

Interactive comment on “Reviews and syntheses: Influences of landscape structure and land uses on local to regional climate and air quality” by Raia Silvia Massad et al.

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We thank Referee #1 for their careful reading and useful comments. Both reviews have very conflictual views of our paper. Reviewer 2 thinks we have done a relatively good job and encourages us with a limited amount of suggested changes. Reviewer 1 rejects our work with a very critical point of view. A 3rd review would have been quite helpful in that sense.

Reviewer general comments

Summary: The authors aim to review how land use affects climate and air quality. They

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present a framework for categorizing land use, and apply it to different aspects of the earth system, in order to demonstrate relationships between biosphere, climate, and air quality. They also present current challenges to understanding the effects of land use on air quality, provide suggestions for different groups to work together to address these challenges.

I appreciate the effort to synthesize this information, and I generally agree with the abstract, but this paper falls very short of its goals. It is poorly organized, repetitive, inconsistent in its application of the framework, contains enough awkward language up front that the goals of the paper are not clear, and the conclusions do not follow from the information presented. Additionally, there isn't a unifying story to make sense of the extremely diverse information presented. For example, the air quality aspect is in the title and highlighted in the abstract, but is not addressed until page 23, and then only elaborated upon in a few sections. Also, main conclusions focus on model shortcomings, but there isn't a modelling review included.

It seems to me that this is about 5 papers mashed into one. Most of the text reads like a list, and links and meaning across the different sections and information are not made. The middle section alternates between pedantic textbook material and an uncritical presentation of many studies. I suggest that the authors think about what point they want to make, and focus on that point. For example, the material is here for a review of land use and air pollution. But there is a lot extra physics information that doesn't need to be presented in order make the point that the physical processes are an influence

*Reply:

We will re-organize the manuscript to respond to the reviewers concerns according to the following:

- We will review the abstract so as to better reflect the objectives and the content of the manuscript

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- We will complete the introduction with supplementary literature related to land-use, land cover changes, and update if necessary. In the Introduction, we will precise that this review is intended to be accessible to the specialists (i.e., mainly scientists) and non-specialists (e.g., land-planners, stakeholders and decision-makers).

- We will move the “textbook material” highlighted in section 3 to an appendix to provide fundamentals of physics, chemistry and biology for those who may not be familiar with the theory that is behind the reviewed studies.

- We propose to profoundly re-organize section 3. Rather than the “physical”, chemical” and “biogeochemical” subsections further subdivided (repetitively) by land categories, we propose two main sub-sections organized by land use and land cover changes: Land cover changes (deforestation, wetland conversion, urbanisation), Land intensification (agricultural intensification and urban intensification)

- Within each section, we will separate the literature review according to “experimental” and “modelling” studies, and we will critically summarize the shortcomings of each. We will use the conclusions (Section 5.1: synthesis of current knowledge) to back up the different sections. We would like to express here that this is a substantial revision of our paper.

#Comment:The introduction and framework are general and vague. Make a solid, but concise, assessment of land use/cover change as a foundation, with literature to back it up, and move on to the effects you want to review.

*Reply:The assessment of land use/cover change is already in section 2 of the manuscript (rather than in the introduction). We will add a section detailing the potential impacts of those changes on the atmospheric compartment (which will be a very brief summary of sections 3.1.1, 3.2.1 and 3.3.1, the details of which will be moved to an appendix section). For us, the introduction is here to present the specificities of our review compared to other existing reviews in the literature and to state the objectives of this review.

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#Comment: The land categorization is applied inconsistently, probably due to its overlapping nature. Maybe delineate by urban, agriculture, and other lands. Part of the confusion and repetition arises because the urban changes are land cover changes, but these two have been separated.

*Reply: The difficulty is in the fact that we are not looking at land use but at land use changes. We will however make the effort to limit the categories we look at regarding the Urban changes. We will separate urban intensification (considered as a Land use change) from urbanisation (land cover change).

#Comment: The physical, biological, chemical distinction does not work. The physical isn't related to the rest (except in 4.3 where it is relevant and sufficient), and the biological and chemical are both about biological emissions, with a fuzzy distinction between primary biogeochemistry (CO₂, CH₄, N₂O), and trace gases and aerosols. Stick to the chemical species you are interested in, and organize them around the land categories or land changes.

