Also, we explained how we have defined the different EFAs in Section "2.2. Calculating Ecosystem Functional Attributes (EFAs)" . Lines 145 to 158.

*C23. - Line 96: What does this mean? Are you inviting readers to see the workflow in Fig.2? I would suggest to modify slightly to something like "The workflow is provided in Fig.2" or else delete this entirely.
R23: Yes, we are inviting readers to see the workflow in Fig.2. We have modified this sentence following referee#2 suggestion "*the workflow is provided in Fig. 2*". Line 98.

*C24. - Line 100-101: Is it worth briefly mentioning why the study (and specifically these ecosystem dynamics) are interesting/important? perhaps a word on the role of mountains as biodiversity hotspots providing ecosystem services to downstream societies, and the considerable spatial gradients that one observes in these systems. For consideration.
R24: Thank you for the suggestion. We modified the paragraph to include the suggestion as follows: *"...and mountain ecosystem services supply since humankind depends on freshwater of mountain regions, are hotspots of biodiversity and a key destination for recreation activities (Grêt-Regamey et al., 2012)."* Lines 101-103.

2 Data description

2.1 Data acquisition and processing

*C25. - Lines 103-104: EVI should have been already introduced by now, please use the abbreviation directly.
R25: Ok, we have reviewed all the parts of the text where this occurs and corrected them. Now, in the new manuscript, the word appears for the first time and the following references are abbreviations.

*C26. - Lines 106-107: It is not clear whether this statement is still making a comparison with the other potential indices, or rather whether this is simply a generic statement about EVI (which may or may not also apply to others).
R26: Is still making a comparison with the other potential indices, to clarify that, we have modified the sentence as follows: *"Furthermore, EVI reduces the influence of atmospheric conditions on vegetation index values and correct for canopy background signals"*. Line 110 in the version with track changes.

*C27. - Lines 117-118: Higher than what? "high density green leaves".
R27: Thank you for the correction. We have modified that (line 120 track changes new version).

*C28.- Lines 120-121: Calculated instead of obtained.
R28: Modified.

*C29. - Here and elsewhere, you should provide the full name of something and then the abbreviation in parentheses, not the other way around!

R29: Ok, we have reviewed all the parts of the text where this occurs and corrected them. Thank you for pointing out this issue.

*C30. - Line 123: "choosing" is this done automatically? I assume so, but this should be specified.

R30: Yes, it is done automatically, so we have specified as follows: *"MOD13Q1.006 EVI product is computed from atmospherically corrected bi-directional surface reflectances by choosing automatically the best available pixel value from all the acquisitions (4 per day) in a 16-day period based on quality, cloud presence, and viewing geometry (Huete et al., 1997; Didan et al., 2015)."* Lines 124-127 of the new version with track changes.

*C31. - Line 126. - I'm slightly confused by this. You say above that the algorithm chooses the pixel values based on quality (the best per pixel within a given 16 day window), but here you say you obtain a maximum-value composite (which to me would involve taking the maximum value per pixel within each period). Or was it a combination of both; i.e. you first identify pixels that meet a quality criteria, and then take the maximum? Please kindly.

R31: The algorithm used by the MOD13Q1.006 product chooses the best available pixel value from all the acquisitions from the 16 day period. The algorithm operates on a per-pixel basis and requires multiple observations (16 days) to generate a composited EVI. Due to orbit overlap, multiple observations may exist for one day and a maximum of four observations per day may be collected. The MOD13Q1 algorithm separates all observations by their orbits providing a means to further filter the input data.

Once all 16 days are collected, the MODIS algorithm applies a filter to the data based on quality, cloud presence, and viewing geometry (Fig. 2). Cloud-contaminated pixels and extreme off-nadir sensor views are considered lower quality. A cloud-free, nadir view pixel with no residual atmospheric contamination represents the best quality pixel. Only the highest quality, cloud-free, filtered data are retained for compositing (Huete et al. 1997, Didan 2015). The goal of the compositing methodology is to extract a single value per pixel from all the retained filtered data, which is representative of each pixel over the particular 16-day period. The compositing technique uses an enhanced criteria for normal-to-ideal observations, but switches to an optional backup method when conditions are less than ideal (Fig. 2).

Fig. 2. MODIS compositing algorithm data flow (from Didan et al. 2015).

*C32. - Line 127: I don`t think this language is appropriate; please just give the cell size in m at the equator or in decimal degrees.

