

Reviewer #1

The authors attempt to emulate hypothesized causal links between plant traits, climate and ecosystem functions by constructing a Bayesian Network (BN). Here links between traits and functions are based on expert knowledge, and the causality reflected in the BN is as good as the expert knowledge of the causal links. The authors then reevaluate the relative importance of plant traits and climate in determining ecosystem functions through a sensitivity analysis based mainly on FLUXNET data. Building on this they argue that climate indirectly affects ecosystem functions via its control on plant traits. We agree that, from an ecological perspective and considering the increasing availability of data, exploring different methods to analyze the interactions climate-vegetation involved in the ecosystem functions is a relevant and meaningful research topic.

The authors have carefully considered all the comments, questions and suggestions given during the first review. The issues of reproducibility and the lack of an appropriate model validation have been overcome for the most part by the authors with a k-fold cross-validation (Table S1), a better description of the data used (Table 1), appropriate references to justify the assignment of links to the BN (Table 2), and a clear specification of the discretization method and the reasoning behind it. In the supplementary material, the authors provided the validate confusion matrix; it can effectively confirm the effectiveness of the BN method in this study. The limitations of the study are objectively stated in the discussion section.

We are glad to see that most of our main concerns have been addressed, and we consider that the manuscript can be published after taking into account the few additional comments below we still have based on the revised manuscript.

Response: Thank you for your insightful comments, which have been very helpful in improving the manuscript. We revised this manuscript in accordance with your few additional comments.

Specific Comments

- The authors should not overstate the power of BNs to quantify causality. A little bit of caution is warranted here. We suggest that the authors include a statement in the abstract in which they recognize that the causality reflected in the BN is as good as the expert knowledge of the causal links.

Response: added in Abstract: 'The causality reflected in the BN is as good as the expert knowledge of the causal links.'

- The criteria to assign the links involving climate variables were clarified significantly with Table 2 and appropriate references. Some references for the CSWI links are still missing: P -> CSWI and VPD -> CSWI. Based on the manuscript references, the reference Nelson et al. 2018 can support the assignment of these links. Please add this reference to Table

2.

Response: P -> CSWI and VPD -> CSWI links and the reference Nelson et al. 2018 were added in Table 2.

- In Figure 5, the sentence “red for high values and in blue for low values” may cause some confusion if no further explanation is provided. Is the relationship between color depth and numerical values based solely on values or sorting?, and is the scale the same across the entire table?.

Response: added in the figure caption: ‘Color depth is dependent on values and the scale is the same in each row’.

- In row 335, that is quite a meaningful way of predicting the future ecological properties at a global scale. However, it is quite difficult to achieve it due to the calculation cost. Many novel models based on BN and other causality networks could create more possibilities to deal with such complex real life situations (DOI: 10.1038/s42256-020-0218-x & DOI: 10.1038/s42256-022-00445-z). Maybe the authors would like to mention the state of the art here?

Response: elaborated as ‘Such research frameworks in BN-based modeling may be difficult due to high computational costs given the large amount of data. Fortunately, recently proposed new causal models have the potential to address this limitation, such as the introduction of causality into deep learning frameworks (Luo et al., 2020; Cui and Athey, 2022).’

- The authors have provided a validation of their results through a k-fold cross-validation which will allow comparisons with future studies. However, it would be useful to clarify to the reader what is the criteria behind the selection of the variables ETmax, GPPsat, and NEPmax for the model validation. It should be made very clear early on that these are the primary objectives (i.e. the terminal nodes) of the study.

Response: elaborated in methods: ‘These three nodes are the main terminal nodes and primary objectives of the BN and represent the main water and carbon-related ecosystem functions, respectively. The accuracy of these three variables can largely reflect the overall performance of BN.’

- Please verify that each table and figure is referred to in the text of the manuscript. Additionally, the manuscript still needs some writing and grammar improvements. An English check is required.

Response: Table and figure were verified. The Table 2 was not referred to and we added ‘The explanation of added causal links was shown in Table 2.’ Writing and grammar issues were also improved.

Reviewer #2

The revision includes a major effort by clarifying methods, approach and the representation and interpretation of the results. Especially, the building of the statistical model and the inclusion of previous knowledge became clearer and comprehensible. The text benefits from the removal of redundant paragraphs and sharpening of the conclusions. With these revisions only minor text corrections are necessary before publication.

Response: Thank you for your insightful comments, which have been very helpful in improving the manuscript. We revised this manuscript in accordance with your few additional comments.

Minor remarks:

There are still some remaining misspellings and text fragments so that an independent reader could go through the text. Some examples of needed edits are listed here:

L 272: Please explain what you mean with 'is relatively reliable' for the BN-Based analysis.

Revised: 'relatively reliable in terms of the represented mechanisms of causal links'

L. 286: You refer repeatedly to the reference study Migliavacca et al. (2021) but please do not use abbreviated words like here the 'ref.' and replace these references by the citation.

Revised: 'in the ref. (Migliavacca et al., 2021)' was replaced with 'in Migliavacca et al., 2021'

L. 287: Please exchange twice in this line 'chosed' with 'chosen'.

Replaced.