Comment No	From Page	From Line	To Page	To Line	Comment	Response
33557	0	0	0	0	Overall interesting and informative chapter, nice work! [Sonia Seneviratne, Switzerland]	Thanks.
33567	0	0	0	0	It would be useful to mention somewhere in the chapter the impacts of droughts on the carbon cycle (e.g. recent paper of Humphrey et al. 2018, Nature: Humphrey, V., J. Zscheischler, P. Ciais, L. Gudmundsson, S. Sitch, S.I. Seneviratne, 2018: Sensitivity of atmospheric CO2 growth rate to observed changes in terrestrial water storage. Nature, 560, 628-631). This constitutes a possible global-scale effect of a regional-scale feedback. [Sonia Seneviratne, Switzerland]	Accepted. Text revised.
6273	0	0	0	0	A lot of inconsitency throughout in the use of subscripts (or not) in chemical formula. [Tristan Quaife, United Kingdom (of Great Britain and Northern Ireland)]	Taken into account
40457	0		0		Please see my general remarks on the report and those on the SPM. I appreciate the developments of chapter 2 from the FOD. Chapter 2 is addressing all the elements identified during scoping. It could better convey the sense of knowledge developments and needs to improve the style. Aspects of deep uncertainty could be explicitely covered (as done in SRCOCC, which refers to e.g. permafrost). The ES could touch aspects linked with global greening / browning covered in the chapter. [Valerie Masson-Delmotte, France]	The new ES includes a statement on global greening and browning. The chapter was restructured with the last section assessing improved ecological and biogeochemical process understanding, that needs to be included into climate models and ESMs. A box on CO2 fertilization, a key uncertainty in projecting future Carbon sink and the state of vegetation, assesses the latest literature
40459	0		0		The ES could be more explicit on what is new, recent trends, knowledge developments and knowledge gaps. [Valerie Masson-Delmotte, France]	We have rewritten most bullets and paragraphs of ES to highlight these key messages.
40465	0		0		Providing a bullet point on carbon in soils which could feed the SPM could be relevant. [Valerie Masson-Delmotte, France]	Soil carbon in ES
40469	0		0		I have a concern with the style of the chapter. It has a tendency to highlight key findings upfront, then list a long suite of references after sentences. My recommendation, in line with IPCC standards, is to first guide the reader (why do we assess this), then assess the evidence and agreement from the literature (which papers provides what, why relevant etc), then write a summary statement of the key finding using the calibrated language. [Valerie Masson-Delmotte, France]	We tried to follow this suggested style in revision.
40487	0		0		Issues linked with changes in emission of pollen by plants and allergy - health aspects are missing throughout the report. Could they be addressed in Chapter 2, for instance in 2.3.3 (climate driven changes in terrestrial ecosystems , and their implications)? [Valerie Masson-Delmotte, France]	Rejected. We do not have time to include CA specialists any more and the ones we questioned reported limited literature on the issue. We decided to leave this out.
40549	0		0		There is a strong imbalance of section 2.7. The title refers to adaptation nd mitigation but the substance is only targetting mitigation. Why? [Valerie Masson-Delmotte, France]	Noted and section restructured
40555	0		0		Would chapter 2 provide background information on tipping points, abrupt change, irreversibility? This is covered in a superficial way in a box in chapter 7 which needs to be carefully discussed and where the assessment needs to be rigorous and balanced. [Valerie Masson-Delmotte, France]	We have assumed that the theme of tipping points and irreversibility is situated in the context of risk assessment and therefore chapter 7, who use the burning embers diagram to make the assessment. However, in Chapter 2 implicitly addresses the theme of thresholds in ecosystems in the first three paragraphs 2.3.4. Also in this section is assessed the emergence of novel climates and implications of this which implicitly assesses thresholds. Section 2.6.3.2 also assesses the feedback of permafrost on the climate. Additionally Chapter 6 assesses tipping points in the context of the irreversibility of biophysical impacts of warming (6.5.5)

Comment No	From Page	From Line	To Page	To Line	Comment	Response
24115	0	0			The role of forest management (the GHG impacts of managing forest without the involvement of land-use change) is not well explained and underrepresented, although it is a very big factor in the overall land GHG balance. [Zoltán Rakonczay, Belgium]	Accepted. Text revised.
24117	0	0			whole chapter 2: The proliferation of new acronyms of activities (LULCC, HLULCC, FLULCC, LCUM, etc.) of dubious usefulness is disturbing and confusing. They shoudl be dropped and/or simplified. Whatever is retained should be carefully cross-referneced with established terms, such as LULUCF and AFOLU. [Zoltán Rakonczay, Belgium]	We have checked throughout chapter to make them consistent, now use AFOLU, an IPCC stardard term
22373	0	1			General Comment - insufficient synthesis of key messages on fluxes and their links to MRV and mitigation (both in this chapter and the SPM) The messages in section 2.4 on GHG fluxes (and their relation to global mitigation efforts also in 2.7) are extremely important. However, the sections are extremely complicated, difficult to follow and not well synthesised. This may also be why they are not adequately reflected in the SPM (only in Box 1.1). Please make a greater effort to state the key information clearly, starting with the key points (and only later explaining the details of the caveats and methodological issues). Suggested framing of the key points could be: - Mitigation action (e.g. the Paris goals) and the pathways (published most recently in SR1.5) require net zero GHG emissions - The meaning of net zero emissions is subject to interpretation, which should be reflected in this report; - Although land globally is a carbon sink (the 6.3 GtCO2), "anthropogenic" AFOLU is a significant emissions source (12% of CO2, 24% of the main GHGs), but more clarity should be given on what is/is not included in "anthropogenic" (our ability to separate it from "natural" fluxes); - Most models/ pathways towards Paris goals (and their 'net zero' points) use models that estimate current net AFOLU emissions of 4.9 GtCO2. However, estimates based on national inventories estimate emissions of only 0.1 GtCO2. This difference is explainable. It does not mean that the inventories or models are incorrect. But it does raise serious implications for how progress towards global goals is measured. - Conclusion: the scientific community must propose ways of dealing with this discrepancy to ensure that global progress towards the Paris goals is not overestimated or underestimated. [Anastasios Kentarchos, Belgium]	Noted and text revised to include greater synthesis
22375	0	1			General Comment - length & structure The report is several times longer than the intended page count. Authors should be encouraged to streamline. For example, the substantive sections within each chapter should present the key arguments at the beginning. Debates about data sources and different methodologies should only be supporting material - and could possibly be moved to an annex. At times the chapter seems to take an opposite approach, providing lots of detailed information up-front, that is not always synthesised at the end of the section. [Anastasios Kentarchos, Belgium]	Thanks. Some sections are much longer than expected, but entire chapter exceeds page limit by about 1% as indicated by TSU. We have reorganzied materials at chapter and section level to make the storyline more logical and report chapter more readable, following your suggestions.
21663	0				Please cross-check all the numbers given in Tables 6.4ff in chapter 6, and reconcile with your chapter. If numbers are different, can they be rconciled? If Chapter 6 gives numbers that your chapter doesn't, why? Could you provide those numbers? Ideally, chapter 6 should be able to grab all numbers it needs for those tables from your chapter, not from the primary literature. [Andy Reisinger, New Zealand]	Accepted and cross-checked

Comment No	From Page	From Line	To Page	To Line	Comment	Response
18041	0				The usage of units is not always consistent. For "years" sometimes "yr" and sometimes "y" is used (e.g., page 5, lines 34 and 36). For "days" sometime "d" and sometimes "days" is used (e.g., page 19, lines 15 and 19). This should be unified in the whole document. [Clemens Schwingshackl, Switzerland]	Thanks. We have checked the entire chapter to make sure usage of units are consistent.
7307	0				This is a long and dense chapter and is likely to be hard for policymakers to read and understand. The figures are also often not easily understood by the "non-scientist" - so thought should be given to using tables that summarise the key points. For example, Chapter 4 uses summary tables well. [Debra Roberts, South Africa]	Good point. We have revised the lengthy sentences and complicated figures, and tried to summarize some key points with tables.
1385	0				In order to recognize if reference is a meta-analysis, please, refer to "The Handbook of Research Synthesis and Meta-analysis" (2009), Eds. Cooper, Hedges and Valentine, 600 pp. A meta-analysis includes effect size estimation for each study, summarizing effect sizes across studies by using weighting procedure, as well as estimation of heterogeneity of effect sizes and subgroup analysis. Any conventional statistics or modelling are not a meta-analysis. [Elena Valkama, Finland]	noted - when it is not referring to a proper meta analysis, this term is not used
32699	0				This chapter is very difficult to read. Some sections are repetitive. There is a lack of integration, resulting in sections that partly repeat each other but provide a somewhat different message on the same topic. Some more coherence is needed. [, Belgium]	We have further improved the chapter to make it more readable.
21863	0				Understanding of vegetation-aerosol-cloud cover related processes have developed but uncertainties are still very large and global estimates are almost impossible to give. However, there are new research results which illuminate the additional cooling effect of boreal forests through BVOC-aerosol-CCN mechanism. The role of this new infomation should also be analysed when discussing the net climate impacts of forest related actions. These uncertainties related to aerosols ought to be reflected especially in Ch 2. Please see references Spracklen et al. 2008, https://doi.org/10.1098/rsta.2008.0201, Liao et al. 2013, https://doi.org/10.5194/acp-14-8295-2014, Kulmala et al. 2014 http://hdl.handle.net/10138/228728, Nikinmaa et al. 2017 Biogeoscience Discussion https://doi.o [, Finland]	YES, I agree that the vegetation-aerosol-cloud cover issue would need more coverage, but you know that only a few papers exists such as Dom and Markku you mentioned. This issue will be better covered in AR6 chapter 6, SLCF that is under preparation. It would be too much detail to discuss the uncertainties issues in this section, since the report is quite broad.

Comment No	From Page	From Line	To Page	To Line	Comment	Response
33589	0				Please clarify wether the text about causes and effects of atmospheric water vapor is a new finding since AR5. AR5 gave the impression that levels of water vapor are mostly decided by atmospheric temperatures, not by emissions. This draft report, however, confirms that levels of water vapor also results from rates of irrigation ch. 2.2.7 (p 25) and 2.6.2.2.1 (p 83), and from rates of evapotranspiration more in general (see ch 2.6.1.1.1 (p 74, line 20-21)), which is no big surprise. However, the effects of this perturbation is not substantiated, which would be of high interest. Similarly, the finding is not so much reflected for other land use changes that may alter/intensify hydrological cycles. For instance, for deforestation in ch 2, p. 79 it is clear that there is a shift in rates of evapotranspiration, while the report only refers to a contrasting effect of cloud formation opposed to the GHG effect of vapor as such. Finally implications of this finding is not explored in subsequent assessment of various response options, for instance in ch. 6. Thus, in ch. 6, irrigation is mostly presented as helpful for food security, for productivity (and therefore carbon balances), and for local evaporative cooling. However, all of these effects are most pronounced under water-limited conditions. Hence, discharges down-stream will also be reduced, which may logically also reduce food security, carbon balances and evaporative cooling down-stream. Therefore, regional effects may be a zero sum game, leading to ambivalence. To surpass such ambivalence, overall judgement on effects for hydrology and atmospheric water vapor would be most helpful. A hypothesis would be that while irrigation (and other hydrological intensification) leads to local cooling, it also leads to higher energy transfer to the atmosphere so that levels of atmospheric water vapor increases, leading to global warming. [, Norway]	Noted. You're correct, the changes in atmospheric water vapor content resulting from changes in land are often referred to but not really quantified. This is because the literature does not provide information on numbers, but only discuss qualitative changes. This is a real gap in the understanding of how and by how much land influences climate
29657	0				Thank you to the authors for their work on this chapter [, Saint Lucia]	Thanks.
17637	0				Please check the use of the uncertainty language in the Executive Summary (and overall chapter), and use confidence statements, in line with the calibrated uncertainty language. [, Sweden]	Thanks, we hve checked uncertainty language throughout chapter and ES, and made necessary revisions.
28969	0				This chapter contains a lot of valuable information. It is quite heavy reading and in my view the authors still need to improve the presentation of the material. The structure is sometimes confusing to me. Changing the structure at this late stage is not possible, but it would help if the authors sharpen the text and reduce repetitions. Revisions to make it clearer how the various sections are diferent and hwo they relate to each other would help. The ES however, gives a quite good overview of material assessed and the finindings. [Jan Fuglestvedt, Norway]	We have reorganized materials cross section to avoid duplication and make entire chapter more integrated.
28971	0				The chapter is still too much of a review and I hope the authors can strengthen the assessment aspects. [Jan Fuglestvedt, Norway]	We have further improved by focusing on assessment instead of review.
28973	0				Many of the references are quite old, and I hope the authors can try to use more recent literature - to the extent possible. [Jan Fuglestvedt, Norway]	We have replaced most old references with newer ones.
28981	0				On use of scenarios: Somewhere in the chapter it should be explained why there there is a "literature lag"; ie that many impact studies referred to are based on old scenarios like SRES; while the later part of the chapter use new SSPs. [Jan Fuglestvedt, Norway]	Noted and considered

Comment No	From Page	From Line	To Page	To Line	Comment	Response
28983	0				In many cases the unit CO2e is used even if only one gas is discussed. This shuld be avoided. At LAM1 it was agreed that mass units should be used and that CO2e should be avoided to the extent possible. If used, it should be stated clearly how CO2e is calculated (which is done in a very few cases, e.g. fig 2.34) [Jan Fuglestvedt, Norway]	We need to give the time-frame for CO2-e in Table 2.4.1
29001	0				The amout of info in the chapter is sometimes overwhelming, and I am ofter left with the impression that "everything matters" without seeing what is important and what is less important. [Jan Fuglestvedt, Norway]	Noted. There are 3 levels in the processes we're presenting: 1) what already exists in land models and is robust, 2) what is known robustly but not yet included, and 3) emerging processes that we suspect may become important. What we're trying to say is that all processes need to be checked in terms of their importance. We do not yet have the quantification of those processes in the climate system, with respect to climate change so we don't know. We've tried to improve this in the final draft.
29017	0				In several cases it is said that "future projections show...". I find this too general and it woudl be very helpful if more info about scenario or level of warming is indicated. [Jan Fuglestvedt, Norway]	Accept, scenario information added.
26699	0				The report is very interesting and represents a valuable source of information. However, it is not so easy to read [Mathieu Jonard, Belgium]	We have further improved the chapter to make it more readable.
26701	0				since its structure promotes a certain dispersion and redundancy of the information. [Mathieu Jonard, Belgium]	We have further improved the chapter to make it more readable.
26703	0				The same subject is sometimes treated in various sections making difficult to synthesize the take home message. [Mathieu Jonard, Belgium]	We have reorganized materials cross section to avoid duplication and make entire chapter more integrated.
26705	0				For example, the biophysical effects on climate are discussed in the sections 2.1, 2.2, 2.6 and 2.7. [Mathieu Jonard, Belgium]	reorganized
26707	0				The titles of the sections and sub-sections are not always exclusive, meaning that [Mathieu Jonard, Belgium]	Sub-titles revised to reflect contents
26709	0				some subjects can potentially be treated in different sections. Consequently, this is not always easy to identify where [Mathieu Jonard, Belgium]	continue
26711	0				to find the information we are looking for. I am convinced that the same content could be presented [Mathieu Jonard, Belgium]	continue
26713	0				in less pages (- 35%) by reorganising the structure. This would make the report easier to read and increase its impact. [Mathieu Jonard, Belgium]	continue
26715	0				I am ready to help reorganising the structure if this option is retained. [Mathieu Jonard, Belgium]	Thanks.
347	0				there should be a consistencey in sign of sinks/sources (is negative flux to or from atmosphere). That should be clearly stated at the beginning of the chapter [Tobias Rütting, Sweden]	Accepted, the text has been revised
2493	0				This report is well-written and summarized the latest advances in recent years regarding to the land-climate interactions. My expertise is mainly on carbon emissions from land-use change and future land-based climate mitigation. I think the authors did a very good job in organizing all the papers in this field. However, the titles in the Table of Contents are a little bit too long to get the structure of this chapter. Please also find some small errors below. [Wei Li, France]	Yes, agree. We have revised some lengthy sub-section titles as suggested.

Comment No	From Page	From Line	To Page	To Line	Comment	Response
15851	1	1	1	1	General comments: This chapter is full of information, with a lot of redundacy, and the table of content is not very easy to follow. Quite difficult chapter to read, please try to harmonize a little bit. The authors work at the scales of biomes, but with no distinction about for example needle leaves versus broad leaved forests, amazon tropics versus central africa etc; sometimes the conclusions then seem very general. As a functional forest ecologist, I understand that the IPCC focuses on crabon balances, but per se they are really not enough to account for the climate impacts on ecosystems. Ecosystems are also suffering and see their vulnerability increase and this could jeopardize the conclusions of the GCM. There are strong links between biodiversity, carbon cycle, ecosystems structure, fitness, ecosystems services etc. It should be enhanced somewhere that counting on ecosystems to sequester carbon is only a way to gain time, to support the transition of our societies towards less GHG emitting systems. [Caroline Vincke, Belgium]	We have further improved the chapter to make it more readable.
15853	1	1	1	1	See Baldocchi and Penuelas, 2019. Global change Biology. [Caroline Vincke, Belgium]	Noted.
34061	1	1	1	1	Completely unclear why a summary figure on mitigation potential is in chapter 2 ….And this seems the only place where BECCS potential are shown .. [Elke Stehfest, Netherlands]	Noted
313	1	1	1	1	Was it ever explained in the plain common laguage anywhere in the report that CO2, CH4 and N2O have a very different GHG potential? And why seemingly small CH4 and N2O emissions are so important? -- I could not find it, but may be it was explaind in the other parts. [George Burba, United States of America]	Rejected. We do not have the space to review basic climate change science.
1281	1	1	1	1	GENERAL COMMENT: I find Section 2.7 unbalanced (Climate consequences of land-based mitigation and adaptation response options) which I would consider the most important section for policy-makers. With the exception of two of its subsections, all other subsections solely deal with GHG balances. Most subsections even don't mention the biophysical effects (except the section on bioenergy which I found very well balanced despite the sensitivity of the topic). I understood that one of the objectives of this chapter was to stress the importance of the biophysical effects of land-based mitigation options and the progress made on this issue since AR5 (that is what I understood from the introduction of the chapter). Some of the conclusions made in section 2.7.3.2 implicitly assume that the biophysical effects of land-based mitigation are climate neutral. This is an unacceptable assumption given the science that was reviewed in the preceding 100 pages. [Sebastiaan Luyssaert, Belgium]	Noted and revised to provide greater balance
1285	1	1	1	1	GENERAL COMMENT: The studies of 25, 50 or 100% afforestation are interesting from an academic point of view but I think that within the context of the IPCC it would be good to mention a realistic afforestation potential. The net afforestation potential is most likely zero and it is more likely that the future will bring net deforestation (see Erb et al 2016 in Nature Communications doi/10.1038/ncomms11382). We also have a pretty good idea where deforestation will occur. So, why not refining this discussion by moving beyond highlighting hypothetical results? I have the feeling that after 20 years of afforestation/deforestation of studies we should be able to do better and present a more informative summary (= more relevant for policy makers). [Sebastiaan Luyssaert, Belgium]	Accepted. Most of them are not cited anymore

Comment No	From Page	From Line	To Page	To Line	Comment	Response
1287	1	1	1	1	GENERAL COMMENT: The report is largely focused on the question and results of land cover change. I think it is a pity that more recent (but less mature) work on the impact on land management is hardly mentioned. I realize that I'm biased but I think the study of Erb et al 2016 in GCB (doi/10.1111/gcb.13443) gives a nice overview of the state-of-the-art in that field. Along the same lines I was disappointed to see that the combined biophysical and biogeochemical effects of "cattle" and "forest management" are hardly mentioned and not at all discussed in detail (prior to section 2.7 – but also not in section 2.7 see above). [Sebastiaan Luyssaert, Belgium]	Noted. We respectefully disagree. Land management is discussed in many sections and also other chapters with respect to its impacts on the emissions of GHG. What is correct is that the discussion on its impact on the physical climate system is reduced. We have now added some text on forest management, however you must realize that even if recent progress has been made, the literature remains poor with respect to the impacts of land management of regional climate
1289	1	1	1	1	GENERAL COMMENT: I'm confused by the structure of the chapter as a whole. Several topics are mentioned in at least three separate sections: afforestation/deforestation, urban heat island, agricultural management. I have a hard time understanding the differences between sections 2.2, 2.6 and 2.7. Could this be combined in a single more comprehensive section? [Sebastiaan Luyssaert, Belgium]	Accepted. We have substantially revised section 2.2 and harmonized it with 2.6 wherever there were duplicates.
24289	1	12	1	12	Change Bernsten to Berntsen [Terje Berntsen, Norway]	Changed
4091	1		118		This is a key chapter. However, the way it is organized, its storyline, provide a misleading perception: the uncertainties prevail over the certainty. This and at this stage, regarding a number of key topics is very preoccupying. Consequential reasoning may lead the less informed audience towards scepticism and eventually brings water at the mill of deniers, and inaction. It is highly suggested to organize paragraphs, boxes, to include specific boxes and so provide a more balanced view (perhaps some anticipation from the FAQs). The "certainties" should be highlighted and given higher dignity! [Turi Fileccia, Italy]	Revised by highlighting certainties over uncertainties
12857	1	1	119	24	Overview: This is a very impressive document, but much of it is hard to digest. Lists of references are often given in place of physical insight, though there are some paragraphs with good amounts of physical insight. Scenarios referred to by physical mechanism (e.g. assumptions about temperature or N concentration) would mean a lot more than, e.g.. RCP8. The categories of, e.g., robust evidence seem to frequently take the place of any physical description of evidence. A layperson would have great difficulty in understanding many sections. I suggest going thru the doc and replacing jargon and model labels, where possible, with physical descriptions/insight as to analysis paths and data acquisition and prediction. It would also be very helpful if there were a 1-to-1 correspondence between headings in the Exec Summary and the Table of Contents/structure of the chapter, with chapter numbers in the exec summary in ascending order. [Robert Treuhaft, United States of America]	Executive summary is not intended to have a 1-to-1 correspondencewith the Table of Content/structure of the chapter. The chapter was restructured to improve flow of the assessment and improve readability, including references to other chapters in which many concepts such as representative concentration pathways (RCP) scenarios were introduced. The report also now includes a glossary of the established scientific terms used across the three IPCC working groups.
24715	1		119		Knowledge gaps and key uncertainties are missing from this chapter, although this is specified throughout the chapter. [gunnar austrheim, Norway]	noted - this aspect is improved key knowledge gaps in new section 2.7

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14107	1	1	187	14	Overall comment: The chapter is comprehensive and provides an excellent review of the available literature on land-climate interactions. I did not note any serious gaps in the content. However, I felt the content of other chapters in the report could be better (more fully) cross-referenced. Also, I was surprised at the number of typological errors and inconsistencies. These were not enough to cause problems with following the content of the chapter. I also noted a few occasions where text/figures were missing. I have tried to highlight as many of these as possible in my more specific comments below. I would have liked to have had the time to read thoroughly and comment on the other draft chapters in the report. Unfortunately my paid job as a university professor has got in the way - so I have had to be content with concentrating on Chapter 2, the subject of which is where a lot of my current interest and expertise resides. [David Taylor, Singapore]	Agree, we have coordinated with chapter 3, 4, 5 to make them consistent by cross referencing. We also checked typos throughout the chapter and corrected.
14109	1	1	187	14	Referencing: the range of references cited is impressively comprehensive. However there are lots of errors in referencing, from inconsistencies in the format of text-based references (placing of brackets, ordering of references when several are cited at once), to errors in references through to references cited in the text but not listed in the reference list. I have tried to highligh as many of these errors in the "Editorial" commetns below. [David Taylor, Singapore]	Checked and corrected
8891	1	1	187	14	The UNCCD SPI reviewers welcomed the progress made on SOD Chapter 2. The UNCCD SPI reviewers would like to stress the following supplementary points i) The chapter include a general relationship between drought and climate change, but would be useful to include examples or suggestions on how the regions can make an adaptation on the impacts of the climate change and drought, ii) Many aspects on desertification, land degradation and food security outlined in chapter 2 are associated with the chapters 3, 4 and 5 of this report. Chapter 2 would therefore greatly benefit from including cross-references to the following chapters wherever possible, this would also strengthen the storyline across the chapters and also strengthen the integrative nature of this special report, ii) Consider defining terminology, UNCCD SPI would recommend to consolidate spatial scales (local, regional) definition (see UNCCDP SPI comment on SPM). [Jean-Luc Chotte, France]	Thank you for the constructive suggestions. (1) It falls beyond the approved scope of this chapter to discuss adaptation options and we refer the reviewers to Chapters 4, 6 and 7 where adaptation is discussed in various sections. (2) We have greatly reduced the sections on desertification, land degradation and food security as there was a lot of overlap between these sections and the chapters so we cross-reference to the chapters as appropriate. (3) We appreciate the desire for consolidation of spatial scale, however, in many instances this is not appropriate for the biophysical environment. For example climate space (and time) scales have specific meanings wrt atmospheric phenomena that are not transferable to land process scales.
8899	1	1	187	14	General: Many aspects on desertification, land degradation and food security outlined in chapter 2 are associated with the chapters 3, 4 and 5 of this report. Chapter 2 would therefore greatly benefit from including cross-references to the following chapters whereever possible. This would also strengthen the storyline across the chapters and also strengthen the integrative nature of this special report. [Jean-Luc Chotte, France]	Agree, we have coordinated with chapter 3, 4, 5 to make them consistent by cross referencing.

Comment No	From Page	From Line	To Page	To Line	Comment	Response
17021	1	1	187	15	General comments chapter 2: - Well presented, just rather exhaustive on AR5 and the link to the report theme is not always evident to the reader. - Full of acronyms, that are often defined in different places, such as greenhouse gas (GHG), gross primary production (GPP) or soil organic carbon (SOC). A final reading will likely harmonise the use of the many acronyms in the text. - The chapter is very comprehensive and one wonders how the information presented relates to the scope of the report, such as the emission/removal accounting passages and the extrensive discussion of models. Biogenic Volatile Organic compounds are affecgted by climate changie, but are they of relevance to processes of land degradation and desertification? In case one agrees than one should also demonstrate how. The chapter also contains a fair amount of repetitions of the same message. For example, on page 94 one learns "Carbon stored in biomass and soils is at risk of future climate change, natural disturbances and future management changes for example harvesting of forests." One should have understood as much by now. - 67 pages of references, which is about half of the pages with text. [Roland Hiederer, Italy]	We have attempted to clarify in the chapter 2 introduction as well as throughout the chapter links to three pillar chapters and the themes of the report . We tried to be consistent and define acronyms at their first mentioning in the chapter 2. The scope of the report and chapter 2 includes an assessment of knowledge on emissions of non-greenhouse gases which affect regional climate. BVOCs are precursors of secondary aerosols which play an important role in many regions of the world. We have clarified it in the section 2.5. Models are discussed extensively because they are one of the main tools to understand past land-climate interactions and the only tool to predict future.
8623	1	1	187	16	General remark : I found the chapter very long, with many redundancies and lack of harmonisation between chapters. All of this made the chapter very difficult to read, even for a sceintist. A deep editorial work is needed to reduce and harmonize the chapters. [Marc Aubinet, Belgium]	Removed redundancies and enhanced integration in revision.
8917	1	1	187	57	General comment on chapter 2: The chapter include a general relationship between drought and climate change, but would be usufull to include examples or suggestions on how the regions can make an adaptation on the impacts of the climate change and drought. [Jean-Luc Chotte, France]	This is beyond the scope of this chapter
8919	1	1	187	57	GENERAL: Consider using terminology “extreme climate conditions” and ”extreme weather events” instead of “extreme climate events” and change in the text accordingly. Definition of “extreme climate events” (previously and after used in text of this Chapter) is given at page 31, lines 12-13 – is this a proper definition? Since climate is a statistical knowledge derived from long term weather observations, it is very strange to use an expression “climate event”. It is more suitable to say “extreme climate conditions” and for “events” use the terminology “extreme weather events”. Where is stated only “climate extremes” (for example at page 9, line 27) it is appropriate terminology if it points out to extreme climate parameter values (like temperature, precipitation, etc.). [Jean-Luc Chotte, France]	Accepted. We have altered the text to use the more correct terminology “extreme climate conditions” and ”extreme weather events” as appropriate. However, where citations refer to “extreme climatic events”, e.g. Ummenhofer and Meehl (217), we remain true to the literature and retain the terminology “extreme climatic events” as these events may be, for example multi-year droughts, which are not weather-scale events.
33965	1		187		Commending the CLAs and Las on putting this chapter together. Great work on a very complex topic! [Cecile de Klein, New Zealand]	Thanks.
1297	1		187		In general the chapter is very nicely written and the studies on regional level is included in the second order draft. So no more ammendments are required. [Pushp Raj Tiwari, United Kingdom (of Great Britain and Northern Ireland)]	Thanks.
3105	1	1			The chapter page limit is substantially exceeded. [, Russian Federation]	We have reduced the size by removing duplication and some details.
3157	1	1			Radiative forcing' is one of key concepts used in the chapter. It should be clearly defined somewhere: is it associated with the top of the atmosphere, with the tropopause, etc. [, Russian Federation]	Noted. You are correct and Radiative Forcing is now defined in the Glossary
3193	1	1			The term 'meta-analysis' is used in many sections throughout the chapter. It would be helpful to explain once the meaning. [, Russian Federation]	noted - when it is not referring to a proper meta analysis, this term is not used

Comment No	From Page	From Line	To Page	To Line	Comment	Response
17271	2	19	2	20	not clearly and precise assessed about the contribution about the climate change to the global vegetation photosynthesis. In current world, the continution of warming to the global vegetation photosynthetic activities is the most important one, rather than other factors winth the climate change, such as the precipitation change, wind speed change. After having a clear revised assessment available on the contribution of warming to the global vegetation photosynthsisi, it is better to make that assessment be inclusive into the SPM section. [Chengyi Zhang, China]	Noted. This is covered in the section that assesses rates ofgreening and browning. Greening and browning are proxies for photosynthetic activity.
2227	2	28	2	46	The links in the table of content is well done however, I suggest the the automatic table of content should be edited so that numbers will be well aligned. For Line 28(from), for line 35(in) for line 46(land) [Idowu Owoeye, Nigeria]	Changed
2225	2	19	9	21	I suggest the sentence should be written as Climate change is expected to alter the distribution patterns of land cover (Schlaepfer et al. 2017), species composition, diversity, vegetation, structure, productivity (Zhu et al. 2016), nutrient and water cycles. I am making this suggestion so to ensure that “alter”& ” “and” is simply used in the sentence. [Idowu Owoeye, Nigeria]	Sentences revised accordingly
235	2	1	11	1	Is the amount of CO2 emissions mentioned here , related to fossil fuel combustion only, or in addition to the CO2 emissions from the natural resources also . If related to the artificial resources only , I think more explanation is needs. [Ali Geath Eljadid, Libya]	Noted. Text revised.
233	2	27	11	31	Land use change causes significant modification on both land and atmosphere, [Ali Geath Eljadid, Libya]	Noted. Not sure whether this is an incomplete question or a comment. Anyway YES, land use causes significant changes on land and in this chapter we focus essentially on how those changes impact climate and not on how land affects land (e.g. changes in flooding, erosion, biodiversity, ...)
231	2	35	26	35	This paragraph should focus directly on the tropical ,and polar regions more than the other factors. [Ali Geath Eljadid, Libya]	Reject. We are unable to ascertain where in the text this comment is directed.
2229	2	1	66	1	Please check the last words of the sentence. The sentence ended with "by" (Scott et al. 2017). It looks incomplete. [Idowu Owoeye, Nigeria]	Revised
2231	2	1	82	1	Please check the sentence before the bracket "(2012)" No name was included in the reference, before the stated year. [Idowu Owoeye, Nigeria]	Checked and corrected
2233	2	52	96	52	Please correct grammer "be an problem for credible estimates" "It should be" be a problem" [Idowu Owoeye, Nigeria]	Checked and corrected
2235	2	1	98	3	Improvements in industrial efficiency are typically cost effective, "would" improve the productivity of the sector, reduce pollution, and have the potential to mitigate emissions (Zhang et al. 2013b; Dickie et al. 2014) Please check the use of "would" in the sentence. Do you mean this would or it would improve the productivity..... [Idowu Owoeye, Nigeria]	Checked and revised
2237	2	48	98	44	"(robust evidence, high agreement(Griscom et al. 2017;" Please edit by putting a space between--- "agreement and (Griscom et al. 2017" [Idowu Owoeye, Nigeria]	Revised
2239	2	3	99	3	"initially present in native ecosystems. (Houghton and Nassikas 2018b) have estimated a cumulative." This is unclear. Is Houghton and Nassikas 2018b a refrence to the sentence, ... initially present in native ecosystems or is it starting the sentence, ... have estimated a cumulative sequestration potential of 439 GtCO2 yr-1 between 2016 and 2100 if deforestation and wood harvest were stopped and secondary forests were allowed to recover. If it is starting a sentence I suggest the bracket be removed. [Idowu Owoeye, Nigeria]	Checked and revised
2241	2	41	100	41	"does not support climate mitigation when there is snow on the ground," should be completed. Since there is a comma after the word "ground". [Idowu Owoeye, Nigeria]	Revised

Comment No	From Page	From Line	To Page	To Line	Comment	Response
2243	2	31	101	36	(Although charcoal has been used traditionally by many cultures as a soil amendment, “modern biochar”, produced in facilities that control emissions, is not widely used. A global analysis of technical potential, in which biomass supply constraints were applied to protect against food insecurity, loss of habitat and land degradation, estimated technical potential abatement of 3.7–6.6 GtCO2-eq yr-1 (including 2.6–4.6 GtCO2-eq yr-1 carbon stabilisation), with theoretical potential to reduce total emissions over the course of the century by 240–475 GtCO2-eq ((Woolf et al. 2010). Please correct/edit the "(" infront of "Although" charcoal... it is not enclosed in a bracket and also check the bracket in front of Woolf et al. 2010. if it should be double or single. [Idowu Owoeye, Nigeria]	Checked and revised
6937	2	43			There seems to be a problem with this sentence, as it moves into line 44? [Debra Roberts, South Africa]	Checked and revised
417	3	3	3	3	The word "coherence" is not the right word - I do not know how to interpret it [Andrew Pitman, Australia]	Revised
14337	3	3	3	3	"Range of coherence levels" is an unclear phrase. I'm not sure what it means precisely [Benjamin Sulman, United States of America]	Revised
38645	3	3	3	3	"There is a range of coherence levels in the understanding of…" doesn't make sense. [, United States of America]	The original sentence was deleted
28975	3	3	3	3	What is meant by "range of coherence" ? [Jan Fuglestvedt, Norway]	Revised
17297	3	3	3	3	The expression "range of coherence levels" is very rarely used (Google search) and hard to understand even for native speakers. For the first paragraph of the executive summary, plain language should be used. [Jarle W. Bjerke, Norway]	Revised
12813	3	3	3	3	The meaning of "coherence level in the understanding" is not clear. "Coherence" has a specific mathematical definition It is not referred to here. [Robert Treuhaft, United States of America]	Revised
16965	3	3	3	3	Suggested to modify "There is a range of coherence levels …". The meaning of the sentence is not evident. [Roland Hiederer, Italy]	The original sentence was deleted
18029	3	3	3	5	I would split this sentence into two sentences to make it better understandable. [Clemens Schwingshackl, Switzerland]	Revised
17623	3	3	3	5	This seems just to say that we understand some things better, and some things worse, and that the whole issue of land-climate interaction is deeply uncertain. The first part is trivial (In addition, the previous sentence already expresses the key issue, i.e. complexity), and second part is easily misleading, as there is knowledge on many issues, which the overall chapter also informs about. Suggest deletion. [, Sweden]	the sentence was deleted
18203	3	3	3	5	sentence structure/language; coherence does not imply uncertainty [Julia Nabel, Germany]	the sentence was deleted
17063	3	3	3	5	This sentence is rather important, but at the same time rather vague. As it is now is states that the uncertainty is a consequence of the range of coherence levels. That is not directly the case although the range of coherence levels is likely to contribute to the complexity (and uncertainty) on the matter. Also, what is meant by levels? Processes (physcial/chemical/biological)? Spatial? Temporal? [Morten Andreas Dahl Larsen, Denmark]	The original sentence was deleted
17625	3	5	3	5	Is "a new" entirely correct here, or would "improved" or "further improved" be more nuanced? [, Sweden]	Checked and revised

Comment No	From Page	From Line	To Page	To Line	Comment	Response
419	3	5	3	7	I think this assessment that a "new understanding has emerged" is not really true. I fully accept that many elements of land-climate interactions have been explored and examined but in many cases this has led to more understanding about how mucu we do not know. I think we have developed a better understanding of what we do and do not know but this has not translated into improved modelling in general or better predictions. Perhaps it is the precise English but it feels contradictory with the recognition later in the chapter of major knowledge gaps [Andrew Pitman, Australia]	Revised
38647	3	5	3	7	Scope of "new understanding" should include chemicals as well as water, energy, and GHGs (BVOCs). [, United States of America]	Extended
28977	3	6	3	6	Aerosols should be added after GHGs [Jan Fuglestvedt, Norway]	Assessed in section 2.5
18031	3	7	3	7	The line has many "and" and "or" and thus it is hard to understand. I would recommend again, to split the sentence to make it easier to understand it. This part might be read by most people, since it is the beginning of the chapter. Thus, it should be easy to understand. [Clemens Schwingshackl, Switzerland]	Revised
14759	3	7	3	7	add the prior to impacts [Jizhong Zhou, United States of America]	Added
3057	3	11	3	11	Suggestion: replace 'As a result of warming due to anthropogenic climate change' with 'As a result of anthropogenic warming'. [, Russian Federation]	Accept. Text revised
7503	3	11	3	17	Thawing permafrost is also an important self-reinforcing feedback that will amplify warming as the thawing permafrost releases carbon dioxide and methane into the atmosphere, which even a small amount of carbon from permafrost (1%) can double the current rate of warming; see World Bank & International Cryosphere Climate Initiative (ICCI) (2013) ON THIN ICE: HOW CUTTING POLLUTION CAN SLOW WARMING AND SAVE LIVES, 17 (“Permafrost scientists estimate that release of just one percent of stored carbon in the form of methane will double current rates of warming due to methane’s more powerful near-term forcing effects.”) and Schuur E. A. G., et al. (2015) Climate Change and the Permafrost Carbon Feedback, NATURE 520: 171–179, 171 (“At the proposed rates, the observed and projected emissions of CH4 and CO2 from thawing permafrost are unlikely to cause abrupt climate change over a period of a few years to a decade. Instead, permafrost carbon emissions are likely to be felt over decades to centuries as northern regions warm, making climate change happen faster than we would expect on the basis of projected emissions from human activities alone.”). [Durwood Zaelke, United States of America]	Noted. There is limited evidence about the rate of the feedback of permafrost melting on the atmosphere (see 2.6.3.2 which deals with the theme of this comment) therefore this was not included in the executive summary.
7583	3	11	3	17	Thawing permafrost is also an important self-reinforcing feedback that will amplify warming as the thawing permafrost releases carbon dioxide and methane into the atmosphere, which even a small amount of carbon from permafrost (1%) can double the current rate of warming; see World Bank & International Cryosphere Climate Initiative (ICCI) (2013) ON THIN ICE: HOW CUTTING POLLUTION CAN SLOW WARMING AND SAVE LIVES and Schuur E. A. G., et al. (2015) Climate Change and the Permafrost Carbon Feedback, NATURE 520:171–179. [Kristin Campbell, United States of America]	Noted. There is limited evidence about the rate of the feedback of permafrost melting on the atmosphere (see 2.6.3.2 which deals with the theme of this comment) therefore this was not included in the executive summary.
12815	3	11	3	17	This is so general as to not be very useful. General terms such as "novel" should be avoided. [Robert Treuhaft, United States of America]	Accept. Text revised to be more succint and specific
12817	3	11	3	46	There is only one number (line 41) in 4 sections of Implications. Each qualitative statement, or at least one per paragraph, should have a number so the reader knows exactly what's going on. [Robert Treuhaft, United States of America]	Agree, we have rewritten ES to include more numbers.
22377	3	13	3	13	Shifts are not only associated with latitute, but also with altitude [Anastasios Kentarchos, Belgium]	Accept. Text revised to include altitude

Comment No	From Page	From Line	To Page	To Line	Comment	Response
421	3	15	3	17	The bold heading to this paragraph is about the tropics. The text on the lines 15-17 are about high latitudes. This text should therefore me under a separate subheading, or the subheading should be more general [Andrew Pitman, Australia]	Accept. Bold text revised to include tropics and mid-latitudes.
14761	3	19	3	19	Since 1980s [Jizhong Zhou, United States of America]	Accept. Sentence has been restructured and reworded to include new information.
3345	3	19	3	22	I wonder if there is high agreement that "Since the 1980s, global vegetation photosynthetic activity (i.e. greening) has increased primarily as a result of CO2 fertilisation, nitrogen deposition, and climate change". This is because the second sentence indicates that "since the mid-1990s, trends of decreased photosynthetic activity (browning) have increased"? How could we understand that? [Rongshuo Cai, China]	Accept. Sentence has been restructured and reworded to include new information.
423	3	19	3	27	This paragraph is jumbled. It needs re-writing so it is clear what the authors mean the reader to understand [Andrew Pitman, Australia]	Accept. Sentence has been restructured and reworded to include new information and greater clarity.
7349	3	19	3	27	Using the word "fertilisation" for CO2 may be considered as a positive treatment. I think better to use increased CO2 levels [Erhan Akca, Turkey]	Noted. However, the phrase "CO2 fertillization" is an accepted term commonly used in the land use community. We therefore retain the phrase.
14763	3	20	3	20	climate warming , not climate change because elevated CO2 is also climate change [Jizhong Zhou, United States of America]	Accept. Text revised as suggested
17627	3	21	3	21	It is not clear what has increased ("increased trends of decrease"). Have existing trends become stronger? Are more regions/locations showing such a trend? [, Sweden]	Noted. Sentence has been restructured and reworded to include new information and greater clarity.
22379	3	24	3	24	Does it make sense to discuss a global greening/browning trend, given that regional patterns vary? Also, different sentences in the paragraph seem to disaree on whether there is a general greening, browning (or greening-to-browning) trend. Re-phrase. [Anastasios Kentarchos, Belgium]	Noted. Sentence has been restructured and reworded to include new information and greater clarity.
17629	3	24	3	24	The whole sentence speaks of regional increases in browning and greening, respectively. It is not clear how this translates into uncertain global trends (in principle, global mean trend may be small even in the presence of significant regional trends). Please clarify, and also add appropriate confidence statement(s). [, Sweden]	Noted. Sentence has been restructured and reworded to include new information and greater clarity.
13391	3	25	3	25	The description of browning is too simplified. Browning is caused by many different processes, such as icing, fire, insect outbreak etc. See paper by Phoenix and Bjerke (2016) in Global Change Biology 22: 2960-2962: Arctic browning: extreme events and trends reversing arctic greening [Anders Bryn, Norway]	Noted. This is accounted for in the main body of the text.
16589	3	26	3	27	What about increased growing season temperatures? [Siri Lie Olsen, Norway]	Accept. Text revised to include this
3059	3	29	3	29	' increases in frequency, intensity and duration of extreme climate events ' is a part of 'climate change '. Suggestion: the beginning of the phrase could be as follows: ' Changes in mean values of climatic variables '. [, Russian Federation]	Acccept. Sentence altered to reflect this
38649	3	29	3	29	Should "extreme climate events" be reworded as "extreme weather events"? [, United States of America]	Accept. Text revised as suggested
3349	3	29	3	30	I would suggest to use "high confidence" to replace (robust evidence, high agreement) and hereafter to follow the judement and expression of 《Guidance Note for Lead Authors of the IPCC Fifth Assessment Report on Consistent Treatment of Uncertainties IPCC Fifth Assessment Report on Consistent Treatment of Uncertainties》. [Rongshuo Cai, China]	Accept. Text revised as suggested
33555	3	29	3	30	Add "some" before "extreme events". Not all extreme events are increasing or becoming more frequent (e.g. cold extremes) [Sonia Seneviratne, Switzerland]	Accept. Text revised as suggested

Comment No	From Page	From Line	To Page	To Line	Comment	Response
20993	3	29	3	37	Try to present both risks and opportunities (even if the latter are limited) to showcase balanced language. The previous paragraph recall that their was mainly a greening since the 80s. Speak of the potential for this trend to continue in the future (or of the impact in the reduction of the risk of frost in various regions). [, United Kingdom (of Great Britain and Northern Ireland)]	Noted. However, the greening is a function of mean change in temperature (not extremes) and also anthropogenic land change.
3347	3	31	3	33	Questions: 1) Why Is the Indonesia not involved in the South East Asia? 2) The assessment result of Heat Waves is a bit different from the chapter 3 of Special Report on Global warming of 1.5°C, which pointed out that “The strongest warming of hot extremes is projected to occur in central and eastern North America, central and southern Europe, the Mediterranean region (including southern Europe, northern Africa and the Near East), western and central Asia, and southern Africa (medium confidence).” [Rongshuo Cai, China]	1. Accept. 2. Noted. It should be noted that heat waves are a subset of "hot extremes". Therefore the geographic distrubution of this subset in this special report may be different to the geographic distribution of all "hot extremes" in SR15.
427	3	33	3	33	Therre is an on-going narrative that drought risk will increase. I know this is throuhout the literature, but there is also literature that suggests that how drought risk is assessed forces a false impression of increasing drought risk. A discussion on this is presented her: Nature Climate Change volume 9, pages44–48 (2019) and in an associated News and Views in the same jounal. In general, I think the evidence that there will be a general increase in drought underglobal warming is speculative. It might be right but it is not appropriate to speculate. [Andrew Pitman, Australia]	Noted. Thanks for the reference. We note the paper is very careful to talk about non-water-limited regional and the only region mentioned in the executive summary statement that conflicts with that of the papers Figure S1 is potentially the southern Amazon However, for this region there is much literature that points to increased drought frequency so we have decided to retain the assessment of "medium confidence" of increased future drought in these regions.
669	3	34	3	34	Please check if this is true for the whole Amazon. To me it seems like evidence is pointing towards a dryer Southern Amazon, while Northern Amazon could get wetter. Please see my further comments on the section 2.3.5. [Anna Sörensson, Argentina]	Accept. You are correct and the thext has been adjusted to reflect this.
17631	3	35	3	35	"Pose the greatest risk" is not very informative as it does not state how great the risk is, how it compares to other factors behind significant risk, etc. [, Sweden]	Accept. Text revised
8907	3	35	3	36	The drought events generate greatest risk not olny on the terrestial ecosystem, there are also risk in acuatic ecosystem in terms of quality and quantityof water and the biodiversity (Reference https://es.greenpeace.org/es/wp-content/uploads/sites/3/2017/11/Sequia-Falta-de-Agua_WEB-1.pdf) [Jean-Luc Chotte, France]	Noted. The reference to ecosystems has been removed and now more generaly refers to GPP.
16591	3	36	3	36	Greater compared to what? [Siri Lie Olsen, Norway]	Accept. Sentence has been altered to remove this confusion.
425	3	39	3	39	I suspect a great deal of the increases in wildfires are associated with rainfall regiemes, fuel loads and not temperature. I cannot prove that, but I doubt the authors can prove that the incresaes are mainly linked with temperature. A little more generalisation of the text could resolve this. [Andrew Pitman, Australia]	There is still much uncertainty on this issue. It would be premature to include all this in the ES. We have only gone by the published work
17633	3	39	3	40	If the temperature and droughts are related (both due to warming), it would be good to rephrase here, so that it is noted. [, Sweden]	The point is relevant but this is a complex issue which cannot be captured in this paragraph on fire attribution
3351	3	39	3	40	The "medium confidence" can replace the (Medium evidence, medium agreement) here. Based on the《Guidance Note for Lead Authors of the IPCC Fifth Assessment Report on Consistent Treatment of Uncertainties IPCC Fifth Assessment Report on Consistent Treatment of Uncertainties》, the use of uncertainty language in the following text is the same or similar. [Rongshuo Cai, China]	Accepted. Done
20995	3	39	3	45	Wildfires are an area of intense debate - it would be useful if A 4.5 in the SPM could be expanded with some of these messages, e.g.lengthened fire weather season by 18.7% , fire trends and impact on future ghg emissions. [, United Kingdom (of Great Britain and Northern Ireland)]	The point is relevant but this is a complex issue which cannot be captured in this paragraph on fire attribution
26891	3	39	3	46	Please provide an assessment of the information available about the attribution of changes in fire activities to human activities. [, Germany]	This aspect has much uncertainty and it would too much text to include in the ES. The main box of fire has more detail.