*Reply: We agree with your analysis. We will remove this distinction in our text and re-organise the paper by categories of land-use changes, detailing for each category the impacts on the atmosphere and differentiating "experimental results" and "modelling results" so as to include a review of models. Thanks to this re-organisation, we will show the links between different studies and we will be more critical of the results based on other results. However one objective of our paper is to clearly put forward the various ways land and atmosphere interact (via changes in physical processes, biological and chemical processes), and which are almost never considered together in climate models (nor global nor regional). This will be clarified in the discussion.

#Comment: Develop meaning and relationships through the presentation of the literature. Having separate discussions later, or pedantic explanations before, leaves the information essentially as a list, and the later discussions become repetitive and do not have the references to back up statements.

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*Reply: By re-organising the manuscript as explained in responses 1 and 3 and by moving the “textbook” material to an appendix, we think that the literature review will improve, will become less pedantic and more discursive, rather than a list. The section “synthesis of current knowledge” (5.1) will be merged within section 3 to follow on directly and synthesize the review done. This way the discussion section will come earlier in the manuscript and will be less repetitive.

#Comment: To show integration of processes, put them in the same section. Present evidence for each one and the evidence for how they interact. Segregating them by section makes it difficult to make linkages without repetition. For example, section 4.3 starts to tie together vegetation, boundary layer, and air pollution, and is understandable without the lengthy textbook sections in part 3.

*Reply: We agree with the reviewer and, as stated above (Response 4), we will merge sections on physical, chemical and biological processes involved in land use changes and we will discuss their impacts in a more comprehensive way that looks at the interactive system as a whole.

#Comment: To criticize models, you need a model review.

*Reply: A model review (or references to already existing model reviews) will be integrated in section 3 within each land cover change section, as it can be seen in the new table of contents below. Our intention is not to criticize models but rather to show that there are today two ‘niches’ that have not been sufficiently looked at: 1) the combined physical-biological-chemical effects of land changes on climate at all spatial scales, 2) the specific ‘territorial’ scale that is smaller than the continental one and larger than a single city.

#Comment: To make conclusions about what is lacking, the gaps and limitations of existing work need to be explained in the review, rather than listing all the literature results as facts. Currently, the paper reads like everything has been figured out, but the conclusions state that hardly anything has been figured out. The shortcomings of

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the models are not reviewed, but are presented as main conclusions.

*Reply: By re-organising section 3 and making a more critical review of the literature, we will be able to present more clearly the gaps and limitations of models as well as experimental results, and to move on directly to the discussion and conclusion sections. Again our main argument is not to say that everything has been figured out nor that 'hardly anything has been figured out' but that the main pieces of the puzzle have not yet been assembled, nor applied at the specific spatial scale we're targeting.

Specific comments/suggestions:

#Comment: Abstract (page 1) physical, chemical, and biogeochemical land-atmosphere interactions is a very broad topic, while the paper focuses on air quality impacts of land use. the abstract needs to be clear about the focus of the paper.

*Reply: The abstract will be rewritten in order to make the focus of the paper clearer. We are surprised though that the reviewer gets the impression we are focusing on air quality while discussion on this only occurs in 1/3rd of the paper.

#Comment:The focus on urban/peri-urban and air quality is not clear. until the last few sentences This leaves the reader wondering why the rapidly growing body of literature on the effects of LULCC on the earth system is not accounted for (only a few papers are cited in the intro).

*Reply: We will state at the beginning of the introduction the specificities of the manuscript to justify the choice of literature cited. As discussed above, there is no specific focus on air quality. Air quality is one of the 3 aspects we're targeting. Between our 2 reviewers, one has understood our point, not the other. We will work towards clarifying this in the updated version.

#Comment:page 2, line 7: Not sure that anthropized is a word. Anthropogenic seems correct, although not usually applied this way.

*Reply: We do not believe "anthropogenic" is the correct term to be used. We will

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replace anthropized by man-shaped.

#Comment:page 2, line 9: reference for energy balance?

*Reply: A reference will be added

#Comment:section 2 and use and intensification - this does not seem to be the appropriate title for section 2 - section 2 covers a lot more than this

*Reply: We will change the title to: Land Cover and Land Use changes: history, dynamics and challenges. We will also add text to this section explaining what is our understanding of agricultural intensification and urban intensification.

#Comment:page 4 lines 21-23: the section should start with this. it is unclear why the land use section starts with land cover. see comment above.