R32: Thank you for your comment. Now, we rewritten following the referee#2 suggestion: *"Despite its moderate spatial resolution (232 meters spatial resolution at the equator), we chose the MOD13Q1.006 product as the basis for our data since it offers a long time series (almost 20 years) every 16 days, which allows for the characterization of the temporal dynamics of ecosystem functioning (Anderson et al., 2018)."* Lines 129-132 of new manuscript version track changes.

*C33.- Line 133: In my view it would be better to include these URLs in the reference list, but I leave this to journal policy.

R33: For the moment, we will remain so unless the journal indicates otherwise.

*C34. - Lines 133-134: Just a curiosity, are these images not available directly in GEE? The need to download and upload them to GEE would seem to complicate the workflow a little.

R34: The images are available directly in GEE. We indicated it in Section *"4.1. Data attribution"* but it is not well expressed in this part of the text, thank you for pointing it out. Now, it appears as follows: *"MOD13Q1.006 images were available in Google into the Earth Engine (GEE) servers https://developers.google.com/earth-engine/datasets/catalog/MODIS_006_MOD13Q1), where we processed them. GEE combines a multi-petabyte catalog of satellite imagery and geospatial datasets…".* Lines 133-140 of the track changes version.

*C35. - Line 138: Perhaps remove this, because as a reader I don`t see why you are providing me with these generic links.

R35: Done, removed. Lines 141-142 new track changes version.

*C36. - Line 140: So I don`t understand, does MODIS already provide EVI pre-computed, or did you actually compute it as part of this study? Or did you only make the composites and aggregated time-series analyses?

R36: Yes, MODIS offers pre-calculated EVI (see R31). Despite the high standard quality of the 16-day EVI maximum value composite in MOD13Q1, we assessed the effect of the additional application of the QA mask flags which resulted in no significant change in the results. Therefore, we use the MODIS EVI data to aggregate time-series analysis.

2.2 Calculating Ecosystem Functional Attributes (EFAs)

*C37. - Line 143: So in each case, the products here are maps over the study area? If so, I think it would be good to specify that.

R37: Yes, so ok, we have specified that "We calculated three EFAs maps…" Line 145 new version with track changes.

*C38.- Please write in proper sentences "This component of the analysis is presented in full in Supplement A"

R38: Done. Thank you for the suggestion. Lines 157-158 of the new version.

2.3 Identifying Ecosystem Functional Types (EFTs)

*C39. - Line 166 and 176: Sensitivity instead of sensibility. Beware this common "false friend". Insert space.

R39: Done. Thank you for pointing this out.

2.4 Deriving Ecosystem Functional Diversity metrics

*C40. - Line 182: It is not strictly "surrounding" if the reference pixel is the top left one. Perhaps just say "in the 4x4 search window".

R40: Ok. We have changed the sentence following referee#2 suggestion.

*C41.- Line 183: Please explain what you mean by "saturating" here.