Comment No	From Page	From Line	To Page	To Line	Comment	Response
22381	3	41	3	41	I would suggest to omit decimals here, i.e. 19% instead of 18.7%, since the uncertainty range exceeds the decimals. [Anastasios Kentarchos, Belgium]	The number has been omitted now
14617	3	41	3	41	18.7% seems excessively precise for something like fire season. [, Canada]	Accepted. Although this figure is from a published paper, the number has been removed and the sentence written in more general terms
25317	3	41	3	41	A word should be said on very recent mega-fires, including 2017 and 2018, even if it is to say that scientific knowledge of these very recent events is still too limited to be included in this report. [, France]	The mega fires have been mentioned in the main text. This is too much detail for the ES as these events have happened very recently and causes are unclear. There is little published work.
3061	3	41	3	41	An uncertainty statement (likelihood) would be appropriate here. [, Russian Federation]	Accepted. Provided
8895	3	41	3	41	Is there a reference for the 18.7% statistic claim? [Jean-Luc Chotte, France]	Noted. Text altered to more generically reflect drought.
1749	3	41	3	41	Perhaps the authors could comment on the fires occurring worldwide during 2018, as a way of making the problem more concrete. [William Lahoz, Norway]	Noted. Assessment based on the available scientific literature
16593	3	42	3	43	Briefly mentioning why there is less burning in grasslands and savannahs would be informative. [Siri Lie Olsen, Norway]	Noted and revised
22383	3	45	3	45	Delete "net"! [Anastasios Kentarchos, Belgium]	Noted and clarified
20997	3	45	3	45	the adjective net needs clarifying in the expression "net fire emissions of GHG and carbonaceous aerosols". Please clarify by using more precise wording such as "increasing/higher than the sink in the following years..." [, United Kingdom (of Great Britain and Northern Ireland)]	Noted and clarified
24119	3	45	3	45	Delete "net"! [Zoltán Rakonczay, Belgium]	Noted and clarified
23669	3	50	3	50	Regional effects of global warming or Global warming signal at a regional scale? [Xiyan Xu, China]	Taken into account. We were talking about the regional manifestation of global warming. The statement has substantially changed but we tried to make this point clear
3353	3	50	3	51	I would suggest to use "medium confidence" to replace the (Medium evidence, medium agreement) and hereafter to follow the judement and expression of 《Guidance Note for Lead Authors of the IPCC Fifth Assessment Report on Consistent Treatment of Uncertainties IPCC Fifth Assessment Report on Consistent Treatment of Uncertainties》. [Rongshuo Cai, China]	Taken into account. We have made a better use of IPCC confidence language. However this specific item has been completely rewritten
429	3	51	3	51	I think this statement is "robust" and I note that most later assessments are robust. [Andrew Pitman, Australia]	Taken into account. We have made a better use of IPCC confidence language. However this specific item has been completely rewritten
17635	3	51	4	1	Should avoid indicating stated decrease with negative numbers. (Negative decrease is an increase…) [, Sweden]	Taken into account. However this specific item has been completely rewritten
22385	3	51	4	3	It is odd to expose irrigation as the first example in the summary. No objection on substance, but this unqualified reference may present irrigation as a desirable activity, without regard to the source of irrigation water or the sustainability of the irrigation scheme, despite the fact that competition for water is increasing, many irrigation schmemes are patently unsustainable and some of the more water-efficient irrigation schemes (drip irrigation, subsurface irrigation) may have lesser benefits than those stated here. It would be advisable to qualify the statement or bring another (more generalisable) example. [Anastasios Kentarchos, Belgium]	Taken into account. Our executive summary statements have been completey rewritten and this section does not start anymore with statements regarding land management
24121	3	51	4	3	It is odd to expose irrigation as the first example in the summary. No objection on substance, but this unqualified reference may present irrigation as a desirable activity, without regard to the source of irrigation water or the sustainability of the irrigation scheme, despite the fact that competition for water is increasing, many irrigation schmemes are patently unsustainable and some of the more water-efficient irrigation schemes (drip irrigation, subsurface irrigation) may have lesser benefits than those stated here. It would be advisable to qualify the statement or bring another (more generalisable) example. [Zoltán Rakonczay, Belgium]	Taken into account. Our executive summary statements have been completey rewritten and this section does not start anymore with statements regarding land management

Comment No	From Page	From Line	To Page	To Line	Comment	Response
12415	3	51	4	6	The logic of these sentences does not unfold clearly enough. Quantitative information on the degrees of warming elicited by land use changes is once again missing. [Hans Poertner and WGII TSU, Germany]	Taken into account. Our executive summary statements have been completey rewritten and we have tried to include estimates wherever possible
28315	3	1	7	49	Though in the chapter title, sustainable land management is not mentioned in the executive summary. Moreover, the framework within which countries are developing policys to pursue SLM towards multiple benefits, including climate change adaptation and mitigation is land degradation neutrality, which is not mentioned in the entire chapter. This needs to be addressed as LDN is the framework endorsed by the country Parties to the UNCCD, it is SDG target 15.3, and SLM is one of the means embraced to reduce the risk of land degradation in management systems, particular through methods which maximize soil organic carbon, one of the indicators of LDN. The citations are: Orr, B.J., A.L. Cowie, V.M. Castillo Sanchez, P. Chasek, N.D. Crossman, A. Erlewein, G. Louwagie, M. Maron, G.I. Metternicht, S. Minelli, A.E. Tengberg, S. Walter, and S. Welton. 2017. Scientific Conceptual Framework for Land Degradation Neutrality. A Report of the Science-Policy Interface. United Nations Convention to Combat Desertification (UNCCD), Bonn, Germany. and Cowie, A.L., B.J. Orr, V.M. Castillo Sanchez, P. Chasek, N.D. Crossman, A. Erlewein, G. Louwagie, M. Maron, G.I. Metternicht, S. Minelli, A.E. Tengberg, S. Walter, and S. Welton. 2018. Land in balance: The scientific conceptual framework for Land Degradation Neutrality. Environmental Science & Policy 79:25-35. doi: 10.1016/j.envsci.2017.10.011 [Barron Joseph Orr, Germany]	Sustainable land management is not in the title of the chapter 2 . The scope of the chapter 2 does not include sustainalble land management. Chapter 4 has focused on land degradation and chapter 7 on climate risks and sustainable and management.
20991	3	1	7	49	The significant role of peatlands should be quantified and feature more prominantly across the report, and this should be reflected in the Executive Summary of Chapter 2 in particular, and most definitely in the SPM: Northern Hemisphere peatlands take up 3% of land area but store 30% of the global soil carbon pool (Blodau, C., 2002. Carbon cycling in peatlands A review of processes and controls. Environmental Reviews, 10(2), pp.111-134.). Maintaining peatlands is vital, and this IPCC report will underpin policies to promote the protection of these environments. [, United Kingdom (of Great Britain and Northern Ireland)]	Peatland issues are well covered by SROCC report, we cross checked with SROCC and filled some gaps in revision.
8893	3	1	7	49	the overarching concept sustainable land management is not once mentioned in the executive summary of this chapter, although it is included in the title of this special report. We therefore warmly encourage you to include this concept in executive summary. [Jean-Luc Chotte, France]	We have highlighted SLM in ES and main text
17089	3	1	7	50	My general comment about this introduction is that it lacks : - Elements concerning the potential synergies between climate mitigation options based on CDR and other mitigation strategies based on biophysical processes (ex. surface albedo management as in Akbari et al. 2009, Davin et al. 2014 or Carrer et al. 2018). The mitigation options presented in table ES 2.1 should present potential climatic benefits/tradeoff through changes in evapotranspiration, surface albedo, surface roughness. Indeed for some mitigation option the biophysical effect could counter balance the GHG mitigation effect. - also the introduction lacks of elements allowing the comparison of the climate benefit of CDR approaches vs biophysical processes (e.g. SRM via surface albedo management). For instance, is the albedo effect of afforestation stronger than the C storage effect ? What is the net climatic effect of storing C in agricultural soils (as it will decrease soil surface albedo, the consequence would be a climate warming through the albedo effect that could compensate/overwhealm (?) the benefit of the CDR effect) ? [Eric Ceschia, France]	Agree, and enhanced

Comment No	From Page	From Line	To Page	To Line	Comment	Response
32195	3	1	7	50	We think that some elements are lacking in this introduction : - Elements concerning the potential synergies between climate mitigation options based on CDR and other mitigation strategies based on biophysical processes (ex. surface albedo management as in Akbari et al. 2009, Davin et al. 2014 or Carrer et al. 2018). The mitigation options presented in table ES 2.1 could present potential climatic benefits/tradeoff through changes in evapotranspiration, surface albedo, surface roughness. Indeed for some mitigation option the biophysical effect could counter balance the GHG mitigation effect. Albedo effects are instantaneous and completely reversible, and can be interesting for quick impact, complementary to the GHG effects. They also don't present any risks, and can be usefull in heat waves. The global effects of GHG and biophysical effects including water and albedo should be more studied. - also the introduction lacks of elements allowing the comparison of the climate benefit of CDR approaches vs biophysical processes (e.g. surface albedo management). For instance, is the albedo effect of afforestation stronger than the C storage effect ? What is the net climatic effect of storing C in agricultural soils (as it will decrease soil surface albedo, the consequence would be a climate warming through the albedo effect that could compensate/overwhealm (?) the benefit of the CDR effect) ?" [, France]	Agree, and enhanced
12405	3	2		7	Such introductory paragraph is unusual and not common to all chapters. A unified approach would be needed, otherwise dropping is suggested. The value of such text seems limited. [Hans Poertner and WGII TSU, Germany]	the paragraph was dropped
12407	3	11		12	The bullet point should ideally start with a bold sentence representing the full content of the bullet point, for example one with a global view. [Hans Poertner and WGII TSU, Germany]	Accept. Text revised to be more succint and specific
26889	3	11			The formulation "warming due to anthropogenic climate change" is peculiar because warming is the most important characteristics of climate change: please revise. [, Germany]	Accept. Text revised
6935	3	14			Add a statement that these "disturbance beyond current regimes" will have repercussions that are impossible to predict. Somehow it needs to come across very strongly that the functioning of ecosystems is so poorly understood in its full complexity, especially with regard to microbes (all, not just the few that cause disease), microfauna/flora, species interactions and soil ecosystems, that we are far from being able to predict the kind and level of change we will see unfold in a radically changing climate. And it is these less-understood components that are likely to see greater changes and have the greater impact. [Debra Roberts, South Africa]	Taken into account. A new ES statement concerning this has been drafted and is traceable to section 2.2
12409	3	19		27	The magnitudes of changes of these relevant processes remain obscure. Providing quantitative or semi-quantitative estimates or orders of magnitude would help to understand better and e.g. differentiate between whether projected mean global or regional changes are by e.g. 5 or 95 %. [Hans Poertner and WGII TSU, Germany]	Accept. The statement has been updated as a result or a recent influential publication which has also seen the addition of quantitative information on the degree of greeening attributable to cropland and re and aforrestation.
12411	3	29		37	The magnitudes of changes of these relevant processes remain obscure. Providing quantitative or semi-quantitative estimates or orders of magnitude would help to understand better and e.g. differentiate between whether projected mean global or regional changes are by e.g. 5 or 95 %. [Hans Poertner and WGII TSU, Germany]	Noted. Because of the large uncertainties in the literature it is difficult to cite quantitative data. There is specifiiy in that regions that are suceptible to extreme heat events are listed.

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33021	3	29			Good paragraph, I havent checked the statements against the AR5 WGI extremes table (it would be good if they are not too far out unless explained why) but they seem reasonable. My main comment is that a few paragraphs down emphasize the impact of land cover on extreme events. it might be good to connect or at least place adjacent both paragraphs and emphasize the potentially coupled effects and feedbacks, with land cover influencing extremes, and extremes influencing vegetation. [Gabriele Hegerl, United Kingdom (of Great Britain and Northern Ireland)]	Noted and thanks for the positive feedback
26893	3	40			Please be more concrete regarding "implications for fires". We assume that they increase in terms of frequency and intensity as well as area burned? Please specify. [, Germany]	There is much uncertainty about future wildlife under climate change. It would be too much detail to include in the ES
12413	3	41			Although limited such quantitative information provides a useful perception of the magnitude of change. [Hans Poertner and WGII TSU, Germany]	Thanks but the quantitative part has been deleted based on another referees' comments
22389	4	16	3	16	Change "affects" to "effects" [Anastasios Kentarchos, Belgium]	Taken into account. The text and the statements have been substantially revised
5489	4	1	4	1	why it is said following irrigation? [Sanaz Moghim, Iran]	Noted. Following irrigation means changes once the area is irrigated. However we have substantially revised our executive summary statements and this sentence does not exist anymore
5491	4	1	4	1	is it right as large as -3C to -8C, at least mention a place or add a reference? [Sanaz Moghim, Iran]	Noted. The numbers refer to many references cited in the text and it gives an upper limit from various studies. However we have substantially revised our executive summary statements and this sentence does not exist anymore
16595	4	1	4	2	Is this detailed example needed? [Siri Lie Olsen, Norway]	Taken into account. We have substantially revised our executive summary statements and this sentence does not exist anymore
20999	4	2	4	3	Regarding irrigation, only the local impact is mentioned "irrigation dampens warming during the growing season" while potential impact on the water content within the atmosphere is not discussed. Please provide a more balanced discussion. [, United Kingdom (of Great Britain and Northern Ireland)]	Taken into account. You are correct but most papers relate changes in temperature but not in rainfall, that is why it is hard to have a balance analysis. However we have substantially revised our executive summary statements and this sentence does not exist anymore
25319	4	3	4	4	A sentence about forest degradation should be added. [, France]	Rejected. This chapter is not discussing forest degradation but assessing the effects of changes in land use on local, regional and global climate
5493	4	3	4	4	Irrigation can also affect the cloud and precipitation, it is good to mention this [Sanaz Moghim, Iran]	Noted. You are correct and this is discussed in the text, but there is not enough evidence in the literature to allow an assessment on the links between irrgation and cloudiness. However we have substantially revised our executive summary statements and this sentence does not exist anymore
17211	4	3	4	5	This is an odd way of putting it. GHG emissions from deforestation? Yes, that causes surface warming, but to call the latter GHG-induced is nonsense. It is "deforestation-induced". [Hoang Anh Le, Vietnam]	Noted. The entire statements in this section of the executive summary have been rewritten and this 'non sense' has hopefully disappeared
38651	4	3	4	6	Sentences should be present tense, not future tense: "Deforestation in tropical regions enhances GHG-induced surface warming..." "Urbanisation enhances..." [, United States of America]	Editorial. Thank you
431	4	5	4	5	My understanding is the main impact of urbanisation is in winter, not during heatwaves. I am no expert here but checking this would be sensible. [Andrew Pitman, Australia]	Noted. This statement is supported by evidence in the text (now in the cross chapter box on urbanization)
5495	4	8	4	8	more specific about process, what it means! [Sanaz Moghim, Iran]	Taken into account. Our sentence was not correct as we meant Land 'conditions' and not processes, that is the greeness and wetness of the land essentially. We have corrected that
435	4	8	4	13	This section is consistent with my understanding and is framed well [Andrew Pitman, Australia]	Noted. Thank you

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18033	4	8	4	13	Climate change can also lead to a shift of the regions, in which soil moisture influences the evolution of heat waves (see e.g., Seneviratne et al., 2006: Land–atmosphere coupling and climate change in Europe, Nature; Fischer et al. 2012: Changes in European summer temperaturevariability revisited, GRL) [Clemens Schwingshackl, Switzerland]	Taken into account. We have reformulated the statement and it hopefully covers this issue although not specifically
17639	4	8	4	13	If there is available literature that looks into the impact of reduced snowcove on cold extremes, through changing cooling via outgoing longwave radiation, it would be good to mention.. [, Sweden]	Noted. We haven't actively looked for such literature and are hoping this will be covered in the special report on oceans (SROCC) as they also cover the role of the cryosphere in the climate system
14339	4	9	4	9	"Precipitations" is not a correct word. "heavy precipitation events" would be a better wording [Benjamin Sulman, United States of America]	Editorial. Thank you
12819	4	9	4	52	There are no numbers in 5 paragaphs of bio effects. It is too qualitative. The reader will not know how significant any of these claims are. [Robert Treuhaft, United States of America]	Taken into account. Our executive summary statements have been completey rewritten and we have tried to include estimates wherever possible.
291	4	10	4	11	Meaning of the sentence starting from "Dry soil moisture…" is not clear. Perhaps something is missing. [George Burba, United States of America]	Taken into account. We've re-written it as follows "Wherever Dry soil moisture decreases anomalies favour summer heat wave conditions are favoured through reduced evapotranspiration"
31849	4	10	4	13	word choice: "favour" might be better replaced with "amplify" or "strenghten" [Martijn Slot, Netherlands]	Taken into account. We have added strengthened but favoured is also correct as if your soil is wet enough you will not get a heatwave, while if it dries up you may get one
18035	4	11	4	12	Under which conditions does vegetation amplify extreme events and under which conditions does it dampen them? It would be good to name this more precisely (e.g., forests vs. grasslands or when vegetation is dying…) [Clemens Schwingshackl, Switzerland]	Taken into account. We have completely revised the statement to make it more explicit
22387	4	15	4	15	It is not clear why land use and land cover changes are separately mentioned. Does it imply a substantive difference? Would "land use change" include changes of land use that does not involve a change in land cover? If so, this usage indicates a drastic departure from how "land-use change" has been defined and used under the UNFCCC, the Kyoto Protocol, in multiple IPCC guidance documents and the SR on LULUCF. Conversely, if "land-use change" implies land cover change (as it has been usually understood), then it would be sufficient (and much clearer) to refer only to land cover change or land-use change. [Anastasios Kentarchos, Belgium]	Noted. It is a collective choice to use this 'phrasing' to account for changes in land cover distribution as well as changes in land management
38653	4	15	4	15	"Land cover and land use changes affect both local and remote areas." What does "local" mean in this context? Populated? [, United States of America]	Noted. This entire statement has been revised as it did not correctly reflect our intended message
24123	4	15	4	15	It is not clear why land use and land cover changes are separately mentioned. Does it imply a substantive difference? Would "land use change" include changes of land use that does not involve a change in land cover? If so, this usage indicates a drastic departure from how "land-use change" has been defined and used under the UNFCCC, the Kyoto Protocol, in multiple IPCC guidance documents and the SR on LULUCF. Conversely, if "land-use change" implies land cover change (as it has been usually understood), then it would be sufficient (and much clearer) to refer only to land cover change or land-use change. [Zoltán Rakonczay, Belgium]	Noted. It is a collective choice to use this 'phrasing' to account for changes in land cover distribution as well as changes in land management
38655	4	15	4	16	Bold statement should be "high agreement." There is no dispute that LCLUC impacts remote areas through carbon cycling and climate change; and there is no dispute that it impacts local areas including extreme events (previous paragraph) and air temperature through albedo and evapotranspiration (following paragraph). There is less agreement about remote non-GHG affects; if this is the intention, then carbon should not be used as the example in the paragraph of BGC impacts, and the bold sentence should narrow scope to non-GHG affects. [, United States of America]	Taken into account. We have revised our confidence statements but it is not correct that 'there is no dispute about remote effects of land' when we talk about biophysics. Those are very difficult to evaluate.

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433	4	15	4	21	I think the text here around biogeochemical remote effects are correct. In contrast, the text around remote effects from biophsyical changes are not correct. There are arguments around remote impacts from biophysical impacts - and I know there is a lot of literature supporting this, but there are also literature contradicting it. Some of the arguments are presented in 26. Lorenz, R., A.J. Pitman, and S.A. Sisson, 2016, Does Amazonian deforestation cause global effects; can we be sure?, J. Geophysical Research, 121, 5567-5584, doi:10.1002/2015JD024357. In this paper, we did demonstrate that many of the previous studies that found remote impacts used flawed statistics. I am *not* saying biophysical changes do not cause remote impacts - rather I think the evidence is contradictory and so the assessment in this section ismisleadng on the biophysical impacts. [Andrew Pitman, Australia]	Accepted. We have substantially revised the statement. We do not talk about very long-distance teleconnections but only about downwind influence
25001	4	15	4	21	How this is linked to climate change, not too clear; Suggested to contextualize with climate change; simple relationship does not add a value. [Binaya Shivakoti, Japan]	Noted. Land cover change can be the result of climate change [as discussed in section 2.3 and in previous statements]; land-use change is a driver of climate change and can also be a consequence of climate change. We thus are convinced that the statement is relevant for this report
18039	4	15	4	21	Here, it might be worth to also mention ET and albedo changes again, as they go along with land cover and land use changes. [Clemens Schwingshackl, Switzerland]	Noted. We have substantially revised our statements. This one has been re-written and talks about biophysical processes (not just albedo and evapotranspiration) and those processes are presented in the preceding statement.
8921	4	15	4	21	Impact of airborne dust, which may be consequence of land changes, should be mentioned here. [Jean-Luc Chotte, France]	Rejected. You are correct of course but this is not dealt with in chapter 2. Hopefully this statement is coming out of chapter 3 as they report on long distance transport of dust
33047	4	15	4	21	This paragraph dont mention the effects that changes in land use land cover use may have on evapotranspiration, waterproduction and ecoststem services thay may be obtained from forest, grasslands, scrub, among others. The idea would be to mention it in a general way in order to introduce the reader to which main types of lannd use/land cover use area baing affected. [Jesus Alejandro Prieto Amparan, Mexico]	Rejected. You are correct of course but this is not dealt with in chapter 2. Chapter 2 does not discuss how land impacts land, but how land impacts the atmosphere
23671	4	15	4	33	These two paragraphs provide how the land cover change affects climate in local and regional scale. It seems to me the second paragraph should be given first, because the second paragraph gives the mechanisms of biogeochemical (CO2) and biophysical (water and energy) proceses, and then theses biogeochemical and biophysical cycles affect local and remote climate through convection and energy transfer. These two paragraphs could be merged. [Xiyan Xu, China]	Taken into account. Statements and their order have been substantially revised and hopefully are more consistent in the way you suggest
2467	4	16	4	16	Consider effects instead of affects [Lawrence Aribo, Uganda]	Taken into account. The text and the statements have been substantially revised
31851	4	16	4	16	"effects" (not "affects") [Martijn Slot, Netherlands]	Taken into account. The text and the statements have been substantially revised
26895	4	16	4	24	If possible, add the level of confidence (or agreement and evidence). [, Germany]	Taken into account. The text and the statements have been substantially revised
22391	4	16	4	26	"The absence of global effect is the consequence…" It should either read "…a global effect…" or "…global effects…" [Anastasios Kentarchos, Belgium]	Taken into account. The text and the statements have been substantially revised
18037	4	18	4	18	Does "upward" mean vertical motion? In this case, it might be better to replace "upward and pole-ward" by "vertical and horizontal (pole-ward)" to make it clearer. [Clemens Schwingshackl, Switzerland]	Noted. Yes upward means vertical. The statement has been substantially revised and those words are not there any more
19027	4	19	4	20	to hemispheric or to global through hemispheric [Joanna Wibig, Poland]	Noted. Yes upward means vertical. The statement has been substantially revised and those words are not there any more. But 'hemispheric' meant larger than regional, at the scale of one hemisphere (not global yet)

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3063	4	21	4	21	replace 'to ' with 'and '? [, Russian Federation]	Noted. Would have been a good idea but the statement has been substantially rephrase
8923	4	23	4	24	In assertion that land related changes can cause change in climate parameters, it should be stated clear that impact is scales-dependant on scales of land based interventions and/or land changes. [Jean-Luc Chotte, France]	Noted. What we understand is that you wish to make clear that land use is provoking additional climate change where land is perturbed. We have tried to improve this
16597	4	23	4	33	This paragraph would benefit from stating when the considered historical changes took place. [Siri Lie Olsen, Norway]	Accepted. The statement now starts with 'anthropogenic land cover changes since pre-industrial time'
437	4	23	4	42	These sections are consistent with my understanding and are framed well [Andrew Pitman, Australia]	Noted. Thank you although sentences have changed but will hopefully still please you!
25003	4	23	4	42	Suggest to combine historic and future climate induced changes into one paragraph or at least link them in some way to clarify why both historic and future changes are important and mentioned in the executive summary [Binaya Shivakoti, Japan]	Taken into account. We are not anymore refering to future changes as there is not enough literature to assess. However future estimates are combined with statements refering to mitigation strategies
28545	4	24	4	25	I assume this means that there is limited evidence and low agreement that land use change affected global mean surface temperature. But the statement is that there is no agreement on the effect, so it reads as if there is limited evidence and low agreement that there is no agreement. It would make more sense to state that land change doesn't appear to affect global mean temperature, and give it medium evidence and medium to high agreement (depending on your assessment of the evidence). [Alan Di Vittorio, United States of America]	Taken into account. The statement has been entirely re-written
28823	4	24	4	26	Line24 refers the statement to have 'no agreement' whereas line 26 says 'low agreement'. [Lokesh Chandra Dube, India]	Taken into account. The statement has been entirely re-written
17641	4	26	4	26	"The absence of global effect" is misleading, if the previous statement holds, i.e. that it cannot be said whether there has been an effect or not. Suggest "This is a consequence..." [, Sweden]	Taken into account. The statement has been entirely re-written
15595	4	26	4	28	Too much simplified. Missing many factors, like aerosols, evaporation etc. [Tuomo Kalliokoski, Finland]	Taken into account. The statement has been entirely re-written. Changes in evaporation are accounted for in those estimates as discussed in section 2.6.1. Aerosols if they are a response to changes in antthropogenic land cover are not accounted for; this is part of the missing processes that are discussed in section 2.2 and 2.5
17643	4	27	4	28	"led to global warming" and "led to global cooling",,, it should be made clear here that these are about warming and cooling contributions or suchlike, not absolute/net trends. [, Sweden]	Taken into account. The statement has been entirely re-written
14341	4	28	4	28	"annual average cooling" would be more precise. I assume that is what is meant here [Benjamin Sulman, United States of America]	Taken into account. The statement has been entirely re-written
24125	4	28	4	28	The following is a very strong statement: "increased land surface albedo in extra-tropical regions led to global annual cooling". This is well-established for deforestation occurring at high latitudes, but much less so for "extra-tropical regions" in general. I am not aware of the "robust" evidence, and doubt the "high agreement". Furthermore, if the statement is correct, it brings into question the characterisation of afforestation/reforestation as a "mitigation measure" in multiple places in the report. This needs to be reconciled/qualified. [Zoltán Rakonczay, Belgium]	Taken into account. Most statements have been entirely re-written and re-ordered following your and others' recommendations. We're hoping the changes are satisfactory
38657	4	30	4	30	Why choose 8.5 result to show here? [, United States of America]	Noted. We are not refering to future scenarios anymore. RCP8.5 was chosen as it is the scenario that has been the most studied in the literature and thus the one from which an assessment could be attempted
12821	4	30	4	30	RCP8.5 is not defined. This will limit the readership to those who are familiar with it. [Robert Treuhaft, United States of America]	Noted. We are not refering to future scenarios anymore. However RCPs are described in a specific box in the report

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38659	4	30	4	32	"Under RCP8.5 scenario, model-based estimates do not indicate a major contribution from future land use changes to global annual surface air temperature increase, but indicate significant regional temperature increases." It would be useful to indicate that this is independent of the fact that projected net emissions from land use change ARE expected to contribute to increased concentrations of atmospheric CO2e, leading to increased average global temperature. (Ref p. 5) [, United States of America]	Noted. The distinction between the effects on climate land have via CO2 or via biophysical effects is more clearly described and distinguished in section 2.6.1 now. However we have remove statements about future scenarios in the executive summary
33049	4	30	4	33	Acordiing to several authors, the scenario of representative concentration pathway 8.5 is a unstable scenario to asses its relationship whit land use/landcover and the increase or dedrase of temperature. [Jesus Alejandro Prieto Amparan, Mexico]	Noted. I'm not sure I understand why you say the scenario is 'unstable'. However we have not removed the statement from the executive summary
17273	4	35	4	42	it has been provided that the climate induced changes in land cover and functioning in Arctic and Boreal regions, and Tropical regions. That kind of changes in other regions, middle latitude and sub-tropical, should be provided as well. [Chengyi Zhang, China]	Noted. We have removed the entire statement from the executive summary.
18205	4	35	4	42	caption "positive and negative" + first sentence "amplification or dampening or warming .. differ", yet both examples are negative describing enhanced warming [Julia Nabel, Germany]	Noted. We have removed the entire statement from the executive summary.
7381	4	39	4	39	melting of snow and thawing of permafrost (a few other instances in the chapter speak about melting permafrost, whereas 'thawing' would be the correct term) [Stephan Stephan Gruber, Canada]	Noted. We have removed the entire statement from the executive summary.
21001	4	40	4	42	the trends of rainfall vary very much by regions within the tropics, with very uncertain outcomes for some such as the Sahel. Add a qualifier such as "on average". The phrase would then read "In tropical regionsm wher on average climate-induced reduction in rainfall are projected..." [, United Kingdom (of Great Britain and Northern Ireland)]	Noted. We have removed the entire statement from the executive summary.
14619	4	41	4	41	Rainfall projections in the tropics are subject to considerable uncertainty (see AR5, p. 1078, Figure 12.22). I would therefore rewrite this sentence as follows: "A possible reduction in rainfall in the tropics would result in land browning and a reduction in tree cover, which would enhance warming and potentially further reduce rainfall.". Reference: Stocker, Thomas F., et al. "Climate change 2013: the physical science basis. Intergovernmental panel on climate change, working group I contribution to the IPCC fifth assessment report (AR5)." New York (2013). [, Canada]	Noted. We have removed the entire statement from the executive summary.
21003	4	44	4	47	What does the medium evidence, medium agreement statement relate to here? The key message should be that 'there is growing recognition that regional climate is strongly affected by natural land aerosols', 'however…' That said, should this say anthropogenic and natural aerosols? [, United Kingdom (of Great Britain and Northern Ireland)]	Taken into account. The statement has been entirely re-written
16599	4	44	4	52	This paragraph would benefit from stating when progress in aerosol quantification was made. [Siri Lie Olsen, Norway]	Taken into account. The statement has been entirely re-written
16601	4	44	4	52	A few words about how aerosols are relevant in a climate change context should be provided at the start of the paragraph. [Siri Lie Olsen, Norway]	Taken into account. The statement has been entirely re-written
25005	4	46	4	46	Considerable uncertainty': better to mention it as considerable scientific uncertainty because it is a limitation of current science to decode apparant changes [Binaya Shivakoti, Japan]	Taken into account. The statement has been entirely re-written
17079	4	47	4	48	Even if measurements are local can't we consider that the Aeronet network contributes to that globaldirect observation ? [Eric Ceschia, France]	Taken into account. The statement has been entirely re-written
293	4	47	4	48	"There are no direct observation… on regional scale: - Is this correct? Does not EPA and California ARB and SCAQMD watch these on large scale? [George Burba, United States of America]	Taken into account. The statement has been entirely re-written
32187	4	47	4	48	Even if measurements are local can't we consider that the Aeronet network contributes to that globaldirect observation ? [, France]	Taken into account. The statement has been entirely re-written

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38661	4	47	4	50	This seems an odd sentence to support the lack of high confidence in the process. The same thing could be said of land carbon emissions ("no direct observations on global or regional scales; emissions derived from ... top-down or bottom-up inventories or models" yet experts are quite confident about the direction and scale of land carbon emissions and their impacts. [, United States of America]	Taken into account. The statement has been entirely re-written
12823	4	51	4	51	CMIP5-class is not defined. [Robert Treuhaft, United States of America]	Taken into account. The statement has been entirely re-written
25007	4	28	5	28	Is the net annual removal really true? Please check again and also tally with the recent UNEP emission gap report [Binaya Shivakoti, Japan]	Accepted. Text revised.
2773	4	41	5	1	Remove several plural forms from the sentence to read "…to represent land aerosol emissions, chemistry, and secondary aerosol production, and thus their feedback to climate" [Bettina Weber, Germany]	Noted. We have removed the entire statement from the executive summary.
7505	4	44	5	1	Furthermore, reduction of anthropogenic aerosols will contribute additional warming by way of unmasking warming that is presently being offset by the reflective properties of aerosols. Aerosols from air pollution will decline in the coming years as a means for preserving air quality and promoting healthier air conditions, but their removal will lead to additional warming of 0.3 ºC in 2050 and 0.6 ºC in 2100. See Xu and Ramanathan (2017) Well below 2 °C: Mitigation strategies for avoiding dangerous to catastrophic climate changes, Proc. Natl. Acad. Sci., doi: 10.1073/pnas.1618481114; Ramanathan and Xu (2010) The Copenhagen Accord for limiting global warming: Criteria, constraints, and available avenues, Proc. Natl. Acad. Sci., doi: 10.1073/pnas.1002293107; Ramanathan and Feng (2008) On avoiding dangerous anthropogenic interference with the climate system: Formidable challenges ahead, Proc. Natl. Acad. Sci., doi: 10.1073/pnas.0803838105. [Durwood Zaelke, United States of America]	Taken into account. The statement has been entirely re-written
17645	4	44	5	1	This would fit nicely into a discussion of knowlegde gaps, not the Executive Summary. Under knowledge gaps, the potential importance should be explained, such as the possible magnitude and nature of forcing through changes in these emissions. [, Sweden]	Taken into account. The statement has been entirely re-written
7585	4	44	5	52	Furthermore, reduction of anthropogenic aerosols will contribute additional warming by way of unmasking warming that is presently being offset by the reflective properties of aerosols. Aerosols from air pollution will decline in the coming years as a means for preserving air quality and promoting healthier air conditions, but their removal will lead to additional warming of 0.3 ºC in 2050 and 0.6 ºC in 2100. See Xu and Ramanathan (2017) Well below 2 °C: Mitigation strategies for avoiding dangerous to catastrophic climate changes, Proc. Natl. Acad. Sci. 114(39):10315–10323; Ramanathan and Xu (2010) The Copenhagen Accord for limiting global warming: Criteria, constraints, and available avenues, Proc. Natl. Acad. Sci. 107(18):8055–8062; Ramanathan and Feng (2008) On avoiding dangerous anthropogenic interference with the climate system: Formidable challenges ahead, Proc. Natl. Acad. Sci. 105(38):14245–14250. [Kristin Campbell, United States of America]	Taken into account. The statement has been entirely re-written
12417	4	8		42	Once again, quantitative information on the magnitudes of changes in all of these bullet points is missing. [Hans Poertner and WGII TSU, Germany]	Taken into account. Our executive summary statements have been completey rewritten and we have tried to include estimates wherever possible
23641	4	15		16	"affects both local and remote areas". What does this mean? What is remote? Local to who? [Kerri Finlay, Canada]	Taken into account. The statement has been substantially revised. We now refer to downwind changes within limited distance.
6939	4	15			"local and remote areas" : Perhaps say "can have local and remote effects". [Debra Roberts, South Africa]	Taken into account. The statement has been substantially revised. We now refer to downwind changes within limited distance.

Comment No	From Page	From Line	To Page	To Line	Comment	Response
33023	4	24			I am not aware of any study of past climate change over the instrumental period detecting or attributing global scale land use change as a factor, although there are some studies looking at regional effects. This small global effect is in many ways meaningless and not sure its worth highlighting it. [Gabriele Hegerl, United Kingdom (of Great Britain and Northern Ireland)]	Taken into account. The statement has been entirely re-written
6941	4	28			The "cooling" effect of albedo is very difficult to understand except where ice is replaced with soil/vegetation. Bare soil in warm climates is sun-baked and not desirable. Albedo gets mentioned often throughout the report, but there is no clear explanation of exactly when, where, why and how it plays a part in different parts of the world. Or was this covered in detail in AR4/5? Section 3.4.2 is not very clear. It seems that albedo is mostly a by-product that needs to be understood and taken into consideration for modelling purposes, but that is is not something that needs to be otherwise considered as a factor in climate related decisions. Is that right? Perhaps this should be explained? Perhaps add this to Figure 2.2 which shows what happens to solar radiation. [Debra Roberts, South Africa]	Noted. Yes albedo is covered in AR5, substantially and is presented in section 2.2. The statements have however been substantially revised and are hopefully more easy to read
4387	4	31			Under RCP8.5 scenario, 31 model-based estimates do not indicate a major contribution from future land use changes to global annual surface air temperature increase, but indicate significant regional temperature increases (limited evidence, 33 medium agreement). How is that surface air temperature, does not have any influence on regional temperature ? How about air current travelling from region to region If this is so, it means that regional temperature is independent and not affected by global air movement [Daniel Danano Dale, Italy]	Noted. We have removed the entire statement from the executive summary. Discussion on how land affects climate for this scenario is discussed in section 2.6.1. In any case the available literature never discusses what you would be interested in: changes in the flow of air masses from one region to another
5487	4	31			Under RCP8.5 scenario, 31 model-based estimates do not indicate a major contribution from future land use changes to global annual surface air temperature increase, but indicate significant regional temperature increases (limited evidence, 33 medium agreement). How is that surface air temperature, does not have any influence on regional temperature ? How about air current travelling from region to region If this is so, it means that regional temperature is independent and not affected by global air conditions [Daniel Danano Dale, Italy]	Noted. We have removed the entire statement from the executive summary. Discussion on how land affects climate for this scenario is discussed in section 2.6.1. In any case the available literature never discusses what you would be interested in: changes in the flow of air masses from one region to another
3071	5	1	5	52	This part of ES is crucially depended on definitions: emission (gross and net), removal (gross and net), direct and indirect emissions/removals, etc. However, these concepts are even not mentioned in the current draft of the Glossary. [, Russian Federation]	Glossary doesn't contain many of the terms used in the ES.
25321	5	3	5	3	In addition to recent trends over the past decade, values should be given to show the magnitude of emissions and removals from the land sector over longer time steps (ideally since the beginning of the industrial era, or since the 1950s, if not). [, France]	Rejected. Longer term changes are outside the scope of this assessment.
17647	5	5	5	5	Perhaps not really "land", but rather "Land sector", vegetation and soil (land-based ecosystems), or suchlike. [, Sweden]	Rejected. My understanding is that "land sector" usually refers to anthropogenic effects.
16967	5	5	5	5	Use of capital letters: Chapter 1 uses "greenhouse gases", also line 3. [Roland Hiederer, Italy]	Editorial
2775	5	5	5	6	Change sentence structure to read "…making it difficult to separate anthropogenic from natural fluxes of GHGs" [Bettina Weber, Germany]	Accepted. The revised ES should help dispel the confusion.
17649	5	5	5	6	What is affected by the drivers? GHGs, or emissions and removals? Please clarify. [, Sweden]	Accepted. The revised ES should help dispel the confusion.
29065	5	5	5	7	Please reconsdier the wording and the use of the uncertainty language. What does robust evidence, and high agreement point to? That it is difficult to seprate fluxes? [Jan Fuglestvedt, Norway]	Accepted. The revised ES should help dispel the confusion.

Comment No	From Page	From Line	To Page	To Line	Comment	Response
22395	5	5	5	16	It would be useful to simplify the paragrapgh. Perhaps have a separate paragraph explaining how the concepts of "anthropogenic", "direct/indirect" and AFOLU relate to each other. [Anastasios Kentarchos, Belgium]	Accepted. See revised text.
22397	5	5	5	16	Keep this paragraph focussed on the general principles. Do not use "AFOLU" (a term specific to the inventories). Do not refer here to stocktake under the Paris Agreement. [Anastasios Kentarchos, Belgium]	Accepted. Text revised.
30877	5	5	5	16	the point of this paragraph is not clear - it is more of a set of introductory comments than an evidence statement [Mike Morecroft, United Kingdom (of Great Britain and Northern Ireland)]	Accepted. Text revised.
17441	5	5	5	16	It is important for the global stocktake to move in the AFOLU sector from net emissions to gross emissions (and separately gross removal) in order to better compare them with the gross emissions in other sectors and to see the full mitigation potential to reduce gross emissions (and increase gross removals) of the AFOLU sector. [Taehyun Park, Republic of Korea]	Agreed. The revised ES makes this point.
24127	5	5	5	16	This section is overly complicated and appears internally inconsistent/contradictory. - It is confusing to refer to AFOLU (which is an inventory sector) in a narrative description of land-based emissions and removals. It is not clear whether this reference is meant to refer to what IS reported under AFOLU in the inventories, or what SHOULD BE reported under the inventories following the 2006 GL, or some other concept of "AFOLU". It would be preferable to refrain from referring to inventory terminology in this general part of the text. - It is also unhelpful to suggest, as the text does, that "AFOLU" includes only the "direct" anthropogenic emissions and removals. This directly contradicts current inventory guidance on AFOLU, whereas all emissions and removals on managed land must be included in AFOLU, with managed land being "a proxy" for anthropogenic impacts, but clearly not a scientifically or technically correct representation of "direct" anthropogenic emissions/removals. A clear separation of anthropogenic and natural effects may be conceptually feasible in a model (although interactions make it unlikely), but not possible in reality or in the inventories. - Saying that AFOLU contributes "around 24%" of GHG emissions isuggests that AFOLU emissions (i.e., "direct" human-induced) can actually be estimated to a single digit accuracy. Is that the case? Could such an estimate be replicated? - The above estimate is also difficult to interpret, as it fails to recognise sinks, therefore it is unclear whether or how sinks have been taken into account in AFOLU and in the overall total (of which AFOLU is supposed to be 24 % of). The language suggests that the total anthropogenic GHG emissions would include indirect anthropogenic land fluxes, but AFOLU would not. Is that the case? - It is also misleading to suggest that AFOLU does not contain natural disturbances or indirect GHG emissions/removals. It is neither required, nor possible to fully separate those (except in models). - The way the factors affecting GHG fluxes are presented suggests that all legacy effects of past management (related to age-class distribution of forests, recovery of forest area and carbon stocks after past deforestation and degradation) would be considered "direct anthropogenic". That may be a valid interpretation, but that would internalise most of the "residual carbon sink" into AFOLU, which in turn would question the validity of the 24 % figure quoted. [Zoltán Rakonczay, Belgium]	Accepted. Text revised.
14621	5	6	5	6	I suspect it should be "[...] of GHGs from natural fluxes". [, Canada]	I don't understand the comment.
26897	5	6	5	6	"...difficult to separate anthropogenic fluxes of GHGs from natural" change to "...difficult to separate anthropogenic from natural fluxes of GHGs." [, Germany]	Accepted. Text revised.