*Reply: We agree and we will start this section with lines 21-23.

#Comment:section 2.2: not much definition here. in fact you acknowledge that definitions vary considerably

*Reply: Title changed

#Comment:page 5, lines 23-26: confusing- i am not sure what these numbers refer to.

*Reply: These numbers will better explained.

#Comment:page 6, lines 7-8: reference?

*Reply: Reference will be added.

#Comment:not sure all these equations are necessary. this whole section seems like a textbook. who is the audience? a shorter description of how things change is more meaningful. The description can cite various studies on these effects, and be more digestible by the reader. there are no citations in this section. actually, this section can be deleted because the next 3 sections are the ones that makes the point.

*Reply: This section will be moved to an appendix. Moreover, in the Introduction, we

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will precise the reader to whom the paper is addressed to.

#Comment: this section makes the case of the previous section.

*Reply: This section will be moved to an appendix

#Comment: page 12, line 29: and burning, and understory treatment, and different types of harvest, and planting

*Reply: Sentence will be added.

#Comment: again, this section makes the point of section 3.1

*Reply: This will be addressed by changing the organisation.

#Comment: section 3.1.3 urban intensification this should probably be grouped with LULCC and it doesn't need all the references to the equations

*Reply: References to equations will be removed. The sections will be modified as stated above in the general replies.

#Comment: section 3.2 biological this textbook section is unnecessary as the following sections make the case

*Reply: Agree and will be removed to an appendix.

#Comment: 3.3 chemical another long textbook section

*Reply: Agree and will be removed to an appendix.

#Comment: 3.3.1 land use intensification (page 23) here is a review relevant to land change and air quality. But it reads more like a list than a review of evidence for making a point.

*Reply: Title will be changed to land cover change. Content as stated above will be merged with other sections and will be synthesized to read less as a list.

#Comment: 3.3.2 ag intensification it seems like the previous ag section was cut short

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to put the information here

*Reply: These sections will be merged as stated above.

#Comment:3.3.3 urban page 23: what are the suggested trees in CA?

*Reply:We will specify which tree species are concerned.

#Comment:4.1 local to meso and 4.2 ecosystem these don't seem to have any relation to air quality

*Reply: In this paper we focus on the effects of LULCC and LI on air quality but also on local climate. This will be clarified in the introduction.

#Comment:4.3 air quality this is relevant, and expands upon sections 3.3.1-3.3.3 but now you have mashed together the land type framework

*Reply: We agree with you, however in this section we have chosen to look at the interactions from a landscape/regional perspective and to discuss how differently LULCC and LI interact together within a spatial framework.

#Comment:5.1 this is a lengthy repetition of the previous reviews without the citations

*Reply: This section will be removed and merged within the new section 3 as stated above.

#Comment:page 34 you really haven't shown the linkages and feedbacks. the information is all compartmentalized. While your challenges are legitimate, it isn't clear how you reached them based on the previous reviews. there are little to no citations in this section, especially regarding modelling. you also don't acknowledge that models are essentially simplifications, and that they cannot contain every single detail, and that not every single detail matters for the desired outcome of a model.

*Reply: By changing and better discussing the literature in the modified section 3 we believe this question will be addressed. We will acknowledge model specificities as

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3. Human driven land use and land management changes and their impact on climate and air quality

3.1. Land Cover Change

3.1.1 Experimental studies

3.1.2. Modeling studies

3.1.3. Critical synthesis of studies

3.2. Land intensification (agricultural and urban)

3.2.1 Experimental studies

3.2.2. Modeling studies

3.2.3. Critical synthesis of studies

4. Interactions between different land cover, uses and management over a mosaic landscape: impacts on land-surface exchanges

4.1. Local- to Meso-climate perspective

4.2. Ecosystem functioning perspective

4.3. Air quality perspective

5. Discussion

5.1. Challenges ahead

5.2. Towards interdisciplinary approaches: some examples

5.2.1. Urban – agricultural – natural triptych in a N pollution context

5.2.2. Urban greening – UHI - and impact on VOC / NO_x / O₃ loop

6. Bridge the gap between communities: the need for developments in the interplay

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between climate scientists and spatial planners

6.1. Introducing/reintroducing climate expertise into the spatial planning process

6.2. More consideration for land-use management

7. Conclusion

Interactive comment on Biogeosciences Discuss., <https://doi.org/10.5194/bg-2018-419>, 2018.

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