

Interactive comment on “Can land degradation drive differences in the C exchange of two similar semiarid ecosystems?” by Ana López-Ballesteros et al.

Anonymous Referee #1

Received and published: 10 July 2017

This short paper attempts to describe the impacts of land degradation in semiarid ecosystems on carbon fluxes on the basis of the differences observed between two eddy covariance flux sites in SE Spain. The authors clearly demonstrate that most of the expected meteorological controls over C flux are equivalent between sites, but the carbon fluxes are strikingly different, varying by a couple of orders of magnitude. As they highlight, this difference in observed net carbon flux is a result of contrasting fluxes of carbon from “subterranean ventilation”. As the authors have addressed in other publications, this large carbon efflux cannot be accounted for due to in-situ concurrent biological activity – and this greatly complicates interpretation of contrasting results between the sites, and thus the assessment of the impacts of land degradation.

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Unfortunately, the authors do not address this challenge very effectively, and in its current form there is little support for any conclusion about the impacts of land degradation on carbon fluxes. It maybe that the nature of the sites makes it impossible to carry out such a comparison convincingly, but addressing a number of areas is required before this can be determined.

First, the nature of the disturbance and extent to degradation needs to be described in more detail. The similarities between the sites are described in detail, but the crucial differences need more full description than Table 1, and more importantly, the biological implications of this differences (detailed hypotheses) need to be articulated.

Second, these hypotheses need to detail biological controls and the non-biological controls over C fluxes at these two sites, and the fluxes need to be interpreted in that light. In particular, it is differences in productivity that would be key to understanding this. Although it will be difficult given the atypical conditions of a large non-concurrent biological carbon efflux, NEE should be partitioned, and GPP between the sites compared. In addition, there should be a more detailed comparison of the ET fluxes, which in these ecosystems seem to be providing a more comparable indication of ecosystem function. And taken together, it would be interesting to assess inter-site differences in water use efficiency.

Third, the EVI time series as an indicator of productivity requires a closer examination. Given the differences in vegetation cover between the sites (Table 1), it is the similarity in EVI values, rather than the differences (except in the final year), between the two sites that seems most striking. This would suggest that productivity between the sites is not very different, and EVI based GPP estimates would be similar. Does observed tower GPP support this?

Fourth, the downward trend in maximum annual EVI is interesting, and could be investigated more, and potentially over a longer time period. Is it significantly related to a trend in precipitation, and a trend in productivity from the towers? The contrasting

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response between the sites in the final year of the record is striking, is it reflected in the tower flux record also – it seems the record is complete over the winter period at least?

Fifth, given that soil CO₂ concentration is measured at two depths, is it possible to estimate soil CO₂ flux? This could be used to partition the concurrent biological CO₂ signal, versus non-biological, and potentially the impacts of degradation on these two different processes.

Overall, a considerable amount of additional analysis is required to separate out the signal from biological and non-biological controls over carbon fluxes from these two sites. It is only then when the flux can be interpreted in terms of vegetation productivity that the impacts of degradation can be assessed in a way that provides insight into processes that are more broadly applicable across semiarid ecosystems.

There are very few grammatical and spelling errors, a few very minor points:

P2 L19 – “concretely” is a strange word choice here and elsewhere – “definitively” is better in some cases, or it can just be removed.

P7 L31 - “punctual” is a strange word choice here – not sure what you are trying to convey

P7 L32 – Daily times series are hard to decipher in Figure 5. Its always a challenge to convey this information. Maybe using a solid black, and ensuring the graphic is a full-page width would help.

P9 L3 – I believe it would be normal to correct pressure to sea-level equivalents before making comparisons such as these.

Interactive comment on Biogeosciences Discuss., <https://doi.org/10.5194/bg-2017-77>, 2017.

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