Comment No	From Page	From Line	To Page	To Line	Comment	Response
2777	5	7	5	7	Removal in singular "The emission and removal of CO2..." [Bettina Weber, Germany]	Accepted. Text revised.
17651	5	7	5	7	Suggest "the land-related emissions and removals" or suchlike, to avoid misundertandings. [, Sweden]	Accepted. Text revised.
23673	5	10	5	19	line 10: AFOLU contributes 24% anthropogenic GHG. Line 19: AFOLU contributes 12% anthropogenic CO2. Is the another 12% contributed by CH4 and N2O? [Xiyan Xu, China]	Yes. Revised text should help.
22399	5	11	5	12	What is the meaning of a combined emissions of these gases? Is this by their 100 year GWP. [Anastasios Kentarchos, Belgium]	CO2-equivalents for what time period?
3065	5	11	5	12	24% : are emissions of all three gases measured in tons, CO2-eqs, or other units are involved? Is it about net or gross emissions? [, Russian Federation]	Accepted.
28979	5	11	5	12	I think you should avoid the aggregation of the thee different GHGs. T [Jan Fuglestvedt, Norway]	Rejected. The text includes a Table that helps interpretation.
28825	5	12	5	12	emission and removals of GHG' to be changed to 'emissions and removls of GHGs' [Lokesh Chandra Dube, India]	Accepted. Text revised.
32815	5	12	5	16	Also look at the underlying chapter on p. 37, section 2.4. This is an erroneous interpretation of what the Paris agreement says and "requires." Please have a legal expert review this before publication. For example the global stocktake is expressly NOT going to compare country reports. The stocktake will review AGGREGATE information only. The Paris agreement does NOT create a "need to ensure consistency." [Doreen Stabinsky, United States of America]	Accepted. References to the Paris Agreement are deleted.
38663	5	12	5	16	"Estimating 'anthropogenic' emission and removals of GHG is necessary in support of both the UNFCCC and the Paris Agreement. It is expected that the global stocktake will compare country reports of national Greenhouse Gas Inventories submitted to the UNFCCC with modelled mitigation pathways. This expectation implies a need to ensure consistency between, or reconciliation of, different approaches to estimating anthropogenic fluxes." (1) It should not be a focus of this report to presume what information should be considered under the global stocktake, or by individual Parties. This report should focus objectively on increasing the state of scientific understanding between the interactions between the global climate and land systems. (2) While it will be important for each Party to estimate its net anthropogenic emissions, thus in some cases for the Party to clearly report on how it has distinguished anthropogenic from non-anthropogenic, for the GST it will be important to assess the overall level of net emissions -- both anthropogenic and non-anthropogenic. Anything less would give an incomplete perspective on global concentrations and temperature scenarios. Also ensure that COP-24 outcomes are reflected. [, United States of America]	Accepted. Text revised.
3067	5	13	5	13	It is enough to mention UN FCCC only, because the Paris Agreement is under the convention.In addition, not all IPCC members have yet ratified the Paris Agreement. This may cause unnecessary problems with the adoption of this report by the Panel. [, Russian Federation]	Accepted. Text revised.
15325	5	13	5	14	Suggest defining the term 'global stocktake' and give it context within the passage. [, Australia]	Term deleted from the text, here.
22401	5	13	5	16	Speculating on the format of the global stocktake is not appropriate. Better merely to say "Estimating “anthropogenic” emission and removals of GHG is necessary in support of both the UNFCCC and the Paris Agreement including its global stocktake", then delete the rest of the sentence. [Anastasios Kentarchos, Belgium]	Accepted.

Comment No	From Page	From Line	To Page	To Line	Comment	Response
17653	5	13	5	16	Could delete "It is expected… to estimating anthropogenic fluxes." It is a bit prescriptive in flavour and probably not a direct assessment outcome. Also, the previous sentence already makes the connection. [, Sweden]	Accepted.
40289	5	18	5	18	global models estimate a MEAN net AFOLU emission [Thelma Krug, Brazil]	Accepted. Text revised.
33591	5	18	5	22	It would be helpful to have the numbers differentiated in deforestation, AR, FM etc. It should be noted more clearly that the quanified emissions are fluxes from the sources in 2007-2009, and does not consider the long term removals under FM. [, Norway]	Accepted in part. Text has been revised but does not attribute fluxes to particular types of management.
17443	5	18	5	26	AFOLU emissions of 4.9 GT CO2 per year (12% of total CO2 emissions) is a number resulting from combining gross emissions with gross removals. It is crucial to separate gross emissions from gross removals and to show both figures in order to not mask but show the show the full mitigation potential in the AFOLU sector. [Taehyun Park, Republic of Korea]	Accepted. The point is made in a subsequent bullet.
21673	5	18	5	36	In these two paras, please be clearer whether the figures include indirect emissions (given the important clarification provided in the preceding para). The term "net AFOLU emissions" will to policymakers signal a correspondence to inventory emissions, but coming from models I assume net AFOLU here excludes indirect emissions whereas inventory AFOLU don't? [Andy Reisinger, New Zealand]	Accepted. Text revised.
26899	5	18	5	36	If we understand correctly, the indirect anthropogenic impacts on unmanaged land are causing approximately twice as many removals as the direct anthropogenic impacts on managed land? If that is so, please make this clearer perhaps with an "as a result" statement. Some may read these headline statements and think they contradict each other. Therefore it would be helpful to add clarifying text, for example "although the direct affects to managed land result in a net source of emissions, the indirect anthropogenic impact on unmanaged lands results in a net sink." Also, if we understand correctly, the lines 32-34 give the net balance of these two impacts. This net result should also be contained in a bold statement. [, Germany]	Accepted. Revised text should make this clear.
12825	5	18	5	41	Could the reduced AFOLU number for 2005-2015 be indicative of the error in the measurement? [Robert Treuhaft, United States of America]	Yes. The revised text should help.
3069	5	19	5	19	Is it 12% of NET anthropogenic global emissions? Clarify, please. [, Russian Federation]	Accepted. Text revised.
17445	5	20	5	20	The executive summary talks about afforestation only, also in contexts that should include reforestation [Taehyun Park, Republic of Korea]	Accepted. Text revised.
8355	5	22	5	22	These models don't either explicitly model the emission/sequestration resulting from agricultural management itself [Marc Aubinet, Belgium]	Accepted. Text revised.
31853	5	22	5	22	"net CO2 source" instead of "CO2 net source" [Martijn Slot, Netherlands]	Accepted. Text revised.
15597	5	24	5	26	Some of the DGVMs do not have management effect properly described or still at all, only the differences between two steady states. [Tuomo Kalliokoski, Finland]	Agreed.
17655	5	28	5	28	"removal" and negative numbers would amount to increase. Please adjust as appropriate. [, Sweden]	Editorial
30879	5	28	5	29	the phrase 'due to the indirect anthropogenic effects of global change on unmanaged lands' is not correct and not needed. It should be replaced with simply 'by unmanaged lands'. (Even without global change there would still be a land sink for C [Mike Morecroft, United Kingdom (of Great Britain and Northern Ireland)]	Accepted. Text revised.

Comment No	From Page	From Line	To Page	To Line	Comment	Response
22403	5	28	5	30	It is incorrect to suggest that "unmanaged lands" remove 28% of anthropogenic CO2. It is terrestrial sinks combined (including all managed land, but excluding removals taken into account under land-use change) that comprise the sink. A very signifcant portion of the sink is in managed forest, and partly due to age class dynamics (incl. recovery from past management). The overall land balance is not only estimated by "global vegetation models", but largely informed by other elements of the global carbon cycle. [Anastasios Kentarchos, Belgium]	Accepted. Text revised.
26125	5	28	5	30	In the phrase "indirect anthropogenic effects of global change on unmanaged lands" replace "global change" with "GHG emissions" - or "GHG concentrations" [Reid Detchon, United States of America]	Rejected. Both changes in climate and changes in atmospheric composition are included in global change.
38665	5	28	5	32	The methodology underlying the calculation of the -11.2 ± 3 Gt estimated as indirect anthropogenic effects "on unmanaged lands" actually includes some removals on managed lands. This would be the case especially for countries that calculate forest sinks based on look-up tables of annual sequestration rates rather than using national inventories. So it would be more accurate to characterize that sink as the "net removal due to indirect anthropogenic effects ... on unmanaged lands and on managed lands where they are not quantified or estimated due to methodological limitations." Grassi et al. make this point. [, United States of America]	Accepted. Text revised.
31855	5	28	5	36	Negative sign before the net removal, and the net land-atmosphere flux CO2 sink numbers is a little challenging to interpret without a word or two about the sign conventions perhaps [Martijn Slot, Netherlands]	Editorial
3073	5	30	5	30	Should it be ' GROSS anthropogenic emissions' [, Russian Federation]	Accepted. Text revised.
2779	5	30	5	32	CO2: write "2" in subscript [Bettina Weber, Germany]	Accepted.
16969	5	31	5	31	Subscript for 2 in CO2. [Roland Hiederer, Italy]	Accepted.
38667	5	31	5	32	Subscript CO2 in a few instances. [, United States of America]	Accepted.
939	5	31	5	32	CO2: use subscript [Nocera Francesco, Italy]	Accepted.
295	5	32	5	32	CO2 the 2 is not subscript-ed here and in a few places throughout the text. [George Burba, United States of America]	Accepted.
16971	5	32	5	32	Subscript for 2 in CO2. [Roland Hiederer, Italy]	Accepted.
38669	5	32	5	34	Recommend making the global net direct and indirect CO2 flux value its own finding in bold. This is a key finding and should be treated as such. [, United States of America]	Accepted. Text revised.
33075	5	32	5	34	The net sink given here seems to come from the net AFOLU above, 4.9 GtCO2/y, minus 11.2 GtCO2/y on unmanaged land as indicated in this paragraph, = -6,3 GtCO2/y as reported in this sentence. But if this is true, where is the indirect sink on managed land, given that the previous paragraph suggests that it is not included in the reported 4.9GtCO2/y? The chapter says that indirect effects on managed land are substantial, so why does it not show here? Is it 11.2 GtCO2 reported in this paragraph actually from unmanaged land only? [Philippe Marbaix, Belgium]	Accepted. Text revised.
30051	5	34	5	34	Typo: -6.3±3.0 should be changed in -6.3±2.6 as stated in the main text (page 38, line 10 in section 2.4.1.1) [, Netherlands]	Editorial

Comment No	From Page	From Line	To Page	To Line	Comment	Response
17059	5	35	5	42	While I realize the need for highly specific topics/sub-topics for adeqaute scientific precision and confidence level descriptions, the drawback is that multiple influences on one (or more) outocomes is left untreated. This paragraph is just one example of such an issue: The resulting climate is state to depend on the hydrological cycle. However, some regions are already affected by anthropogenic changes to the hydrological cycle to an extent that contributes to these effects. I suggest adding a statement on this isse. [Morten Andreas Dahl Larsen, Denmark]	Accepted. Text revised.
18043	5	38	5	39	If I understand correctly, the 0.1 GtCO2y-1 are referring to the 4.9 GtCO2y-1 mentioned in line 18 of page 5. In this case, it would be 4.8 GtCO2y-1 lower (and not 4.7 as mentioned in the text). [Clemens Schwingshackl, Switzerland]	Accepted.
28827	5	38	5	39	'AFOLU global net CO2 flux reported in national GHG Inventories was a source of 0.1 GtCO2 y-1 during 2005 to 2015': Consider that not all countries have provided natioanl GHG inventories for the period upto 2015 hence this estimation may be dubious. [Lokesh Chandra Dube, India]	Noted.
22405	5	38	5	45	There should be a reference to the completeness and quality of the inventories. The text should not pretend that all land areas in the world are represented by comparable inventories. It should also be pertinent to indicate the ration of land (especially forest land) covered by inventories (for the countries that have inventories). [Anastasios Kentarchos, Belgium]	Accepted. Text revised.
11683	5	38	5	45	Lacks "evidence" and "agreement" ratings of other paragraphs. [Paul Dirmeyer, United States of America]	Noted and confidence language added where appropriate
17447	5	38	5	45	It should be mentioned that the problem of national GHG inventory underreporting of AFOLU fluxes starts as well with the lack of separating gross emissions from gross removals. This masks the full mitigation potential of both emission reductions and removal increases. It instead invites parties to downplay national emissions and inflate national removals. [Taehyun Park, Republic of Korea]	Accepted. Text revised.
17657	5	40	5	41	"conceptual differences" is a bit unclear. Could omit "conceptual" as it does not seem to be needed. [, Sweden]	Accepted. Text revised.
33967	5	47	5	47	Land itself is not a source of CH4 - 'land use' is (i.e. land used for animal production). Therefore suggest to include 'and land use' after 'land' [Cecile de Klein, New Zealand]	Rejected, we have kept the formulation as the title of the chapter is land-climate interactions.
17659	5	47	5	47	"Land sector" rather than just "land". [, Sweden]	Rejected. "Sector" refers to economic activities like agricultural sector or forestry sector, not land
38671	5	47	5	47	Methane sources from land are missing termites, biofuel burning, and livestock (or specify livestock and rice agriculture individually). [, United States of America]	Rejected, we are referring to anthropogenic sources not natuarl one.
21675	5	47	5	48	I'm not clear if the 61% of anthropogenic emissions is including natural emissions from wetlands (somewhat strange to include a natural source in a percentage comparison of anthropogenic emissions). Please clarify. [Andy Reisinger, New Zealand]	Accepted, the text has been revised
297	5	47	5	48	Head senstence is not clear. Anthropogenic or natural? "Accounting for" or "is 61% compare to"? [George Burba, United States of America]	Rejected, we say clearly that we are referring to anthropogenic emissions.
25323	5	47	5	48	The data leading to 61% come from table 2.2 which attributes them to the year 2012 and not to the period 2005-2015. [, France]	Accepted, in part. The table has been removed, but the figure remains. Using an average over a time period is more robust than a single year number and 61% is the estimate for this time period.
3075	5	47	5	48	Is this 61% of net or gross emission? Clarify, please. [, Russian Federation]	Rejected, there is no gross or net emissions related to CH4.

Comment No	From Page	From Line	To Page	To Line	Comment	Response
21005	5	47	5	49	The phrase in bold is about anthropogenic CH4. It is confusing for the reader to start the next phrase which elaborate on it with a non-anthropogenic source "natural wetlands". Add the share of land in total CH4 emissions (including natural sources) in the first phrase and/or separate more clearly natural sources and anthropogenic ones in the rest of the paragraph, especially considering that some such as biomass burning might be a mix of anthropogenic and natural sources. [, United Kingdom (of Great Britain and Northern Ireland)]	Accepted, the text has been revised
5497	5	47	5	49	any reference! [Sanaz Moghim, Iran]	Rejected, we are not using references in the ES
30047	5	48	5	49	The sum of agriculture and rice cultivation in table 2.2 is 136 (or maybe 137 due to rounding). However, where does the upper limit of 140 come from? As with natural wetlands one would expect it to be the 'top-down' number of table 2.2, but that number is 200 Tg and also includes emissions from landfills and biomass burning. Note that if this number is adapted, it should also be adapted in box SPM.1. [, Netherlands]	Accepted, we have reworked the entire paragraph to show that livestock and rice are responsible for this growth
26127	5	48	5	49	After "agriculture" insert ", especially livestock production" (per Fig. 2.14) [Reid Detchon, United States of America]	Rejected, rice is also a growing source
25325	5	49	5	49	It is not clear how [137-140] is derived from the third column of Table 2.2. It seems that it comes from a combination of [100-112] with [25-39] which cannot lead to [137-140]. [, France]	Accetped, the text has been revised
17661	5	49	5	52	A low confidence finding may not be very useful in the Executive Summary. (In addition, "To the larger role" is also unclear - larger than estimated before? Larger than natural wetland emissions?) [, Sweden]	Accepted, the sentence has been deleted
28829	5	52	5	52	Methane loss through reactions with OH radicles is not found substantiated in the report. OH is produced predominantly in the tropical atmosphere in the presence of water vapour and sunlight. Thus the removal of CH4 takes place mainly in the tropical region. Using MIROC4-ACTM model simulations, CH4 loss rate are estimated over India at 5.5 Tg/yr in year 2000 and 5.8 Tg/yr in 2016 (Patra et. al, 2014, 2016, 2018). https://doi.org/10.1038/nature13721; https://doi.org/10.2151/jmsj.2016-006; https://doi.org/10.2151/sola.2018-016 [Lokesh Chandra Dube, India]	Accetpted, the text has been modified
22393	5	3	6	24	(see also general comment above on fluxes in Ch2) The information in this section paragraph is extremely important. However, it is far too technical for placement as statements in the Executive Summary. The main arguments relevant to policymakers need to be stated clearly before the technical and methodological details are explained. The headline should be that definitional differences ('anthropogenic', 'managed') etc, can lead to major differences in estimated net emissions (including whether 'land' is considered a source or net sink). This is important in a global climate action context as lines 5-16 explain. The paragraph can also discuss the need to better understand this difference and reconcile different estimates, but should leave the technical details for the body of the chapter. Also it is very difficult to keep track of how the different figures relate to each other (the 24%, 12%, 4.9 GtCO2, -11.2 GtCO2, -6.3 GtCO2, +0.1 GtCO2, 4.7 GtCO2...). Consider presenting fewer figures (only those which are essential to support an argument. Also consider re-ordering these statements so they have a more 'narrative' logic. In particular explaining the purpose of using one estimate or another (in what circumstances is it relevant to use each of the different figures presented.consult the flux from the vegetation models, The current logic of presenting one methodology per paragraph is difficult for non-experts to follow. [Anastasios Kentarchos, Belgium]	Accepted. The revised ES should help dispel the confusion.
24261	5	47	6	12	Please ensure consistency of emission figures with Ch 5, as non-CO2 emissoins are mainly from agriculture [Francesco Tubiello, Italy]	Accetped, the text has been revised

Comment No	From Page	From Line	To Page	To Line	Comment	Response
31857	5	47	6	12	These two sections mention confidence, while all other sections mention evidence & agreement, which seems inconsistent [Martijn Slot, Netherlands]	Accepted, we have worked to improve the consistency across all chapters
21677	5	50	6	1	There is no reference to growth in emissions from tropical agriculture, as has been pointed to by some studies (e.g. Schafer et al) as he driver for renewed emissions growth. Has this been dismissed (sorry I ran out of time to read the underlying chapter). Also, please clarify that net CH4 removals via soils are much smaller than anthropogenic emissions and is not the dominant loss term, otherwise some people will fixate on whether climate change can solve CH4 emissions automatically by increasing removals via soils. [Andy Reisinger, New Zealand]	Accepted partially, we have revised the paragraph and refer to agricultural emissions, not all of which are in the tropics
12419	5	3			These bullet points do a better job of conveying quantitative information and thereby the magnitude of changes. [Hans Poertner and WGII TSU, Germany]	Put quantitative data in the bullets.
6943	5	12			Is it worth adding "...both through increased emissions and reduced sequestration"? - is it correct to say that? Land use changes have net-positive emissions effects partly because of reduced sequestration, this should be clearly stated. [Debra Roberts, South Africa]	Accepted. Text revised.
23643	5	18		36	These two bolded points seem contradictory. I think the authors are noting in the first one, that managed land is a carbon source, while in the second, unmanaged land is a carbon sink? If so, the wording could be much clearer to indicate the differences among points. [Kerri Finlay, Canada]	Accepted. Text revised.
17081	5	38			AFOLU global net flux has not been defined, therefore I didn't understant what was the difference between AFOLU global net flux and global bookkeeping modelling [Eric Ceschia, France]	Accepted. Text revised.
32189	5	38			AFOLU global net flux has not been defined, therefore I didn't understant what was the difference between AFOLU global net flux and global bookkeeping modelling [, France]	Accepted. Text revised.
6947	5	39			So countries are only reporting 2%, compared to global bookkeeping models? This needs to be explained in more detail. [Debra Roberts, South Africa]	Accepted. Text revised.
23645	5	47		52	Why are natural wetlands included in this accounting? Everything else in this paragraph is antropogenic in origin (as is the context of the bolded text). If this is how the accounting is done, do natural wetlands include peatlands as well? [Kerri Finlay, Canada]	Noted, both are acceptable in IPCC and confidence statements indicate more robust conclusions thanevidence and agreement statements.
21007	6	1	6	3	It seems that the last phrase of this paragraph is about projection while the rest of the paragraph was about historical trends. Makes it clearer by starting the phrase with a qualifier such as. "In the future, effects of changes in CH4 due to changes..." [, United Kingdom (of Great Britain and Northern Ireland)]	Accepted, the text has been revised
21009	6	1	6	3	The point made could be made clearer by using the expression "a key role" or "the major factor of change" rather than "the key role". [, United Kingdom (of Great Britain and Northern Ireland)]	Accepted, the text has been revised
299	6	3	6	3	Should not CH4 releases from melting permafrost (a portion due to land use change) be added here, and then referred out to IPCC Cryospher report? [George Burba, United States of America]	Noted, this seems like a subject for the land degradation chapter, but I think the cryosphere report covers this adequately and there is no need to repeat that here.
3077	6	5	6	12	Very brief information of natural N2O sources would be appropriate here. [, Russian Federation]	Rejected, we have limited space and this report is focused on anthropogenic emissions

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21011	6	7	6	8	The 11Tg value quoted for "natural sources" seems to include indirect emissions of fertiliser application , those from rivers and estuaries resulting from leaching after fertilisation. It would be relevant to mention the corrected level of anthropogenic./ natural sources when classifying those indirect emissions as anthropogenic (especially considering that this is the approach within GHG inventories) or at least to mention that there is some controversy about the split, as was done in the SPM of the EPA 2010 report about "Methane and Nitrous Oxide Emissions from Natural Sources". [, United Kingdom (of Great Britain and Northern Ireland)]	Accepted, the paragraph has been revised to focus on anthropgenic sources in response to this and other comments
28547	6	8	6	8	For how long have the sources been decreasing? [Alan Di Vittorio, United States of America]	Noted, we have removed this from the ES to make room for other information, but we dicsuss this in greater detail in section 2.3
14343	6	10	6	11	In this sentence, it is not clear whether the factor that is being underestimated is N2O flux or the climate change and agricultural intensification drivers of N2O flux. The sentence should be reworded for clarity [Benjamin Sulman, United States of America]	Accepted, we have revised the text and I think the meaning is now clear
22407	6	10	6	12	Not clear what is not part of models and which models are referred to [Anastasios Kentarchos, Belgium]	Accepted, the sentence has been replaced.
17663	6	10	6	12	Does this imply a larger or a smaller flux? [, Sweden]	Accepted. Both actually, we have revised the text and I think the meaning is now clear
12917	6	14	6	24	Is it possible to put some numbers in for the many claims made in this paragrah? [Robert Treuhaft, United States of America]	Quantification added where possible based on the available scientific literature
17665	6	15	6	15	"remain uncertain" combined with high confidence would not seem to align with the contents of the paragraph. It also distracts from the fact that there seems to be high/medium confidence level knowledge. Is the issue here not so much of all aspects, but the global net of positive and negative contributions (which on regional scales may add to more certain net impacts?)? [, Sweden]	Confidence language revised
32977	6	15	6	15	I think that all different responses of soil organic matter due toclimatic changes should be presented. [Jose Joao Souza, Brazil]	Accepted where possible based on the available scientific literature
30881	6	17	6	17	plant microbe symbioses' is too vague - be explicit. [Mike Morecroft, United Kingdom (of Great Britain and Northern Ireland)]	Noted
21013	6	18	6	21	The two sentences on SOC seem to contradict each other. Please clarify. [, United Kingdom (of Great Britain and Northern Ireland)]	Accepted and clarified
8357	6	20	6	20	It strange to read that increased litter inputs will accelerate carbon losses while such inputs are recommanded in order to increase carbon sequestration in the soil (2.7.2.1) [Marc Aubinet, Belgium]	Noted. Statement revised in redrafting
14345	6	20	6	21	The "robust evidence, high agreement" language here is somewhat contradictory with the text on page 21 and 22 describing how meta-analyses have given conflicting results about warming effects on heterotrophic respiration and soil organic matter stocks [Benjamin Sulman, United States of America]	Confidence language revised
14623	6	23	6	23	It could be argued that there is high evidence and high agreement on thawing permafrost increasing Soil Organic Carbon (SOC) loss and altering CH4 and CO2 emissions balance. [, Canada]	Confidence language revised
18045	6	23	6	24	In the whole paragraph, CO2 fertilisation is not mentioned, but only in the very last sentence. For me it is thus not clear, how CO2 fertilisation is connected to the rest of the paragraph and I wonder whether the sentence should be rephrased. [Clemens Schwingshackl, Switzerland]	Noted. Statement revised in redrafting
26901	6	23	6	24	If possible, add the level of confidence (or agreement and evidence) in line 24. [, Germany]	Confidence language revised

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21015	6	23	6	24	This is an important message that should be part of the opening sentence and should be considered for uplifting to the SPM. However, needs a confidence statement. [, United Kingdom (of Great Britain and Northern Ireland)]	Raised to SPM writing team. Confidence language revised
26129	6	23	6	24	Amend "projected climate change is expected" to: "projected climate change impacts are expected" [Reid Detchon, United States of America]	Editorial
16603	6	24	6	25	Briefly mentioning the benefits of CO2 fertilisation would be informative. [Siri Lie Olsen, Norway]	Accepted
31671	6	28	6	28	Affected is mentioned more than one time - same sentence [, Brazil]	Editorial
25327	6	29	6	29	"Response options" should be avoided as it is too close to "response measures", from UNFCCC negotiations. It would be better to use "land-based options". [, France]	Changed to 'mitigation response options' and land-based response options where appropriate
17667	6	32	6	37	The table makes the Executive Summary a bit complicated, and could be referred to the underlying chapter. The exceptions mentioned that unevenly apply to the estimates further complicate the clarity of the message, which also suggests that the detailed information would be better to present with the further context. The bold text is significant, however. [, Sweden]	Noted, with the revision the table has been removed
24897	6	33	6	33	Reference of the corresponding table is Table ES 2.1 instead of Table ES.1 [Borbala Galos, Hungary]	Noted, with the revision the table has been removed
14625	6	33	6	33	Should be Table ES 2.1. [, Canada]	Noted, with the revision the table has been removed
18207	6	33	6	33	Table ES2.1? [Julia Nabel, Germany]	Noted, with the revision the table has been removed
6235	6	33	6	33	Reference to Table ES.1 should be ES 2.1 [Tristan Quaife, United Kingdom (of Great Britain and Northern Ireland)]	Noted, with the revision the table has been removed
5355	6	34	6	37	In my view it is very important to distinguish options that could be combined or even be synergistic (e.g. reduced food demand or biomass supply-chain waste would reduce land demand and hence make more land available for afforestation) from those that are mutually exclusive (e.g. if land is afforested and the full C sequestration potential is expected to be exploited, it cannot be used for bioenergy production, or, conversely, if it is used for bioenergy production, then the forest will not sequester as much C as it could, if left unused). This is now only very tentatively mentioned (line 34f), but indeed understanding these systemic effects is key in this area! [Helmut Haberl, Austria]	Noted, with the revision the table has been removed
14347	6	37	6	37	"Shifting to healthy diets" seems like incorrect wording in this context. I assume this refers to diets that are associated with lower greenhouse gas emissions. Whether those diets are more healthy seems outside the scope of this document. [Benjamin Sulman, United States of America]	Noted, with the revision the table has been removed
13177	6	37	6	37	Table ES 2.1. reducing food waste and diet shitfs are not really "land-based". Theyare part of the broader food system. Suggest to separate out and ensure conissetency across chapters. [David Cooper, Canada]	Noted, with the revision the table has been removed
32817	6	37	6	37	The table and underlying analysis should include:forest protection, forest and ecosystem restoration, avoided grassland conversion, natural forest expansion, agroforestry, reduction in use of synthetic nitrogen fertilizers, pasture management, estimates of carbon stocks in collectively owned/managed lands. See an extensive literature on these mitigation options, with reduction potential estimates, reviewed in Dooley et al. 2018. [Doreen Stabinsky, United States of America]	Noted, with the revision the table has been removed
7355	6	37	6	37	The level of biochar seems not realistic moreover studies on biochar have conflicts with eachother please see https://www.ethz.ch/en/news-and-events/eth-news/news/2014/04/biochar-is-there-a-dark-side.html. So, that table needs to be reviewed! [Erhan Akca, Turkey]	Noted, with the revision the table has been removed

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26903	6	37	6	37	The table with mitigation potentials is very useful. Some further pieces of information would also be very policy relevant which we would request be included here: 1) How much of the mitigation potential of each measure is carbon dioxide removal as opposed to reduced emissions? 2) Do these potentials derive from modelled scenarios or from literature reviews? 3) What are potential socio-economic barriers that might occur when each option is rolled out at a global scale? Pease include a reference to the chapter where these issues are addressed. 4) How do these mitigation options interact with sustainable development (possible interference with SDGs), maybe in another chapter? Please include a reference to the chapter where these issues are addressed. 5) Recalling the discussion in chapter 5.5.2, the mitigation potential of dietary changes is related to the reduction of animal-sourced food. The term "Shifting to healthier diet" does not reflect this. Please revise. 6) It would be helpful to give the mitigation potential of bioenergy with CCS separately from bioenergy without CCS. Some literature gives evidence of increased emissions due to bioenergy, depending on the scenario (e.g. if it is driving deforestation). Therefore a correct representation of bioenergy would have to have a potential ranging between negative and positive values. 7) Lastly, we suggest to order the options considering their GHG reduction potential. [, Germany]	Noted, with the revision the table has been removed
26905	6	37	6	37	An explanation of "CO2e" as CO2 equivalent would help to understand Table ES 2.1. Please use CO2-eq, as in the glossary. [, Germany]	Noted, with the revision the table has been removed
33983	6	37	6	37	Table ES 2.1: This is a very informative table we would suggest that you further develop by including median vaslues for the different options, similarly to the dots in Figure 2.32 page 95. [, Norway]	Noted, with the revision the table has been removed
21017	6	37	6	37	It would be useful to split the line "agriculture management" between the generalisation of "best practices" already implemented outside of experimental settings today and changes that are more radical if the latter are covered in the estimate or to provide an additional line to cover major potential changes (e.g. GM editing of the microbial flora of cows to reduce CH4 emissions from ruminants,...)_ [, United Kingdom (of Great Britain and Northern Ireland)]	Noted, with the revision the table has been removed
21019	6	37	6	37	It would be useful to improve the discussion about competition for land across alternatives within the chapter executive summary, idealy quantitatively, and at least qualitatively as stated on page 94 "Thus, estimates of mitigation potential are very sensitive to assumptions about future agricultural intensification". One option could be to add columns about the assumptions in terms of land consumed/liberated should the full potential be achieved in table ES2.1. As a minimum, a brief mention of enabler options that could free land for mitigation based on land : this category could include beyond the "shift to healthy diets" already mentionned increasing effort to improve yields at least. Other options such as vertical farming, diversification of the sources of proteins beyond those associated with the shift to healthy diet alone (consumption of "meat" produced in lab, insects,... in place of red meat). [, United Kingdom (of Great Britain and Northern Ireland)]	Noted, with the revision the table has been removed
38673	6	37	6	37	"reduced forested degradation" needs to be "reduced forest degradation". [, United States of America]	Noted, with the revision the table has been removed

Comment No	From Page	From Line	To Page	To Line	Comment	Response
12827	6	37	6	37	Reduced deforestation and Forest management in the table seem overlapping. Adding GtCO2 for reduced for and management may be double counting? [Robert Treuhaft, United States of America]	Noted, with the revision the table has been removed
17449	6	37	6	37	The data presented in Table ES 2.1 seem to be based on a variety of studies, with each figure of this table being discussed in differnt parts of the report. References need to be clear and transparent here. It would help to have all references joint up somewhere - for example, the table could be repeated in the main text and fully referenced there. [Taehyun Park, Republic of Korea]	Noted, with the revision the table has been removed
213	6	37	6	37	The last row says shifting to healthy diets. I think it means shifting to vegetarian diets. The evidence is really mixed on the extent to which vegetarian is actually healthier, and using the term healthy diet does not convey what you mean. You mean vegetarian which avoids all the conversion losses in converting plant material to animal. That is true even if the vegetarial diets are less healthy. [Wallace Tyner, United States of America]	Noted, with the revision the table has been removed
3207	6	37	6	38	Table Table ES. 2.1 Afforestation/Reforestation: Medium evidence, (the long-term permanence of the carbon storage due to increased fire risk in young plantations is unknown) [Maria Ulrika Johansson, Sweden]	Noted, with the revision the table has been removed
7385	6	24	7	51	The conclusion that reforestation and BECCS coud each supply more than a couple of GtCO2/y of negative emissions is an accurate reflection of IAM results and other analyses that do not take account of what may be the dominant factors that will limit thei application of these land-hungry options: the fact that food production must double by midcentury in the face of likely ongoing demand for animal protein and the need to preserve remaining biodiversity. These conclusions effectively ignore the emerging literature on the links betwee food shortages, climate change and human conflict, which could generate costs that dwarf those in IAMs. The fact that IAM's don't include those costs is not an adequate reason to include upper bounds fr possible BECCS and afforestation/reforestation that could cause real harm. Links to the literture in this area can be found in the new US National Academy of Sciences report on Negative Emissions. But see the many papers by Solomon Hsiang, and espially the 2016 review by Crleton and Hsiang in Science. [Stephen Pacala, United States of America]	Noted and linked to findings in Chapter 6 regarding competition for land
31673	6	25	25	28	What about land productivity in low latitudes. Any evidence? [, Brazil]	Noted and assessed based on available scientific literature
18047	6	0			Table ES 2.1. What is "reduced forested degradation"? Should it be "reduced forest degradation"? [Clemens Schwingshackl, Switzerland]	Noted, with the revision the table has been removed
23647	6	14		15	It seems odd to have responses that "remain uncertain" as having "robust evidence and high agreement". Lots of researchers agree that they don't know what will happen? [Kerri Finlay, Canada]	Confidence language revised
6949	6	14			Litter gets buried by soil fauna, which is highly susceptible to heat and moisture; carbonised litter also gets washed deeper into the soil for longer term sequestration, by rain water, depending on soil permeability and compaction, which in turn is strongly affected by plants and soil organisms, which in turn are susceptible to climate. The effect of climate change on soil organisms goes much beyond "microbial respiration", and is not sufficiently covered. [Debra Roberts, South Africa]	Noted and revisions based on available scientific literature
17083	6	20			are they strong evidences that linter inputs will increase ? In agriculture it may be the opposite if harvest increases (e.g. through the use of straw or of cover crops for biofull production) [Eric Ceschia, France]	Noted and revisions based on available scientific literature
32191	6	20			Are there strong evidences that litter inputs will increase ? In agriculture it may be the opposite if harvest increases (e.g. through the use of straw or of cover crops for bioenergy [, France]	Noted and revisions based on available scientific literature

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23649	6	23		24	Is there any estimate of how much climate change will "counteract potential benefits of CO2 fertilization"? Would be nice to know if this would counteract by 10% or 100% [Kerri Finlay, Canada]	Noted and revisions based on available scientific literature
21679	6	37			Some of the numbers given in this table don't seem to be consistent with the numbers given in Chapter 6 or chapters 3-5 (e.g. "agricultural management"). Please reconcile those differences. [Andy Reisinger, New Zealand]	Noted, with the revision the table has been removed
17085	6	37			it should be said more clearly that this table shows the CO2e mitigation effect associated to reduction in GHG emissions for the options presented here but that it does not include the biophysical effects (e.g. albedo effects, converted in CO2e following the methodology published by Bright et al. 2015 in Environ. Sci. Technol. 2015, 49, 3291−3303 : DOI: 10.1021/es505465t). I would suggest at least to indicate what would be the sign of the biophysical effects (cooling or wraming) of those options through changes in albedo, evapotranspiration, surface roughness...using one column for each biophysical process. That would help identifying potential synergies or trade off bewteen mitigation options based on CDR and the ones based biophysical processes (e.gx through surface albedo management contributing to the SRM approaches). [Eric Ceschia, France]	Noted, with the revision the table has been removed
32193	6	37			it should be said more clearly that this table shows the CO2e mitigation effect associated to reduction in GHG emissions for the options presented here but that it does not include the biophysical effects (e.g. albedo effects, converted in CO2e following the methodology published by Bright et al. 2015 in Environ. Sci. Technol. 2015, 49, 3291−3303 : DOI: 10.1021/es505465t). I would suggest at least to indicate what would be the sign of the biophysical effects (cooling or wraming) of those options through changes in albedo, evapotranspiration, surface roughness...using one column for each biophysical process. That would help identifying potential synergies or trade off bewteen mitigation options based on CDR and the ones based biophysical processes (e.g through surface albedo management contributing to the SRM approaches). [, France]	Noted, with the revision the table has been removed
23651	6	37			As above, I take issue with the term "healthy diets" - "plant-based" would be more accurate (if this is what you mean). While there are many cases where the two terms are synonymous, I would argue that eating meat in some regions/ contexts is a healthy option (both environmetnally and physiologically) [Kerri Finlay, Canada]	Noted, with the revision the table has been removed
28985	7	1	7	1	I dont thin "anticipate" is the right word here. You could perhaps use "contain" instead. [Jan Fuglestvedt, Norway]	Accepted. Changed accordingly.
5005	7	1	7	2	Regarding the sentence "Future Representative Concentration Pathway (RCPs) scenarios anticipate key contributions to climate change mitigation from land-based options, interlinked with other sectors", it may be a bit too strong to say "key" for all RCPs. Modification to, e.g., "one of the key contributions" is desirable. [, Japan]	Accepted. Changed accordingly.
26907	7	1	7	5	Please revise the formulation "Future RCP scenarios" consistent with the definitions of scenarios and pathways in this report. In our understanding the RCPs do not determine the "anticipated key contributions from land-based options", rather the underlying scenarios do this (supported by SSPs and IAMs). Please clarify this in the text. [, Germany]	Rejected. The text cleary states RCP scenarios and hence refers to the underlying scenarios and not the RCPs.

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32831	7	1	7	12	Scenarios are treated with misplaced concreteness. They should not reify particular options just because they are easily modeled. Keep figure 2.32 always in mind. Don't just talk about the content of RCPs, afforestation, and BECCS. [Doreen Stabinsky, United States of America]	Rejected. This section is especially about the scenarios modelled by IAMs and hence focuses on afforestation, BECCS but also on agricutural emission reduction options.
14021	7	1	7	27	It's vital to bring out the conflict in these two statements – biophysical effects are very important, but not included in IAMs. Therefore existing scenarios (RCPs, SSPs) do not fully account for the full effects of LULUC [Chris Jones, United Kingdom (of Great Britain and Northern Ireland)]	Accepted. 'However, despite few exceptions, most IAMs neglect the biophysical effects of land-use such as changes in albedo or evapotranspiration' has been added to the text.
12829	7	3	7	3	the reader will have no idea what these mitigation scenarios are. Can you either give a brief summary of what they cover, or omit the references to RCPX. [Robert Treuhaft, United States of America]	Rejected. The RCPs are fairly common in climate change science and IPCC. In addition, they are introduced in chapter 1.
38675	7	3	7	4	More appropriate to say that the RCPs 'assume', rather than 'indicate', land-based mitigation can have these carbon sequestration potentials. The Integrated Assessment Models make generalized assumptions about land that require testing. [, United States of America]	Rejected. Land outcome from IAMs are not assumptions but simulation results - and thos indicate strong reductions in CO2 emissions.
17669	7	4	7	4	These are reductions in the sense that they lead to avoiding additional emissions, not reducing existing levels. Compare with line 7 that specifies for methane and nitrous oxide emissions that they are reduced compared to a no-mitigation baseline, which evidently applies for the statement on carbon dioxide as well. Please clarify. [, Sweden]	Accepted. Changed accordingly.
40293	7	4	7	4	suggest to change avoided deforestation to reduced deforestation and CO2 removal from afforestation. [Thelma Krug, Brazil]	Accepted. Changed accordingly.
18049	7	6	7	6	The abbreviaton BECCS is not explained before, so it might be worth to explain it here. [Clemens Schwingshackl, Switzerland]	Accepted. Changed accordingly.
26909	7	6	7	6	Please introduce "BECCS" before use in text. [, Germany]	Accepted. Changed accordingly.
26131	7	6	7	6	Spell out BECCS on first reference [Reid Detchon, United States of America]	Accepted. Changed accordingly.
2495	7	6	7	6	define "BECCS" [Wei Li, France]	Accepted. Changed accordingly.
21021	7	8	7	8	The level exposed are not the emission reductions but the emissions levels contrary to what one could understand from the phrase for CH4. Use the type of languge used for N2O for CH4. "CH4 emissions are 3.7, 3.0 and 2.1 Gt CO2eq yr-1 in 2100" [, United Kingdom (of Great Britain and Northern Ireland)]	Accepted. Changed accordingly.
17671	7	8	7	9	Are the 2, 1.6 and 1.2 of N2O emission reductions (as for CH4) or future levels? Cf. "are". [, Sweden]	Noted. These levels refer to a no-nitigation baseline in 2100 as stated in the text.
28549	7	9	7	9	should this be stated as reduction in n20 emissions "by" 2.0…? [Alan Di Vittorio, United States of America]	Accepted. It has been described in more detail that the text refers to annual emissions.
2497	7	9	7	9	"emission" to "emissions" [Wei Li, France]	Accepted. Changed accordingly.
17673	7	9	7	12	Are these factors not accounted for in the mitigation scenarios mentioned earlier in the paragraph? Cf. "In addition". Please clarify. [, Sweden]	Unclear statement.
18209	7	11	7	12	evidence/agreement? [Julia Nabel, Germany]	Accepted. Evidence and agreement included.
2499	7	11	7	12	Not accurate. Miscanthus may not need much N fertilisation. [Wei Li, France]	Rejected. Miscanthus may not need much. But still - especially for high yields it needs fertilization with N.
17675	7	14	7	14	This depends on the scale, assumedly, of such mitigation. Suggest "Large-scale land-based mitigation…" or suchlike. [, Sweden]	Accepted. Changed accordingly.
21023	7	14	7	14	may be preferable to mention actual temperature targets instead of 'Paris Targets' or replace with "the long-term temperature goal of the Paris Agreement." [, United Kingdom (of Great Britain and Northern Ireland)]	Accepted. Changed accordingly.
25329	7	14	7	16	Here, the "Paris Agreement long-term temperature goal" should be the wording to be used. [, France]	Accepted. Changed accordingly.

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38677	7	14	7	16	"Land-based mitigation in support of the Paris Targets will have large-scale consequences on the extent of forest cover and area under bioenergy crops, with implications for land carbon storage and biophysical effects on regional temperature." Suggest reframing as (1) it is unclear what "Paris Targets" are, and (2) mitigation actions may be undertaken for multiple reasons. Suggest reframing as "Land-based mitigation consistent with global and national climate goals..." [, United States of America]	Accepted. Text has been changed to Large-scale land-based mitigation in support of the the long-term temperature goal of the Paris Agreement.
28987	7	14	7	20	Use km2 instead of Mha ? (As in SR1.5 SPM) [Jan Fuglestvedt, Norway]	Accepted - changed accordingly
17275	7	14	7	27	If it is supported by robust evidence that Land-based mitigation in support of the Paris Targets will have large-scale consequences on the extent of forest cover and area under bioenergy crops, with implications for land carbon storage and biophysical effects on regional temperature. Reasonablly, what consequences will occur about/on the crop production and food security? I do think that issue should be assessed objectively. [Chengyi Zhang, China]	Noted. Trade-offs of land-based mitigation are discussed in detail in chapter 6 of SRCCL.
32819	7	14	7	27	What sort of land-based mitigation? Forest and ecosystem restoration? Dietary change? There are implicit assumptions and unfounded conclusions coded into this entire paragraph. The reification of model outputs -- with the only possibilities being BECCS and large-scale afforestation -- is extremely problematic, effectively erasing the contnet of table ES 2.1. "Land-based mitigation" is not equivalent to "BECCS+afforestation". The Paris targets can be reached with a range of land-based mitigation options that are not "BECCS+afforestation." This entire paragraph should be written to accurately portray the range of options under consideration. Don't use IAM model outputs to reify a particular, problematic, small set of technologies as the only way forward. [Doreen Stabinsky, United States of America]	Rejected. This paragraph clearly speaks about climate change mitigation pathways, bioenergy and afforestation.
7507	7	14	7	27	Burning wood instead of coal increases CO2, and leaves a “carbon debt” for 44 to 104 years, depending on forest type. See Sterman et al. (2018) Does replacing coal with wood lower CO2 emissions? Dynamic lifecycle analysis of wood bioenergy, ENVTL. RESEARCH LETTERS. [Durwood Zaelke, United States of America]	Noted. Unclear statement.
7587	7	14	7	27	Burning wood instead of coal increases CO2, and leaves a “carbon debt” for 44 to 104 years, depending on forest type. See Sterman et al. (2018) Does replacing coal with wood lower CO2 emissions? Dynamic lifecycle analysis of wood bioenergy, ENVTL. RESEARCH LETTERS. [Kristin Campbell, United States of America]	Noted. Unclear statement.
14349	7	17	7	17	"vary" would be a better word than "change" in this context [Benjamin Sulman, United States of America]	Reject. We used the word 'change' as these are changes in land area.
14351	7	19	7	19	The wording of the sentence makes it unclear whether the lower estimate is 5 thousand or 5 thousand million. [Benjamin Sulman, United States of America]	Accepted. This sentence has been excluded.
38679	7	20	7	20	Recommend inserting the words 'terrestrial mitigation' before 'options'. [, United States of America]	Accepted. Changed accordingly.
38681	7	20	7	21	The net carbon effects are also affected by how these mitigation policies are designed and implemented, which is worth noting. [, United States of America]	Accepted. Changed accordingly.