R41: Regarding kernel size, we chose a 4x4-pixel kernel as a balance between spatial resolution and saturation of the EFT richness variable. That is, using kernels of 2x2 and 3x3 pixels resulted in a high proportion of kernels that reached the highest possible richness value (4 and 9 EFT classes per kernel, respectively), so the EFT richness variable was highly saturated. Using kernels of 5x5 or greater number of pixels never saturated the maximum number of pixels in a kernel but resulted in too coarse outputs (grain size greater or equal to 5x5 pixels). The 4x4 kernel offered the finest spatial resolution of the EFT richness map and was never saturated. In other words, the maximum EFT richness within a 4x4-pixel kernel that we registered was 13, but the potential maximum number could have been 4x4=16 (Fig. 3).
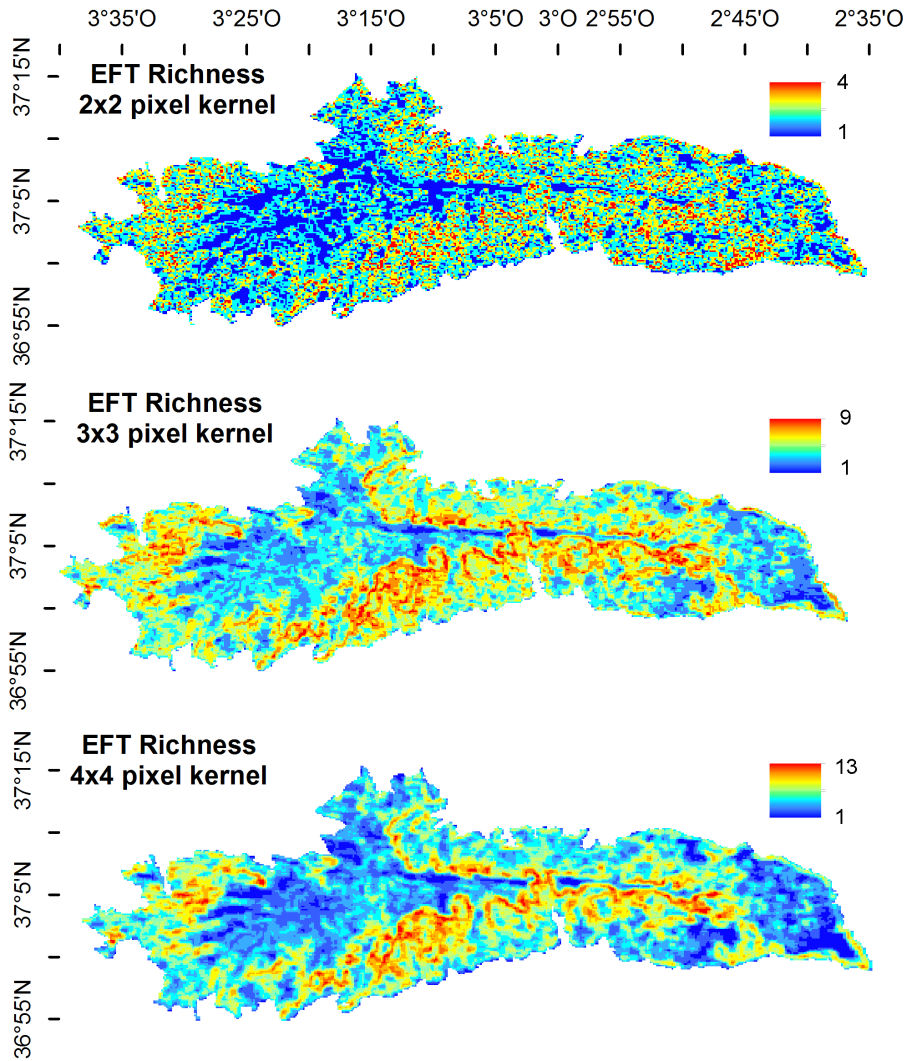
Fig. 3. EFT Richness for 2x2, 3x3 and 4x4-pixel kernel sizes. A 4x4-pixel kernel was chosen since it offered the finest spatial resolution that did not saturate the number of EFT classes per kernel.

Any richness measurement exercise depends on spatial scale (i.e., both grain and extent) of assessment (Arponen et al., 2012). Regarding grain, when using species distributions to identify hotspots, the actual values of species richness found in each cell will increase with grain from a dataset built at 1x1 km to a dataset built at 10x10 km. However the regional spatial patterns of species richness will not vary widely (Rahbek 2005). In our analysis, the maximum number of EFTs found in a kernel could also vary depending on the kernel size, as stated above. If we used smaller kernel sizes, we would find lower and saturated EFT richness values. By contrast, with a larger kernel size (e.g. 5x5), the observed patterns would be too coarse.

*C42. - Line 192: Insert had obtained.
R42: Done.

*C43. - Line 192-193: "we assigned to each pixel in the EFT map such value according to the pixel EFT class". This does not make sense to me; please rephrase.
R43: The new sentence is: *"We assign to each pixel in the EFT map its rarity value. Hence, the EFT rarity map spatial resolution was the same as the resolution as the EFT map (232 m)."*

2.5 Characterizing inter-annual stability in ecosystem functioning

*C44. - Line 196: Interesting you choose "stability" rather than "instability" or "change". The latter would probably be more general.

R44: We choose stability to refer to interannual variability and dissimilarity in ecosystem functioning. It is true that it could be called instability or change as well. They are terms that refer to the same concept.

*C45. - Line 209: What are x and y here?

R45: Equation 5 refers to the Jaccard index: $J(X,Y) = |X \cap Y| / |X \cup Y|$, where the Jaccard index for two data sets (X = set 1; Y =set 2) is equal to the size of the intersection divided by the size of the union of the data sets. In the new manuscript, we have given the explicit definition of X and Y in the same way as in this response. Lines 210-211 of the new track changes version.