Comment No	From Page	From Line	To Page	To Line	Comment	Response
15261	7	21	7	24	There is too much emphasis on BECCS utilising new energy crops and not enough exploration of the potential for BECCS to use existing surpluses of low-grade wood, forest residues, mill residuals and waste wood. Also, the potential to bring under-managed forests and woodland into management (excluding high carbon forests, primary or virgin forests) e.g. in a UK context there are many thousands of ha of unmanaged low-grade hardwood stands that could benefit from thinning and management. In the US there are millions of hectares of forest that could be thinned to produce more saw-timber and solid wood products, with by-products used for BECCS. Improving forest management and actively harvesting and replanting increases carbon sequestration and storage. https://www.forest2market.com/hubfs/2016_Website/Documents/20170726_Forest2Market_Historical_Perspective_US_South.pdf [Andrew Dugan, United Kingdom (of Great Britain and Northern Ireland)]	Rejected. This text is on mitigation pathways simulated by IAMs - and hence the mitigation options they cover.
32829	7	21	7	24	This comment also applies to the discussion in the underlying chapter on pp. 102-104. The phrasing here does not quite capture the conclusions of Harper et al. and seems to misinterpret them. Ideally the phrasing in the report would be more alligned with the content of the paper, which looks at the NET LOSS of carbon, even over the long term, from BECCS. The paper also concludes that forest-based mitigation (i.e., not cutting them down) "has a wide range of co-benefits..." Read the paper again and revise the treatment in the chapter to correct the current mis-interpretation. [Doreen Stabinsky, United States of America]	Paper revisited
33593	7	21	7	24	Quotation: "In high carbon lands such as forest and peatlands, the carbon benefits of land protection are greater in the short-term than converting land to bioenergy crops for BECCS, which can take several harvest cycles to “pay-back” the carbon lost (medium evidence, medium agreement)." Comment: To what extent are short term goals relevant in this respect? All the RCPs and the balance goal of the Paris agreement are long term goals. The overall goal of the climate convention is to stabelize the GHG consentration in the atmosphere at a level that will prevent dangerous interference with the climate system. Such stabilization will be long term. BECCS will reduce the amount of carbon in the carbon cycle instatenously. Therefore check if this argument is correct? [, Norway]	Statement checked and revised accordingly
30967	7	21	7	24	It should also be noted that due to the release of greenhouse gases when burning biomass, and the impacts on biodiversity and the carbon sink of harvesting for bioenergy/BECCs on an industrial scale, protecting high carbon lands is also the most effective long-term option. [Kelsey Perlman, France]	Accepted. The importance of reduced deforestaion is mentioned in the upper paragraph.
17677	7	22	7	23	The overall message is unclear. What is "shorter-term" and how does the balance shift for longer term. "Several harvest cycles" may be a fairly short time for some bioenergy crops. What is optimal in mitigation strategies? [, Sweden]	Accepted and statement revised to clarify
38683	7	22	7	24	After the current sentence in lines 22-24, suggest adding that, in some instances, implementing forest carbon mitigation and bioenergy policies concurrently can create greater benefits, particularly in the near term, than when implemented in isolation. This finding is based on recent literature: Baker et al. (2019). Potential complementarity between forest carbon sequestration incentives and biomass energy expansion. Energy Policy. 126. 391-401. 10.1016/j.enpol.2018.10.009. https://www.sciencedirect.com/science/article/pii/S030142151830661X Another example is Favero et al. (Climatic Change, 2017), which focuses on interaction between BECCS and C policies. [, United States of America]	Thank you for the literature suggestion
18051	7	25	7	25	Remove "While" [Clemens Schwingshackl, Switzerland]	Editorial

Comment No	From Page	From Line	To Page	To Line	Comment	Response
21025	7	25	7	27	The last phrase is misleading due to the combined use of "only" and "but". Either remove the first or replace the second by "and". "In the temperate to boreal regions, dampening would only occur during the growing season but additional regional warming would occur during the snowy season (predominantly due to decreased albedo)" OR "In the temperate to boreal regions, dampening would only occur during the growing season and additional regional warming would occur during the snowy season (predominantly due to decreased albedo)" [, United Kingdom (of Great Britain and Northern Ireland)]	Statement checked and revised accordingly
30883	7	25	7	27	this needs to be qualified that it will depend on regional and site conditions - many temperate regions have very little snow and deciduous trees and would not have a net warming effect [Mike Morecroft, United Kingdom (of Great Britain and Northern Ireland)]	Statement checked and revised accordingly
14627	7	27	7	27	Regarding the text: "decreased albedo in conifer forests", albedo in wintertime deciduous forest is still quite high, so afforestation to deciduous forest would not lead to additional regional warming. [, Canada]	Accepted. More information has been included and the text modified as suggested.
38685	7	27	7	27	Suggest inserting the phrase 'to some degree' before the word 'counteracted' to convey that this counteracting behavior is only partial. [, United States of America]	Accepted. More information has been included and the text modified as suggested.
17679	7	29	7	29	"Alternative" to what? Or is the meaning to say that such pathways exist? Please clarify. [, Sweden]	Accepted. 'Alternative' has been excluded from the text.
23675	7	29	7	30	The alternative pathways are not specified and how much is the CDR potential? [Xiyan Xu, China]	Accepted. The text has ben strongly modified and now spells out the pathways in more detail.
18053	7	29	7	32	Why is this paragrpah so short? It looks a bit like somebody requested it, but nobody really wanted to work on it. It might thus be worth to extend it a bit and to also include some references (if available) [Clemens Schwingshackl, Switzerland]	Accepted. The text has been strongly modified.
15327	7	29	7	32	Suggest clarifying this section as it appears to have double-negative. That is, it is unclear how lifestyle changes and agricultural intensification relate to carbon dioxide removal. [, Australia]	Accepted. More information has been included and the text modified as suggested.
33595	7	29	7	32	Consider to in addition also mention that pathways without CDR also include substancial amounts of low or zero carbon electricity production. [, Norway]	Rejected. This aspect has been treated in detail in the SR1.5 and not in the SRCCL.
11779	7	29	7	32	This paragraph might become more useful for the target audience of the Executive Summaries if you could say more clearly what the existance of these modelled pathways means with respect to reality. Do they suggest that it might be possible to limit warming to 1.5/2°C with limited need of land-demanding CDR? Under what conditions? [Hans Poertner and WGII TSU, Germany]	Accepted. The text has ben strongly modified and now spells out the pathways in more detail.
38687	7	32	7	34	This text is not clear. Suggest adding the word 'global' before "land carbon sink" in line 32. Is the 3.1 ± 0.9 Pg C net removal annual, and what does the 'within 10 years' signify? Is that a projected sequestration amount? [, United States of America]	Text revised to clarify
22409	7	34	7	37	"About a quarter of the 2030 mitigation already pledged by countries under the Paris Agreement is expected to come from land-based mitigation measures (medium evidence, high agreement). Most of the Nationally Determined Contributions (NDCs) submitted by countries include land-based mitigation, mainly reduced deforestation and forest sinks." This should probably read as "… mainly reduced deforestation and increased forest sinks." [Anastasios Kentarchos, Belgium]	Accepted. Text revised to clarify
28551	7	34	7	41	This seems to refer to the same pledges as the statement and table on page 6 lines 29-37, but the results are very different. [Alan Di Vittorio, United States of America]	Text revised to clarify

Comment No	From Page	From Line	To Page	To Line	Comment	Response
25009	7	34	7	41	How the pledge by conutries's NDC compares with what is needed? [Binaya Shivakoti, Japan]	Noted. Also addressed in the SR1.5
26055	7	34	7	41	Some mitigation options such as Soil CCS technologies may cause land degradation and deep water contamination. [Noureddine Yassaa, Algeria]	Noted. Co-benefits and trade-offs also addressed in Chapter 6
38689	7	35	7	37	Word missing. "Most of the Nationally Determined Contributions (NDCs) submitted by countries include land-based mitigation, mainly reduced deforestation and INCREASED/ENHANCED forest sinks." [, United States of America]	Accepted and revised
14111	7	37	7	38	I don't think the sentence "Few included …." is accurate or necessary here. I know the NDCs for Southeast Asian countries, and at least three refer specifically to bioenergy- Malaysia, Indonesia and Cambodia have targets for bioenergy:fossil fuel mixes in future, with the % of biofuel in the mix increasing. Moreover, as these are NDCs they are meant to specifically refer to actions within a country. Most bioenergy plans will involve countries investing in offschore schemes (e.g. plantations in other countries) and thus would not be expected to be included in their NDC, especially as details regarding carbon markets, replacement for REDD+ etc have yet to be agreed.. [David Taylor, Singapore]	Noted and revised based on the available scientific literature
22411	7	38	7	39	"Full implementation of country pledges (NDCs) is expected to result in net removal of 0.4 to 1.3 GtCO2 y-1 in 2030 compared to the net flux in 2010…" confusing. Does it mean a net emissions reduction compared to 2010? Or does it mean a 1 GtCO2e net sink? [Anastasios Kentarchos, Belgium]	Text revised to clarify
3079	7	38	7	39	The statement is unclear: 'net removal of 0.4 to 1.3 GtCO2 y-1 in 2030' is the estimate of absolute reduction; there is no need in comparison with 2010 flux or any other value. [, Russian Federation]	Text revised to clarify
5499	7	41	7	41	can we add the name of some regions or countries that followed those land-based mitigations? [Sanaz Moghim, Iran]	Text revised to clarify
11781	7	43	7	43	"Strong action in the energy sector" can mean anything. Please be more specific to avoid misinterpretation. [Hans Poertner and WGII TSU, Germany]	Partially accepted. Due to space limitations no more additional information could be included. In addition, the text has been modified stating now 'other sectors'. The ES bullet has been shifted to ch6 ES list.
21027	7	43	7	45	This sentence could perhaps be improved - suggestion. 'Land sector CDR has the technical potential to balance unavoidable emissions. However, large scale land based CDR is associated with multiple feasibility and sustainability constraints and is not a substitute for strong and early action in the energy sector. Delayed action would increase future reliance on land based CDR.' (as mentioned in another comment, a clear message along these lines on the CDR implications of delayed action would be helpful in SPM) [, United Kingdom (of Great Britain and Northern Ireland)]	Noted. The text has been changed in general.
25011	7	43	7	49	What about cascading impact on land based emission with increasing warming to minus all the efforts to remove GHG from land based sectors. Not sure if this report (e.g., Chapter on risk) touches it as well considering land based ecosystem being the the most sensitive to changing climate [Binaya Shivakoti, Japan]	Noted. However, the impact of Climate Change has not been included here.
26915	7	43	7	49	This headline statement together with the underlying paragraph is a very important point for policy makers and it is based on robust evidence with high agreement. It should therefore be presented in the SPM as well. It is an important message to highlight that under the specific circumstances mentioned land use could possibly be enough to offset unavoidable emissions. [, Germany]	Noted.

Comment No	From Page	From Line	To Page	To Line	Comment	Response
21029	7	43	7	49	This would be a good time to make the link to the 1.5 report & 1.5 pathways and in particular explaining that CDR is needed not just to compensate for residual emissions but also to achieve net negative emissions. [, United Kingdom (of Great Britain and Northern Ireland)]	Accepted. Changed accordingly.
28989	7	43	7	49	This para is important, but the wording could be clearer. CDR can compensate for unavoiadble emissions, but can also be used to comepensate for lack of early emission reductions - this should be made mroe clear. And it shoudl be made clear if "....strong early action..." refer to emissions recutions or early deployment of CDR [Jan Fuglestvedt, Norway]	Accepted. The text has been improved for better understanding.
25331	7	45	7	46	The Paris Agreement, in its Article 4.1, does indeed call the Parties to achieve a balance between anthropogenic emissions by sources and removals by sinks in the second half of the century, but it is absolutely false to say that the Paris Agreement states that this balance is designed to cover the emissions that are difficult to reduce, and it is even more wrong to say that the Paris Agreement considers the emissions that are difficult to reduce are those of air transport. [, France]	Accpeted. The text now states that there is a need for anthropogenic removals to compensate for residual emission as well as to achieve net negative emissions.
17681	7	46	7	46	"balance hard" is unclear. [, Sweden]	Accepted. Text has been changed accordingly. It now states 'compensate for residual emission'.
17683	7	46	7	46	In the longer term (such as beyond 2050 and global net zero emissions), it is not necessarily so that air transport is fueled by fossile fuels. Or is the reference here to contrails? [, Sweden]	Accepted. The examples have been excluded.
22413	7	46	7	49	"There is sufficient technical potential for land sector carbon removals, but this would require strong early action to be a realisable potential on the short time-scales required, with potential consequences for land competition as well as other trade-offs, synergies and governance issues discussed elsewhere in the SRCCL.". "...strong early action to have a notable effect given the short time scales required..." reads better than "...strong early action to be a realisable potential on the short time-scales required..." [Anastasios Kentarchos, Belgium]	Accepted. Changed accordingly.
5007	7	46	7	49	Concerning the sentence "There is sufficient technical potential for land sector carbon removals, but this would require strong early action to be a realizable potential on the short time-scales required", We would suggest clarifying: 1) technical potential is "sufficient" to "what"; and 2) the reason why "this would require strong early action (...)". [, Japan]	Accepted. Text has been modified taken these suggestions into account.
26917	7	49	7	49	If possible, add the level of confidence (or agreement and evidence). [, Germany]	Noted. Level of agreement and evidence is in the text.
349	7	6			BECCS not defined [Tobias Rütting, Sweden]	Accepted. Changed accordingly.
26911	7	10			Please specify the quantity of decreased CH4 and N2O emissions from such dietary shifts, or provide a reference to the relevant SRCCL chapter where this is assessed. [, Germany]	Accepted. Reduction in N2O and CH4 emissions are based on both - improved management as well as dietary shifts. To make this more clear the text now states. CH4 and N2O emissions are reduced compared to a no-mitigation baseline due to improved agricultural and livestock management as well as dietary shifts away from emission-intensive livestock products.
12421	7	14		27	Giving % changes of area in relation to natural and used land surface would improve intuitive understanding of the magnitudes of change. [Hans Poertner and WGII TSU, Germany]	Accepted. Changed accordingly.
26913	7	18			Please define "second generation bioenergy crops". [, Germany]	Accepted. Changed accordingly.
12423	7	29		32	Connecting to SR1.5 would support coherent messaging across Special Reports. [Hans Poertner and WGII TSU, Germany]	Accepted. Changed accordingly.

Comment No	From Page	From Line	To Page	To Line	Comment	Response
6951	7	29			It would be helpful to include more detail on lifestyle changes and what exactly they would look like, in a format that can be understood and used by common people. For example, apparently the mean global meat consumption is around 42kg per year (112g per day), 32-80 for developing/developed countries (http://www.worldwatch.org/global-meat-production-and-consumption-continue-rise). How much of the existing emissions can be avoided by reducing meat consumption to x g per person per day on average? Fig 5.14 and that section contain useful information, but how does this translate into actual grammage? "Reducing meat consumption" is too vague. Also, what is the emissions per km travelled by car (by size of engine)? or per household appliance? There is lots of information on this on the Internet but it is not rigorously assessed. This is the sort of information that would be extremely useful if it was readily available in an IPCC report. With 7.6billion people alive, individual choices can have a huge impact, especially in parallel with industrial and national level transformation. What needs to come out more clearly is that climate change needs to be addressed not in an either-or manner, but in an any-and-all options manner. For this, quality, relevant, numerical information, in the right format, is needed to help individuals make high-impact personal choices. [Debra Roberts, South Africa]	Accepted. More details are included. But the main explanations are based in the chapter text and could not be included due to space limitations.
12425	7	35			The specifics of land-based mitigation should be mentioned here. [Hans Poertner and WGII TSU, Germany]	Noted, but comment unclear
17087	7	37			none included SRM approches based on surface albedo management. [Eric Ceschia, France]	Rejected. Unclear comment
15599	8	5	5	7	I would add here that also this report is missing the known processes, i.e. BVOC-Aerosol-CCN, due to the lack of studies really implementing this effect. [Tuomo Kalliokoski, Finland]	Yes, knowledge is summarized at end of each section
28553	8	2	8	2	While climate may determine potential land cover given enough time, land use has been the primary determinant of land cover for several centuries. More accurately, climate affects land cover and biosperic processes, which in turn affect climate. [Alan Di Vittorio, United States of America]	Agree, and a sentence added
33559	8	2	8	2	Nice title! [Sonia Seneviratne, Switzerland]	Thanks
28991	8	6	8	6	Aersols shoud be added after GHGs [Jan Fuglestvedt, Norway]	Added
2781	8	7	8	7	"This chapter assesses…" [Bettina Weber, Germany]	Revised
12747	8	7	8	7	"assess" should be substituted with "assesses" [Tiziana Susca, United Kingdom (of Great Britain and Northern Ireland)]	Revised
3249	8	7	8	7	Spelling: change assess to "Assesses" [Viola Heinrich, United Kingdom (of Great Britain and Northern Ireland)]	Revised
1751	8	7	8	7	assess -> assesses. [William Lahoz, Norway]	revised
24729	8	8	8	8	Edit on the punctuation on "in land cover, use, and functioning for both global and regional climates." [Mark Owidhi, Kenya]	Revised
3251	8	8	8	8	Change ''It examines science advances' to 'scientific advances' (?) [Viola Heinrich, United Kingdom (of Great Britain and Northern Ireland)]	Revised
18211	8	8	8	13	sentence structure/language [Julia Nabel, Germany]	Edited
22415	8	10	8	10	Delete "changes" [Anastasios Kentarchos, Belgium]	Revised
18057	8	10	8	10	"...how changes land from direct...": remove "land" [Clemens Schwingshackl, Switzerland]	Revised

Comment No	From Page	From Line	To Page	To Line	Comment	Response
38693	8	10	8	10	Perhaps change sentence to: "... including how climate change, variability, and extremes influence managed and unmanaged lands and how direct (e.g., land use change and land management) and indirect (e.g., increasing atmospheric CO2 concentration and nitrogen deposition) land changes influence the climate system on local, regional, and global scales." [, United States of America]	Revised
13339	8	10	8	10	Wording is confusing in the phrase " … and how changes land from direct …"; is an 'in' missing between 'changes' and 'land'? [Gregory Duveiller, Italy]	Corrected
28993	8	10	8	10	"on" is missing before "land" [Jan Fuglestvedt, Norway]	Revised
17065	8	10	8	10	"how changes land" - not understood - rephrase? [Morten Andreas Dahl Larsen, Denmark]	Revised
1029	8	10	8	10	Replace "how changes land from" by "how changes from" [Sebastiaan Luyssaert, Belgium]	replaced
16605	8	10	8	10	This sentence needs editing. [Siri Lie Olsen, Norway]	Edited
40295	8	10	8	10	…and how changes IN land from ... [Thelma Krug, Brazil]	Corrected
2469	8	10	8	12	Revisit the sentence to improve the flow [Lawrence Aribo, Uganda]	Revised
13755	8	10	8	12	The last part of this phrase is not clear. Starting "and how changes land from direct…" [Moira Doyle, Argentina]	Revised
38697	8	13	8	13	CO2 emissions, not C. [, United States of America]	Revised
19029	8	14	8	14	on Fig 1 the percentage scale should be added to lower line: unmanaged land, agriculture, forestry [Joanna Wibig, Poland]	Figure is a conceptual chart without numerical details.
8359	8	14	8	14	Biophysical effects (albedo, roughness) could appear more explicitly in the figure as they are discussed below [Marc Aubinet, Belgium]	Figure revised to better present biophysical effects
15329	8	14	8	21	Suggest that Figure 2.1 explain the acronym BVOC. [, Australia]	BVOC is explained in SRCCL glossary
24899	8	15	8	15	Fig 2.1 does not indicate that processes in the soil are also part of the biochemical cycle [Borbala Galos, Hungary]	Figure revised to address the concerns
16607	8	15	8	16	This sentence needs editing. [Siri Lie Olsen, Norway]	Edited
33597	8	15	8	21	The figure gives an impression of forestry as a source of emissions, and that the CO2 released is removed by unmanaged land. Sustainable forest management, where the carbon stocs are maintained or strengthened will in a climate relevant time scale absorb all, or more CO2 than emitted. Right panel of the figure is named "forestry" but is actually deforestation or forest degradation. On page 99 (line 23) it is described that forest management has the potential to mitigate 2-5.8 Gt CO2 yr-1 in 2030. It does not seem right to illustrate forestry as an source of emissions. Please consider to revise the figure. [, Norway]	Figure revised to address the concerns
38699	8	17	8	17	There is no shortwave radiation feedback to the atmosphere. Add SW and LW arrows to the figure, and fix the figure legend. [, United States of America]	Figure revised to address the concerns
13341	8	17	8	17	Missing word 'the' between "determine" and "amount" [Gregory Duveiller, Italy]	Corrected
13343	8	20	8	20	Missing word 'the' between "both" and "amount" [Gregory Duveiller, Italy]	Corrected
28995	8	23	8	23	re "brief assessment": In my view this is more a review. [Jan Fuglestvedt, Norway]	We have enhanced assessment instead of review for entire chapter
28997	8	23	8	38	The structure is confusing. Would be good if you could explain and motivate better for the chosen structure. [Jan Fuglestvedt, Norway]	Explained in revision
3083	8	26	8	26	Suggestion: add ' fluxes' to ' GHGs' [, Russian Federation]	Revised
31859	8	26	8	26	"assesses" instead of "assess" [Martijn Slot, Netherlands]	Revised
17067	8	26	8	26	Change "assess" to "assesses" [Morten Andreas Dahl Larsen, Denmark]	Revised
2501	8	26	8	26	"assesses" [Wei Li, France]	Revised
31861	8	30	8	30	"affects" instead of "affect" [Martijn Slot, Netherlands]	Revised

Comment No	From Page	From Line	To Page	To Line	Comment	Response
2503	8	30	8	30	"affects" [Wei Li, France]	Revised
40297	8	34	8	34	change global stock take to global stocktake [Thelma Krug, Brazil]	Revised
40299	8	34	8	35	… and credibility in measuring, reporting and verifying the climate impacts … [Thelma Krug, Brazil]	Changed
16609	8	35	8	35	What does "it" refer to? [Siri Lie Olsen, Norway]	Revised and clarified
17069	8	37	8	38	Future changes: proposed, recommended or projected -> vague [Morten Andreas Dahl Larsen, Denmark]	We now use projection
40467	8		8		The figure may also include sheep, not just cows. Source? Level of scientific understanding of various processes? [Valerie Masson-Delmotte, France]	Revised as livestock
14113	8	1	12	33	Page 11, lines 23-25 - reference should be "et al", page 12, line 33 "cross" should be "across [David Taylor, Singapore]	Revised
22417	8	23	12	33	The storylines and knowledge recap are extremely important, but they need to be integrated into the chapter overview so that the reader can trace how the knowledge is taken forward in the chapter. [Anastasios Kentarchos, Belgium]	Reorganized and more integrated in subsequent section
15121	8		118		Most of my comments were taken into account in this version [Ibouraïma Yabi, Benin]	Thanks
18055	8	0			Figure 2.1: The first sentence is grammatically not correct. [Clemens Schwingshackl, Switzerland]	Revised
38691	8	7			Change "assess" to "assesses". [, United States of America]	Revised
38695	8	10			Change "and how changes land from direct ..." to "and how changes in land use and land cover from direct ..." Also, this is a pretty long, complicated sentence. Might want to make into two sentences. [, United States of America]	Revised
23653	8	15		21	Inland waters are not included in this figure. We now know that these are very important in the global carbon cycle (see references in last point below). [Kerri Finlay, Canada]	We consider inland water as part of natural ecosystems
38701	8	26			Change "assess" to "assesses". [, United States of America]	Revised
38703	8	27			Change "non-GHG and aerosols (Section 2.5) exchanges between land and atmosphere ..." to "non-GHG and aerosol (Section 2.5) exchanges between the land and atmosphere ..." [, United States of America]	Revised
38705	8	30			Change "affect" to "affects". [, United States of America]	Revised
38707	8	30			Change "feedback" to "feed back" since using as a verb. [, United States of America]	Revised
24901	9	8	9	8	This subtitle has no numbering [Borbala Galos, Hungary]	Edited
30743	9	8	9	8	I would advise against the use of the phrase "Chapter story lines", and rather use "Chapter lines of investigation". Hopefully, this is not a story book, but a scientific chapter! [Francois Engelbrecht, South Africa]	Reject
25013	9	9	9	9	Did not see 'feedback loop' in the executive summary [Binaya Shivakoti, Japan]	Added in ES
17277	9	9	9	15	It should be clear that all the cases or only a few that it can be explained that up to 30% of precipitation and surface radiation variance in the regions where the feedback of the interactions between biosphere and atmosphere takes place. [Chengyi Zhang, China]	Noted

Comment No	From Page	From Line	To Page	To Line	Comment	Response
30751	9	9	9	51	It is not clear what the authors would like to achieve with this section. If the purpose is merely to present the main lines of investigaiton of the chapter, they should do that without trying to also include their main findings in this section. Because - that is what the section currently comes down to - they provide a set of incomplete references to try and substantiate a number of very strong statements. Rather they shoud simply present the main lines of investigation and leave it to the rest of the chapter to properly investigate each of these. Conclusions can be drawn in the conclusions section. This section reads a bit like a set of conclusions. [Francois Engelbrecht, South Africa]	Agree, 2.1 is shortened and details moved to other sections
3085	9	10	9	11	Some climate trends might be favorable for some species. Why always 'constrain'? [, Russian Federation]	Agree, revised
30745	9	12	9	15	"Changes of land surface functioning and land use alter the land-atmosphere fluxes of GHGs/non-GHGs, water, and energy, and therefore, feedback to climate system. Biosphere–atmosphere feedbacks are considered as globally widespread, and explain up to 30% of precipitation and surface radiation variance in regions where feedbacks occur." Please provide references for this very strong statement, [Francois Engelbrecht, South Africa]	Revised
38709	9	13	9	13	"Biosphere-atmosphere feedbacks" should be referred to as land surface-atmosphere feedbacks if it is meant to include feedbacks from soil moisture, snow cover, etc., which do not necessarily have a direct link to biological processes. [, United States of America]	Yes, soil and snow processes are included in bioshpere
24731	9	13	9	15	There is need to add a refernce on the sentence beginning from "Biosphere–atmosphere feedbacks……." [Mark Owidhi, Kenya]	Reference added
439	9	14	9	14	This statement about 30% is new to me. It needs references. Not a single reference. It is a big statement. [Andrew Pitman, Australia]	Revised
5501	9	14	9	14	add reference for up to 30% of precipitation! [Sanaz Moghim, Iran]	reference added
2505	9	14	9	14	what is the ref for this sentence? [Wei Li, France]	Revised
441	9	15	9	15	This is misstated - feedbacks occur everywhere. There is not a square metre of the land where feedbacks do not occur! I am not sure what the key point being made here but it needs revision [Andrew Pitman, Australia]	Agree, revised
38715	9	15	9	15	The sentence "Substantial biosphere-precipitation feedbacks are often found in regions that are transitional between energy and water limitation, such as semi-arid or monsoonal regions." is incomplete. Sea-breeze precipitation could be considered a biosphere-precipitation feedback. [, United States of America]	Details covered by section 2.6
30747	9	15	9	16	"Substantial biosphere–precipitation feedbacks are often found in regions that are transitional between energy and water limitation, such as semi-arid or monsoonal regions.". Please provide references for this very strong statement. What exactly is meant with substantial? Can you rather describe the importance of this feedback quantitively, in terms of its percentage cpntribution to variability? [Francois Engelbrecht, South Africa]	Details covered by section 2.6

Comment No	From Page	From Line	To Page	To Line	Comment	Response
693	9	16	9	17	I acknowledge the biosphere-radiation feedback in the Mediterranean region reported by Green et al. (2017). Although in a recent study about the albedo parameterization and land use change effect in a regional climate model it was found that the albedo parameterization is a high uncertainty factor in this region. Rather climate changes occurred due to the land cover change by afforestation. The high temperature discrepancies between the deforesation simulation and the afforestation simulation in the Mediterranean region stem primarily from differences in evapotranspiration rather than from the albedo effect. Therefore, the land cover change impact is higher in this region than the model uncertainty due to the albedo parameterization. [Merja Tölle, Germany]	Edited
18059	9	17	9	17	What is meant with "Mediterranean climate regions"? The regions around the Mediterranean or also other regions in the world with similar climate as the Mediterranean? [Clemens Schwingshackl, Switzerland]	We meant Mediterranean climate zones
33599	9	17	9	17	Substantial biosphere-radiation feedbacks can also be pronounced in areas with seasonal snow cover, especially as solar radiation is strengthened in spring. [, Norway]	Agree, and sentences revised
8305	9	17	9	17	Add thew following sentence to end of the sentence“Besides the impact of GHGs and anthropogenic activities, clouds and aerosols can alter the surface incident solar radiation and the downward longwave radiation. Variation in surface radiation fluxes is essential to local land-atmosphere turbulent fluxes, and resulting in significant spatial pattern of warming of land surface temperature (Du et al., 2017).” Du, J., Wang, K., Wang, J., and Ma, Q.: Contributions of surface solar radiation and precipitation to the spatiotemporal patterns of surface and air warming in China from 1960 to 2003, Atmos. Chem. Phys., 17, 4931-4944, https://doi.org/10.5194/acp-17-4931-2017, 2017. [kaicun Wang, China]	Reject, not relevant
16611	9	17	9	17	Merge this sentence with the previous? [Siri Lie Olsen, Norway]	Edited
3087	9	18	9	19	Global terrestrial ecosystems': please, specify the meaning of the term. [, Russian Federation]	Term defined in SRCCL glossary
14355	9	18	9	32	This paragraph is very vegetation-focused. It should also mention impacts to soils, especially carbon and nutrient cycling and erosion [Benjamin Sulman, United States of America]	Agree, and sentences revised
17279	9	18	9	32	In your headline, "changing climate" was used, however in the text body the "climate change" did appear 6 times, but not the "changing climate. I do think a clear difination (or explaination) of "changing climate" is needed to let your audience understand what "changing climate" is and "climate change" as well. [Chengyi Zhang, China]	They are the same, as defined by IPCC
30749	9	18	9	32	Here the reader also needs to be referred to SR1.5, which discussed in great deal climate change impacts on biodiversity and vegetation biomes under 1.5 vs 2 degrees C of global warming. [Francois Engelbrecht, South Africa]	Yes, corss reference added
17281	9	22	9	24	If you do mant to do an assessment about the "impacts of climate change on vegetation", I do think that impacts not only "are reflected in a series of physiological processes", but also in other vegetated processes, such as "interactions between two species". [Chengyi Zhang, China]	Noted, but we focus on climate change related processes
13393	9	23	9	24	I think competetive interaction is too exclusive. Should be renamed to biological interactions, which include competition etc. [Anders Bryn, Norway]	Agree, and sentences revised
26919	9	24	9	24	Please insert ", whereas changes in soil temperature and soil moisture affect soil respiration and thus SOC stocks." [, Germany]	Added
24733	9	27	9	28	Can you give an example of a scenario where climate extremes are driver behind interrupted changes of land surface through catastrophic disaster events. This will be essential towards supporting that statement [Mark Owidhi, Kenya]	detailed assessment is provided section 2.3

Comment No	From Page	From Line	To Page	To Line	Comment	Response
14353	9	28	9	28	I think "interrupted" should be replaced with "abrupt" [Benjamin Sulman, United States of America]	Changed
2471	9	31	9	31	Consider intensify instead of intensity [Lawrence Aribo, Uganda]	Revised
16613	9	31	9	31	This sentence needs editing. [Siri Lie Olsen, Norway]	Edited
26921	9	32	9	32	Please add reference. [, Germany]	cross reference to Chapter 1
13345	9	35	9	35	For info, the study Alkama & Cescatti 2016 has been superseded/updated by Duveiller & al (2018, Nature Communications) which tackles multiple vegetation cover transitions instead of only deforestation, and further adresses the effects of both changes in temperature and its underlying energy balance processes , [Gregory Duveiller, Italy]	Noted
1031	9	35	9	35	Delete the citation of Alkama end Cescatti 2016. The paper links remote sensing based land cover changes to air temperature. By using satellite data it is focussed on local effects and therefore does not well demonstrate "important and complex role in the climate system". In my opion Swann et al 2012 doi/10.1073/pnas.1116706108 would be a better reference. [Sebastiaan Luyssaert, Belgium]	Deleted
17283	9	36	9	36	Perhaps, the "land is a source and a sink ofr several GHGs" is not correct? Since that the land is a source of several GHGs is correcr, but the land is not a sink of "CH4", nor "N2O"? [Chengyi Zhang, China]	Agree, and sentences revised
671	9	37	9	37	"Plus the nature of the land surface…", please re write to eliminate the "Plus". E.g. the sentence could start: "The nature of the land surface…" [Anna Sörensson, Argentina]	Revised and clarified
1033	9	37	9	42	Consider adding BVOC emissions to the list of bioohysical properties. See Unger 2014 DOI/10.1038/NCLIMATE2347 [Sebastiaan Luyssaert, Belgium]	BVOC is assessed in section 2.5 and 2.6
18061	9	41	9	41	The reference should be "Thiery et al. 2017" (not Wim et al.). It seems as if the first and last names in this reference are exchanged (see reference list). [Clemens Schwingshackl, Switzerland]	Corrected
31863	9	41	9	41	"Wim et al" should be "Thiery et al" Wim is the first name here. [Martijn Slot, Netherlands]	Corrected
695	9	41	9	41	Wim is the first name of the author. Please change to Thierry et al. 2017. [Merja Tölle, Germany]	Corrected
1035	9	41	9	41	Wim is the first name, Thiery is the last name of the author. Same msitake occurs throughout the chapter. [Sebastiaan Luyssaert, Belgium]	Corrected
33563	9	41	9	41	There is a problem with the "Wim et al." reference. The last name of the author is "Thiery" and not "Wim". Also the names of the other authors are only included as initials in the reference entry. [Sonia Seneviratne, Switzerland]	Corrected
33565	9	41	9	41	The "Thiery et al. 2017" reference (listed here as "Wim et al.") only refers to the effects of irrigation. Other relevant effects of land surface processes on heatwaves include: 1) soil moisture feedbacks, e.g. Vogel et al. 2017, GRL (Vogel, M.M., R. Orth, F. Cheruy, S. Hagemann, R. Lorenz, B.J.J.M. Hurk, and S.I. Seneviratne, 2017: Regional amplification of projected changes in extreme temperatures strongly controlled by soil moisture-temperature feedbacks. Geophysical Research Letters, 44(3), 1511-1519. - already cited); 2) land albedo forcing, e.g. Hirsch et al. 2017, JGR (already cited). [Sonia Seneviratne, Switzerland]	References added
16615	9	42	9	49	This part seems very detailed compared to the rest of the chapter. [Siri Lie Olsen, Norway]	Agree, some details are now moved to subsequent sections
15601	9	49	9	51	Does this study account for VOCs and aerosols and also indirect effect on cloud albedo? [Tuomo Kalliokoski, Finland]	Yes, assessed in section 2.6 and 2.5

Comment No	From Page	From Line	To Page	To Line	Comment	Response
28999	9	8	10	24	I see the effort to help the reader to understand the structure. But the "Chapter 2 storylines" is actually confusing to me. And it takes a long time and much reading before the reader gets to the real material; i.e. too much introduction. [Jan Fuglestvedt, Norway]	Agree, 2.1 is shortened and details moved to other sections
16973	9	34	10	1	It is not obvious how the interactions between climate and land differ from those presented under the first paragraph of the chapter. One could probably merge those two parts and align the structure to the heading "2.1.1 Climate determines land cover & land cover affects climate", which states only two aspects. [Roland Hiederer, Italy]	Modified
633	9	49	10	1	"The conclusion that 'the increasing trend in leaf area index (LAI) contributed to the warming of boreal zones through a reduction of surface albedo and to an evaporation-driven cooling in arid regions (Forzieri et al. 2017)' remains debated. In particular, the LAI contribution to boreal warming revealed by Forzieri et al. (2017) based on statistical regression has been criticized by a technical comment by Li et al. (2018). Li et al. (2018) show that the positive sensitivity of temperature to the boreal greening can be derived from the positive response of vegetation to boreal warming, which indicates that results from a statistical regression with satellite data should be carefully interpreted." Ref: Li, Y., Z. Zeng, L. Huang, X. Lian, and S. Piao, 2018a: Comment on "Satellites reveal contrasting responses of regional climate to the widespread greening of Earth". Science, 360, eaap7950, doi:10.1126/science.aap7950. [Shilong Piao, China]	References added, and sentences revised to reflect more balanced views
443	9	9	40	40	Repeating an earlier comment … this is about biophysical changes at the surface and the statement concludes with there being global scale impacts from these changes on the global scale. I think that is not clear and it is certainly not something that can be said with confidence. See Lorenz, R., A.J. Pitman, and S.A. Sisson, 2016, Does Amazonian deforestation cause global effects; can we be sure?, J. Geophysical Research, 121, 5567-5584, doi:10.1002/2015JD024357. There are many papers - by Findell for example that do not find global scale changes from biophysical changes. To broaden this point - those studies that might identify global changes often impose wholly unreaslistic scale changes - deforesting the whole of the tropics for example. These are senitivity studies that have merit but we should not believe them to indicate how the real world works. [Andrew Pitman, Australia]	Details covered by section 2.6
38711	9	13			Change "feedback" to "feed back" for use as a verb. [, United States of America]	Reject
38713	9	13			Change "to climate system" to read "to the climate system". [, United States of America]	Revised
38717	9	31			Change "intensity" to "intensify". [, United States of America]	Revised
14023	9	34			Not only does land COVER affect climate, but CO2-induced changes in vegetation functioning have a major impact. It is becoming increasingly appreciated that stomatal closure affects rainfall – in some areas more than the direct effects of global warming. Betts et al (2007; Nature) and Gedney et al (2006; Nature) showed marked impacts in runoff, both simulated and in detectable impacts on river flow. More recently Samset et al (2016; GRL) use PDRMIP multi-model analysis of state-of-the-art ESMs to show the regional response of rainfall to CO2 is very different to other GHGs – due to the effect of CO2 on plant physiology [Chris Jones, United Kingdom (of Great Britain and Northern Ireland)]	Agree, and sentences revised
14357	10	2	10	2	Instead of "understanding scales", it would help to be more precise. Cross-scale interactions? Impacts at different spatial and temporal scales? [Benjamin Sulman, United States of America]	Revised and clarified

Comment No	From Page	From Line	To Page	To Line	Comment	Response
38719	10	4	10	4	Regarding "The biophysical impacts of land use change on climate are considered to be locally significant only (AR5), however, increasing evidence suggest that these impacts may go well beyond local level." There's a new paper about this: https://www.earth-syst-dynam-discuss.net/esd-2018-66/ [, United States of America]	Thanks, cited
4037	10	4	10	4	I think the sentence would be clearer if it was written: "The biophysical impacts of land use change on climate are considered to be significant only locally…." [Vassilis Daioglou, Netherlands]	Sentence rewritten
2783	10	4	10	5	"…significant only (AR5); however, increasing evidence suggests that these impacts may go well beyond the local level." [Bettina Weber, Germany]	Revised
28555	10	4	10	9	This description does not logically reach the desired conclusion that there are regional effects. While the reference may be approprieate, it isn't clear why locat biophysical effects alter regional climate.Other papers exist that show more clearly regional effects and teleconnections of land cover change (see papers by abby swan and johannes winckler). There is a lot to draw from in section 2.6.4. [Alan Di Vittorio, United States of America]	Details covered by section 2.6
33601	10	4	10	9	The text concludes that geophysical effects of land use are constrained to the local/regional level, while there are suggestions that effects beyond such level. An alternative approach could be that while effects are proximate, they may add up to substantial effects on the global level. [, Norway]	Partially agree, and sentences revised
12831	10	4	10	9	It is stated in bold that impacts go beyond local level. Give example of why we think this is true (only local example is given). [Robert Treuhaft, United States of America]	Details covered by section 2.6
2507	10	5	10	5	"suggests" [Wei Li, France]	Revised
445	10	9	10	9	This text is framed well - "local and reigonal climate". I think that is wholy defensible. It does not say global … and so is inconsistent with earlier statements. I would suggest keeping this statmenet and chnaging the earlier ones. [Andrew Pitman, Australia]	Agree, and sentences revised
1037	10	9	10	9	Consider adding Winckler et al 2017 doi/10.1175/JCLI-D-16-0067.1 to the citation. [Sebastiaan Luyssaert, Belgium]	Reject
28559	10	10	10	16	The statement does no logically follow the description. How does reducing emissions mitigate regional climate change? Regional climate effects are not necessarily dependent on global co2 concentrations. [Alan Di Vittorio, United States of America]	Revised and clarified
26133	10	10	10	16	This paragraph should be reflected in the Executive Summary [Reid Detchon, United States of America]	Added in ES
26923	10	15	10	15	For consistency purposes CDR or removals should be used, unless "negative emissions" is introduced more prominently somewhere. In SR 1.5 the term was limited only to net-negative emissions. Otherwise CDR or removals were used. Consistency in this regard would help to avoid confusion. [, Germany]	Revised and clarified
17755	10	15	10	16	Suggest replacing the last sentence, or developing it a bit more, in line of: "However, land-based negative emissions, by e.g. afforestation/reforestation might stand in conflict with other goals, such as food production, biodiversity and ecosystem resilience." [, Sweden]	Revised and clarified
3209	10	15	10	16	Replace last sentence with: However, land-based negative emissions, by e.g. afforestation/reforestation might stand in conflict with other goals, such as food production, biodiversity and ecosystem resilience (Smith et al. 2013). [Maria Ulrika Johansson, Sweden]	Replaced
24735	10	15	10	16	Give examples of biophysical and economic factors [Mark Owidhi, Kenya]	Details covered by section 2.6 and 2.7

Comment No	From Page	From Line	To Page	To Line	Comment	Response
28561	10	17	10	24	The statement is not logically connected to the description.How do complex effects relate to spatial heterogeneity? If models are coherent, where does the major uncertainty come from? [Alan Di Vittorio, United States of America]	Revised and clarified
13395	10	17	10	24	These sentences are a bit unclear, because of the example given in line 21; after tropical deforestation. Are the next example, also in line 21 also about tropical forests? Or is that comment also for boreal forests etc? [Anders Bryn, Norway]	Revised and clarified
7509	10	17	10	24	Comment: Some feedbacks are not readily included in the calculations, particularly those relating to carbon released from thawing permafrost and from wetlands, which leads to risks of overshoot are tipping points and feedbacks that once surpassed cannot be easily or quickly rectified, and the self-reinforcing feedbacks will further amplify warming. See Xu and Ramanathan (2017) Well below 2 °C: Mitigation strategies for avoiding dangerous to catastrophic climate changes, Proc. Natl. Acad. Sci., doi: 10.1073/pnas.1618481114 and and Committee to Prevent Extreme Climate Change (2017) Well Under 2 Degrees Celsius: Fast Action Policies to Protect People and the Planet from Extreme Climate Change. [Durwood Zaelke, United States of America]	Assessment on tipping points extended in section 2.4
7589	10	17	10	24	Some feedbacks are not readily included in the calculations, particularly those relating to carbon released from thawing permafrost and from wetlands, which leads to risks of overshoot are tipping points and feedbacks that once surpassed cannot be easily or quickly rectified, and the self-reinforcing feedbacks will further amplify warming. See Xu and Ramanathan (2017) Well below 2 °C: Mitigation strategies for avoiding dangerous to catastrophic climate changes, Proc. Natl. Acad. Sci. 114 (39) 10315–10323. [Kristin Campbell, United States of America]	Assessment on tipping points extended in section 2.4
637	10	17	10	24	As a introduction to Chapter 2 storylines, one should not only list evidences supporting the overall coherent biophysical behavior of the state-of-art climate models, but also display references that emphasize the uncertainty of processes existing in current understanding of land-climate feedback. For example, systematic biases in the simulated land surface albedo and the underestimated ratio of transpiration to evapotranspiration (T/ET) from previous CMIP5 climate models. We suggest that one may add the following sentence to the end of this paragraph. "Even so, the large spread in the simulated land-climate feedback still exists among current CMIP5-class models, such as the systematic overestimation in simulated seasonal cycle of land surface albedo (Li et al. 2016b) and the underestimated role of vegetation in transpiring water to the atmosphere (Lian et al. 2018)." Refs: Li, Y., T. Wang, Z. Zeng, S. Peng, X. Lian, and S. Piao 2016b: Evaluating biases in simulated land surface albedo from CMIP5 global climate models. J. Geophys. Res. Atmos., 121, 6178-6190, doi:10.1002/2016JD024774. Lian, X., and Coauthors, 2018: Partitioning global land evapotranspiration using CMIP5 models constrained by observations. Nat. Clim. Chang., 7, 640-646, doi:10.1038/s41558-018-0207-9. [Shilong Piao, China]	Thanks, sentence added accordingly
1039	10	18	10	18	Consider adding Alkame and Cescatti 2016 doi/10.1126/science.aac8083 to the citation. [Sebastiaan Luyssaert, Belgium]	This paper is cited
38723	10	19	10	19	"land-climate feedbacks" (plural). [, United States of America]	Revised
25333	10	20	10	20	The significations of these acronyms should be given. [, France]	Added in new Box 2.1, as well as in Chapter 1
16617	10	20	10	24	Is this part needed? [Siri Lie Olsen, Norway]	Revised
15603	10	21	10	24	Do any of these studies account for the aerosol effect? [Tuomo Kalliokoski, Finland]	Aerosol issues is assessed by section 2.5 and 2.6

Comment No	From Page	From Line	To Page	To Line	Comment	Response
29725	10	22	10	22	The soil-moisture satellite product article (http://dx.doi.org/10.1016/j.rse.2017.07.001) may be referred. [Muhammad Ashfaqur Rahman, Italy]	Rejected
447	10	23	10	23	The statement that many changes are simulated robustly - including radiation, clouds and rainfall, is simply not true. Several models might simulate similar changes (they do not for rainfall, or clouds) but this sttement is siply invalid in the context of climate modelling. There are many papers highlighting rainfall, clouds and radiation as the grand challenges of the 21st century and to say the land comunity thinkgs we simulate these "robustly" is simply not right. See: Bony, S., B. Stevens, D.M.W. Frierson, C. Jakob, M. Kageyama, R. Pincus, T.G. Shepherd, S.C. Sherwood, A.P. Siebesma, A.H. Sobel, M. Watanabe and M.J. Webb, 2013, Clouds, circulation and climate sensitivity, Nature Geoscience, 8, 261-268, doi: 10.1038/NGEO2398 or Marotzke, J., C. Jakob, S. Bony, P.A. Dirmeyer, P.A. O'Gorman, E. Hawkins, S. Perkins-Kirkpatrick, C. Le Quéré, S. Nowicki, K. Paulavets, S.I. Seneviratne, B. Stevens and M. Tuma, 2017, Climate research must sharpen its view, Nature Climate Change 7, 89–91, doi:10.1038/nclimate3206 [Andrew Pitman, Australia]	Thanks, revised accordingly. Added "However, grand challenges remain in properly simulating land-climate interactions in terms of rainfall, clouds and radiation (Bony et al. 213; Marotzke et al. 217)"
30755	10	26	10	26	"Recap" is a too informal word for a scientific report. "Overview" is better. [Francois Engelbrecht, South Africa]	Edited
29823	10	27	10	31	If there are not enough evidences, and there are uncertainities and difficult to quantify, it cannot be concluded that there is low agreement on the net change in global mean temperature as a result ofd land use change. [Souparna Lahiri, India]	Reject
29003	10	33	10	38	very good! And important to be able really do it. [Jan Fuglestvedt, Norway]	Thanks
2473	10	34	10	34	builds in or builds on?? [Lawrence Aribo, Uganda]	Edited
30767	10	36	10	36	It is stated that the chapter will refer to the SROCC report. However, this is not true, and SROCC is not utilised at a single place in the chapter. [Francois Engelbrecht, South Africa]	SROCC is cross referenced in section 2.4 and 2.6, related to permafrost and peatland
14025	10	38	10	40	"glaring inconsistency" – surely if you can address this it should be a headline statement in your exec summary? [Chris Jones, United Kingdom (of Great Britain and Northern Ireland)]	Revised and clarified
30757	10	38	10	40	"We also try to reconcile the inconsistencies across the various IPCC reports, for example the glaring inconsistency between WGI and 40 WGIII of AR5, whereas the LUC flux of WGI is interpreted in WGIII as the total AFOLU CO2 balance." The authors are part of the IPCC, and they should take care to be more constructive when critisising previous IPCC reports. Remove the word "glaring" and replace "inconsistencies across" with "inconsistencies that may exist across" [Francois Engelbrecht, South Africa]	Agree, and sentences revised
38725	10	40	10	40	Is there a reference for this WGI and WGIII inconsistency? Or can more detail be provided? [, United States of America]	No reference found, but sentence revised
14359	10	42	10	42	"recapture" should be "recapitulate" [Benjamin Sulman, United States of America]	Edited
30759	10	42	10	42	Replace "recapture" with "review" [Francois Engelbrecht, South Africa]	Edited
40301	10	46	10	46	in RELATION to AR4 or relative to AR4 [Thelma Krug, Brazil]	Revised
18063	10	47	10	47	I would add a second digit in the uncertainty indication of the CH4 radiative forcing to be consistent with the estimate. [Clemens Schwingshackl, Switzerland]	added
3089	10	49	10	49	Suggestion: to unify units, use Gt(CO2) [, Russian Federation]	Edited following IPCC style
673	10	50	10	50	Zhao et al. 2018, I don't find this reference in the list. [Anna Sörensson, Argentina]	I don't see this citation
40303	10	48	19	48	in RELATION to AR4 or relative to AR4 [Thelma Krug, Brazil]	Revised

Comment No	From Page	From Line	To Page	To Line	Comment	Response
30753	10	4	24		Once again, this reads like a set of conlusions, or even an ES. It is very odd to find such a section at the beginning of the chapter. Rather rephrase, to state what the main lines of investigation will be, rather than to give all the answers at the beginning of the chapter. At this point, the reader has nothing to look forward to! [Francois Engelbrecht, South Africa]	Agree, 2.1 is shortened and details moved to other sections
38721	10	4			It seems like the word, "only" should be removed. [, United States of America]	Revised
351	10	14			remove "-" before and after ± [Tobias Rütting, Sweden]	Removed
27741	10	17		24	For a more recent citation; this is also shown in Muri, H. (2018) The role of large - scale BECCS in the pursuit of the 1.5°C target – an Earth system model perspective. Environmental Research Letters. vol. 13 (4). [Helene Muri, Norway]	References added in section 2.5 and 2.7
353	10	45			"by 150%" [Tobias Rütting, Sweden]	Revised
355	10	46			delete "in" before "relative" [Tobias Rütting, Sweden]	Deleted
357	10	48			delete "in" before "relative" [Tobias Rütting, Sweden]	Deleted
6239	11	1	11	5	Change in bracketing style. I wasn't clear if this was meant to indicate something specific. [Tristan Quaife, United Kingdom (of Great Britain and Northern Ireland)]	Changed
2509	11	10	11	10	maybe use "land carbon sink" instead of "land carbon storage" [Wei Li, France]	Edited
3391	11	10	11	10	largely determined by changing climate -> human actitivies are also important [Yuyu Zhou, United States of America]	Agree, and sentences revised
15119	11	11	11	12	The distinction between north and south polar regions should be made clearer. The circumstances of the polar regions are unique and distinct. The Arctic for example, is an area of frozen sea surrounded by land while the Antarctic is the (polar) opposite. The regional distinctiveness of the north and south polar regions, and the uniquely different ways that they are responding to climate changes, presents significantly different challenges in the north and the south. I propose the most significant distinction between north and south polar regions is temperature: mean elevations in the Arctic, where the North Pole is at sea level, are thousands of meters different than those of the Antarctic where the South Pole is located at 2,300m (CIA - World Factbook, 2017). Owing to the dry adiabatic lapse rate of the Antarctic, temperatures drop an average of -9.6° C per 1,000 meters of elevation gain (NOAA – Lapse Rates, n.d.), making the relatively high altitude of Antarctica one of the reasons that it is so much colder that the Arctic. The annual mean temperature at the north pole is +1.6 and the water a few meters beneath the pole is -1.8°C (NOAA – Arctic Program, 2018), compared with the south pole, where the annual mean temperature is -49.3°C (ASMA5 – Climate, 2012). Antarctica's topography also contributes to the famous katabatic winds that pour down towards the coast from the polar plateau, reaching speeds over 300 km/h (ICECUBE – South Pole Neutrino Observatory, n.d.). It is no surprise that the coldest temperatures on earth have been recorded in the Antarctic, where the current record stands at -93.2°C (NASA – Science Visualization Studio, 2013; Perkins, 2013). The temperatures of the north and south poles are as different (50.9° C) as the north pole is from El Azizzia in the Libyan desert, where the world's highest temperature was recorded (Khalid et al., 2013). The regional distinctiveness of the north and south polar regions, and the uniquely different ways that they are responding to climate changes, presents significantly different challenges in the north and the south. [Gordon Macdonald, Canada]	Checked and revised

Comment No	From Page	From Line	To Page	To Line	Comment	Response
7511	11	11	11	14	Note (from that same study referenced here) that 3.4 million square kilometers of permafrost has already thawed in the 20th century. [Durwood Zaelke, United States of America]	Noted, assessed in section 2.4
7591	11	11	11	14	Note (from that same study cited here) that 3.4 million square kilometers of permafrost has already thawed in the 20th century. [Kristin Campbell, United States of America]	Noted, assessed in section 2.4
40331	11	16	11	16	remove comma after manure, to read manure left on pasture [Thelma Krug, Brazil]	Don't see the words
449	11	20	11	20	"has enhanced" should be "has been enhanced" [Andrew Pitman, Australia]	Revised
22419	11	23	11	25	Unless this is a particular IPCC style citations like this one should be shortened to first author, only. [Anastasios Kentarchos, Belgium]	Corrected
1041	11	23	11	25	Check citation format (too many authors are listed) [Sebastiaan Luyssaert, Belgium]	Corrected
16619	11	23	11	25	No need to spell out all author names [Siri Lie Olsen, Norway]	Corrected
5503	11	27	11	28	I believe it is not right to say "not radiative" since surface temperature and also hydrologic cycle are closely tied to the radiation. [Sanaz Moghim, Iran]	Agree, and sentences revised
225	11	27	11	31	Please add - land use changes causes additional (effects and modofications ,) [Ali Geath Eljadid, Libya]	Added
17071	11	27	11	31	Could this paragraph elaborate on the anthropogenic aspects of this land use change? [Morten Andreas Dahl Larsen, Denmark]	Both natural and anthropogenic
12833	11	27	11	31	"Uncertainty" for hydrological feedback). Try to put in a number. [Robert Treuhaft, United States of America]	This is recap, details provided in subsequent sections
451	11	30	11	30	Yes - this is true. Low agreement on the SIGN of the net change in global mean temperautre. And yet betore many statements are made that we simulate these things robustly. There is a deep inconsistency in aspects of this Chapter - as if the climate modellers whiting nice sections have not talked to the land use change people writing nice sections. Please note - not a criticsms ... I do remember what it was like! [Andrew Pitman, Australia]	Noted
30761	11	33	11	39	This paragraph requires linguistic editing. [Francois Engelbrecht, South Africa]	Edited
26925	11	33	11	39	Please add reference. [, Germany]	See AR5 WG1
22421	11	35	11	36	The setence is not well structured. Not clear what is meant by "dependent explanation" [Anastasios Kentarchos, Belgium]	Revised
5505	11	35	11	36	how an increase in aerosol levels can decline surface wind! even the impact of aerosal on radion depends on types of aerosal, it needs to be more specific, at least add references. [Sanaz Moghim, Iran]	See AR5 WG1
22423	11	37	11	37	N deposition has also increased and this has enhanced LAI and thus transpiration [Anastasios Kentarchos, Belgium]	Noted
38733	11	37	11	37	Reference needed (i.e., DOI: 10.1038/NCLIMATE2614). [, United States of America]	Sentence removed
22425	11	38	11	38	The two sentences make reference to specific hunidity and relative humidity, which are quite different measures. Therefore the word However does not make sense. [Anastasios Kentarchos, Belgium]	Sentence removed
18065	11	38	11	38	Is there a reference for this sentence? [Clemens Schwingshackl, Switzerland]	Sentence removed
12835	11	41	11	41	"very high confidence" without a number is counterproductive. Give a number, such as the probability that flood X happened by random accident is less than 0.01 (or something like that). Look at page 12 lines 11-16; lots of quantitative numbers. This leads to much more credibility. [Robert Treuhaft, United States of America]	Revised

Comment No	From Page	From Line	To Page	To Line	Comment	Response
5357	11	51	12	33	In my view it is decisive to mention in this discussion that the potential for land-based mitigation strongly depends on the future demand for land-based products such as food, fibre and bioenergy, and on future trajectories of cropland yields and livestock feeding efficiencies, as these factors co-determine the land area that could be assigned to land-based mitigation. Also, the feedbacks to ecosystem services and biodiversity are, in my view, so important that some caveats need to be introduced in this text. These are also discussed later (e.g. p94) but this text needs to work "standalone" without inviting misinterpretations. [Helmut Haberl, Austria]	Agree, detailed assessment in section 2.7
38727	11	7	14	11	CO2 fertilization should be mentioned in this section as a source of uncertainty. [, United States of America]	Reflected in new Box 2.1
215	11	16	14	51	This comment applies to this section and other parts of chapter 2. There is new research that suggests the albedo effect of a mature forest creates warming that is not normally accounted for in models. The citation is Favero, A., B. Sohngen, Y. Huang, and Y. Jin. 2018. "Global cost estimates of forest climate mitigation with albedo: a new integrative policy approach." Environmental Research Letters 13. I think this issue is important, and we need to make sure it is covered. It is possible I missed it, but wanted to include this comment to make sure this is handled. [Wallace Tyner, United States of America]	Assessment extended in section 2.6
38729	11	24			It seems like this reference should be shortened to "et al." [, United States of America]	Corrected
38731	11	34			The increase should be "uncertain" rather than "constrained". Also, recent ET and soil moisture products seem to be changing this (https://doi.org/10.1016/j.rse.2018.09.023 , https://doi.org/10.1002/wat2.1168). [, United States of America]	See AR5 WG1
29825	12	4	12	5	that deforestation has decreased is largely misleading mainly due to the increasing reporting of countries of net forest cover which hides deforestation by adding the land under plantations and afforestation which may not be forests at all and does not have the characteristics and features of forests deforestated and does not account for biodiversity loss. In chapter 1, this issue has been raised in terms of lack of proper data and satelite image and related to the definition forests. Also deforestation has to include loss of natural and primary vegetation due to degradation. [Souparna Lahiri, India]	Agree, and sentences revised
30763	12	5	12	9	Change "Recent SR15" to "The recent SR1,5 report". This sentence is too long and requires linguistic editing. [Francois Engelbrecht, South Africa]	Edited
8171	12	11	12	28	The mixed use og km2, Mha, ha and percent makes comparison difficult [Harold Leffertstra, Norway]	Units revised to keep consistency
16621	12	11	12	28	These paragraphs need better integration with the rest of the chapter by linking the described changes in land-use more clearly to climate. [Siri Lie Olsen, Norway]	Agree, moved to section 2.7
26927	12	14	12	16	For consistency, it would be helpful to give the settlement expansion in percent as well. If we understand correctly, this would be an expansion of 250%, which definitely catches eye. The current formulation makes it look smaller compared to the other percentages, giving the impression that it is being downplayed. [, Germany]	Revised
38735	12	15	12	15	This contrasts with Table 1.1, which shows that urban areas comprise less than 1% of the ice-free land area. 7.6% seems high. What is the definition for "urban and settlements"? [, United States of America]	7.6% refers to urban and villages
26929	12	15	12	16	The fact, that almost a third of the global land area (ice free?) is identified as "land degradation hot spots" is highly relevant for policy makers. Please consider lifting this information to the ES and SPM levels. [, Germany]	This is highlighted in Ch.4 ES

Comment No	From Page	From Line	To Page	To Line	Comment	Response
26931	12	18	12	28	Please provide information on the global land area degraded per year and consider lifting this information to the ES and SPM level. [, Germany]	Please refers to Ch.4
38737	12	18	12	28	Ensure that all land area units are consistent for comparability (ha vs. km2). [, United States of America]	Edited to keep unit consistency
6703	12	19	12	19	UNDESA (2018) does not apper in References. [Akihiko Ito, Japan]	Sentence removed
927	12	21	12	21	Avoid initiating a phrase with a numeral such as '60%...". Use 'sixty per cent'... instead. [Edson Leite, Brazil]	Edited following IPCC style
929	12	21	12	21	Avoid initiating a phrase with a numeral such as '60%...". Use 'sixty per cent... Instead. [Edson Leite, Brazil]	Edited following IPCC style
6241	12	22	12	22	"has" -> "have" [Tristan Quaife, United Kingdom (of Great Britain and Northern Ireland)]	Revised
14361	12	22	12	23	The wording of this sentence is confusing and needs to be revised. Maybe "In Latin America and the Caribbean, conversion of forest to cropland increased 17% and conversion of forest to pasture increased 57%"? [Benjamin Sulman, United States of America]	Revised accordingly
16975	12	24	12	25	Suggested to convert unit "ha" to "km2" to make figures more comparable. [Roland Hiederer, Italy]	Edited to keep unit consistency
26933	12	26	12	28	To better understand what the estimated forest area in 2050 means, it would be helpful to compare it to the current forest area or give the related percent loss/gain compared to today. [, Germany]	Sentence removed
30765	12	30	12	30	Avoid the use of the first person in the text. [Francois Engelbrecht, South Africa]	Revised
16977	12	30	12	30	In the context of this report the sentence "The way we manage our land is largely constrained by climate change and extremes…" could be modified to mention also other significant constraints from economic and social sectors. [Roland Hiederer, Italy]	Revised
2511	12	30	12	30	"determines" [Wei Li, France]	Edited
31865	12	30	12	31	"determines" instead of "determine" [Martijn Slot, Netherlands]	Revised
14363	12	31	12	33	This sentence is awkwardly written and needs to be revised [Benjamin Sulman, United States of America]	Revised
31867	12	33	12	34	"across" instead of "cross" [Martijn Slot, Netherlands]	Revised
26935	12	38	12	38	Please explain the abbreviation ESM (earth system models) when its first mentioned, not on page 3 line 13. [, Germany]	Addressed by changing paragraph order.
23711	12	38	12	38	It is odd to start this section with model uncertainties. [Xiyan Xu, China]	Agreed - addressed by adding Introductory sentences and changing the paragraph order.
7513	12	40	12	47	The non-linear aspect of these changes is increased with increased forcing, leading to even further uncertainty; see Good P., et al. (2015) Nonlinear regional warming with increasing CO2 concentrations, NATURE CLIMATE CHANGE 5:138–142, 140–141 (“Nonlinearity has implications not just for the ensemble mean, but also for the spread of model projections. In general, an increased spread at higher forcing should be expected: the relative importance of nonlinear mechanisms grows with increasing forcing, so their contribution to model spread does likewise. Conceptually, this can be thought of as including an extra uncertain process at higher CO2 concentrations. This inflation in model spread at higher forcing is large when nonlinearities are uncertain, and seems to be especially relevant for change per kelvin of global warming.”). [Durwood Zaelke, United States of America]	addressed by adding a new sentence.
7593	12	40	12	47	The non-linear aspect of these changes is increased with increased forcing, leading to even further uncertainty; see Good P., et al. (2015) Nonlinear regional warming with increasing CO2 concentrations, NATURE CLIMATE CHANGE 5:138–142. [Kristin Campbell, United States of America]	addressed by adding a new sentence.

Comment No	From Page	From Line	To Page	To Line	Comment	Response
15797	12	41	12	42	The role of disturbances is indeed very important, and also the duration necessary for the ecosystem to recover. Different duration are needed t restore either leaf area index, biomass, carbon stocks etc. See Trumbore et al. 2015 Science Vol 349. This is well said p34, l34 to l37, same chapter. [Caroline Vincke, Belgium]	addressed by revising the last sentences in the pre-emble of 2.2.
26937	12	41	12	42	Please revise or provide an explanation for the term "logging harvesting" [, Germany]	"logging harvesting" is corrected to "logging"
26939	12	41	12	42	It is unclear what is meant here: resilience and recovery are reactions to a disturbance, how can they be influenced by a disturbance? Please give more clarity or revise accordingly. [, Germany]	sentence revised to address the confusing construction.
17073	12	49	13	6	I believe that more complex hydrologicla process such as lateral redistribution of groundwater (flow) could be added to the list of processes that are not included in these models. [Morten Andreas Dahl Larsen, Denmark]	Noted, but the list follows what AR5 recognized.
14115	12	36	26	33	Page 14 - text in lines 29 to 36 is largely a repeat of text in lines 21 tp 27. Page 17, line 27 - sentence starts with "(Mercado et al. 2018)" - should be "Mercado et al. (2018)". Page 17, line 38, missing "on" between "effects" and "plant". Page 22, line 18 "E. et al. 2011" seems incomplete. Page 24, line 36, missing space between "irrigation" and "(Hirsch" and same on page 25, line 3 between "return" and "(Bustamante". Page 26, line 20 "result" rather than "results". [David Taylor, Singapore]	All responded (or text deleted and no longer relevent).
1753	13	3	13	3	You introduce ESM in the previous page. [William Lahoz, Norway]	Done
28277	13	8	13	8	The intercations of climate change-short lived climate forcers from biogenic emissions forests, wetlands, and other terresterial sources need to be further assessed. [Noureddine Yassaa, Algeria]	short lived climate forcers is now mentioned, and referred to 2.5
18067	13	9	13	9	It's not only heat exchanges, but also water. Maybe you can replace it by "water and energy exchanges" [Clemens Schwingshackl, Switzerland]	"hydrological cycles" is now mentioned to address this point.
14365	13	9	13	18	This paragraph should also mention plant physiological responses such as stomatal conductance, root distributions, and other ecohydrological traits as an important control on these biophysical interactions [Benjamin Sulman, United States of America]	Addressed by adding a few sentences to the paragraph
13757	13	12	13	14	Which are the references that lead to this high confidence statement? [Moira Doyle, Argentina]	It is not necessary to assess the confidence level, as this is not meant to be an asssessment statement, but rather an introductory overview of 2.2.
3373	13	13	13	14	One specific example will give more clarity. [Narendra Dalei, India]	revised to address this point
14629	13	14	13	14	Turbulent heat fluxes refer to both, latent heat fluxes and sensible heat fluxes. I would rewrite the sentence as follows: "[...] through their influences on albedo, latent heat fluxes, sensible heat fluxes, and momentum fluxes". [, Canada]	revised to address this point
23677	13	14	13	14	This sentence is not accurate. Turbulent flux is a broad concept, it could be turbulent heat flux (Latent heat, sensible heat) or turbulent momentum flux (Reynold stress). Momentum fluxe also presents in laminar flow. [Xiyan Xu, China]	revised by simply stating "turbulance" and explaining how it affects heat transfer
453	13	15	13	16	I think the prime regulator of the heat and water cycle is the sun and the amount of rainfall. Forests are the prime moderator on these - the amount of energy and water. [Andrew Pitman, Australia]	Noted - but the term "moderator" does not make sense without mentioning the sun and rainfall as the primar deteminant factors.

Comment No	From Page	From Line	To Page	To Line	Comment	Response
14631	13	17	13	17	Land surface models include the biophysical interactions described above since their early development (Pitman, 2003). The sentence is, therefore, misleading, as the reader may think that such interactions have only recently been incorporated. I would replace "Recent ESMs" with "Land surface models". Reference: Pitman, A. J. (2003, April). The evolution of, and revolution in, land surface schemes designed for climate models. Int. J. Climatol. 23(5), 479–510. [, Canada]	rephrased to avoid such confusion.
30889	13	17	13	17	much uncertainty involved' this conveys the wrong impression. 'Complexity and uncertainty about the magnitude of some fluxes', might be better - there is no uncertainty about the basic fact that trees take up carbon when they grow [Mike Morecroft, United Kingdom (of Great Britain and Northern Ireland)]	revised to address this point
5009	13	19	13	20	The Figure 2.2 shows biogeophysical processes. It might be better to show also a schematic representation of biogeochemical processes. [, Japan]	noted
26941	13	19	13	23	Figure 2.2: please clarify description: "Schematic of the biophysical exchanges that occur at the land (soil-vegetation) / atmosphere from (Bonan 2016)." [, Germany]	Figure is replaced and is no longer relevant.
14367	13	20	13	20	The characterization of soil processes in this figure is problematic. In panel A, the figure implies that temperature always decreases with soil depth and that soil heat flux is always downward. However, the opposite is often true in fall and winter when the air may be colder than the soil and the upper soil layers may be the coldest. This can be a very important process in permafrost ecosystems (e.g. Commane et al., PNAS, 2017). In panel B, the plot of soil water versus depth suggests that surface layes are always wetter than deeper soils, which is untrue especially in wetlands. Since this figure is meant to be a general summary of these fluxes, I suggest changing these aspects so it is more applicable to the full range of ecosystems. In addition, the figure ignores the role of roots in water uptake from the soil and hydrological redistribution within the soil. [Benjamin Sulman, United States of America]	Figure is replaced and is no longer relevant.
15605	13	25	13	25	This definition does not account for the biophysical change in cloud albedo due to changed aerosols. [Tuomo Kalliokoski, Finland]	sentence revised to address this point
13397	13	29	13	35	The sentence starting with "One reason for this uncertainty …" (line 34-35) should follow directly after the sentence ending with "…..climate system (Ciais et al. 2013)." (line 29-31). The example between those two sentences spoil the logic. [Anders Bryn, Norway]	No longer an issue as the sentence in-between is deleted (as it duplicates 2.4).
38741	13	29	13	36	Repeat of L21-27. Suggest deletion. [, United States of America]	Done
23679	13	30	13	31	It is odd to have "in order to adequately model the Earth's climate system" in this sentence. [Xiyan Xu, China]	agreed - and deleted
30887	13	32	13	32	rephrase to indicate that it is not simply 'widely believed' but 'there is evidence that….. ' [Mike Morecroft, United Kingdom (of Great Britain and Northern Ireland)]	sentence deleted and is no longer relevant
1755	13	32	13	32	Is it appropriate to use “believed” here and elsewhere? Would “understood” be better? [William Lahoz, Norway]	sentence deleted and is no longer relevant
3091	13	33	13	33	Suggestion: to unify units (Gt, Pg, etc.) [, Russian Federation]	sentence deleted and is no longer relevant
12837	13	33	13	33	Try to stick with Pg CO2, as that is what is in most o the rest of the report. Or pick one either pg CO2 orC and be consistent. [Robert Treuhaft, United States of America]	sentence deleted and is no longer relevant
13763	13	8	14	51	This section has to many references to future developments in the chapter which makes it very hard to follow [Moira Doyle, Argentina]	Noted
6597	13	18	18	20	We recommend to add more resolution in the figure 2.2. [, Mexico]	Figure is replaced and is no longer relevant.
38739	13	21			Add the word "interface" after "atmosphere". [, United States of America]	Figure is replaced and is no longer relevant.

Comment No	From Page	From Line	To Page	To Line	Comment	Response
17091	13	27			Net CO2 uptake (Photosynthesis - ecosystem respiration) by forest has counteracted the atmospheric CO2 increase by fossil fuel emissions. Not photosynthesis alone. [Eric Ceschia, France]	Photosynthetic CO2 uptake is revised to "Net ecosystem CO2 uptake"
32197	13	27			Net CO2 uptake (Photosynthesis - ecosystem respiration) by forest has counteracted the atmospheric CO2 increase by fossil fuel emissions. Not photosynthesis alone. [, France]	Photosynthetic CO2 uptake is revised to "Net ecosystem CO2 uptake"
23575	13				The word in Figure 2.2 is not clear, [Huai Jianjun, China]	Figure is replaced and is no longer relevant.
13399	14	2	14	2	I think that one of the main problems is to seperate the effects of climate from those of regrowth following succesion in mountain regions, and to estimate the potential change regulated by abandonment. This is discussed in a paper by: Bryn, A., Dourojeanni, P., Hemsing, L.Ø. & O'Donnel, S. (2013): A high-resolution GIS null model of potential forest expansion following land use changes in Norway. Scandinavian Journal of Forest Research 28(1): 81-98. [Anders Bryn, Norway]	Noted, but is too specific to be mentioned in the paragraph.
14633	14	3	14	3	Large tree-ring analysis shows the opposite; specifically, that warmer growing seasons have decreased the growth of the most common conifer tree in Canada (see Girardin,et al. (2016). Negative impacts of high temperatures on growth of black spruce forests intensify with the anticipated climate warming. Global Change Biology, 22(2), 627-643). [, Canada]	sentence deleted (as it is redundant to detailed discussion later) and no longer relevant.
1043	14	4	14	4	Consider adding BVOC emissions as a biogeochemical interaction. See Unger 2014 DOI/10.1038/NCLIMATE2347 [Sebastiaan Luyssaert, Belgium]	addressed earlier in the section
8925	14	6	14	9	Rephrase "but also remotely through cross-regional movement of the atmosphere" to "but also remotely, impacting synoptic scale atmospheric circulation" or to "but also remotely through synoptic scale atmospheric circulation". [Jean-Luc Chotte, France]	sentence revised
6599	14	6	14	19	We suggest to include the consequences in blue carbon ecosystems related of land cover changes. [, Mexico]	referene to blue carbon, SR1.5 and SROCC made
18069	14	8	14	8	Change to "movements of air" [Clemens Schwingshackl, Switzerland]	accepted and changed
16623	14	14	14	14	Conversion of peatland forest to what (or is it supposed to read "peatland to forest")? [Siri Lie Olsen, Norway]	rephrased to clarify
29827	14	15	14	17	this is again misleading, clubbing afforestation, reforestation and forest restoration together. These are varrying processes with enough differences and distinctions. When there are uncertainties involved one cannot make such a general conclusion. [Souparna Lahiri, India]	sentence modified to avoid this impression
38745	14	15	14	18	Observation-driven CLM4.5 modeling showed afforestation/reforestation contribute to projected increase in net carbon uptake in temperate PNW US forests by 2100, using conservative scenario of afforestation only where forests existed (>50 yrs bp) and conversion of 125K ha non-forage grass crop to native forest. Ref: 1. Law, B.E., T.W. Hudiburg, L.T. Berner, J.J. Kent, P.C. Buotte, and M. Harmon. 2018. Land use strategies to mitigate climate change in carbon dense temperate forests. Proc. Nat. Acad. Sci. 115(14):3663-3668. https://doi.org/10.1073/pnas.1720064115 [, United States of America]	this reference is to be cited in the Cross Chapter Box on Reforestation and Aforestation
16625	14	17	14	17	A few words about what this uncertainty comprises would be useful. [Siri Lie Olsen, Norway]	sentence modified to avoid this impression
3211	14	18	14	18	add an s on "fuel loads", and replace wild fire with "wildfire risk" [Maria Ulrika Johansson, Sweden]	changed to read "increased fuel loads and wildfire incidents". The term "risk" is not adopted per IPCC report use of "risks".
23681	14	18	14	18	Confused with the second part: fire suppression lead to increased wild fire in man-made forests? [Xiyan Xu, China]	"man-made" is removed, as the statement applies to forests in genera (how fire fire suprressions leads to forst plantations is well established in the SE US).

Comment No	From Page	From Line	To Page	To Line	Comment	Response
17285	14	18	14	19	the "fire suppression" not only may lead to increased fuel load and wild fire in man-made forest, but may have a similar effects on natural forest". [Chengyi Zhang, China]	"man-made" is removed, as the statement applies to forests in genera (how fire fire suprressions leads to forst plantations is well established in the SE US).
38747	14	18	14	19	The statement is too broad. Current and future fire vary spatially, and the general reference to fire suppression and fuel loads is too simplistic. Under two climate models and RCP 8.5, CLM4.5 tailored to western U.S. showed low vulnerability to mortality from wildfire in 82% of the western U.S. from 2020-2049, and high vulnerability only in 14% of the forest area mostly in the Rocky Mts and Sierra Mts. The CLM fire model has been improved and it compares well with past burn area. Ref: Buotte, P.C., S. Levis, B.E. Law, T.W. Hudiburg, D.E. Rupp, J.J. Kent. 2018. Near-future forest vulnerability to drought and fire varies across the western US. Global Change Biology. DOI: 10.1111/gcb.14490 [, United States of America]	addressed by modifying sentence.
16627	14	18	14	19	This sentence would benefit from a clearer link between fires and climate. [Siri Lie Olsen, Norway]	noted
14635	14	19	14	19	Fires are often incorporated into ESMs (see Rabin et al. (2017). The Fire Modeling Intercomparison Project (FireMIP), phase 1: Experimental and analytical protocols Geoscientific Model Development, 20, 1175-1197). [, Canada]	addressed by modifying sentence.
5011	14	21	14	21	Bolding should be extended up to the end of ~regions." [, Japan]	bolding is removed
18071	14	21	14	22	What is highly confident? That the magnitude and sign differ among regions? This seems to me as a rather weak statement (i.e., we are sure that the signal is different). Is there also evidence that there is a signal in the single regions and is this signal robust? [Clemens Schwingshackl, Switzerland]	bolding is removed
28563	14	21	14	27	This is duplicate of the following paragraph [Alan Di Vittorio, United States of America]	Duplication deleted
455	14	21	14	27	The key thing here in explaining why the topics differs from the high latitudes is snow, snow albedo feedback and snow masking. There are many papers by Richard Betts that demonstrate this. Snow needs to be properly examined here too. [Andrew Pitman, Australia]	sentence revised, and the issue is raised by replacing Figure 2.2
14369	14	21	14	27	This paragraph could also mention biophysical effects associated with agriculture (Gerken et al., 2018, doi:10.1175/JHM-D-17-0117.1) [Benjamin Sulman, United States of America]	Noted- but This reference should be for 2.6.
16629	14	21	14	27	Delete this paragraph (duplication). [Siri Lie Olsen, Norway]	Duplication deleted
15607	14	21	14	27	Please remove, repeated below. [Tuomo Kalliokoski, Finland]	Duplication deleted
24903	14	21	14	36	Lines 21-27 have the same content as lines 29-36. Overlapping has to be removed [Borbala Galos, Hungary]	Duplication deleted
17287	14	21	14	36	words of those 2 paragraphs did simply repeat, please have a revision. [Chengyi Zhang, China]	Duplication deleted
14637	14	21	14	36	The two paragraphs L21-27 and L29-36 are essentially identical. Please delete the first of these two paragraphs. [, Canada]	Duplication deleted
25335	14	21	14	36	These two paragraphs are repeated. [, France]	Duplication deleted
33603	14	21	14	36	Effects for boreal regions should also be mentioned. Line 29-36 repeats line 21-27. [, Norway]	Noted- section is absorbed in other sections
38749	14	21	14	36	There is an apparent duplication of a paragraph here. [, United States of America]	Duplication deleted
24717	14	21	14	36	The third and the fourth paragraph is overlapping. Moreover, on the topic of deforestaion, tropical and temperate zones are missing, but no info is given on LULCC in boreal ecosystems as far as I can see? [gunnar austrheim, Norway]	Duplication deleted

Comment No	From Page	From Line	To Page	To Line	Comment	Response
8361	14	21	14	36	The two paragraphs are almost copy paste of each other. I suggest to remove one of them. [Marc Aubinet, Belgium]	Duplication deleted
31869	14	21	14	36	replicate sections on L21-27 and L29-36, with the second being better cross referenced than the first [Martijn Slot, Netherlands]	Duplication deleted
17257	14	21	14	36	These 2 paragraphs are the same (except the first sentence). [Noémie Janot, France]	Duplication deleted
40305	14	21	14	36	the two paragraphs belween lines 21 and 36 are repeated. [Thelma Krug, Brazil]	Duplication deleted
931	14	21	14	66	It seems these two paragraphs say the same thing, therefore it would a repetion, which should, then be removed one of them. [Edson Leite, Brazil]	Duplication deleted
13759	14	22	14	27	This paragraph is repeated in the following parragraph line 30 to 36 [Moira Doyle, Argentina]	Duplication deleted
13401	14	22	14	36	Several lines with repeated text [Anders Bryn, Norway]	Duplication deleted
18073	14	24	14	24	Shouldn't increased albedo lead to a cooling effect? [Clemens Schwingshackl, Switzerland]	corrected to "increased albedo", and sentences fine tuned
14639	14	24	14	24	The authors write that "In the temperate zones, deforestation has a cooling effect through reduced albedo and a warming effect through decreased evapotranspiration and latent-heat transfer, which offset each other (Findell et al., 2017)." There are three points I would like to raise here. First, a cooling effect would be caused by an increase in surface albedo rather than a decrease. Second, evapotranspiration and latent heat transfer describe the same process. The authors should describe changes in sensible heat flux next to latent heat flux, instead. Third, the sentence is misleading as it suggests that the impacts of changes in turbulent heat fluxes are cancelled out by changes in the surface albdeo. This is, however, not the case. Quoting from Findell et al. (2017): "In the temperate zone, the observations show a clear warming with deforestation throughout the year, peaking in NH summer. [...] furthermore the albedo driven processes dominant in boreal winter do not drive the midlatitude response. [...] The summertime northern mid-latitude response to anthropogenic LULCC [...] is dominated by a reduction of latent heat flux [...] and an increase of sensible heat flux in the altered regions, particularly in regions converted to croplands. [...] the changes in vegetation characteristics and functioning are accompanied by a statistically significant mid-latitude warming and dry- ing of the near-surface atmosphere." I would rewrite the sentence in P2-14 L24 as follows: "In the temperate zones, deforestation has an overall warming effect caused by a reduced latent heat flux and enhanced sensible heat flux." Reference: Findell, K. L., A. Berg, P. Gentine, J. P. Krasting, B. R. Lintner, S. Malyshev, J. A. Santanello, Jr, and E. Shevliakova (2017, October). The impact of anthropogenic land use and land cover change on regional climate extremes. Nat. Commun. 8(1), 989. [, Canada]	Corrections are made.
26943	14	24	14	24	In Chapter 1 and section 2.6.1.1, albedo is increased due to deforestation. What is correct? In addition, reduced albedo usually leads to warming. Please check. [, Germany]	corrected to "increased albedo", and sentences fine tuned
13347	14	24	14	24	The phrase "deforestation has a cooling effect through reduced albedo" is correct but could be expanded by saying that it is amplyfied by the masking effect that forest has on snow. Then, it should be specified that this 'extra' cooling effect will be cancelled in a future warmer climate if it become too hot for snow to stay. Maybe this is addressed further on, but perhaps it should be introduced here? [Gregory Duveiller, Italy]	corrected to "increased albedo", and sentences fine tuned
17291	14	24	14	24	Should it read "increased albedo" and not "reduced albedo"? [Jarle W. Bjerke, Norway]	corrected to "increased albedo", and sentences fine tuned

Comment No	From Page	From Line	To Page	To Line	Comment	Response
2475	14	24	14	24	Confirm reduced albedo causes cooling in temperate areas [Lawrence Aribo, Uganda]	corrected to "increased albedo"
26717	14	24	14	24	Cooling is not due to "reduced" albedo but to "increased" albedo. [Mathieu Jonard, Belgium]	corrected to "increased albedo", and sentences fine tuned
38751	14	24	14	25	Findell et al. (2017) also said that the change in vegetation (deforestation) was accompanied by a statistically significant mid-latitude warming and drying of the near surface atmosphere. They also found statistically significant near-surface warming in regions with historical LULCC, in agreement with recent observations. Findell showed albedo dominates in the boreal zone with a cooling effect winter through May (snow cover) due to deforestation. In the temperate zone, warming associated with deforestation occcured throughout the year, consistent with finer resolution satellite data in Alkama & Cescatti (2016). [, United States of America]	Corrections are made, and Alkama & Cescatti (216) cited.
30891	14	24	14	36	I think this somewhat misrepresents Findell et al and could be a problem. In boreal zones deforestation generally has a cooling effect through albedo change, but the pattern is not so clear in the temperate zone and is likely to be absent where the snow period is short and many trees are deciduous. [Mike Morecroft, United Kingdom (of Great Britain and Northern Ireland)]	Corrections are made, and Alkama & Cescatti (216) cited.
17293	14	25	14	25	Bright et al. 2017 (already cited elsewhere in the chapter) should be cited in addition to Findell et al. [Jarle W. Bjerke, Norway]	Done
15609	14	29	14	34	The aerosol effect not taken into account here. [Tuomo Kalliokoski, Finland]	Done
457	14	29	14	36	this para is very similar to the previous one. I suspcectone was put in to replace another and one should be deleted. [Andrew Pitman, Australia]	Duplication deleted
14371	14	29	14	36	This paragraph was repeated twice [Benjamin Sulman, United States of America]	Duplication deleted
18075	14	29	14	36	This is the same as the previos paragraph and should thus probably be removed. [Clemens Schwingshackl, Switzerland]	Duplication deleted
3093	14	29	14	36	The same as pp.21-27 [, Russian Federation]	Duplication deleted
18213	14	29	14	36	paragraph doubled [Julia Nabel, Germany]	Duplication deleted
26719	14	29	14	36	This paragraph just duplicates the previous one. [Mathieu Jonard, Belgium]	Duplication deleted
1045	14	29	14	36	This paragraphs seems to be a rewrite of the previous paragraph p14 lines 21 to 27. Delete the former. [Sebastiaan Luyssaert, Belgium]	Duplication deleted
359	14	29	14	36	repetition from line 21-27 [Tobias Rütting, Sweden]	Duplication deleted
3253	14	29	14	36	Paragraph from lines 29-36 is a copy of the paragraph from lines 21-27 [Viola Heinrich, United Kingdom (of Great Britain and Northern Ireland)]	Duplication deleted
2513	14	29	14	36	duplicate paragraph [Wei Li, France]	Duplication deleted
23683	14	29	14	36	A repetion of the last paragraph [Xiyan Xu, China]	Duplication deleted
17295	14	32	14	34	Sentence duplicated. Same sentence already appears on same page, lines 32-34. [Jarle W. Bjerke, Norway]	Duplication deleted
16631	14	34	14	34	Make clear whether these effects completely or partially counteract each other. [Siri Lie Olsen, Norway]	avoided by deleting misleading part of the sentence
29005	14	38	14	41	Useful clarification. Should come earlier [Jan Fuglestvedt, Norway]	paragraph is to be removed (duplication to Chapter 1)
3375	14	38	14	41	Citation is needed. [Narendra Dalei, India]	paragraph is to be removed
3095	14	41	14	41	anthropogenic GHGs'? Is CO2 amongst them? May be it is about fluxes? [, Russian Federation]	paragraph is to be removed (duplication to Chapter 1)
23685	14	43	14	45	First, these two sentences conflict. Second, the description of "southernmost permafrost regions forest trees" is confusing. Third, Baltzer et al. (2014) proposed accelerated permafrost thawing lead to boreal forest loss. [Xiyan Xu, China]	paragraph is to be removed (duplication to Chapter 1)
16633	14	44	14	45	This sentence seems misplaced. [Siri Lie Olsen, Norway]	paragraph is to be removed (duplication to Chapter 1)

Comment No	From Page	From Line	To Page	To Line	Comment	Response
2515	14	44	14	45	explain why "forest trees substantially delay thawing of permafrost" [Wei Li, France]	paragraph is to be removed (duplication to Chapter 1)
16979	14	47	14	47	Change "ESMs studies" to "ESM studies". [Roland Hiederer, Italy]	paragraph is to be removed (duplication to Chapter 1)
13403	14	49	14	51	Unclear what the term "structural uncertainty of the land models" includes. Could this be explained better? [Anders Bryn, Norway]	paragraph is to be removed (duplication to Chapter 1)
14373	14	50	14	50	There is also evidence that parameter uncertainty is a significant factor (Luo et al., 2015, doi:10.5194/bg-12-4373-2015; Todd-Brown et al., 2014, doi:10.5194/bg-11-2341-2014) [Benjamin Sulman, United States of America]	paragraph is to be removed (duplication to Chapter 1)
38743	14	3			Add the word "and" before "lengthening". [, United States of America]	sentence deleted and no longer relevant
17093	14	6			replace " the atmospheric physical state..." by "the carbon, N and surface energy budget, the atmospheric physical state..." [Eric Ceschia, France]	noted, but no longer relevant with change in the sentence structure
32199	14	6			replace " the atmospheric physical state..." by "the carbon, N and surface energy budget, the atmospheric physical state..." [, France]	noted, but no longer relevant with change in the sentence structure
17095	14	21			this section should compare the biogeochemical effects whith all the biophysical effects, not only the biophysical effects among them in order to identify the net climatic effects. Otherwise it should be move p 2-13 line 19 [Eric Ceschia, France]	agreed - paragraphs reordered
32201	14	21			this section should compare the biogeochemical effects whith all the biophysical effects, not only the biophysical effects among them in order to identify the net climatic effects. Otherwise it should be move p 2-13 line 19 [, France]	agreed - paragraphs reordered
17097	14	24			replace "has a cooling effect through reduced albedo" by "has a cooling effect through increased albedo". [Eric Ceschia, France]	corrected to "increased albedo", and sentences fine tuned
32203	14	24			replace "has a cooling effect through reduced albedo" by "has a cooling effect through increased albedo". [, France]	corrected to "increased albedo", and sentences fine tuned
23655	14	24			"cooling effect through reduced albedo" - shouldn't this be the opposite? Reduced albedo has a warming effect? [Kerri Finlay, Canada]	corrected to "increased albedo", and sentences fine tuned
27743	14	29		36	uri, H. (2018) The role of large - scale BECCS in the pursuit of the 1.5°C target – an Earth system model perspective. Environmental Research Letters. vol. 13 (4), should also be cited here. [Helene Muri, Norway]	This comment is not understandable
17099	14	29			redundant with previous paragraph and this section should compare the biogeochemical effects whith all the biophysical effects, not only the biophysical effects among them in order to identify the net climatic effects. Otherwise it should be move p 2-13 line 19 [Eric Ceschia, France]	paragraph are rearranged
17101	14	33			replace "has a cooling effect through reduced albedo" by "has a cooling effect through increased albedo". [Eric Ceschia, France]	corrected to "increased albedo", and sentences fine tuned
8363	15	2	15	15	This paragraph, by referring to Farquar's model, describes only CO2 assimilation by C3 plants but ignores C4 (and, less critically, CAM) plants. Even if C4 plants species are a minority, they include largely distributed crop species as maize, sugar cane, mil and sorgho. It is known that C4 plants respond differently to temperature and to CO2 concentration. Models only based on Farquar's photosynthesis model could thus be biased. I'm not sure there are robust models of photosynthesis for C4 plants (except those of Collatz, Aust J Pl Phys, 1992). If not, there is a knowledge gap that should be aknowledged. [Marc Aubinet, Belgium]	paragraph rephrased to address this point
1673	15	2	15	51	There was relatively high confidence on the contribution of the increase in CO2 concentration on the rising productivity of natural vegetation during the past decades. However, there were few descriptions on the impact of the increase in CO2 concentration on crop productivity. Please explain the reason. [Jing Wang, China]	noted - but it is beyond the scope