3 Sensitivity and uncertainty analyses

*C46. - Line 244 and 249. Use "on the contrary" and capitalize "kernel".

R46: Done.

4 Data structure and availability

*C47. - Lines 269-270: This is not true as that site only visualizes the datasets, and sets readers back to PANGAEA to download them. Please make this statement more accurate.

It should also be made clear to readers that not all or the output datasets generated are visualized here; it seems to be only the annual summaries?

Also, for EFT at least, the legend in the visualiser is out off/minor

R47: We have rewritten this paragraph to accurate it as follows: "*Datasets are available for downloading in PANGAEA: https://doi.pangaea.de/10.1594/PANGAEA.924792?format=html#download (Cazorla et al., 2020a), and we have also developed an ad-hoc visualization for the inter-annual summaries at Sierra Nevada Global Change Observatory-LTER site (http://obsnev.es/apps/efts_SN.html).*" Lines 268-273 of track changes new version.

We also have modified the EFT legend in the ad-hoc visualizer so that it can be seen in its entirety.

4.1 Data attribution

*C48. - Lines 287-288: OK so your earlier statement that these data were "downloaded" and then put in GEE should probably be revised.

R48: Done. The images are available directly in GEE. We have modified that to indicate it in all parts of the text in which this is referred to. See R34.

*C49. - Lines 290-291: I may have missed it, but I don`t recall much description of how this boundary file was used in the analysis, e.g. the incoming datasets were first clipped to the study area. Also, I assume a small buffer was applied so that 4x4 pixels could be assessed even for those target pixels right on the edge?

R49: We have specified this process in the manuscript in the section called "3 Sensitivity and *uncertainty analyses*", in particular, under the heading "*2.4.2. Kernel size and borderline effect on*

EFT richness" as follows: *"Pixels with NoData values were not considered a distinct class to compute EFT richness along the study area borderline. For these reason, it is important to note that the sliding windows along the borderline of the study area could systematically show lower EFT richness in our dataset than in reality"* (Lines 259-261 of track changes new version).

5 Data usage in Ecology and Conservation

5.1 Case study

*C50. - Line 344-345: This is quite strange for a data descriptor. In such an article, no research question have been specified /justified, so I am quite surprised to see some "results" (i.e. detailed analyses of the datasets generated) presented here.
R50: Ok, we have removed the Subsection of results (5.1.1., 5.1.2, 5.1.3., 5.1.4.), as the referee#2 suggest, it could be quite strange for a data descriptor. However, we would like to know the point of view of the journal's editor.

6 Conclusion

*C51. - Line 409: OK, this makes it clear that everything is related to carbon gains; please use this formulation at the two earlier points where this was not fully clear.
R51: Done.

*C52. - Line 410: I think calling them "patches" could be slightly misleading for some readers, as it suggests (to me at least) grouping of pixels with similar characteristics, whereas I understand these EFTs were actually generated at the pixel level in this study.
R52: Ok, thank you for the suggestion. We have changed "patches" by "grouping pixels" (lines 110-111).

*C53. - Lines 411-412: Language changes. Provide information about instead of inform on. Revise. "as a focal ecosystem function"?
R53: Revised. Lines 413-414 in the new version with track changes .

Figures

*C54. - Line 739: Please ensure that high resolution figures are provided for final publication; I can hardly read the key here, which is important because it is not provided elsewhere to my understanding.

R54: Thank you for the appreciation. In the new manuscript the figures are uploaded with the highest quality. This has happened because exporting the PDF file lowers the quality of the images. We have modified this to avoid a drop in quality, however, for the final publication the images will be sent separately in high quality.

References

Alcaraz-Segura, D., Paruelo, J. and Cabello, J.: Identification of current ecosystem functional types in the Iberian Peninsula, Global Ecol and Biogeogr, 15(2), 200–212, doi:10.1111/j.1466-822X.2006.00215.x, 395 2006.

Alcaraz-Segura, D., Cabello, J., Paruelo, J. M. and Delibes, M.: Use of Descriptors of Ecosystem Functioning for Monitoring a National Park Network: A Remote Sensing Approach, Environ Manage., 43(1), 38–48, doi:10.1007/s00267-008-9154-y, 2009.

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