Comment No	From Page	From Line	To Page	To Line	Comment	Response
38753	15	3	15	7	That statement is true, but one might clarify that the Farquhar model was designed for C3 plants and isn't as well-suited for C4 (major crops) and CAM (desert) plants. [, United States of America]	revised to address this point
33043	15	3	15	51	Plant physiological responses and acclimations to increases 2 in CO2 and variations (temperature is not always increasing depending on the place/time of the year) in temperature. Plant respond to stress by producing stress/heat/cold shock proteins and each of these responses has a different impact on the overall growth (biomass) and productivity (yield, incldluing nutrient content) of the plant. [Neeraja Havaligi, United States of America]	Noted- too specific to address.
31871	15	4	15	4	Add "von Caemmerer and Farquhar 1981" (Von Caemmerer, S.V. and Farquhar, G.D., 1981. Some relationships between the biochemistry of photosynthesis and the gas exchange of leaves. Planta, 153(4), pp.376-387) and "von Caemmerer 2000" (Von Caemmerer, S., 2000. Biochemical models of leaf photosynthesis. Csiro publishing.) [Martijn Slot, Netherlands]	von Caemmerer and Farquhar 1981 is added, replacing Faquhar 1989
1047	15	4	15	4	Check citation format (brackets should be around the years, not around the author name) [Sebastiaan Luyssaert, Belgium]	Mendeley issue to be corrected in the final copy editing
23687	15	4	15	6	which then incorporates the effects of …, nutrient availability into CO2 uptake by plants? [Xiyan Xu, China]	paragraph revised and no longer relevant
12749	15	12	15	15	The sentence "However, recent empirical work, including those explained in the following subsections, allows improved model prediction of photosynthesis-carbon balance in the warmer and CO2 rich future as detailed in subsequent subsections." should be modified as follows "However, recent empirical works, including those explained in the following subsections, allow improved model prediction of photosynthesis-carbon balance in the warmer and CO2 rich future as detailed in subsequent subsections." [Tiziana Susca, United Kingdom (of Great Britain and Northern Ireland)]	suggestion incorporated
23689	15	13	15	13	Remove "including those explained in the following subsections" [Xiyan Xu, China]	rephrased (see response to the comment 12749)
38755	15	15	15	15	The lack of a CO2 fertilization effect in tropical tree ring data stands in stark contrast to top-down and model-based estimates of the land carbon sink, almost all of which require a strong fertilization effect to balance the global carbon budget. Is it too speculative to comment on how to resolve this apparent conflict (e.g., increased soil carbon storage, reduced mortality, lateral export or shifts in plant allocation strategies)? [, United States of America]	Noted
25381	15	17	15	17	We suggest to detail further the CO2 fertilisation effect, including through quantitative assessment and uncertainty analysis. See GENERAL COMMENT ON CO2 FERTILISATION EFFECT. [, France]	The paragraph is revised to be more informative yet concise.
13761	15	17	15	17	No definition of CO2 fertilisation in this section nor in Glossary [Moira Doyle, Argentina]	definition added at the beginning of the section
6723	15	17	15	24	In this section, I recommend adding statements about the responses of allocation and turnover of photosynthase under changing environment, because these processes are highly uncertain in the present studies. For example, Friend et al. (2014) analyzed differences of carbon sturnover in the present biome imapct assessment models. Friend, A.D., Lucht, W., Rademacher, T.T., Keribin, R.M., Betts, R., Cadule, P., Ciais, P., Clark, D.B., Dankers, R., Falloon, P., Ito, A., Kahana, R., Kleidon, A., Lomas, M.R., Nishina, K., Ostberg, S., Pavlick, R., Peylin, P., Schaphoff, S., Vuichard, N., Warszwski, L., Wiltshire, A., Woodward, F.I., 2014. Carbon residence time dominates uncertainty in terrestrial vegetation responses to future climate and atmospheric CO2. Proc. Nat. Acad. Sci. U.S.A. 111, 3280–3285. [Akihiko Ito, Japan]	reference added

Comment No	From Page	From Line	To Page	To Line	Comment	Response
17317	15	17	15	24	The CO2 fertilization hypothesis is challenged in a recent study that will appear in Nature Sustainability soon (January or February 2019). It shows that the two major reasons for an overall greening of the earth are afforestation programs in China and increasing use of fertilizers on croplands in India. When this study is published, it should be given much emphasis in this report [Jarle W. Bjerke, Norway]	reference added (along with reference to Cross Chapter Box on aforestaion an reforestation)
31873	15	18	15	18	"high confidence that …could potentially" The language of confidence seems at odds with the hypothetical nature of 'potentially' [Martijn Slot, Netherlands]	noted - but paragraph revised and no longer relevant
30893	15	18	15	18	not 'could potential enahnce' but 'usually enhances…..' [Mike Morecroft, United Kingdom (of Great Britain and Northern Ireland)]	noted - but paragraph revised and no longer relevant
38757	15	18	15	24	Cite doi:10.1038/nature22030 [, United States of America]	reference cited
38759	15	18	15	24	It is important to note that there is not a direct relationship between increased net photosynthesis and growth. This point is made in the next bullet. [, United States of America]	The subsection is revised to address this point more clearly.
29829	15	18	15	38	How could there be high confidence when in the next para starting from line 26 it says that this is highly variable and uncertain. Please avoid misleading and incorrect conclusions. [Souparna Lahiri, India]	revised to address this concern
1049	15	20	15	20	Check citation format (Field instead of FIELD) [Sebastiaan Luyssaert, Belgium]	Medeley data base error -corrected
38761	15	20	15	46	In the cited synthesis of flux site data, Keenan et al. (2013) found an increase in WUEi for 21 mesic temperate and boreal forest types due to increasing GPP and decreasing LE, which was attributed to a strong CO2 fertilization effect. However, none of the sites were seasonal drought-affected sites. In a separate study on such sites, WUEi increased with increasing soil water deficit in semi-arid young and mature ponderosa pine sites and increasing VPD in a mesic Douglas-fir site. Young pine was impacted the most. The increased WUEi was because ET was significantly lower while GPP didn't vary much (Kwon et al. 2018). There were similar years of data, but no clear correlation with increasing CO2. Regional differences should be highlighted in this section, as the Keenan findings don't relate to the western U.S. forests which generally experience dry summers. Ref: Kwon, H., B.E. Law, C.K. Thomas, B.J. Johnson. 2018. The influence of hydrological variability on water use efficiency in forests of contrasting composition, age, and precipitation regimes in the Pacific Northwest U.S. Agric. For. Meteorol. 249:488-500. DOI: 10.1016/j.agrformet.2017.08.006 [, United States of America]	The paragraph became more concise by reducing details (and thus, Kwan et al. 218 was not cited), while regional differences are pointed.
23691	15	23	15	24	Do you mean ameliorate the impact of future droughts and heat stresses on grassland net carbon uptake? [Xiyan Xu, China]	noted
14375	15	26	15	28	I suggest also citing Norby and Zak (2011, doi:10.1146/annurev-ecolsys-102209-144647), a comprehensive review of FACE results [Benjamin Sulman, United States of America]	suggestion noted, but this is an older reference than those cited.
14379	15	26	15	38	This section could also cite Norby and Zak (2011) review of FACE results and Ellsworth et al. (2017, doi:10.1038/nclimate3235) which focused on P limitation in a FACE experiment [Benjamin Sulman, United States of America]	Noted
6243	15	26	15	38	A key paper missing here is: Norby, R.J. and Zak, D.R., 2011. Ecological lessons from free-air CO2 enrichment (FACE) experiments. Annual review of ecology, evolution, and systematics, 42, pp.181-203. [Tristan Quaife, United Kingdom (of Great Britain and Northern Ireland)]	suggestion noted, but this is an older reference than those cited.
13405	15	28	15	28	Körner 2015 is missing in the reference list [Anders Bryn, Norway]	Reference added
1757	15	29	15	29	Do you need the word “indeed”? I suggest you omit needless words, here and elsewhere. Another example of such words is “in fact” in P. 2-22, L. 35. [William Lahoz, Norway]	"indeed" removed

Comment No	From Page	From Line	To Page	To Line	Comment	Response
16635	15	31	15	34	How does temperature influence the effect of elevated CO2 on plant growth? [Siri Lie Olsen, Norway]	Noted- too specific to address in this assessment
30895	15	35	15	35	Terrer et al talk about a continuum not on/off view of N limitation [Mike Morecroft, United Kingdom (of Great Britain and Northern Ireland)]	sentence revised to address this point
3097	15	35	15	36	Editing is needed. [, Russian Federation]	sentence revised to address this point
14377	15	36	15	36	Additional citations could include Phillips et al. (2011, doi:10.1111/j.1461-0248.2010.01570.x), Drake et al. (2011, doi:10.1111/j.1461-0248.2011.01593.x) [Benjamin Sulman, United States of America]	noted
17259	15	36	15	37	What about micorrhizal funghi ? It could be better to edit the expression to plant root-soil-microorganisms [Noémie Janot, France]	mycorrhizal fungi are discussed in a later subsection
16981	15	40	15	40	Remove "consistent" from "consistent consequence" or rephrase sentence. [Roland Hiederer, Italy]	removed and sentence revised
459	15	40	15	41	I think this statement is true. In addition, under elevated CO2 we see an intensification of the hydrological cycle So why do people think droughts wil lincrease? OF course, they might, but this statement points to one side of the feedback process that moderates the risk of (at least) seasonal drought. [Andrew Pitman, Australia]	the sentence revised to avoid a misleading impression
38763	15	50	15	50	There is more literature on this topic -- i.e., DOI: 10.1038/NCLIMATE2614 [, United States of America]	noted
8365	15	17	16	20	In a general way, this section confounds "plants" anbd "forests". The second paragraph (P15L40 and foll.), for example refers to "plants" while all references (except Reich and Hoppy) refer in fact to forest. This is the same in the third paragraph (P16L8 and foll) where "all major biomes (L11)" refers to the paper of Silva that only treats of forest biomes. More generally, it should be better specified if the given information refer to all plant species or only to forests.. [Marc Aubinet, Belgium]	point taken and some care given in revision on this point - but forest trees dominate the land sink strength associated with vegetation
18077	15	17	16	34	There is also evidence that the CO2 fertilisation (resp. the CO2 physiological effects) also amplifies heat extremes (Skinner et al., 2018: Amplification of heat extremes by plant CO2 phyisological forcing, Nature Communications) [Clemens Schwingshackl, Switzerland]	interesting, but it is premature to assess this prospect as there is not sufficient concensus
33969	15	2	19	7	The content of sections 2.2.2 and 2.2.3 may benefit from including work from other key research groups and aithors on these topics. Examples include: M.J Hovenden and colleagues; P.C.D Newton and colleagues [Cecile de Klein, New Zealand]	Noted- section is absorbed in other sections
28279	15	2	34		Plant emissions of Biogenic volatile organic compounds and the formation of secondary organic aerosol under high CO2 and temperature scenarios heed be assessed. The adapation of plants to high CO2 and temperature through the emissions of BVCOs, eg isoprene, need to be assessed, [Noureddine Yassaa, Algeria]	noted - but this is covered in 2.5
26945	16	18	15	20	Please consider lifting this general information on CO2-fertilisation to the ES and SPM level. [, Germany]	noted
13407	16	4	16	5	Statement should be moderated. Several factors that limit vegetation, for example temperature at northern latitudes [Anders Bryn, Norway]	sentence is deleted (as this idea is discussed in more details in later)
16637	16	4	16	5	This seems simplistic, as plant growth is limited by multiple factors and not just soil nutrients. [Siri Lie Olsen, Norway]	sentence is deleted (as this idea is discussed in more details in later)
15611	16	4	16	5	Good reference for this could be Mäkelä et al. 2008, doi: 10.1111/j.1469-8137.2008.02558.x [Tuomo Kalliokoski, Finland]	Checked and added
15799	16	4	16	6	"..growth is constrained by availabillity of soils nutrients, in particular nitrogen and phosphorus (refs), and the availability of water". Please add the comment on water. [Caroline Vincke, Belgium]	sentence is deleted (as this idea is discussed in more details in later)
14381	16	5	16	5	This would be a good place to cite Ellsworth et al (2017) in reference to P limitation [Benjamin Sulman, United States of America]	sentence is deleted (as this idea is discussed in more details in later)

Comment No	From Page	From Line	To Page	To Line	Comment	Response
8367	16	11	16	11	Here again, "all major biomes" refer in fact only to forest biomes. Needs to be specified. [Marc Aubinet, Belgium]	paragraph revised and this comment is no longer relevant
18079	16	13	16	13	Change to "… Mediterranean trees an increase of about 20%..." [Clemens Schwingshackl, Switzerland]	paragraph revised and this comment is no longer relevant
933	16	13	16	13	I could not understand '...about...' as a verb! Could you check it out? [Edson Leite, Brazil]	paragraph revised and this comment is no longer relevant
13409	16	15	16	19	Strange conclusion, given that there might be other causes for the last 20% than CO2 fertilization. This could for example be a results of succession, reduced biological interactions (negative) etc [Anders Bryn, Norway]	paragraph revised and this comment is no longer relevant
21031	16	22	16	24	In many studies which try to assess the potential impact of CO2 fertilisation, missing processes are subsumed into the calibration of CO2 fertilisation which therefore represents the combined effect of CO2 fertilisation and additional missing processes rather than CO2 fertilisation alone. This is for instance explicitly stated within the article of Schimel, 2015 or Holden, 2013 and would be worth acknowledging within the text of the chapter. We therefore have the impression that the author of the author of the chapter consider whether “high agreement, medium evidence” that significant increases in NPP can be attributed to CO2 fertilisation (and not high agreement, robust evidence of such impact). [, United Kingdom (of Great Britain and Northern Ireland)]	confidence statement is moderated
17319	16	22	16	34	The CO2 fertilization hypothesis is challenged in a recent study that will appear in Nature Sustainability soon (early 2019). It shows that the two major reasons for an overall greening of the earth are afforestation programs in China and increasing use of fertilizers on croplands in India. When this study is published, it should be given much emphasis in this report [Jarle W. Bjerke, Norway]	Accept. With thanks. The results from this paper have been included in the text.
16639	16	22	16	34	Aren't there seemingly contradictory results of remote sensing/modeling and empirical data on the magnitude of the effects of elevated CO2? If so, should this be further discussed? [Siri Lie Olsen, Norway]	the sentence in question is deleted
21033	16	27	16	29	In many studies which try to assess the potential impact of CO2 fertilisation, missing processes are subsumed into the calibration of CO2 fertilisation which therefore represents the combined effect of CO2 fertilisation and additional missing processes rather than CO2 fertilisation alone. This is for instance explicitly stated within the article of Schimel, 2015 or Holden, 2013 and would be worth acknowledging within the text of the chapter. We suggest to take into account the conclusion of Schimel where they mentioned “up to 60% of current terrestrial sinks are due to this single feedback. For reasons stated above, this is likely an upper bound, as the atmospheric and forest inventory data include fluxes not due to the CO2 effect.” And rewrite the phrase : “Intercomparison of ESMs suggests that 60% of the recent terrestrial carbon sink can be directly attributed to increasing atmospheric CO2 (Schimel et al. 2015).” as follow “Intercomparison of ESMs suggests that up to 60% of the recent terrestrial carbon sink can be directly attributed to increasing atmospheric CO2, although this is likely an upper bound, as the atmospheric and forest inventory data include fluxes not due to the CO2 effect (Schimel et al. 2015).” [, United Kingdom (of Great Britain and Northern Ireland)]	paragraph revised and this comment is no longer relevant (carbon-budget attribution issues are now consolidated in 2.4)
15613	16	29	16	31	Kalliokoski et al. 2018 paper found out that in boreal forest CO2 fertilization effect had larger impact on GPP than e.g. temperature. https://doi.org/10.1016/j.agrformet.2018.06.030 [Tuomo Kalliokoski, Finland]	Noted
18081	16	42	16	42	Optimal temperature for what? For maximum NPP? Or for optimal NPP? [Clemens Schwingshackl, Switzerland]	revised to be less ambiguous

Comment No	From Page	From Line	To Page	To Line	Comment	Response
14383	16	50	16	50	I would specify that this refers to autotrophic respiration to avoid any confusion [Benjamin Sulman, United States of America]	sentence changed
8369	16	50	16	50	I would specify for clarity that only leaf (plant) respiration is concerned here. [Marc Aubinet, Belgium]	sentence changed
461	16	50	17	12	There are some papers by Jeff Exbryat that make some of these points and might be wrth citing: 48. Exbrayat J-F, A.J. Pitman, and G. Abramowitz, 2014, Response of microbial decomposition to spin-up explains CMIP5 soil carbon range until 2100, Geosci. Model Dev, 7, 2683–269, doi:10.5194/gmd-7-2683-2014. *** Exbrayat J-F, A.J. Pitman, G. Abramowitz, 2014, Disentangling residence time and temperature sensitivity of microbial decomposition in a global soil carbon model, Biogeosciences, 11, 6999–7008, doi:10.5194/bg-11-6999-2014. *** Exbrayat, J.-F., A.J. Pitman, Q. Zhang, G. Abramowitz and Y.-P. Wang, 2013, Examining soil carbon uncertainty in a global model: response of microbial decomposition to temperature, moisture and nutrient limitation, Biogeosciences, 10, 7095–7108, doi:10.5194/bg-10-7095-2013. *** Exbrayat, J.-F., A.J. Pitman, G. Abramowitz and Y.-P. Wang, 2013, Sensitivity of net ecosystem exchange and heterotrophic respiration to parameterization uncertainty, Journal of Geophysical Research, 118, 1-12, doi:10.1029/2012JD018122. [Andrew Pitman, Australia]	Noted
15801	16	44	46	16	See Vicca et al 2012 « Forests with high-nutrient availability produce more biomass per unit photosynthesis than forests with low-nutrient availability because the latter need to invest more photosynthates in root symbionts (refs). Mycorrhizal abundance declines substantially in response to nitrogen and phosphorus fertilization (15 and 32% respectively. Treseder 2004. [Caroline Vincke, Belgium]	Noted- too specific to address in this assessment
1051	17	5	17	5	Delete "To amend this situtation" [Sebastiaan Luyssaert, Belgium]	deleted as suggested
31875	17	5	17	6	Change to "To amend this situation, a global database (GlobResp) has been compiled, leading to a meta-analysis of..." [Martijn Slot, Netherlands]	deleted as suggested
14641	17	5	17	8	There is too much information here. Simplifying the text is suggested. For example, there is no need to know the elevation range of the GlobResp dataset. [, Canada]	sentence simplified as suggested
14385	17	6	17	8	The description of the databases and meta-analyses is confusing. Were there multiple databases? Or one database that supported two different meta-analyses? [Benjamin Sulman, United States of America]	agreed - changed
1371	17	6	17	8	Atkin et al. (2015) used no meta-analysis, but mixed-effects linear models, and Heskel et al. (2016) used modeling approach. So “leading to meta-analysis of 899 plant species…” is not correct. Effect size, which is the first step of meta-analysis, weighted summarized effect size as well heterogeneity of effect sizes across studies and subgroup analysis were not calculated in those articles. [Elena Valkama, Finland]	agreed - changed
38765	17	7	17	7	"Plant functional types"are not defined even though other terms in this section such as "acclimation" are. [, United States of America]	this term was removed from the revised text.

Comment No	From Page	From Line	To Page	To Line	Comment	Response
28839	17	11	17	27	In a recent study, Grillakis et. al (2015) quantified the effect of climate change on the soil temerature regimes, using a JULES Land Surface Model results. They found that the Pergelic soil temperature regions where the permafrost is found, is expected to be reduced by 6.7, 13.0, and 14.0 million km2 in a 2°C, 4°C, and 6°C warmer planet. Major crop production regions between 45 N to 60 N and 45S to 60S (North America's Great Plains, France and Russia in the northern hemisphere, the Pampas grain belt and the Murray-Darling Basin in the southern hemisphere) are expected to shift from Mesic to Thermic and from Thermic to Hyperthermic, enchancing the carbon depletion. Indo-Gangetic Plain and the North China Plain seem more resilient at least up to +4°C. Grillakis, M.G., Koutroulis, A.G., Papadimitriou, L.V., Daliakopoulos, I.N. and Tsanis, I.K., 2016. Climate-induced shifts in global soil temperature regimes. Soil Science, 181(6), pp.264-272. [Manolis Grillakis, Greece]	noted - but not relevant for this section
31675	17	14	17	14	Category (subsistence vs. commercial farmers) (...) (comment: please avoid reinforce a dycothomy that is detrimental to understanding the diversity and mutli-purpose set of systems that composes the agricultural sector. We cannot chose one or other, as the different farming groups have a different role in a growing and diversifyed non-food-producer urbanized society.) [, Brazil]	Not possible to respond - This comment seems to be meant for another part.
5013	17	14	17	20	Some evidence suggests a persistent dependence of warming on respiration "Teramoto, M., Liang, N., Takagi, M., Zeng, J. and Grace, J. (2016) 'Sustained acceleration of soil carbon decomposition observed in a 6-year warming experiment in a warmerate forest in southern Japan', Scientific Reports. Nature Publishing Group, 6(October), pp. 1–14. doi: 10.1038/srep35563." [, Japan]	Noted - The paragraph that the reviewer refers to is about plant acclimation, while the reference suggested by the reviewer is about soil respiration (for which microbial process is large). It is cited in 2.2.3.
38767	17	17	17	17	Note that the Heskel study examined a small number of models -- results may be different in other models (e.g., CLM has a reduction of leaf respiration at high temperature that is inconsistent with much of the observed data) and in some cases the models may be underestimating rather than overestimating the sensitivity. In addition, the modeled base rates may be significantly different from the GlobResp data, affecting the magnitude of the temperature response. The data sets and studies mentioned here have the potential to reduce one of the largest current model uncertainties. [, United States of America]	noted - revised text takes this comment into account
25337	17	22	17	34	There is a lack of information on the impact of temperature on photosynthesis activity. In particular, it would be useful to distinguish between C3, C4 and CAM plants. Some references to use: - Yamori, W., Hikosaka, K., & Way, D. A. (2014). Temperature response of photosynthesis in C 3, C 4, and CAM plants: temperature acclimation and temperature adaptation. Photosynthesis research, 119(1-2), 101-117. - Hueve, K., Bichele, I., Rasulov, B., & Niinemets, Ü. L. O. (2011). When it is too hot for photosynthesis: heat-induced instability of photosynthesis in relation to respiratory burst, cell permeability changes and H2O2 formation. Plant, Cell & Environment, 34(1), 113-126 [, France]	noted - Yamori et al (214) is already cited. Text revised to address the issue of stress responses above the optimal temperature.
22427	17	24	17	24	Should this refer to "optimum growth temperature" instead of just "growth temperature" [Anastasios Kentarchos, Belgium]	Done
1053	17	24	17	24	Delete "(Topt)". [Sebastiaan Luyssaert, Belgium]	Done
1055	17	25	17	25	Replace "Topt" by "optimum temperature" [Sebastiaan Luyssaert, Belgium]	Done

Comment No	From Page	From Line	To Page	To Line	Comment	Response
1057	17	26	17	26	Check citation format (brackets should be around the years, not around the author name) [Sebastiaan Luyssaert, Belgium]	done
1059	17	27	17	27	Check citation format (brackets should be around the years, not around the author name) [Sebastiaan Luyssaert, Belgium]	Done
18083	17	32	17	32	Change to "than increased greening productivity per se" [Clemens Schwingshackl, Switzerland]	rephrased
6245	17	32	17	32	The use of "per se" here is incorrect. [Tristan Quaife, United Kingdom (of Great Britain and Northern Ireland)]	removed
28565	17	34	17	34	what do you mean by growth temperature? Is this the environmental temperature? This is not addressed in the description [Alan Di Vittorio, United States of America]	rephrased
14387	17	38	17	38	I would suggest also citing Wieder et al (2015, doi:10.1038/ngeo2413), Zaehle et al (2010, doi:10.1029/2009GL041345, and Norby et al (2010, PNAS) [Benjamin Sulman, United States of America]	Noted- section is absorbed in other sections
13349	17	38	17	38	is "on" missing between "fertilization effects" and "plant growth"? [Gregory Duveiller, Italy]	done
2477	17	38	17	38	Introduce on (between effects and plant growth) [Lawrence Aribo, Uganda]	noted - revised to address
2517	17	38	17	38	effects "on" [Wei Li, France]	done
13351	17	39	17	39	Missing word "to" between "leading" and "nitrogen" [Gregory Duveiller, Italy]	sentence changed and no longer relevant
1061	17	39	17	39	Replace "leading" by "leading to" [Sebastiaan Luyssaert, Belgium]	corrected
13765	17	40	17	40	stoichiometry of C:N:P, what is this? Please include in glossary [Moira Doyle, Argentina]	the term is removed as it is too technical
12839	17	41	17	41	Define C:N:P [Robert Treuhaft, United States of America]	the term is removed as it is too technical
38769	17	43	17	44	Suggest minor change in sentence: "However, reduced responses to elevated CO2 (eCO2) may not be a simple function of N dilution per se, but instead the result of ..." [, United States of America]	texts revised to address this concern
365	17	43	17	46	you missrepresent the two paper. Both provide meachanism on why a PNL might ot develop.They deal with N availability, not N aqcuisition. [Tobias Rütting, Sweden]	texts revised to address this concern
14643	17	44	17	44	This eCO2 contraction is found only in this and the next few paragraphs. [, Canada]	texts revised to address this concern
15615	17	48	17	48	There should be newer references for this. [Tuomo Kalliokoski, Finland]	texts revised to address this concern
24719	17	48	17	49	Forest is referred to in a general way. Is it possible to specify more, e.g. boreal, temperate, tropical forest? [gunnar austrheim, Norway]	texts revised to address this concern
26721	17	36	18	12	I suggest to mention the monitoring studies that have shown a decline in foliar nutrition (Craine et al., 2018 and Jonard [Mathieu Jonard, Belgium]	noted
26723	17	36	18	12	et al., 2015) : Craine, J. M., A. J. Elmore, L. Wang, J. Aranibar, M. Bauters, P. Boeckx, B. E. Crowley, M. A. Dawes, S. Delzon, A. Fajardo, Y. Fang, L. Fujiyoshi, A. Gray, R. Guerrieri, M. J. Gundale, D. J. Hawke, P. Hietz, M. Jonard, E. Kearsley, T. Kenzo, M. Makarov, S. Marañón-Jiménez, T. P. McGlynn, B. E. McNeil, S. G. Mosher, D. M. Nelson, P. L. Peri, J. C. Roggy, R. Sanders-DeMott, M. Song, P. Szpak, P. H. Templer, D. Van der Colff, C. Werner, X. Xu, Y. Yang, G. Yu, and K. Zmudczyńska-Skarbek. 2018. Isotopic evidence for oligotrophication of terrestrial ecosystems. Nature Ecology & Evolution 2:1735-1744. [Mathieu Jonard, Belgium]	citation added
26725	17	36	18	12	Jonard, M., Fürst, A., Verstraeten, A., Thimonier, A., Timmermann, V., Potocic, N., Waldner, P., Benham, S. ; Hansen, K. ; Merila, P. ; Ponette, Q. ; De La Cruz, A. C ; Roskams, P., Nicolas, M., Croisé, L., Ingerslev, M., Matteuci, G., Decinti, B., Bascietto, M., Rautio, P., 2015. Tree mineral nutrition is deteriorating in Europe. Global Change Biology, 21: 418-430. [Mathieu Jonard, Belgium]	citation added

Comment No	From Page	From Line	To Page	To Line	Comment	Response
5015	17	37	18	12	Very recently, Craine et al. (2018) have published global scale patterns of foliar N concentrations and isotope ratios (δ15N) from more than 43,000 samples acquired over 37 years show that foliar N concentration declined by 9% and foliar δ15N declined by 0.6–1.6‰. Those evidences indicate declines in N supply relative to plant demand, which increase by elevated CO2 and longer growing seasons, at the global scale. This evidence very relevant to the section and should cite their results to upgrade the discussion. Reference: Craine JM, Elmore AJ, Wang L, Aranibar J, Bauters M, Boeckx P, Crowley B E, Dawes M A, Delzon S, Fajardo A, Fang Y, Fujiyoshi L, Gray A, Guerrieri R, Gundale M J, Hawke D J, Hietz P, Jonard M, Kearsley E, Kenzo T, Makarov M, Marañón-Jiménez S, McGlynn T P, McNeil B E, Mosher S G, Nelson D M, Peri P L, Roggy J C, Sanders-DeMott R, Song M, Szpak P, Templer P H, Van der Colff D, Werner C, Xu X, Yang Y, Yu G & Zmudczyńska-Skarbek K (2018) Isotopic evidence for oligotrophication of terrestrial ecosystems. Nature Ecology & Evolution 2:1735–1744. [, Japan]	citation added
315	17	37	18	12	Craine et al. (2018) recently have published global scale patterns of plant leaf N concentrations and isotope ratios (δ15N) from more than 43,000 samples acquired over 37 years, and show that foliar N concentration declined by 9% and foliar δ15N declined by 0.6–1.6‰. Those evidences indicate declines in N supply relative to plant demand that have been increased by elevated CO2 and longer growing seasons, at the global scale. This evidence very relevant to the section and should cite their results to upgrade the discussion. Reference: Craine JM, Elmore AJ, Wang L, Aranibar J, Bauters M, Boeckx P, Crowley B E, Dawes M A, Delzon S, Fajardo A, Fang Y, Fujiyoshi L, Gray A, Guerrieri R, Gundale M J, Hawke D J, Hietz P, Jonard M, Kearsley E, Kenzo T, Makarov M, Marañón-Jiménez S, McGlynn T P, McNeil B E, Mosher S G, Nelson D M, Peri P L, Roggy J C, Sanders-DeMott R, Song M, Szpak P, Templer P H, Van der Colff D, Werner C, Xu X, Yang Y, Yu G & Zmudczyńska-Skarbek K (2018) Isotopic evidence for oligotrophication of terrestrial ecosystems. Nature Ecology & Evolution 2:1735–1744. [Kenzo Tanaka, Japan]	citation added
14389	17	48	18	12	I would add a sentence to this paragraph about P limitation and cite Ellsworth et al. (2017) as an example [Benjamin Sulman, United States of America]	Noted-
3099	17	36	19	9	Very informative review of recently observed effects and possible mechanisms. However, the spatial scale remains unclear that makes it difficult to use by policy-makers. [, Russian Federation]	noted - good point - but the variable results among studies make it impossible to mention the spatial scale to which soil microbial processe can be scaled up.
361	17	39			"leading to" [Tobias Rütting, Sweden]	sentence changed and no longer relevant
363	17	39			Not all ecosystems will develop a N limitation. That should be added here [Tobias Rütting, Sweden]	nnoted - revised text adresses this perspective
30529	18	18	5	7	a verb looks missing [Guillaume Bertrand, France]	revised
367	18	3	18	4	This is only one grassland. Other grasslands show very differetn pattern, e.g. sustained enhahnced biomass growth under elevated CO2 for nearly 2 decades (Andresen et al. 2018. Glob Change Biol. 24:3875–3885) [Tobias Rütting, Sweden]	texts revised to address this concern
38771	18	5	18	5	Suggest sentence change: "CO2 fertilization effect is expected to be proportionally larger in semi-arid habitats because eCO3 reduces stomatal limitation on plant photosynthesis ..." [, United States of America]	done

Comment No	From Page	From Line	To Page	To Line	Comment	Response
6247	18	5	18	5	Missing "The" at start of sentence. [Tristan Quaife, United Kingdom (of Great Britain and Northern Ireland)]	done
31877	18	5	18	6	Change to "The CO2 fertilization effect is expercted to be disproportionally large in semi-arid habitats because of the stimulation of plant water-use efficiency as eCO2 reduces stomatal limitation on photosynthesis" [Martijn Slot, Netherlands]	done
26947	18	5	18	7	The sentence seems to be incorrect or incomplete "where plant water efficiency". [, Germany]	revised
1063	18	5	18	7	Check this sentence. There is something wrong with the word order/grammar "…where plane-water efficiency because…" [Sebastiaan Luyssaert, Belgium]	revised
31879	18	8	18	8	"not observed" instead of "unobserved" [Martijn Slot, Netherlands]	done
1065	18	9	18	9	Replace "…years of eCO2 growth …" by "…years of eCO2, growth …" to stress that it is not "eCO2 growth" but "growth of C4 grasses". [Sebastiaan Luyssaert, Belgium]	revised
38773	18	14	18	14	"symbionts" refers to actual microbes, but "symbiotic interactions" would be a better term here since the full sentence refers to a process. [, United States of America]	changed to symbiosis
16643	18	18	18	18	There does not seem to be a contradiction in the previous sentences? What does "this apparent contradiction" refer to? [Siri Lie Olsen, Norway]	revised
14391	18	21	18	22	I don't think it is correct to characterize root exudation as an alternative explanation. Root exudation is hypothesized to be a mechanism driving rhizosphere priming effects, and measurements of root exudation are likely to also measure at least some component of carbon allocation to mycorrhizae. So root exudation measurements provide support for the hypothesis in the previous sentence rather than an alternative explanation. [Benjamin Sulman, United States of America]	revised to address this concern
371	18	21	18	22	This is not an "alternative" this is priming mentioned in line 20 [Tobias Rütting, Sweden]	revised to address this concern
14393	18	29	18	29	Another citation supporting the continuing debate would be Norby et al. (2017, doi:10.1126/science.aai7976) [Benjamin Sulman, United States of America]	noted - this is a technical comment paper to Terrer et al. 217 cited
16641	18	31	18	41	Should this be a separate paragraph? It does't seem to match the heading in line 24-26. [Siri Lie Olsen, Norway]	Revised to streamline the flow of sentences to address this.
14395	18	35	18	41	These statements about P limitation could also be well supported by Ellsworth et al (2017) and Wieder et al (2015, Nature Geoscience) [Benjamin Sulman, United States of America]	reference added
31881	18	38	18	38	Add "Wright et al. 2018" (Wright, S.J., Turner, B.L., Yavitt, J.B., Harms, K.E., Kaspari, M., Tanner, E.V., Bujan, J., Griffin, E.A., Mayor, J.R., Pasquini, S.C. and Sheldrake, M., 2018. Plant responses to fertilization experiments in lowland, species-rich, tropical forests. Ecology, 99(5), pp.1129-1138.) [Martijn Slot, Netherlands]	reference added
15331	18	39	18	39	Suggest the text explain the acronym ESM - there is explanation on later pages (p.104 and 113) but useful to have first reading spelt out. [, Australia]	noted -it appears much earlier in the Chapter
373	18	39	18	41	But theses ECM do not include feedbacks that migh decrease nutrient limitation (such as priming and mycorrhiza; line 20) [Tobias Rütting, Sweden]	This point is clarified where the sentence is moved as part of the restructuring.
8371	18	50	18	50	remove "depositions" (redundant) [Marc Aubinet, Belgium]	done
8389	18	50	18	50	"deposition" appears twice [Marc Aubinet, Belgium]	corrected
31883	18	50	18	50	delete "deposition" [Martijn Slot, Netherlands]	corrected
8373	18	51	18	51	Do you mean "may be offset" ? [Marc Aubinet, Belgium]	corrected
13353	18	9	19	9	Suggestion: add a comma after "... 12 years of eCO2", to keep the phrase clear [Gregory Duveiller, Italy]	revised

Comment No	From Page	From Line	To Page	To Line	Comment	Response
2219	18	43	19	7	Some recent results of Meta-analysis reported that the application of K fertilizer could enhance soil organic carbon by 2% in China's cropland. In addition, the integrated application of N, P and K fertilizers could bring about a 15% higher of carbon sequestration compared with the single fertilizer application. (Hong ZHAO, Binfeng SUN, Fei LU*, et al., 2017. Roles of nitrogen, phosphorus, and potassium fertilizer in carbon sequestration in a Chinese agricultural ecosystem. Climatic Change, 142: 587). The possible mechanism is the application of K could change the above and below ground biomass allocation of the crop. This information should be added to this paragraph. [Fei Lu, China]	reference added
30531	18	18	32	33	I suggest to precise how rock weathering may provide N fertilization. Does it come from trapped N in sedimentary rocks? [Guillaume Bertrand, France]	revised to address this concern
369	18	20			reference for "priming" missing [Tobias Rütting, Sweden]	simple explanation added
16645	19	1	19	2	N deposition may also strongly influence e.g. species composition, with possible implications for biodiversity (and thereby potentially C storage). [Siri Lie Olsen, Norway]	slightly rephrased to address this point
1067	19	7	19	7	Add the following sentence "N-deposition and N-fertilization of forests was found to affect soil microbial activity, and thus the recycling of soil carbon and nutrients. A meta-analysis suggests that nitrogen deposition impedes organic matter decomposition, and thus stimulates carbon sequestration, in temperate forest soils where nitrogen is not limiting microbial growth (Janssens et al 2010)." doi/10.1038/ngeo844 [Sebastiaan Luyssaert, Belgium]	reference added
25339	19	9	19	9	Concerning the impacts of seasonality changes induced by climate change, additional information should be provided on some specific issues that are currently poorly integrated into the models, such as those associated with plant-animal interactions such as pollination and fruit dispersal, or those associated with seasonal and vegetative stages mismatches (e. g. destructive impact of spring frosts on buds). [, France]	noted - these will be mentioned in 2.3
3355	19	10	19	10	I would suggest to use "high confidence" to replace (robust evidence, high agreement) and hereafter to follow the judement and expression of 《Guidance Note for Lead Authors of the IPCC Fifth Assessment Report on Consistent Treatment of Uncertainties IPCC Fifth Assessment Report on Consistent Treatment of Uncertainties》. [Rongshuo Cai, China]	done
23693	19	10	19	13	The advancement of spring green up is with high confidence, which is inferred by both remote sensing data and CMIP models. Suggest the publication: Xu, X., W.J. Riley, C.D. Koven, G. Jia (2018) Observed and simulated sensitivities of spring greenup to preseason climate in northern temperate and boreal regions, JGR-Biogeosciences, 123, 60-78. [Xiyan Xu, China]	citation added
1759	19	18	19	18	Here you write "northern hemisphere". Elsewhere you capitalize this. [William Lahoz, Norway]	done
1069	19	19	19	19	Replace "8.1-d" by "8.1 days" [Sebastiaan Luyssaert, Belgium]	done
947	19	22	19	23	Would it not be '29 gcm^{-2} (8.4 gcm^{-2})'? [Edson Leite, Brazil]	unit notation is changed (see 14645)
14645	19	22	19	23	The per square metre value is not highly relevant here.The 3.7% per decade is more useful. The presumably standard deviation of 8.4 g/m-2 would even be more inappropriate here. [, Canada]	agreed - numerical descripion changed to regional total estimate by percent per decade
16647	19	25	19	27	This sentence would benefit from an explicit link to climate change and/or elevated temperatures. [Siri Lie Olsen, Norway]	noted

Comment No	From Page	From Line	To Page	To Line	Comment	Response
15617	19	25	19	27	What about the changes in forest management? Does it play any role, at least in Europe? Henttonen et al. 2017 found out that in Finland management effect covered 63% of increased forest growth. https://doi.org/10.1016/j.foreco.2016.11.044 [Tuomo Kalliokoski, Finland]	this issue is discussed in the cross chapter box on afforestation and reforestation
13355	19	25	19	33	The certainty expressed in the trends is misleading, as it has been demonstrated that there are strong inconsistencies and discrepancies between these satellite LAI products and that much caution should be used (see Jiang et al. 2017, Global Change Biology https://doi.org/10.1111/gcb.13787) [Gregory Duveiller, Italy]	Jiang et al 217 is mentioned
6225	19	25	19	33	Throughout Chapter 2 the Zhu et al. (2016) paper is cited a lot. I have no issue with this per se as it is an important paper and there is no doubt large amounts of greening across the world. However there also exist studies that express caution about the interpretation of these data sets. In particular there is a paper by Jiang et al (2017) which is by several of the same authors as the Zhu paper and offers some words of caution. The abstract of that paper finishes: "Caution should be used in the interpretation of global changes derived from the four long-term LAI products." I think it is important that a reference to that paper is added, and that this paragraph (on page 19) is the ideal place for that to occur. Jiang C, Ryu Y, Fang H, Myneni R, Claverie M, Zhu Z. Inconsistencies of interannual variability and trends in long-term satellite leaf area index products. Glob Change Biol. 2017;23:4133–4146. https://doi.org/10.1111/ gcb.13787 [Tristan Quaife, United Kingdom (of Great Britain and Northern Ireland)]	Jiang et al 217 is mentioned
647	19	27	19	27	Due to Comment from Page 41, Line 5, "Piao et al. 2018" here should be modified to "Piao et al., 2018a" [Shilong Piao, China]	editorial
14647	19	30	19	30	Specific values per square metre are not very helpful here. The next sentence which gives percentage changes is appropriate by itself. [, Canada]	agreed - text revised accordingly
649	19	30	19	30	The value "0.068±0.045 m2 m-2 yr-1" refers to the growing season integrated LAI in Zhu et al. (2016) and cannot be used here to represent a global mean LAI greening trend. We suggest that this value may be removed from the text. [Shilong Piao, China]	agreed - text revised accordingly
6707	19	35	19	44	Several multi-model studies analyzed the amplification trend of seasonal cyle in land-atmosphere CO2 exchange. 1: Ito, A., Inatomi, M., Huntzinger, D.N., Schwalm, C., Michalak, A.M., Cook, R., King, A.W., Mao, J., Wei, Y., Post, W.M., Wang, W., Arain, M.A., Huang, M., Lei, H., Tian, H., Lu, C., Yang, J., Tao, B., Jain, A., Poulter, B., Peng, S., Ciais, P., Fisher, J.B., Parazoo, N., Schaefer, K., Peng, C., Zeng, N., Zhao, F., 2016. Decadal trends in the seasonal-cycle amplitude of terrestrial CO2 exchange resulting from the ensemble of terrestrial biosphere models. Tellus B 68, 10.3402/tellusb.v3468.28968. 2: Zhao, F., Zeng, N., 2014. Continued increase in atmospheric CO2 seasonal amplitude in the 21st century projectes by the CMIP5 Earth system models. Earth System Dynamics 5, 423–439. 3: Zhao, F., Zeng, N., Asrar, G., Friedlingstein, P., Ito, A., Jain, A., Kalnay, E., Kato, E., Koven, C.D., Poulter, B., Rafique, R., Sitch, S., Shu, S., Stocker, B., Viovy, N., Wiltshire, A., Zaehle, S., 2016. Role of CO2, climate and land use in regulating the seasonal amplitude increase of carbon fluxes in terrestrial ecosystems: a multimodel analysis. Biogeosciences 13, 5121–5137. [Akihiko Ito, Japan]	these references are added

Comment No	From Page	From Line	To Page	To Line	Comment	Response
26949	19	35	19	44	The statements made here are not valid for most annual agricultural crops as found in the literature for example here: 1) Schmidt M, Reichenau TG, Fiener P, Schneider K (2012): "The carbon budget of a winter wheat field: An eddy covariance analysis of seasonal and inter-annual variability", Agricultural and Forest Meteorology 165, 114-126. 2) Rezaei EE, Siebert S, Ewert F (2017): "Climate and management interaction cause diverse crop phenology trends." Agricultural and Forest Meteorology 233, 55–70. Therefore we suggest adding a sentence like "On agricultural land with annual crops, however, the phenological effect consists mainly of an acceleration of growth and ripening stages, leading to earlier harvest but not to changes in annual net carbon exchange." [, Germany]	partly agreed - citied Rezaei et al 2017
8375	19	38	19	38	Why only in dormant months? What about growing season ? [Marc Aubinet, Belgium]	sentence rephased to avoid this type of reaction
16983	19	43	19	43	Could be either "whether a longer growing season" or "whether longer growing seasons". [Roland Hiederer, Italy]	changed to "longer growing seasons"
15619	19	46	19	48	Yes, but in high latitudes also snow has a major role for albedo effect. [Tuomo Kalliokoski, Finland]	clarified that the seasonal change is about snow-free period
33605	19	46	19	51	The higher albedo for growing season maxima compared to spring minima is surprising. Situation under spring minima will be more similar to that of barren lands, which is generally found to have higher albedo than forested land. The finding seem to indicate that total clearance or total tree cover both have higher albedo than the middle ground. Firstly, this result must depend on the absence of snow, which should be noted. Further, I am curious that the result is mostly an effect of solar strength in summer compared to spring? [, Norway]	clarified that the seasonal change is about snow-free period
5507	19	47	19	47	better to say surface albedo, since cloud albedo is different. Although surface albedo canbe affected by land cover such as ice and snow in different seasons as well (not only by vegetation canopy). [Sanaz Moghim, Iran]	clarified that thhis discussion is about surface albedo
24343	19	9	20	16	Although the comments on GPP variability are broad and relevant, a global value of annual GPP is missing. Previous IPCC reports estimate a value around 120 PgC yr-1. It would be valuable to see a discussion on values of annual global GPP, its uncertainties, and predictions. This might be due to a lack of literature on the topic but bringing it to discussion in the report would add information and call for scientific attention to the matter. [Renato Braghiere, France]	noted - global value of GPP is mentioned in 2.4
28573	19	40	79	45	These are two different ranges for what appears to be the same thing. Is the second range for local effects? [Alan Di Vittorio, United States of America]	comment cannot understood
30533	20	20	6	8	D'ont you think it would be better say "positive feedback to climate change" (i.e. temparature increase in that case) rather than "positive feedback to climate"? [Guillaume Bertrand, France]	noted - the sentence in question has been deleted
5509	20	1	20	2	sensible and latent heat flux is mainly deriven by temperature and humidity, good to mention these factor, add some recent reference for this statement! [Sanaz Moghim, Iran]	mentioned with more recent reference in relation to a new figure from Anderson et al. 211
15621	20	4	20	6	This interpretation omits totally the role of VOCs and their effect on cloud formation through their role as a Cloud Condensation Nuclei. Please see e.g. Kulmala M. et al. (2013) Direct observations of atmospheric aerosol nucleation. Science, 339, 943−946, Kulmala M. et al. (2014b) Chemistry of atmospheric nucleation: on recent advances on precursor characterization and atmospheric cluster composition in connection with atmospheric new particle formation. Annu. Rev. Phys. Chem., 65, 21−37. [Tuomo Kalliokoski, Finland]	mentioned - Kulmala et al. 213 and 214 are cited in 2.5 - so reference is made

Comment No	From Page	From Line	To Page	To Line	Comment	Response
7515	20	6	20	16	Rephrase the sentence relating to Arctic amplification; as written, it suggests greening is THE impact, when it's a collection of impacts. Alternatively, emphasize that the overall decrease in albedo causes Arctic amplification and that greening contributes to that change in albedo. See Overland J. E., et al. (2018) Surface Air Temperature, in ARCTIC REPORT CARD 2018, 6 ("Currently there is no consensus on understanding the full reasons for Arctic amplification. Proposed mechanisms for Arctic amplification include: reduced summer albedo due to sea ice and snow cover loss; the increase of total water vapor content in the Arctic atmosphere; changes in cloudiness, and changes in pollution (Pithan and Mauritsen, 2014; Kim et al., 2017; Acosta Navarro et al., 2016; Dufour et al., 2016)."); see also Overland J. E., et al. (2017) Surface air temperature, in ARCTIC REPORT CARD 2017 ("The greater rate of Arctic temperature increase, compared to the global mean increase, is referred to as Arctic Amplification. Mechanisms for Arctic Amplification include: reduced summer albedo, due to sea ice and snow cover loss; the increase of total water vapor content in the Arctic atmosphere; a summer decrease and winter increase in total cloudiness (Makshtas et al., 2011; Lenaerts et al., 2017); the additional heat generated by newly sea-ice free ocean areas that are maintained later into the autumn (Serreze and Barry, 2011); and the lower rate of heat loss to space in the Arctic relative to the subtropics, due to lower mean surface temperatures in the Arctic (Pithan and Mauritsen, 2014). Arctic warming has also been influenced by past air pollution reductions in Europe (Acosta Navarro et al., 2016)."). [Durwood Zaelke, United States of America]	Noted - but several sentences in question here on Arctic Amplification are deleted from this section, as they are assessed in other sections (2.5 and 2.6),
7595	20	6	20	16	Rephrase the sentence relating to Arctic amplification; as written, it suggests greening is THE impact, when it's a collection of impacts. Alternatively, emphasize that the overall decrease in albedo causes Arctic amplification and that greening contributes to that change in albedo. See Overland J. E., et al. (2018) Surface Air Temperature, in ARCTIC REPORT CARD 2018; see also Overland J. E., et al. (2017) Surface air temperature, in ARCTIC REPORT CARD 2017. [Kristin Campbell, United States of America]	Agreed - but several sentences in question here on Arctic Amplification are deleted from this section, as they are assessed in other sections (2.5 and 2.6),
29007	20	8	20	8	Vegetation changes is one element of the Arctic Amplification. [Jan Fuglestvedt, Norway]	Agreed - but several sentences in question here on Arctic Amplification are deleted from this section, as they are assessed in other sections (2.5 and 2.6),
651	20	16	20	16	We suggest that one may cite the reference Lian et al. (2018) and add the following contents at the end of this paragraph: "This climate mitigation from growing-season vegetation greening is generally underestimated by CMIP5 ESMs, due to their underestimated role of vegetation in transpiring water to the atmosphere and thus cooling the land surface (Lian et al., 2018)." Ref: Lian, X., and Coauthors, 2018: Partitioning global land evapotranspiration using CMIP5 models constrained by observations. Nat. Clim. Chang., 7, 640-646, doi:10.1038/s41558-018-0207-9. [Shilong Piao, China]	Agreed - Lian et al. 218 is added to the reference
25341	20	18	20	18	Additional information should be provided on drought-induced forest die-backs, especially since it is the subject of much scientific debate. Some references: - Jump, A. S., Ruiz-Benito, P., Greenwood, S., Allen, C. D., Kitzberger, T., Fensham, R., ... & Lloret, F. (2017). Structural overshoot of tree growth with climate variability and the global spectrum of drought-induced forest dieback. Global change biology, 23(9), 3742-3757. - Steinkamp, J., & Hickler, T. (2015). Is drought-induced forest dieback globally increasing?. Journal of Ecology, 103(1), 31-43. [, France]	This should be discussed in 2.3

Comment No	From Page	From Line	To Page	To Line	Comment	Response
14397	20	19	20	29	Some recent papers have highlighted the role of stomatal conductance responses to vapor pressure deficit and would be relevant here: Novick et al. (2016, Nature Climate Change); Sulman et al. (2016, Geophysical Research Letters) [Benjamin Sulman, United States of America]	These references are added
24345	20	19	20	29	It is true that new models link plant water transport with canopy gas exchange and energy fluxes, leading to improved predictions of climate change impacts on forests and land-atmosphere interactions, but the uncertainty of these models are very large. In Rogers et al. (2017), the authors discuss a number of points missing in land surface models within ESMs and one of them is the lack of confidence on the link between soil water limitation and carbon assimilation. These models usually use empirical functions relating soil moisture and stomatal conductance, and recent evidences suggest that this type of approach leads to a high uncertainty in evapotranspiration. [Renato Braghiere, France]	agreed - sentence modified to clarify with this reference as well.
14399	20	27	20	29	Another relevant model publication is Bohrer et al. (2005, doi:10.1029/2005WR004181) [Benjamin Sulman, United States of America]	the reference is added
38775	20	27	20	29	The drought sensitivity of the CLM4.5 model was improved when species-specific P50 values were used to modify Btran in CLM (Buotte et al. 2018) -- i.e., species-specific soil water potential values at which half of stem conductivity is lost, allowing for a reduction in GPP due to drought stress. Add ref: Buotte, P.C., S. Levis, B.E. Law, T.W. Hudiburg, D.E. Rupp, J.J. Kent. 2018. Near-future forest vulnerability to drought and fire varies across the western US. Global Change Biology. DOI: 10.1111/gcb.14490 [, United States of America]	the reference is added
463	20	28	20	28	I think this is only true of uncoupled simulations - that is, these new advances are not included in climate model predictions of climate change impacts on forests. I think these advances *will* lead to improved predictions, but not yet. [Andrew Pitman, Australia]	Sentence modified
30769	20	31	20	31	Here the authors need to refer to the 2018 study in Nature Plants, which focuss on mortality of the oldest boabab trres in southern Africa. [Francois Engelbrecht, South Africa]	noted
38777	20	31	20	33	Beetle-related tree mortality in the western U.S. has been primarily in the intermountain region, and drought-related mortality in the southwest U.S. Add ref: Berner, L.T., B.E. Law, A. Meddens, J. Hicke. 2017. Tree biomass mortality from fires, bark beetles, and timber harvest during a hot, dry decade in the western United States (2003-2012). Environ. Res. Lett. 12(6): 065005 [, United States of America]	For Section 2.3
14401	20	31	20	36	Another relevant citation would be Williams et al. (2012, doi:10.1038/nclimate1693) [Benjamin Sulman, United States of America]	Checked and added
14027	20	31	20	36	Example of sticking to remit of assessment since AR5. This paragraph begins “Since AR5,…” but then none of the references are more recent than 2012 [Chris Jones, United Kingdom (of Great Britain and Northern Ireland)]	agreed - the sentence is deleted
17213	20	31	20	36	The references used in this para are not "since AR5" but are from before the writing of AR5. [Hoang Anh Le, Vietnam]	the sentence is modified
6249	20	31	20	36	Another key paper here is Moore et al. (2013). It tempers the some of the results of Kurz et al. (2008) by showing that the reduction in photosynthesis associated with beetle outbreaks is accompanied by persistent reduced ecosystem respiration. Consequently the large fluxes of CO2 to the atmosphere predicted in the Kurz paper have not materialised. Moore, D.J., Trahan, N.A., Wilkes, P., Quaife, T., Stephens, B.B., Elder, K., Desai, A.R., Negron, J. and Monson, R.K., 2013. Persistent reduced ecosystem respiration after insect disturbance in high elevation forests. Ecology letters, 16(6), pp.731-737. [Tristan Quaife, United Kingdom (of Great Britain and Northern Ireland)]	noted - but it is a case study that is possibly too specific

Comment No	From Page	From Line	To Page	To Line	Comment	Response
15803	20	38	20	39	Very important statement! [Caroline Vincke, Belgium]	noted
23695	20	38	20	47	A study showed the tree mortality and growth under drought are related to the height of the trees: Xu, P., T. Zhou, C. Yi, W. Fang, G. Hendrey, and X. Zhao, Forest drought resistance distinguished by canopy height, Environ. Res. Lett. 13 (2018) 075003 (2018). [Xiyan Xu, China]	noted - but perhaps too specific
38779	20	49	20	49	"Plant functional types" are not defiend even thought other terms in this section such as "acclimation" are. [, United States of America]	Explanation added
40475	20		20		Example of new finding : embolism, I do not think that this was assessed in AR5. Important new process for forest dieback, consider capturing this type of thing as new processes and assess their importance / potentially ES - SPM. [Valerie Masson-Delmotte, France]	Noted
33579	20	31	21	2	Successives wet, and warm and dry long and intense conditions are threatening forests covers. As observed in France for instance in 2018, as trees roots don't develop well during especially wet conditions, when dry and warm conditions occur, the tree is unable to capt enough water to face them. As obsevred in the east part of the coutnry, It has been necessary to water 4 years old trees during summer, which is a very exceptionnal situation. (empirical observation) [Nicolas Siorak, France]	interesting - but perhaps too specific for this assessment
21035	20	31	21	32	Would welcome the inclusion of a reference to the extension of insect lifecycles due to climate change, which could increase the liklihood of pest and disease occurances (Bale, J.S., Masters, G.J., Hodkinson, I.D., Awmack, C., Bezemer, T.M., Brown, V.K., Butterfield, J., Buse, A., Coulson, J.C., Farrar, J. and Good, J.E., 2002. Herbivory in global climate change research: direct effects of rising temperature on insect herbivores. Global change biology, 8(1), pp.1-16). [, United Kingdom (of Great Britain and Northern Ireland)]	Rejected, too specific
14403	20	38	21	2	Anderegg et al. (2018, doi:10.1038/s41586-018-0539-7) is another example of a potentially important process regulating vegetation responses to drought at ecosystem scales (diversity in hydraulic traits among plant species within an ecosystem) that models do not currently reproduce [Benjamin Sulman, United States of America]	the reference is added
15805	20	50	21	1	Very important statement! [Caroline Vincke, Belgium]	noted - thanks
17269	21	4	21	4	There is no mention in the paragraph of the interlinks between C (as SOM) cycling and the others cycles of "biogechemically critical elements" such as Fe, S, Mn in soils. The link with N and P cycles in plants has been made in a previous paragraph (2.2.3) but not really in soils [Noémie Janot, France]	Addressed somehwat by rearranging pargaraphs, bringing the one on deep soil C (for which minerals icluding Fe is important). But mentioning S, Mn etc. is beyond the scope of this assessment.
6725	21	5	21	28	In terms of SOC unertainty in the future, Nishina et al. (2014) conducted an in-depth analysis on the basis of ISI-MIP result. They conducted ANOVA to factor-out the uncertaianties cuased by emission scenarios, climate projections, and biome models. Nishina, K., Ito, A., Beerling, D.J., Cadule, P., Ciais, P., Clark, D.B., Falloon, P., Friend, A.D., Kahana, R., Kato, E., Keribin, R., Lucht, W., Lomas, M., Rademacher, T.T., Pavlick, R., Schaphoff, S., Vuichard, N., Warszwaski, L., Yokohata, T., 2014. Quantifying uncertainties in soil carbon responses to changes in global mean temperature and precipitation. Earth System Dynamics 5, 197–209. [Akihiko Ito, Japan]	referenceadded

Comment No	From Page	From Line	To Page	To Line	Comment	Response
6727	21	5	21	28	Tian et al. (2015) investigated global simulations of SOC in MsTMIP and evaluated the uncertainty in the present terrestrial carbon cycle models. Tian, H., Lu, C., Yang, J., Banger, K., Huntzinger, D.N., Schwalm, C.R., Schwalm, C.R., Michalak, A.M., Cook, R., Ciais, P., Hayes, D., Huang, M., Ito, A., Jain, A., Lei, H., Mao, J., Pan, S., Post, W.M., Peng, S., Poulter, B., Ren, W., Ricciuto, D., Schaefer, K., Shi, X., Tao, B., Wang, W., Wei, Y., Yang, Q., Zhang, B., Zeng, N., 2015. Global patterns and controls of soil organic carbon dynamics as simulated by multiple terrestrial biosphere models: current status and future directions. Global Biogeochem. Cycles 29, 10.1002/2014GB005021. [Akihiko Ito, Japan]	reference added
12841	21	7	21	7	SOC has already been defined on page 6. [Robert Treuhaft, United States of America]	Revised to avoid duplication
16985	21	8	21	8	The phrase "of contemporary SOC stocks ranging from 510 to 3040 Pg C." may give the impression, that the models assume this to be the current SOC stock. Yet, the models use the range in SOC stocks as their initial value for the model runs. What value for SOC stocks is used depends on the depth of the soil layer considered in the model to change. One may note that the authors of the cited article used soil, litter, and coarse woody debris to represent SOC, which is not a standard definition. [Roland Hiederer, Italy]	accepted - rephrased
16987	21	12	21	12	Suggested to replace "initial SOC stocks" by "starting SOC stocks used be the EMSs", as given in the related article. [Roland Hiederer, Italy]	accepted-rephrased
16989	21	13	21	17	When referring to processes affecting organic material in the soil it is not SOC, but rather soil organic matter that is the component affected in the soil. SOC is used because it is generally analysed in the laboratory and easier to relate to CO2 emissions and removals. The processes are generally referred to a s mineralisation or decomposition. One should not avoid to use them. [Roland Hiederer, Italy]	noted
14405	21	15	21	17	Good supporting references for this statement would be Sulman et al. (2018, doi:10.1007/s10533-018-0509-z) and Wieder et al. (2018, doi:10.1111/gcb.13979) [Benjamin Sulman, United States of America]	reference added
6157	21	18	21	19	How about FAO soil carbon map? That should be added into as a source SOC data providing global estimates. FAO and ITPS. 2018. Global Soil Organic Carbon Map (GSOCmap) Technical Report. Rome. 162 pp. http://www.fao.org/documents/card/en/c/I8891EN [Aleksi Lehtonen, Finland]	noted - but sufficient with already cited recent references about global soil carbon map
38781	21	19	21	19	PgC from soil to atmosphere seems high as it is about equal to total GPP. This number as referenced by Auffret et al. (2016) applies to total ecosystem respiration, which includes the aboveground plant components (leaf and stem). However the 50% of this total attributed to soil microbial respiration is still correct. [, United States of America]	agreed and corrected (also citing AR5 WG1)
6251	21	19	21	19	Should be SoilGrids [Tristan Quaife, United Kingdom (of Great Britain and Northern Ireland)]	corrected
16991	21	19	21	21	The estimates given by Tifafi at al., 2018 are at odds with other estimates derived for SOC from the data. The original data have been further processed by the authors with some uncertainties concerning the values used for bulk density and lacking a consistent distinction between soil organic carbon and soil carbon, which includes the inorganic part The values do not correspond to those more widely found in the literature. It is recommended to use the more widely accepted range as given by Köchy et al., 2015 or Scharlemann et al., 2014. Just because an article is more recent does not make it better. [Roland Hiederer, Italy]	noted - Tifari et al. report a wide range, within which Kochy et al. (2915) falls.

Comment No	From Page	From Line	To Page	To Line	Comment	Response
16993	21	19	21	21	Köchy, M., Hiederer, R., and Freibauer, A.: Global distribution of soil organic carbon – Part 1: Masses and frequency distributions of SOC stocks for the tropics, permafrost regions, wetlands, and the world, SOIL, 1, 351-365, https://doi.org/10.5194/soil-1-351-2015, 2015. Jörn PW Scharlemann, Edmund VJ Tanner, Roland Hiederer & Valerie Kapos (2014) Global soil carbon: understanding and managing the largest terrestrial carbon pool, Carbon Management, 5:1, 81-91, DOI: 10.4155/cmt.13.77 [Roland Hiederer, Italy]	Kochy et al is cited
2785	21	23	21	23	insert space after "vegetation" [Bettina Weber, Germany]	done
1071	21	23	21	23	Add a space between "vegetation" and "(Bond-Lamberty …" [Sebastiaan Luyssaert, Belgium]	done
6253	21	23	21	23	Missing space before parenthesis [Tristan Quaife, United Kingdom (of Great Britain and Northern Ireland)]	done
8377	21	24	21	24	Why "althought" This seems not contradictory. [Marc Aubinet, Belgium]	no-longer relevant (the sentence was deleted)
15333	21	24	21	26	Suggest clarifying the sentence - use of the word 'although' seems to set the second part of the sentence up in opposition to the first, when it is not clear if this is the case. [, Australia]	no-longer relevant (the sentence was deleted)
17261	21	24	21	26	I find it strange that this sentence does not mention South-east Asia, which represent the largest peatland area. The cited paper evidenced that there was significant peatland areas in Brasil and Congo, but the updated numbers show much larger peatland area in Indonesia than what was previously thought. [Noémie Janot, France]	noted -the sentence in question is removed as peatlands are discussed I details in 2.4
16995	21	24	21	26	The difference can be explained in part by the definition used by Gumbricht et al. 2017 for peat (at least 30 cm of decomposed or semi-decomposed organic material with at least 50% organic matter). The data from Köchy et al., 2015 refers to the area of Histosols in the FAO classification, which differs from the definition of peat (40 cm or more of organic soil material in the upper 80 cm). Thus, not all areas of peat are Histosols. Still, the findings reported by Gumbricht et al. 2017 are significant for global SOC stock estimates. They also show the uncertainty in the field. [Roland Hiederer, Italy]	agreed - revised to reflect this point
22429	21	25	21	25	Change "peatlans" to "peatlands" [Anastasios Kentarchos, Belgium]	corrected
2787	21	25	21	25	"peatlands" instead of "peatlans" [Bettina Weber, Germany]	corrected
8379	21	25	21	25	peatlands (d missing) [Marc Aubinet, Belgium]	corrected
2519	21	25	21	26	need to cite Dargie et al. 2017 Nature paper [Wei Li, France]	cited
16997	21	26	21	26	The terms "peat" used here relates to the organic matter stocks in Histosols. |The sentence could be modified to: "At the moment, estimates of global organic carbon stocks in soils high in organic carbon suffer…" [Roland Hiederer, Italy]	noted - sentence is deleted as part of revision
14407	21	27	21	28	I suggest adding some references related to deep soil organic matter layers and permafrost. Some good ones include Rumpel and Koegel-Knabner (2011, Plant and Soil); Jobbagy and Jackson (2000, Ecol. Appl.); Kochy et al. (2015, doi:10.5194/soil-1-351-2015); Schuur et al. (2015, Nature); Hugelius et al. (2014, doi:10.5194/bg-11-6573-2014) [Benjamin Sulman, United States of America]	there references are cited in revision
2789	21	28	21	28	"… is a substantial addition to this…". I.e. remove "in" [Bettina Weber, Germany]	this sentence is deleted

Comment No	From Page	From Line	To Page	To Line	Comment	Response
6709	21	30	21	31	The number of annual soil carbon efflux, 119 Pg C per year, is higher than most estimates and so should not be shown as a typical value. At least, the range of uncertainty should be added. More certainly, Hashimoto et al. (2015) gave an empirical estimation of 91 [87–95, 95% CI] Pg C yr–1 on the basis of global obserbation dataset. Hashimoto, S., Carvalhais, N., Ito, A., Migliavacca, M., Nishina, K., Reichstein, M., 2015. Global spatiotemporal distribution of soil respiration modeled using a global database. Biogeosciences 12, 4121–4132. DOI: 10.5194/bg-12-4121-2015 [Akihiko Ito, Japan]	corrected - 119 Pg is the land ecosystem total respiration
5017	21	30	21	31	“119 Pg C is estimated to be emitted from soil to the atmosphere” seems to be overestimated, as it would include aboveground autotrophic respiration as well, and the references would not be appropriate to this sentence. The estimated ranges for flux from soil to atmosphere is roughly from 70-100 PgC/yr (e.g. Bond-Lamberty and Thomson 2010; Hashimoto et al. 2015; Raich et al. 2002). Recent studies suggests that the value ranges from 90-100 PgC/yr, although need more studies. References (example): Bond-Lamberty, B., & Thomson, A. M. (2010). Temperature-associated increases in the global soil respiration record. Nature, 464(7288), 579–582. https://doi.org/10.1038/nature08930 Hashimoto, S., Carvalhais, N., Ito, A., Migliavacca, M., Nishina, K., & Reichstein, M. (2015). Global spatiotemporal distribution of soil respiration modeled using a global database. Bio geosciences, 12, 4121–4132. Raich, J. W., Potter, C. S., & Bhagawati, D. (2002). Interannual variability in global soil respiration, 1980–94. Global Change Biology, 8, 800–812. [, Japan]	corrected - 119 Pg is the land ecosystem total respiration
184	21	30	21	31	119 Pg C is estimated to be emitted from soil to the atmosphere" is wrong, and the references are not appropriate to this sentence. I guess, this value includes aboveground autotrophic respiration as well. The estimated ranges for flux from soil to atmosphere is roughly from 70-100 PgC/yr (e.g. Bond-Lamberty and Thomson 2010; Hashimoto et al. 2015; Raich et al. 2002). Recent studies suggests that the value ranges from 90-100 PgC/yr, although need more studies. References (example): Bond-Lamberty, B., & Thomson, A. M. (2010). Temperature-associated increases in the global soil respiration record. Nature, 464(7288), 579–582. https://doi.org/10.1038/nature08930 Hashimoto, S., Carvalhais, N., Ito, A., Migliavacca, M., Nishina, K., & Reichstein, M. (2015). Global spatiotemporal distribution of soil respiration modeled using a global database. Biogeosciences, 12, 4121–4132. Raich, J. W., Potter, C. S., & Bhagawati, D. (2002). Interannual variability in global soil respiration, 1980–94. Global Change Biology, 8, 800–812. [Shoji Hashimoto, Japan]	corrected - 119 Pg is the land ecosystem total respiration
14649	21	31	21	33	This is similar to the Q10 discussion in 2.2.2.2. [, Canada]	noted - but 2.2.2 was about plants, whereas in this section, Q1 is about the soil
8381	21	33	21	33	The reference of Sugama is completely out of scope. [Marc Aubinet, Belgium]	the sentence and reference are deleted

Comment No	From Page	From Line	To Page	To Line	Comment	Response
1373	21	33	21	36	Crowther et al. (2016) performed no meta-analysis, but linear mixed models. The authors extracted over 400 observations from only 49 individual studies creating a problem with non-independence of estimates. van Gestel et al. (2018) also performed the same mixed-model regression analysis by extended dataset. Therefore, results of both papers are doubtful, since no standard meta-analytical method was used; instead, the authors relied on conventional statistical methods. However, conventional statistical analysis is not applicable for independent studies due to their methodological diversity and unequal within study variances across studies, violating the underlying assumptions of conventional statistical analysis. [Elena Valkama, Finland]	agreed - revised for better accuracy
24191	21	34	21	35	unclear sentence: "Crowther et al. (2016) found that warming effects were most sensitive to initial carbon stocks" . What does "initial C stocks" meam? Shouldn't be carbon stocks sensitive to warming instead of warming sensitive to C stocks? [Maria Luz Cayuela, Spain]	agreed - revised for better accuracy
1073	21	43	21	47	This looks like a quote. Keep only the original reference. I expect this quote can only come from one of the two references. Unlikely that both papers wrote exactly the same sentence. [Sebastiaan Luyssaert, Belgium]	the quote is removed
381	21	43	21	47	from which reference is the quote? [Tobias Rütting, Sweden]	the quote is removed
14409	21	47	21	47	Not clear what is meant by "concept": Conceptual model? Conceptual framework? [Benjamin Sulman, United States of America]	the quote is removed
16999	21	48	21	48	Finally, SOM is used instead of SOC. Most of the paragraph relates to SOM (decomposition and mineralisation), not SOC. Where stocks of organic material in the soil are used one may use SOC, but where processes concerning organic material in the soil are described SOM would be the better term. [Roland Hiederer, Italy]	the sentence is removed
3103	21	48	21	51	The difference between SOM and SOC should be clearly explained somewhere in the chapter. [, Russian Federation]	the revision explained the acroynms, and the accuracy of these terms are checked
13357	21	5	22	27	This section, although interesting, is much longer and seems unbalanced with respect to what came before and what comes after. At least with respect to the format of having a main idea in bold, followed by a single synthethic paragraph [Gregory Duveiller, Italy]	agreed - restructured to be more concise
14411	21	51	22	7	There is a lot of literature on how moisture affects microbial processes and decomposition. It's not correct to say that the mechanism is not well understood. A more accurate statement would be "soil moisture influences microbial decomposition processes through a range of mechanisms including controls on substrate diffusion, pore connectivity, oxygen availability, and physiological stress on microbial cells associated with strong matric potential gradients." Some good citations for discussions and analyses of these processes include Davidson et al. (2011, Global Change Biology), Monard et al. (2012, doi:j.1574-6941.2012.01398.x), Skopp et al. (1990, doi:10.2136/sssaj1990.03615995005400060018x), Manzoni et al. (2012, doi:10.1016/j.soilbio.2016.01.006), Yan et al. (2018, doi:10.1038/s41467-018-04971-6); Yan et al. (2016, doi:10.1007/s10533-016-0270-0) [Benjamin Sulman, United States of America]	revised to reflect these points
24193	21	51	22	7	The description of the role of soil moisture on SOM decomposition could be improved. This paragraph doesn't read smoothly. Most soils of the world are aerobic. Why the effect of moisture in anaerobic soils is highlighted? Also, the interactions with vegetation growth should be considered. Moisture favors SOM mineralization, but also the development of vegetation that later on will contribute to SOM. [Maria Luz Cayuela, Spain]	noted- much of this section was deleted to shorten the overall length
375	21	19			"SoilGrids" [Tobias Rütting, Sweden]	corected

Comment No	From Page	From Line	To Page	To Line	Comment	Response
377	21	20			change "soil carbon (SOC)" to "SOC" [Tobias Rütting, Sweden]	corrected
14029	21	30			When discussing SOC dynamics, the role of residence time is at least (I would argue MORE) important than the fluxes. We know that ecosystem respiration must be very close to 120 PgC/yr as it is largely driven by GPP. Only a small imbalance between the two is possible or else the ecosystem would grow/shrink rapidly. So the control on storage is then down to the residence time – see e.g. Carvalhais et al (2014; Nature) for an assessment of how models capture this property [Chris Jones, United Kingdom (of Great Britain and Northern Ireland)]	noted - and partly agreed - but not mentioned (resident time = stock / flux)
379	21	30			what is the range of the estimate for soil emission? [Tobias Rütting, Sweden]	noted - but detailed are discussed in the next paragraph
14031	22	1	22	2	"increased soil moisture lowers mineralization rates". More accurate to say there is an optimum soil moisture for mineralization – above or below this then the rate reduces. Models try to capture this with a range or parametrisations – see, e.g. Falloon et al (2011; Glob. Biogeochem. Cycle) for implications of this choice. [Chris Jones, United Kingdom (of Great Britain and Northern Ireland)]	Accept. Text revised to include this longer-term aspect of climate change impact on ecosystems in the section on greening and browning.
8383	22	1	22	2	This is true at high soil water contents but the contrary is observed at low soil water contents ,decreased soil 2 moisture lowers C mineralisation. Ref (among many others) : - Janssens, I.A., Dore, S., Epron, D., Lankreijer, H., Buchmann, N., Longdoz,B., Brossaud, J., Montagnani, L., 2003. Climatic influences on seasonal and spatial differences in soil CO2 efflux. In: Valentini, R., (Ed.), Fluxes of Energy, Water and Carbon Dioxide of European Forests, Ecological Studies, Springer, Berlin, pp. 235–256. - Subke, J.-A., et al., 2009. Short-term dynamics of abiotic and biotic soil 13CO2 effluxes after in situ 13CO2 pulse labelling of a boreal pine forest. New Phytologist 183 (2), 349–357. -Wang, B., Zha, T. S., Jia, X., Wu, B., Zhang, Y. Q., and Qin, S. G.: Soil moisture modifies the response of soil respiration to temperature in a desert shrub ecosystem, Biogeosciences, 11, 259-268, https://doi.org/10.5194/bg-11-259-2014, 2014. [Marc Aubinet, Belgium]	noted - much of this section was deleted for more concise version in new Section2.7
383	22	1	22	4	Only if iron is abundant in soil. Questionable if this is a widespread case (although maybe important in some soils, but not globally) [Tobias Rütting, Sweden]	noted- much of this section was deleted for more concise version in new Section2.7
14413	22	1	22	5	This characterization of C mineralization under anaerobic conditions is totally inaccurate, focusing on an edge case and ignoring the much more prevalent anaerobic soil preservation processes that underlie peat accumulation in wetlands. There is abundant evidence that anaerobic conditions enhance soil C stocks -- this is the mechanism that causes peatlands to form. This paragraph should be rewritten to describe those peat-producing anaerobic processes as the primary effect of long-term anaerobic conditions, and should cite from the extensive literature on peat formation and peatland biogeochemistry, maybe starting with the Clymo (1984, doi:10.1098/rstb.1984.0002) description of peat-forming processes. Alternative electron acceptors, including iron, do play a role in anaerobic decomposition, but this needs to be placed in the broader context of wetland biogeochemistry. Also note that fluctuations in pH or redox state may increase availability of mineral-associated organic matter under some conditions, but this is a separate process from long-term anaerobic conditions that produce peat. [Benjamin Sulman, United States of America]	noted- much of this section was deleted for more concise version in new Section2.7

Comment No	From Page	From Line	To Page	To Line	Comment	Response
1375	22	5	22	7	This is not a global meta-analysis, but original research, conducted by the same research group using the same sampling methodology ("in October 2008, we sampled 12 sites across the gradient…"). Hawkes et al. (2017) used ANOVA for statistical analysis that is correct in their study. [Elena Valkama, Finland]	deleted
26951	22	7	22	7	At the end of this paragraph we suggest adding a sentence like "Soil moisture also affects the extent to which the soil is warming when air temperature increases." reflecting knowledge for instance found in this textbook: Oke TR (1997): "Boundary Layer Climates." 2nd ed., Routledge, London (UK), 435 pp. [, Germany]	noted- much of this section was deleted for more concise version in new Section2.7
24195	22	9	22	12	The report mentions contradictory results of individual studies on the application of litter on soil organic carbon stocks. There is a recent meta-analysis on this topic (Chen et al 2018, Nutrient Cycling in Agroecosystems). This study summarizes the results of 132 long term (> 10 years) field experiments worldwide and analyze C stocks. I suggest the authors to read this article and they could give more precise conclusions. [Maria Luz Cayuela, Spain]	noted- much of this section was deleted for more concise version in new Section2.7
16649	22	10	22	13	Litter type as well as soil moisture would also affect decomposition and hence SOC accumulation. [Siri Lie Olsen, Norway]	noted- much of this section was deleted for more concise version in new Section2.7
14415	22	18	22	18	I am guessing that "E et al 2011" is meant to be Drake et al 2011. [Benjamin Sulman, United States of America]	corrected
14417	22	18	22	18	I suggest adding "Recent modeling studies suggest that there is considerable uncertainty in the magnitude and direction of microbial decomposition feedbacks to litter addition (Sulman et al., 2018, Biogeochemistry). [Benjamin Sulman, United States of America]	noted- much of this section was deleted for more concise version in new Section2.7
31885	22	18	22	18	Correct reference to "Drake et al. 2011" (instead of "E et al") and correct in reference list: Drake, J.E., Gallet-Budynek, A., Hofmockel, K.S., Bernhardt, E.S., Billings, S.A., Jackson, R.B., Johnsen, K.S., Lichter, J., McCarthy, H.R., McCormack, M.L. and Moore, D.J., 2011. Increases in the flux of carbon belowground stimulate nitrogen uptake and sustain the long-term enhancement of forest productivity under elevated CO2. Ecology letters, 14(4), pp.349-357. [Martijn Slot, Netherlands]	corrected as Sayer et al.211 (but could it be Drake et al.211?)
1075	22	18	22	18	Check citation format (E does not looks like a proper last name) [Sebastiaan Luyssaert, Belgium]	corrected
6255	22	18	22	18	Check reference [Tristan Quaife, United Kingdom (of Great Britain and Northern Ireland)]	corrected
16651	22	32	22	32	It is unclear what the contradiction is here. [Siri Lie Olsen, Norway]	Clarified
23697	22	45	22	45	unexpected responses of SOC cycling…? [Xiyan Xu, China]	noted- much of this section was deleted for more concise version in new Section2.7
15335	22	52	22	52	Suggest consistent labelling of the strength of evidence and consensus. [, Australia]	noted- much of this section was deleted for more concise version in new Section2.7
40477	22		22		section on carbon soil : many new elements compared to AR5, could be more highlighted (ES-SPM). Key issue : timescale of storage (reversibility). [Valerie Masson-Delmotte, France]	noted- much of this section was deleted for more concise version in new Section2.7
38783	22	1	24	1	This entire text section on SOC and microbial responses to change is quite confusing and, in places, contradictory. Sentences like this one -- "Indeed, research on soils from a variety of ecosystems from the Arctic to the Amazon indicated that microbes, in fact, could enhance the temperature sensitivity of soil respiration in Arctic and boreal soils, thereby releasing even more carbon than currently predicted." -- are not well- constructed and are difficult to follow logically. There are very high uncertainies in this topic that the report has underestimated and this entire section is really not worthy of inclusion in the chapter. [, United States of America]	noted- much of this section was deleted for more concise version in new Section2.7

Comment No	From Page	From Line	To Page	To Line	Comment	Response
385	22	18			E? [Tobias Rütting, Sweden]	Noted. This sentence has been removed
17265	23	3	23	4	I dont think "microbially-processed" is necessary [Noémie Janot, France]	noted- much of this section was deleted for more concise version in new Section2.7
22431	23	3	23	5	it is indeed true that there is a new paradigm for stabilisation of soil carbon, which is driven by microbial anabolism. However, the carbon stabilisation is not primarily driven by bonding of microbial-processed material to mineral particles, but also by the inherently more resilient nature of the microbial residues compared to plant residues. [Anastasios Kentarchos, Belgium]	noted- much of this section was deleted for more concise version in new Section2.7
14419	23	5	23	5	Cotrufo et al. (2013, Global Change Biology) should definitely be cited here as well as it was a seminal paper for this framework of soil organic matter formation [Benjamin Sulman, United States of America]	noted- much of this section was deleted for more concise version in new Section2.7
17263	23	7	23	7	Another reference for oxygen limitation: Keiluweit et al. 2017 in Nature Communications : doi: 10.1038/s41467-017-01406-6 [Noémie Janot, France]	noted- much of this section was deleted for more concise version in new Section2.7
14421	23	9	23	11	This should also mention that these bonds can be very sensitive to redox fluctuations [Benjamin Sulman, United States of America]	noted- much of this section was deleted for more concise version in new Section2.7
17267	23	9	23	11	The adsorption of organic metabolites onto mineral surfaces can also increase the release of mineral-associated nutrients (as shown in Swenson et al. 2015 DOI: 10.1016/j.soilbio.2015.07.022 for example) [Noémie Janot, France]	noted- much of this section was deleted for more concise version in new Section2.7
26135	23	17	23	17	The first sentence ("Deep soil layers (below 30 cm) can contain much more carbon than previously assumed") is quite important and should be in bold type [Reid Detchon, United States of America]	noted- much of this section was deleted for more concise version in new Section2.7
17215	23	17	23	20	The evidence of this is not yet strong but this point is highly significant for present and projected fluxes of GHG as the quantity in deeper layers may be affected or not depending on tilling practices (some in temperate climates promote "deep ploughing"). The relative (potential) importance of different aspects discussed in this section could be explained. [Hoang Anh Le, Vietnam]	noted- much of this section was deleted for more concise version in new Section2.7
26727	23	17	23	29	Even if a lot of C is present in deep soil layers, monitoring studies showed that changes in C content occur mainly [Mathieu Jonard, Belgium]	noted- much of this section was deleted for more concise version in new Section2.7
26729	23	17	23	29	in upper layers. This should be mentioned in the text (Grüneberg et al., 2014 ; Jonard et al., 2017). [Mathieu Jonard, Belgium]	noted- much of this section was deleted for more concise version in new Section2.7
26731	23	17	23	29	Grüneberg, E., Ziche, D., Wellbrock, N., 2014. Organic carbon stocks and sequestration rates of forest soils in Germany. Global Change Biology, 20, 2644–2662. [Mathieu Jonard, Belgium]	noted- much of this section was deleted for more concise version in new Section2.7
26733	23	17	23	29	Jonard, M., Nicolas, M., Coomes, D.A., Caignet, I., Saenger, A., Ponette, Q., 2017. Forest soils in France are sequestering substantial amounts of carbon. Science of the Total Environment, 574, 616–628. [Mathieu Jonard, Belgium]	noted- much of this section was deleted for more concise version in new Section2.7
38785	23	18	23	18	Is 'residence times' the right phrase here? Do authors mean 'age' of carbon? [, United States of America]	noted- much of this section was deleted for more concise version in new Section2.7
29009	23	21	23	22	Full reference(s) shoudl be given instead of "protocol" and "guidelines" [Jan Fuglestvedt, Norway]	noted- much of this section was deleted for more concise version in new Section2.7
22433	23	25	23	25	It is not only mineral interactions that stabilise soil carbon, but also the resilient chemical nature of microbial resifdues [Anastasios Kentarchos, Belgium]	noted- much of this section was deleted for more concise version in new Section2.7
22435	23	28	23	28	What is the implication of this carbon transfer? Does it enhance or reduce CO2 emissions? [Anastasios Kentarchos, Belgium]	noted- much of this section was deleted for more concise version in new Section2.7

Comment No	From Page	From Line	To Page	To Line	Comment	Response
14423	23	29	23	29	The reference to "Asefaw et al 2008" is incorrect. The author's name is Asmeret Asefaw Berhe, so the citation should be Berhe et al 2008. Other relevant references to support the statement include Berhe et al. (2013, doi:10.1002/esp.3408), Berhe et al. (2018), and Doetterl et al. (2016, doi:10.1016/j.earscirev.2015.12.005) [Benjamin Sulman, United States of America]	noted- much of this section was deleted for more concise version in new Section2.7
25343	23	31	23	31	A similar subsection could be prepared on "forest management and climate". Some references: - Lindner, M., Fitzgerald, J. B., Zimmermann, N. E., Reyer, C., Delzon, S., van der Maaten, E., ... & Suckow, F. (2014). Climate change and European forests: what do we know, what are the uncertainties, and what are the implications for forest management?. Journal of environmental management, 146, 69-83. - Naudts, K., Chen, Y., McGrath, M. J., Ryder, J., Valade, A., Otto, J., & Luyssaert, S. (2016). Europe's forest management did not mitigate climate warming. Science, 351(6273), 597-600. - Luyssaert, S., Marie, G., Valade, A., Chen, Y. Y., Djomo, S. N., Ryder, J., ... & McGrath, M. J. (2018). Trade-offs in using European forests to meet climate objectives. Nature, 562(7726), 259. - Seidl, R., Thom, D., Kautz, M., Martin-Benito, D., Peltoniemi, M., Vacchiano, G., ... & Lexer, M. J. (2017). Forest disturbances under climate change. Nature Climate Change, 7(6), 395. [, France]	Taken into account. This sub-section does no longer exist in our chapter. Agriculture AND forest management are discussed in former section 2.6
14651	23	39	23	39	I assume this should be Figure 2.3 rather than 2.1. [, Canada]	Editorial. The figure has been removed but the numbering was correct
1761	23	39	23	40	It should be "Demands …are" or "Demand…is". [William Lahoz, Norway]	Editorial
14117	23	39	23	41	Pulp and paper plantations are also a major driver of removal of native forests, especially peat swamp forests in Indonesia. [David Taylor, Singapore]	Noted. This paragraph does not exist anymore in our chapter
23699	23	41	23	44	It seems the Figure 2.3 is neither relavant to land conversion nor to climate and environmental impacts. [Xiyan Xu, China]	Accepted. The figure has been removed
2521	23	44	23	44	Figure 2.3 has nothing to do with this sentence [Wei Li, France]	Accepted. The figure has been removed

Comment No	From Page	From Line	To Page	To Line	Comment	Response
17103	23	31	25	25	I would suggest to add 3 paragraphs in this section. The first one concerning the changes in management that affects soil C stocks/GHG emissions and that allow soil C storage (e.g. cover crops or alley cropping) and reduction in other GHG emissions. Mention the 4/1000 initiative and recall that for croplands (wheat, maize...) the best way to improved GHG budget is to store C in the soil. Also recent studies show that conversion tillage has little or no effect on soil C stocks (see for instance Virto et al 2012). It affects soil vertical distribution in SOC. Also I would suggest to include a table that summarises the mitigation option of different changes in cropland management (with quatifications as in Table S2 and ideally the sign of the biophysical climatic effects following those changes). The second one should address recent findings concerning the biogeophysical effects associated to changes in management regimes in agriculture (e.g. see Davin et al. 2014 ; Luyssaert et al. 2015 ; Kaye & Quemada 2017 ; Carrer et al. 2018) and it should compare this effects with the biogeochemical ones. It is very important to compare the contribution of biogeophysical and biogeochemical effects to net radiative forcing in order to identify the best strategies for climate mitigation. For instance the albedo cooling effect of cover crops (which is one of the most efficient option for storing C in agricultural soils…) is up to 1.7 times their C storage effect in France considering a 100yr time horizon (According to Carrer et al 2018 and Tribouillois et al. 2018 considering similar surface area for their introduction). At the opposite, alley cropping that allow to store the same range of C in agricultural system will cause a decrease in surface albedo that will counter balance part of the climat benefit of C storage. Also, C storage effect of cover crops (or following other changes in management) will stop after a few decades (the soils reaches a new equilibrium ; see Tribouillois et al. 2018) while the albedo effect can last as long as the management regime is maintained (e.g. cover crop vs bare soil). Add a third paragraph specific to grasslands : C or sinks ? effect of management (e.g. grazing intensity) ? mitigation options ? I would suggest to add a Table summarising the mitigation option of different changes in grassland management (with quatifications as in Table S2 and ideally the sign of the biophysical climatic effects following those changes). ?	Taken into account. This section has been entirely revised as it was supposed to only describe the processes at play between land and atmosphere. The biophysical effects you are suggesting to include were already discussed in section 2.6 and have been improved since then. The capacity of agricultural land to store carbon was already discussed in section 2.4 and also in chapter 6 and have been improved.

Comment No	From Page	From Line	To Page	To Line	Comment	Response
32205	23	31	25	25	we would suggest to add 3 paragraphs in this section. The first one concerning the changes in management that affects soil C stocks/GHG emissions and that allow soil C storage (e.g. cover crops or alley cropping) and reduction in other GHG emissions. Mention the 4/1000 initiative and recall that for croplands (wheat, maize...) the best way to improve GHG budget is to store C in the soil. Also recent studies show that conversion tillage can have little or no effect on soil C stocks (see for instance Virto et al 2012). It can affect soil vertical distribution in SOC. This is when comparing no till to tillage, on average, everyting else equal. Then comparing agroecology or conservation agriculture to tillage / conventionnal systems, because of the longer soil covering periods, of the organic matter returned to soil, the quantity of organic carbon increases. So we would suggest to include a table that summarises the mitigation option of different changes in cropland management (with quatifications as in Table S2 and ideally the sign of the biophysical climatic effects following those changes), even if there are incertainties. The second one should address recent findings concerning the biogeophysical effects associated to changes in management regimes in agriculture (e.g. see Davin et al. 2014 ; Luyssaert et al. 2015 ; Kaye & Quemada 2017 ; Carrer et al. 2018) and it should compare this effects with the biogeochemical ones. It is very important to compare the contribution of biogeophysical and biogeochemical effects to net radiative forcing in order to identify the best strategies for climate mitigation. For instance the albedo cooling effect of cover crops (which is one of the most efficient option for storing C in agricultural soils…) is up to 1.7 times their C storage effect in France considering a 100yr time horizon (According to Carrer et al 2018 and Tribouillois et al. 2018 considering similar surface area for their introduction). At the opposite, alley cropping that allow to store the same range of C in agricultural system could cause a decrease in surface albedo that will counter balance part of the climat benefit of C storage, depending on the trees species and the original crops. Also, C storage effect of cover crops (or following other changes in management) will stop after a few decades (the soils reaches-- a new equilibrium ; see Tribouillois et al. 2018) while the albedo effect can last as long as the management regime is maintained (e.g. cover crop vs bare soil). Add a third paragraph specific to grasslands : C or sinks ? effect of management (e.g. grazing	Taken into account. This section has been entirely revised as it was supposed to only describe the processes at play between land and atmosphere. The biophysical effects you are suggesting to include were already discussed in section 2.6 and have been improved since then. The capacity of agricultural land to store carbon was already discussed in section 2.4 and also in chapter 6 and have been improved.
24721	23	32	25	25	Chapter 2.2.7 on Agricultural land managment and climate focus mostly on crop prodution, while the mangement of pasture/animal husbandry for land -climate interactions is hardly mentioned. Would be very useful to include a pragraph or two on how different rangland management impacts various ecosystem functions and processes. [gunnar austrheim, Norway]	Accepted. You are correct Section 2.2 has been substantially revised and focuses on describing the processes at play between land and atmosphere. Changes in land management and cover are described in chapter 1, interacting land and atmosphere are described in former sections 2.4 (for GHG emissions) and 2.6 (for biophysical effects)
17105	23	35			It is worth mentionning that this increase in production occured partly because C allocation to grain increased at the expense of other organs. Because of that a smaller proportion of biomass is returned to the soil explaining part of the decrease in SOC in agricultural soils [Eric Ceschia, France]	Noted. This paragraph does not exist anymore in our chapter
32207	23	35			It is worth mentionning that this increase in production occured partly because C allocation to grain increased at the expense of other organs. Because of that a smaller proportion of biomass is returned to the soil explaining part of the decrease in SOC in agricultural soils [, France]	Noted. This paragraph does not exist anymore in our chapter

Comment No	From Page	From Line	To Page	To Line	Comment	Response
25123	23	43			Below is one early article that pointed out the large inputs of agro-chemicals resulted in large negative externalities on a global scale. Liu J., You L.Z., Amini M., Obersteiner M., Herrero M., Zehnder A.J.B., Yang H. 2010. A high-resolution assessment on global nitrogen flows in cropland. Proceedings of the National Academy of Sciences of the United States of America 107(17): 8035-8040. [Junguo Liu, China]	Noted. The section has been substantially revised and this part has been removed. However externalities are discussed in chapter 6
29831	24	10	12	24	Ths is misleading unless is compared as trade offs with resultant deforestation. [Souparna Lahiri, India]	Noted. This part of 2.2 has been merged with text in section 2.4 where it was more appropriate
38787	24	1	24	1	Blurry and stretched out figure. [, United States of America]	Noted. The figure has been removed as it is not relevant anymore to the section
5359	24	1	24	1	This figure needs to be properly referenced and described in the caption, also it should be noted that there are different maps displaying such data, and they do not entirely match, so the uncertainties and data sources should be appropriately discussed. [Helmut Haberl, Austria]	Noted. The figure has been removed as it is not relevant anymore to the section
24263	24	1	24	2	Are the land use data on the map consistent with FAOSTAT? And hence with numbers reported in the opening of the SPM? Please check. If numbers are those of FAO, please acknowledge in the text. University of Minnesota is not the official reporter of global land use data. [Francesco Tubiello, Italy]	Noted. The figure has been removed as it is not relevant anymore to the section
3213	24	1	24	2	comment on fig 2.3: in Africa and many poor countries it is often impossible to separate pasture land from forest land, it is the same land, often classified as forest on national records, but in practice used as multipurpose pasture land, so the figure map is somehow misleading [Maria Ulrika Johansson, Sweden]	Noted. The figure has been removed as it is not relevant anymore to the section
17001	24	1	24	2	The legend in Figure 2.3 contains two categories, but the graph shows more colours. Either adjust the legend to the graph or the graph to the legend. [Roland Hiederer, Italy]	Noted. The figure has been removed as it is not relevant anymore to the section
6601	24	1	24	5	We recommend to add more resolution in the figure 2.3. [, Mexico]	Noted. The figure has been removed as it is not relevant anymore to the section
3107	24	2	24	2	Fig. 2.3: colors to improve, because, e.g, northern part of Eurasia is hardly attributable either to cropland or to pasture. [, Russian Federation]	Noted. The figure has been removed as it is not relevant anymore to the section
38789	24	2	24	2	Is a figure like this allowed? It appears to be proprietary. [, United States of America]	Noted. The figure has been removed as it is not relevant anymore to the section
1763	24	2	24	2	What is the legend (explanation of the colour scale) in Fig. 2.3? The colours are not all red/brown or green. Consider this for other figures. [William Lahoz, Norway]	Noted. The figure has been removed
3257	24	4	24	4	"Enteric fermentation" may be too technial/may not be immediately obvious or known by all readers [Viola Heinrich, United Kingdom (of Great Britain and Northern Ireland)]	Noted. Former section 2.2 has been substantially revised and the discussion in this paragraph has been merged in section 2.4
17217	24	6	24	9	This Fig 2.4 is not referred to in the text. This figure is interesting but GF/A unit etc is not explained (GF -Groundwater Footprint; gw stress = use/availability etc). [Hoang Anh Le, Vietnam]	Noted. The figure has been removed as any reference to land cover and uses, maps and numbers are presented in chapter 1
38791	24	6	24	10	Perhaps change sentence to "including how climate change, variablity, and extremes influcence managed and unmanaged lands and how direct (e.g., land use change and land management) and indirect (e.g., increasing atmospehric CO2 concentration and nitrogen depostion) land changes influence the climate system on local, regional, and global scales." [, United States of America]	Noted. Former section 2.2 has been substantially revised and the discussion in this paragraph was alread included in section 2.6. Section 2.6 has thus taken on board this and has been updated
13359	24	10	24	10	The correct citation here (according to the references) would be Duveiller et al. 2018b (Nature Communications) instead of Duveiller et al 2018a (Scientific Data) [Gregory Duveiller, Italy]	Noted. This part of 2.2 was already included in 2.6 where it is more relevant. Any discussion on biophysical effects are now grouped in 2.6
8387	24	10	24	14	This fact is apparently not taken into account in bookkeeping models, which could lead to biases. [Marc Aubinet, Belgium]	This section is integrated to new 2.5

Comment No	From Page	From Line	To Page	To Line	Comment	Response
1765	24	12	24	12	“Prodigious” sounds hyperbolic. Would “extensive” be better? [William Lahoz, Norway]	Noted. This part of 2.2 has been merged with text in section 2.4 where it was more appropriate
3467	24	12	24	14	The cited references mainly focus on changes in the NDVI and LAI. Please check whether China is one of the areas experiencing the rapid agricultural LCC. [Jianqi Sun, China]	Noted. This part of 2.2 has been merged with text in section 2.4 where it was more appropriate
17003	24	13	24	13	Acronym for LCC not previously defined (LULCC is defined). [Roland Hiederer, Italy]	Editorial. You are correct those acronyms do not exist anymore in our chapter
23701	24	13	24	14	Suggest the publication that studied the winter greening trend in south Asia related to agriculture management, winter monsoon season is the dry season in south Asia, but due to increased agricultural irrigation, the vegetation are getting greener: Sarmah, S., G. Jia, A. Zhang (2018) Satellite view of seasonal greenness trends and controls in South Asia, Environmental Research Letters 13(3), 034026. [Xiyan Xu, China]	Noted. This part of 2.2 has been merged with text in section 2.4 where it was more appropriate
29011	24	19	24	19	"use" is missing after "water" [Jan Fuglestvedt, Norway]	Revised
17113	24	25	24	33	Mentionning the next two elements would allow to understand what are the main drivers of cropland C budgets : First the amount of C that is exported at harvest is the main driver of cropland C and GHG budget (see meta-analysis by Kutsch et al. 2010 ; Ceschia et al. 2010). When straw are returned to the soil, the plot is generally a C sink. If straw are exported, the plot is generally a C source (even if organic matter is returned as manure ; Ceschia et al. , 2010). Therefore reductions in biomass proportion that returns to the soil (e.g. straw) following breeding improvement affected SOC. In short, increasing harvest index (yield/total aboveground biomass) reduces the C input into the soil. Also the second driver of cropland C budget is the length of the growing period on the plot (for how long there is active vegetation on the plot) that drives the amount of net CO2 fixation (i.e the differences bewteen the amount of C absorbed by photosynthesis and the amount of C respired by the plant and the soil). The longer the plot is coved with vegetation the more CO2 uptake occurs (Ceschia et al. 2010).Therefore winter crop are usually strong CO2 sinks while summer crop are weak CO2 sinks or CO2 sources. Therefore regional changes in the proportion of summer/winter crops would affect their C budget Also cover crop that increase the lenght of vegetated period increase the amount of SOC (Poepalau & Don 2015) ref : Ceschia, E., P. Béziat, J. F. Dejoux, M. Aubinet, Ch. Bernhofer, B. Bodson, N. Buchmann, et al. 2010. “Management Effects on Net Ecosystem Carbon and GHG Budgets at European Crop Sites.” Agriculture, Ecosystems & Environment, The carbon balance of European croplands, 139 (3): 363–83. doi:10.1016/j.agee.2010.09.020. Kutsch, W. L., M. Aubinet, N. Buchmann, P. Smith, B. Osborne, W. Eugster, M. Wattenbach, et al. 2010. “The Net Biome Production of Full Crop Rotations in Europe.” Agriculture, Ecosystems & Environment, The carbon balance of European croplands, 139 (3): 336–45. doi:10.1016/j.agee.2010.07.016. [Eric Ceschia, France]	This section is integrated to new2.5

Comment No	From Page	From Line	To Page	To Line	Comment	Response
32215	24	25	24	33	Mentionning the next two elements would allow to understand what are the main drivers of cropland C budgets : First the amount of C that is exported at harvest is the main driver of cropland C and GHG budget (see meta-analysis by Kutsch et al. 2010 ; Ceschia et al. 2010). When straw are returned to the soil, the plot is generally a C sink. If straw are exported, the plot is generally a C source (even if organic matter is returned as manure ; Ceschia et al. , 2010). Therefore reductions in biomass proportion that returns to the soil (e.g. straw) following breeding improvement affected SOC. In short, increasing harvest index (yield/total aboveground biomass) reduces the C input into the soil. Also the second driver of cropland C budget is the length of the growing period on the plot (for how long there is active vegetation on the plot) that drives the amount of net CO2 fixation (i.e the differences bewteen the amount of C absorbed by photosynthesis and the amount of C respired by the plant and the soil). The longer the plot is coved with vegetation the more CO2 uptake occurs (Ceschia et al. 2010).Therefore winter crop are usually strong CO2 sinks while summer crop are weak CO2 sinks or CO2 sources. Therefore regional changes in the proportion of summer/winter crops would affect their C budget Also cover crop that increase the lenght of vegetated period increase the amount of SOC (Poepalau & Don 2015) ref : Ceschia, E., P. Béziat, J. F. Dejoux, M. Aubinet, Ch. Bernhofer, B. Bodson, N. Buchmann, et al. 2010. “Management Effects on Net Ecosystem Carbon and GHG Budgets at European Crop Sites.” Agriculture, Ecosystems & Environment, The carbon balance of European croplands, 139 (3): 363–83. doi:10.1016/j.agee.2010.09.020. Kutsch, W. L., M. Aubinet, N. Buchmann, P. Smith, B. Osborne, W. Eugster, M. Wattenbach, et al. 2010. “The Net Biome Production of Full Crop Rotations in Europe.” Agriculture, Ecosystems & Environment, The carbon balance of European croplands, 139 (3): 336–45. doi:10.1016/j.agee.2010.07.016. [, France]	This section is integrated to new2.5
22437	24	27	24	27	Carbon loss in agricultural soils is not primarily driven by tillage and overfertilisation, but largely by lower net input of carbon to soils in residues than in native vegetation. Fertilisation may even enhance carbon input and thus soil carbon [Anastasios Kentarchos, Belgium]	This section is integrated to new2.5
13361	24	27	24	27	phrase is strange: "carbon losses due to include ploughing". I suppose "include" should be removed. [Gregory Duveiller, Italy]	Accept. Editorial
17005	24	27	24	27	Change text to "carbon losses due to ploughing and tillage..." or "carbon losses due to management practices that include ploughing and tillage...". [Roland Hiederer, Italy]	This section is integrated to new2.5
19031	24	28	24	30	it is not clear if it is 25-75% of total organic carbon losses or 25-75% of soil organic carbon (in a layer 0-0.3 m or in deeper layer) [Joanna Wibig, Poland]	Accept. Sentence revised for clarity and segment about the USA removed.
3109	24	29	24	29	global agricultural regions': to explain [, Russian Federation]	Noted. This part of 2.2 has been merged with text in section 2.4 where it was more appropriate, and has been updated
2791	24	36	24	36	insert space after "water/irrigation" [Bettina Weber, Germany]	Editorial
1077	24	36	24	36	Add a space between "irrigation" and "(Hirsh ..." [Sebastiaan Luyssaert, Belgium]	Editorial
6257	24	36	24	36	Missing space before parenthesis [Tristan Quaife, United Kingdom (of Great Britain and Northern Ireland)]	Editorial

Comment No	From Page	From Line	To Page	To Line	Comment	Response
40479	24		24		section on CO2 fertilisation effect, link with water use efficiency, greening trends etc should be highlighted in ES / SPM. This is on the radar of public discussion, please provide clear assessment of the state of knowledge. [Valerie Masson-Delmotte, France]	noted- much of this section was deleted for more concise version in new Section2.7
3255	24		24		Figure 2.3: intensity scale bar missing? Either a qualitative (low, medium, high) or quantitative scale bar is needed to give the different shadings in the Figure meaning [Viola Heinrich, United Kingdom (of Great Britain and Northern Ireland)]	Noted. The figure has been removed as it is not relevant anymore to the section
18085	24	0			Figure 2.3: Only the green and brown areas are explained, but what are the yellow areas and what do the different shades of green mean? [Clemens Schwingshackl, Switzerland]	Noted. The figure has been removed as it is not relevant anymore to the section
17107	24	7			in the report most of the times the term biophysical is used instead of biogeophysical. Biogeophysical should be used throughout the manuscript as for instance changes in surface albedo following changes in land cover or management will have an effect on both vegetation and soil reflectance. [Eric Ceschia, France]	Rejected. We disagree. The term biophysical is the correct one as bioGEOphysical implies that we are also considering changes in soil 'geology' which we do not. We're trying to homogeneize the term 'biophysical' throughout the entire report
32209	24	7			in the report most of the times the term biophysical is used instead of biogeophysical. Biogeophysical should be used throughout the manuscript as for instance changes in surface albedo following changes in land cover or management will have an effect on both vegetation and soil reflectance. [, France]	Rejected. We disagree. The term biophysical is the correct one as bioGEOphysical implies that we are also considering changes in soil 'geology' which we do not. We're trying to homogeneize the term 'biophysical' throughout the entire report
17109	24	27			recent studies (e.g. Virto et al 2012) show that the effect of ploughing varies a lot depending on soil types, climate, crop rotations. Meta-analyses (Haddaway et al. 2017; Luo et al. 2010) also show mixed responses. Ploughing mainly has an effect on the vertical distribution of SOC. [Eric Ceschia, France]	This section is integrated to new2.5
32211	24	27			→ recent studies (e.g. Virto et al 2012) show that the effect of ploughing varies a lot depending on soil types, climate, crop rotations. Meta-analyses (Haddaway et al. 2017; Luo et al. 2010) also show mixed responses. Ploughing can mainly have an effect on the vertical distribution of SOC. [, France]	This section is integrated to new2.5
17111	24	28			How do you define fallow-period ? Long fallow-period do not necessarily lead to reduction in soil C loss if they are characterised by long bare soil periods (in general the plot will loose C). If on the opposite during the fallow period, le soil is covered with vegetation (e.g. cover crops), the plot will store C during the fallow period (Ceschia et al 2010 ; Justes et al 2013 : Poeplau & Don 2015). [Eric Ceschia, France]	This section is integrated to new2.5
32213	24	28			How do you define fallow-period ? Long fallow-period do not necessarily lead to reduction in soil C loss if they are characterised by long bare soil periods (in general the plot will loose C). If on the opposite during the fallow period, le soil is covered with vegetation (e.g. cover crops), the plot will store C during the fallow period (Ceschia et al 2010 ; Justes et al 2013 : Poeplau & Don 2015). [, France]	This section is integrated to new2.5
6969	24				Fig 2.3: what are the other colour categories? A map of cropland and pasture only should ideally only show those two categories. [Debra Roberts, South Africa]	Noted. The figure has been removed as it is not relevant anymore to the section
2793	25	3	25	3	insert space after "return" [Bettina Weber, Germany]	Editorial
17007	25	3	25	3	Space missing before bracket in "return(Bustamante et al. 2014". [Roland Hiederer, Italy]	Editorial
1079	25	3	25	3	Add a space between "return" and "(Bustamante …" [Sebastiaan Luyssaert, Belgium]	Editorial
6259	25	3	25	3	Missing space before parenthesis [Tristan Quaife, United Kingdom (of Great Britain and Northern Ireland)]	Editorial

Comment No	From Page	From Line	To Page	To Line	Comment	Response
23703	25	5	25	5	The study revealed the warming impact over 0.85 in the Jing-Jin-Tang urban cluster, a fast expanding urban area in the surroundings of Beijig China, suggest to add the reference: Hu, Y., G. Jia, M. Hou, Y. Liu (2015) The cumulative effects of urban expansion on land surface temperatures in metropolitan Jing-Jin-Tang, Journal of Geophysical Research: Atmosphere, 120(19), 9932-9943. [Xiyan Xu, China]	This entire sub-section has been removed from 2.2 and has been put in a cross-chapter box on urbanization and climate change.
3111	25	8	25	8	Figure 2.4 is redundant, because not referred in the text. [, Russian Federation]	Noted. The figure has been removed as it is not relevant anymore to the section
227	25	9	25	9	Please add - direct effect of agriculture, forestry, water cycle and other land …..etc H17 [Ali Geath Eljadid, Libya]	Noted. The figure has been removed as it is not relevant anymore to the section
29013	25	11	25	12	would be good to indicate sign of the strong climate forcing [Jan Fuglestvedt, Norway]	Noted. This paragraph does not exist anymore in section 2.2. Irrigation effects on climate are more substantially discussed in section 2.6.2.2
14425	25	12	25	25	Another good reference for this paragraph would be Gerken et al. (2018), which found that land use changes increased the likelihood of convective initiation in temperate regions [Benjamin Sulman, United States of America]	Rejected. This is a very interesting paper, however it does not discuss the effects of irrigation on climate
25055	25	12	25	25	This is debatable and not a strong point for climate change discussion. Compared to oceans and surface water systems, all freshwater withdrawal is tiny for exerting a strong climate forcing. There is no debate that irrigation is a major water use sector but it is a gross overstatement to link it with climate forcing. Strongly suggested to delete. Also strong evidence is necessary for "Addition of such vast amounts of water to the land surface can substantially modify regional energy and moisture balances, particularly in conjunction with highly productive agricultural crops with high rates of evapotranspiration. In general, climate studies and assessments of irrigation have sought to quantify and understand how irrigation-induced enhancements in surface latent heat fluxes can impact overall regional energy and moisture balances and interact with larger-scale atmospheric circulation processes, particularly in water-limited domains." [Binaya Shivakoti, Japan]	Accepted. This discussion has been removed from section 2.2 and there is a substantial discussion on the effects of irrigation in section 2.6.2.2. You are correct the effects are not strong on global climate, but they are substantial on local climate and downwind of the irrigated areas
22439	25	22	25	25	Not clear what the conclusion is here. Please elaborate on the last sentence. [Anastasios Kentarchos, Belgium]	Accepted. This discussion has been removed from section 2.2 and there is a substantial discussion on the effects of irrigation in section 2.6.2.2.
23729	25	22	25	25	Providing some quantitative estimates of the irrigation-induced enhancements in surface latent heat fluxes based on climate models will be useful [, India]	Accepted. This discussion has been removed from section 2.2 and there is a substantial discussion on the effects of irrigation in section 2.6.2.2.
1395	25	22	25	25	Providing some quantitative estimates of the irrigation-induced enhancements in surface latent heat fluxes based on climate models will be useful [Krishnan Raghavan, India]	Accepted. This discussion has been removed from section 2.2 and there is a substantial discussion on the effects of irrigation in section 2.6.2.2.
15337	25	25	25	25	Suggest clarifying the implications of most models not accounting for water management. For example, is it a positive or negative impact? [, Australia]	Noted. This discussion has been removed from section 2.2 and there is a substantial discussion on the effects of irrigation in section 2.6.2.2. We are essentially showing strong local impacts of irrigation and downwind. We're touching upon the errors we can make for e.g. asian monsoon when forgetting about irrigation. However we do not have a strong statement about the risks of not including irrigation in climate models.

Comment No	From Page	From Line	To Page	To Line	Comment	Response
1081	25	26	25	26	Add a new section: "2.2.8 Forest management and climate". Given the importance of forest management within the Paris Agreement and it being mentioned in the special report for 1.5 degrees, it may be worth to consider adding such a section. For an example of the content of such a section see Erb et al 2016 (doi/10.1111/gcb.13443). Erb et al 2016 discusses the biogeochemical and biophysical effects of "forestry harvest" as well as of "tree species selection". See also references in Ellison et al 2017 (doi//10.1016/j.gloenvcha.2017.01.002) [Sebastiaan Luyssaert, Belgium]	Noted. The effects of forest management are discussed in section 2.6.2.2 and 2.7
1083	25	26	25	26	A possible statement could be "An increasing body of observational and modelling studies demonstrates that forest management through changes in forest structure and species composition exerts a climate forcing (in some regions). Possible literature sources: Naudts et al 2016 (doi/10.1126/science.aad7270) presents a model based assessment of the climate effects of fores management in Europe between 1750 and 2010. Teuling et al 2017 show how changes in forest structure following a wind storm affect cloud formation (DOI/10.1038/ncomms14065). [Sebastiaan Luyssaert, Belgium]	Noted. The effects of forest management are discussed in section 2.6.2.2 and 2.7
38793	25	29	25	29	"Globally, urbanisation per se is not a direct driver of forest loss..." seems a pretty general statement not applicable to many countries (especially Annex 1 countries), and it's only supported by one source. Ideally, it would be made clear that in some countries urbanization is a direct driver of forest LUC. [, United States of America]	Noted. This sub-section has been removed from section 2.2. There is a new cross-chapter box on ubanization & climate. And you are correct, in the box we do not any more write that urbanization is a direct driver of forest loss
38795	25	29	25	30	"Globally, urbanisation per se is not a direct driver of forest loss (Curtis et al. 2018), but energy and resource demands in urban areas drive global trades and indirectly influence land-climate interactions (2.2.7)." Transportation demands might be added to the list. Growing urban centers also increase demand for transportation connections (largely road), which may open further areas to settlement and land clearing. [, United States of America]	Noted. This sub-section has been removed from section 2.2. There is a new cross-chapter box on ubanization & climate. And you are correct, in the box we do not any more write that urbanization is a direct driver of forest loss
5511	25	29	25	30	urbanisation can be both direct and indirect driver of forest loss! Why it is said not a direct driver … [Sanaz Moghim, Iran]	Noted. This sub-section has been removed from section 2.2. There is a new cross-chapter box on ubanization & climate. And you are correct, in the box we do not any more write that urbanization is a direct driver of forest loss
31887	25	34	25	34	not clear what "heat discharges" means [Martijn Slot, Netherlands]	Noted. This sub-section has been removed from section 2.2. There is a new cross-chapter box on ubanization & climate. To answer your question 'heat discharges' mean release of heat by cities from e.g. air conditioning; it is an additional source of energy that is one of the most important explaining the urban heat island
5513	25	34	25	34	does urbanisation always decrease albedo? [Sanaz Moghim, Iran]	Noted. This sub-section has been removed from section 2.2. There is a new cross-chapter box on ubanization & climate. Regarding albedo we do not anymore refer to this as it is not a major issue regarding climate-cities interactions
6603	25		25		We recommend to add more resolution in the figure 2.4. [, Mexico]	Noted. The figure has been removed
40481	25		25		We need from chapter 2 an assessment on water cycle trend relevant for other chapters (aridity, drought). Need to consolidate across chapters, multiple references to this, but no common ground in the report. Important also for key figures on anthromes at the beginning of chapter 6. Please ensure coherency on these aspects across chapters. [Valerie Masson-Delmotte, France]	Noted. I think this remark is more a general remark for chapter than a specific remark on irrigation. However we were not able to come to an assessment point with respect to the water cycle and we did not have a CA to work on that. We're hoping this will be covered by the specific chapter from AR6-WGI

Comment No	From Page	From Line	To Page	To Line	Comment	Response
7353	25	11			In central Turkey there are more than 110.000 groundwater wells and app.90.000 is illegally operated. This can be added to text. The reference for this is "Akça, E., Takashi, K., & Sato, T. (2016). Development and success, for whom and where: the central Anatolian case. In Land Restoration (pp. 533-541). Academic Press. [Erhan Akca, Turkey]	Noted. We do not discuss anymore amounts of water withdrawn in this section. This is presented in chapter 1 and chapter 5 of the report
28641	25	28		34	Globally, Urbanisation per se is not a direct drives of forest loss; I recommend a global analysis on Urbanisation, imparts ,extreme climate change and forest climate interaction, and also recommend; An integrated combating system on Urban forest loss system should be put in place for comprehensive understanding of direct driver of forest loss. Human population growth changes and growth trends leads to urbanisation which in relation to land degradation and forest loss. [Abiodun Adegoke, Nigeria]	Noted. This sub-section has been removed from section 2.2. There is a new cross-chapter box on ubanization & climate. And you are correct, in the box we do not any more write that urbanization is a direct driver of forest loss
1027	25	28			Add Ayanlade (2017) to this list in (Wang et al. 2016b; Zhong et al. 2017). Deatails are: Ayanlade, A., 2017. Variations in urban surface temperature: an assessment of land use change impacts over Lagos metropolis. Weather, 72(10), pp.315-319. [Sina Ayanlade, Nigeria]	Noted. This sub-section has been removed from section 2.2. There is a new cross-chapter box on ubanization & climate. There is a quite a longer list of cited papers in the box
6971	25				Figure 2.4: Please define the inset graph, what the unit GF/A means, i.e. why a value of 20 means the aquifer is stressed, what the "groundwater footprint" tells you? This figure is not referred to in the text. [Debra Roberts, South Africa]	Noted. The figure has been removed
1767	26	2	24	5	Rebatttu and Dupoux is capitalized here and later in the paragraph. [William Lahoz, Norway]	Editorial
1085	26	2	26	2	Check citation format (Rebattu and Dupoux instead of REBATTU and DUPOUX) [Sebastiaan Luyssaert, Belgium]	Editorial
5515	26	4	26	5	"less than 0.5 C in …" the unit for SUHI is not degree C, it is better to explain more about UHI and its relationship with temperature to clarify what this degree means. [Sanaz Moghim, Iran]	Noted. This entire sub-section has been removed from 2.2 and has been put in a cross-chapter box on urbanization and climate change. For sake of simplicity and lack of space in the box we now only discuss the UHI and not anymore the SUHI
18087	26	5	26	5	Is the result of Rebattu and Dupouy 1945 also confirmed by more recent studies? Their estimation of the UHI effect seems very large to me. [Clemens Schwingshackl, Switzerland]	Noted. This entire sub-section has been removed from 2.2 and has been put in a cross-chapter box on urbanization and climate change. We are citing a large number of recent literature
23707	26	5	26	5	Check this reference, it is supposed to be Estoque and Murayama, 2017 Monitoring surface urban heat island formation in a tropical mountain city using Landsat data (1987-2015). [Xiyan Xu, China]	Editorial. All references have now been checked
28567	26	7	26	18	urban forest can also be a large carbon store, especially where urbanization replaces grassland and agriculture. See McPherson, E.G., Q. Xiao, E. Aguaron (2013). A new approach to quantify and map carbon stored, sequestered and emissions avoided by urban forests. Landscape and Urban Planning, 120:70-84. [Alan Di Vittorio, United States of America]	This section is integrated to new2.5
22441	26	7	26	18	This section can be shortened [Anastasios Kentarchos, Belgium]	Accepted. This entire sub-section has been removed from 2.2 and has been put in a cross-chapter box on urbanization and climate change. The text has been substantially shortened, specially the part you are referring to
2221	26	7	26	18	During the process of urbanization, the conversion from natural ecosystem (e.g., forest or grassland) to urban area is not necessarily the major land use change. Sometimes, e.g., China's urban expansion from 2000-2010, the newly expanded urban area is from cropland rather than natural ecosystem. (Zhiyun Ouyang, Weihua Xu, Yi Xiao. China's ecosystem pattern quality service and evolution [M]. Beijing: Science Press, 2017.) The statement of this paragraph should be more cautious. [Fei Lu, China]	Noted. This entire sub-section has been removed from 2.2 and has been put in a cross-chapter box on urbanization and climate change. The text has been substantially shortened, specially the part you are referring to

Comment No	From Page	From Line	To Page	To Line	Comment	Response
2159	26	7	26	18	I suggest the additional reference for this line. TONOSAKI, Kochi, MURAYAMA,Katsuya,IMAI, Kazutaka, NAGINO, Yoshiaki,2013:Estimation of Soil Carbon Accumulation Rate in Urban Parks,J.Jpn.Soc. Reveget. Tech., 38(3), 373-380,(2013) Sentence to be inserted "Based on the results of a 125 sample survey from urban parks around Tokyo, the carbon accumulation rate 20 years after park establishment was about 1.2MgC/ha/year. [Kochi Tonosaki, Japan]	Noted. This entire sub-section has been removed from 2.2 and has been put in a cross-chapter box on urbanization and climate change. We have little space to discuss carbon changes and hopefully are now citing a sufficient amount of new literature
8391	26	12	26	12	This reference was not found in reference list and did not appear in Scopus. [Marc Aubinet, Belgium]	Editorial. All references have now been checked
6261	26	17	26	17	Missing space before parenthesis [Tristan Quaife, United Kingdom (of Great Britain and Northern Ireland)]	Editorial
5517	26	22	26	23	"Divergent results" not clear, change this phrase! [Sanaz Moghim, Iran]	Noted. This entire sub-section has been removed from 2.2 and has been put in a cross-chapter box on urbanization and climate change. The divergent responses referred to the absence of agreement on how urbanization affect convection
26953	26	27	26	29	The explanation of stronger urbanisation-induced precipitation in the vicinity of large water bodies needs to be extended please. [, Germany]	Noted. This entire sub-section has been removed from 2.2 and has been put in a cross-chapter box on urbanization and climate change.
29015	26	33	26	33	you may end the section 2.2 by saying that there are many known effects, mechansims and relations, but that the quantifications are difficult, the uncertaintes are larger and that many knowledge gaps exist. (Alternatively say this in the intro to 2.2) [Jan Fuglestvedt, Norway]	Noted. This entire sub-section has been removed from 2.2 and has been put in a cross-chapter box on urbanization and climate change.
2795	26	37	26	37	"equator" with small and not capital letter [Bettina Weber, Germany]	Accept. Editorial
30771	26	40	26	42	Here the authors need to point out that vegetation biomes are not solely determined by climate, and changes are not solely in response to climate change. Carvon fertilisation and fire are probably just as important. [Francois Engelbrecht, South Africa]	Accept. Text revised for clarity
17009	26	43	26	43	The term "functioning" in "Functioning within these biomes..." is isolated and a better term might be found. [Roland Hiederer, Italy]	Accept. Text revised for clarity
8393	26	46	26	46	"Madden Julian" (typo) [Marc Aubinet, Belgium]	Accept. Editorial
3379	26	47	26	49	Climate and weather extremes don't shape rather damage ecosystems at various space and time scales. [Narendra Dalei, India]	Accept. Text revised for clarity
33419	26	35	37	11	Attention is given on extreme events, changes in other statistics of climate variables and hence of the water balance is underestimated - see FAQ2.3 [Christophe Cudennec, France]	Noted. We have revised FAQ 2.3 to more appropriatly reflect responses of the water cycle to both mean and extremes.
14119	26	35	37	11	Section 2.3 focuss on the direct effects - but what about the indirect effects of climate change, including changes in the frequency of extreme events, on vegetation? Thus agricultural productivity lost to drought, flooding etc - or to a greater incidence of pests - will need to be replaced, and the spacial fix will presumably involve some further land cover changes, including replaement of "natural" vegetion. Also, what about the climate effects on farmers - e.g. in the form of an increaseed incidence of climatically sensitive infectious diseases such as malaria or schistosomiasis - that could result in changes in agricultural practices and other land cover changes, such as the drainage of wetlands? [David Taylor, Singapore]	Noted. Many of the indirect impacts of climate are assessed in Chapters 3-5, especially in Chapter 5 pertaining to agriculture. There is some mention of the impact of climate on pest activity in 2.3.4 and 2.3.5 but it is not the intention in tChapter 2 to deal with the subsequent impact on crops. The effect of climate on disease falls beyond the scope of this chapter and more correctly is discussed in Chapter 5, section 5.2.4 of the second order draft.
12807	26	55	37	11	Section 3.2 can be merged to other section on in the introduction, because subsection 2.3.2. Desertification and land degradation have own Chapter 3 and Chapter 4, respectively. Similarly, Section 2.3.4 on the influence of climate change to food security, has own Chapter (5) on Food Security. [Raden Susanto, United States of America]	Accept. Many parts of Section 2.3 have been merged with chapters 3-5 to avoid overlap.

Comment No	From Page	From Line	To Page	To Line	Comment	Response
1025	26	1			Add Ayanlade (2016) to this list in (Mohajerani et al. 2017; Phelan et al. 2015). Deatails are: Ayanlade, A. (2016). Seasonality in the daytime and night-time intensity of land surface temperature in a tropical city area. Science of the Total Environment, 557, 415-424. [Sina Ayanlade, Nigeria]	Noted. This entire sub-section has been removed from 2.2 and has been put in a cross-chapter box on urbanization and climate change. The diurnal change in surface temperature in cities is discussed and suported by relevant literature
8733	26	20			"as a results" should be "as a result". [Changxiao Li, China]	Editorial
1427	27	1	27	4	Climate change also can alter the urban land processes. Particularly, global warming is projected to constrain urbanisation in drylands through reducing carrying capacity of water resource. This viewpoint and the relevant references were recommended to add in this section. Please refer to two relevant references: Chunyang He, Yuanyuan Zhao, Qingxu Huang, Qiaofeng Zhang, Da Zhang. 2015. Alternative future analysis for assessing the potential impact of climate change on urban landscape dynamics. Science of the Total Environment, 532: 48-60. doi: 10.1016/j.scitotenv.2015.05.103 Zhifeng Liu, Yanjie Yang, Chunyang He, Mengzhao Tu. 2019. Climate change will constrain the rapid urban expansion in drylands: A scenario analysis with the zoned Land Use Scenario Dynamics-urban model. Science of the Total Environment, 651: 2772-2786. doi: 10.1016/j.scitotenv.2018.10.177 [Chunyang He, China]	Taken into account. This sentence is not concerned with urban impact but the information is now included in the section on urban impacts. There is now also a cross-chapter box on cities.
5519	27	6	27	7	"novel climates that are beyond the envelope of current natural variability" needs to be more clear! [Sanaz Moghim, Iran]	Accept. Text revised for clarity
16529	27	6	27	13	This paragraph is confusing, as it starts out very speficic (tropics, sub-tropics), then turns very general without mentioning changes in other biomes, making the main message hard to grasp. [Siri Lie Olsen, Norway]	Accept. Text revised for clarity
237	27	8	27	8	Recommend “arid and semiarid” [Matthew Petrie, United States of America]	Accept
17075	27	8	27	8	I suggest adding: Matte D., Larsen M.A.D., Christensen O.B. and Christensen J.H., (2019): Robustness and scalability of regional climate projections over Europe. Frontiers in Earth Science. accepted - In press. [Morten Andreas Dahl Larsen, Denmark]	Reject. Thanks for the very interesting reference, but it does not deal with the tropics, which is the focus of the sentence so we do not include it.
5521	27	9	27	11	unclear phrases like "disturbances beyond the range of current natural variability" and " alter the structure, composition and functioning of the system [Sanaz Moghim, Iran]	Accept. Text revised for clarity
14653	27	14	27	14	This is a low-quality global natural vegetation biome map from a North American perspective. The temperate forest area covers over many natural grasslands in southern Canada, and the temperate humid grassland biome extends far into the boreal forest of northwestern Canada. There are many other similar maps of higher quality to choose from. This map that could be used for example is: https://rmgsc.cr.usgs.gov/ecosystems/global.shtml, thought it does not have a simple color scheme and integrates climate, pathology, and land cover. The GlobCover 2009 data used in the above USGS product is simpler to map http://due.esrin.esa.int/page_globcover.php. Any maps should be in an equal area projection, especially in a report so focused on land emissions per unit area. [, Canada]	Noted. The figure has been replaced by a figure depicting bioclimates and not global natural vegetation.
13411	27	14	27	19	How can you show a map of global natural vegetation that is not separating boreal evergreen forests from temperate decidious forests? These two biomes cover wast areas and interacts completely different with climate.....Figure 2.5 must be taken out and replaced by a better one..... [Anders Bryn, Norway]	Noted. The figure has been replaced by a figure depicting bioclimates and not global natural vegetation.

Comment No	From Page	From Line	To Page	To Line	Comment	Response
16531	27	14	27	19	I am surprised that Fig. 2.5 includes a map where the temperate and boreal forests have been lumped (into "temperate forest"), as the boreal region is repeatedly referred to throughout chapter 2. [Siri Lie Olsen, Norway]	Noted. The figure has been replaced by a figure depicting bioclimates and not global natural vegetation.
26955	27	16	27	16	Figure 2.5 Global natural vegetation biomes and their spatial variability: not clear how variability is shown; the figure seems to show only the distribution of biomes at a given time? [, Germany]	Noted. The figure has been replaced by a figure depicting bioclimates and not global natural vegetation.
3113	27	16	27	16	The map indicates spatial DISTRIBUTION of the world bioms rather than spatial VARIABILITY. [, Russian Federation]	Noted. The figure has been replaced by a figure depicting bioclimates and not global natural vegetation.
8395	27	16	27	16	Spatial variability does not appear in the figure. Do you rather mean spatial extension ? [Marc Aubinet, Belgium]	Noted. The figure has been replaced by a figure depicting bioclimates and not global natural vegetation.
6263	27	16	27	16	Suggest "distribution" instead of "variability" [Tristan Quaife, United Kingdom (of Great Britain and Northern Ireland)]	Noted. The figure has been replaced by a figure depicting bioclimates and not global natural vegetation.
23705	27	16	27	16	This figure is more likely showing the spatial distribution of vegetation biomes. Not sure how the spatial variability during the period 1971-2000 is represented. [Xiyan Xu, China]	Noted. The figure has been replaced by a figure depicting bioclimates and not global natural vegetation.
22443	27	16	27	19	Decimals should be avoided here. Providing too many decimals conveys a misleading level of accuracy/certainty. [Anastasios Kentarchos, Belgium]	Noted. The figure has been replaced by a figure depicting bioclimates and not global natural vegetation.
24265	27	16	27	19	Is gang at al 2013 really the source of these data? Or rather, these authors produced a map based on either JRC or FAO land cover maps? Please cite accordingly. [Francesco Tubiello, Italy]	Noted. The figure has been replaced by a figure depicting bioclimates and not global natural vegetation.
17011	27	19	27	19	"Forest" or "forest"? The capital F is not in line with the other names. [Roland Hiederer, Italy]	Noted. The figure has been replaced by a figure depicting bioclimates and not global natural vegetation.
17289	27	22	27	23	the "desertification" dose not only occur in drylands, but also happen in semi-humid lands. Perpaps, you should dicuss the issue intersively with Chapter 3, to make sure what difination and extension of disertification is and about. [Chengyi Zhang, China]	Noted. Many parts of Section 2.3 have been merged with Chapter 3 and is now considerable shorter and more focused on the climatic drivers of desertification. This comment is addressed in this merging.
2797	27	23	27	26	"most drylands that exist along…" [Bettina Weber, Germany]	Noted. Many parts of Section 2.3 have been merged with Chapter 3 and is now considerable shorter and more focused on the climatic drivers of desertification. This comment is addressed in this merging.
8397	27	23	27	28	Sentence not clear. Too much info iun one sentence. Please rephrase. [Marc Aubinet, Belgium]	Noted. Many parts of Section 2.3 have been merged with Chapter 3 and is now considerable shorter and more focused on the climatic drivers of desertification. This comment is addressed in this merging.
8901	27	32	27	33	You may wish to differntiate between 'desertification' and 'aridification' by changing the sentence. Proposal: "… although there are uncertainties in distinguishing between climate-caused aridification and desertification." Rationale: This would support a better differentiation between climate-caused and human induced interventions and would logically lead to the following sentence on "... increase in aridity ..." This would also prevent any controversial discussions on whether climate-caused aridification can be refered to as desertification. [Jean-Luc Chotte, France]	Accept. Text revised for clarity
29019	27	33	27	33	Re "future projections show….": What scenario or level of warming? [Jan Fuglestvedt, Norway]	Accept, scenario information added.
2799	27	33	27	36	"…Noblet-Ducoudré 2017), and the extent…". I.e., insert comma after bracket [Bettina Weber, Germany]	Accept. Editorial
30773	27	35	27	36	Here the author's may want to include a reference on projected changes in drylands in Africa: "Engelbrecht C.J. and Engelbrecht F.A. (2016). Shifts in Köppen-Geiger climate zones over southern Africa in relation to key global temperature goals. Theoretical and applied climatology 123 247-261. DOI 10.1007/s00704-014-1354-1." [Francois Engelbrecht, South Africa]	Accept. Citation added, thanks.

Comment No	From Page	From Line	To Page	To Line	Comment	Response
1009	27	Fig 2	27	Fig 2	A large area o Savanna was not shown in the map, this is the 'Cerrado' in the central region of Brazil, which encompasses about 25% of the country´s territory. [Edson Leite, Brazil]	Noted. The figure has been replaced by a figure depicting bioclimates and not global natural vegetation.
1011	27	Fig 2	27	Fig 2	It would be better to consider the Brasilian northeast a semi-desert, or better still semi-arid, rather than 'savanna', wich it really isn´t. [Edson Leite, Brazil]	Noted. The figure has been replaced by a figure depicting bioclimates and not global natural vegetation.
40485	27		27		"novel climates". This is what needs to be identified here more in depth, visualized (not done in fig 2.5), communicate across chapters to check coherency, and to ES/ SPM. This idea is also developed in SROCC and this could provide a nice common approach. [Valerie Masson-Delmotte, France]	Accept. We define what is meant by "novel climate" and attach a confidence level to this.
30897	27	21	28	15	section 2.3.2 should be largely covered by reference to chapter 3 and not repeated here [Mike Morecroft, United Kingdom (of Great Britain and Northern Ireland)]	Accept. Many parts of Section 2.3 have been merged with chapters 3-5 to avoid overlap.
12809	27	21	28	15	Should be embedded into Chapter 3 and Chapter 4 [Raden Susanto, United States of America]	Accept. Many parts of Section 2.3 have been merged with chapters 3-5 to avoid overlap.
16549	27	22	28	15	It is not clear why chap. 2.3.2 is placed before the much more general chap. 2.3.3. [Siri Lie Olsen, Norway]	Noted. Many parts of Section 2.3 have been merged with Chapter 3 and is now considerable shorter and more focused on the climatic drivers of desertification. This comment is addressed in this merging.
8911	27	22	28	23	Clarify if the definition of desertification ¿Is the same definition as the UNCCD? [Jean-Luc Chotte, France]	Noted. Many parts of Section 2.3 have been merged with Chapter 3 and is now considerable shorter and more focused on the climatic drivers of desertification. This comment is addressed in this merging.
1337	27	30	28	15	In the recent study by Koutroulis, (2019) there are substantial findings for the expansion of drylands framed in terms of Global Warming Levels (1.5, 2 and 4oC according to RCP8.5) which are more suitable for policy-relevant climate impacts assessments. This study take the opportunity of availability of a new set of higher-resolutions transient climate and impacts simulations that were also supported the findings of the study referenced in the Runoff section of the SR15 and figure 3.15 from the publication (Betts, R.A. et al., 2018) The areal coverage of drylands could increase by an additional 7% of the global land surface by 2100 under high end climate change. At a 4 °C warmer world above pre-industrial, 11.2% of global land area is projected to shift towards drier types and 4.24% to wetter. Koutroulis, A. G. “Dryland changes under different levels of global warming.” Science of The Total Environment 2019, 655 (2019): 482-511. doi.org/10.1016/j.scitotenv.2018.11.215 Betts, R.A. et al., 2018: Changes in climate extremes, fresh water availability and vulnerability to food insecurity projected at 1.5°C and 2°C global warming with a higher-resolution global climate model. Philisophical Transactions Royal Society A, 376(2119), doi:http://dx.doi.org/10.1098/rsta.2016.0452. [Aristeidis Koutroulis, Greece]	Accept. Citation added, thanks.
8897	28	1	28	3	Wouldn't the conversion of to subtropical drylands be tied to increased frequency of any types of drought and not just "ecological" drought? I haven't seen ecological drought defined here. The Schlaepher reference speaks to "deep soil" drought, which also commonly refers to "agricultural" drought,. Here is a another recommended reference for ecological drought: HCrausbay, S. D., and Coauthors, 2017: Defining ecological drought for the twenty-first century. Bull. Amer. Meteor. Soc., 98, 2543–2550, https://doi.org/10.1175/BAMS-D-16-0292.1. [Jean-Luc Chotte, France]	Noted. Text altered to more generically reflect drought.
8909	28	2	28	2	Please define ''ecological drought'' [Jean-Luc Chotte, France]	Noted. Text altered to more generically reflect drought.

Comment No	From Page	From Line	To Page	To Line	Comment	Response
239	28	2	28	2	Ecological drought is defined by reduced soil moisture. Recommend changing to "...leading to reduced average soil moisture" [Matthew Petrie, United States of America]	Noted. Text altered to more generically reflect drought.
16533	28	2	28	2	The meaning of the term "ecological drought" is unclear. [Siri Lie Olsen, Norway]	Noted. Text altered to more generically reflect drought.
30775	28	3	28	3	Here the authors may want to provide a second supporting reference, which describes the same finding for subtropical southern Africa "Engelbrecht F., Adegoke J., Bopape M-J., Naidoo M., Garland R., Thatcher M., McGregor J., Katzfey J., Werner M., Ichoku C. and Gatebe C. (2015). Projections of rapidly rising surface temperatures over Africa under low mitigation. Env. Res. Letters. 10 085004." [Francois Engelbrecht, South Africa]	Accept. Citation added.
2801	28	3	28	6	"…cycles of carbon and nitrogen, are expected to shrink by ~25-40%, with negative impacts on…". I.e. please add two commas and adapt values according to publication of Rodriguez-Caballero et al., 2018. [Bettina Weber, Germany]	Noted. Section removed as the content is covered in Ch3.
11531	28	3	28	8	Revisit construction of the sentence [Lawrence Aribo, Uganda]	Noted. Section removed as the content is covered in Ch3.
30777	28	5	28	9	"Worryingly, dryland expansion has been underestimated in the historical simulations of the CMIP5 GCMs (Feng and Fu 2013) and Huang et al. (2016) estimate 56% and 50% of total land surface will be covered by drylands by 2100 under RCP8.5 and RCP4.5, respectively."Remove the word "worryingly". How do the authors know this is an underestimation? They do not provide any updated estimations, or proof for this statement. If new estimations based on peer-reviewed papers can't be provided, this statement needs to be removed from the text entirely. [Francois Engelbrecht, South Africa]	Accept. Edited and further citation added to support the statement about CMIP5 models underestimating historical dryland expansion.
18089	28	6	28	6	I would not use "worringly", but rather a more neutral word like "however". [Clemens Schwingshackl, Switzerland]	Accept. Editorial
29021	28	6	28	6	I dont think you need to use the word "worringly". The rest of the sentence should speak for itself. [Jan Fuglestvedt, Norway]	Accept. Editorial
8903	28	6	28	6	Please consider removing the term "Worryingly". Rationale: The chapter should not tend towards any judgements. [Jean-Luc Chotte, France]	Accept. Editorial
8905	28	8	28	9	After the information on the future projection of the total surfac of drylands you may wish to include a reference to chapter 3, L1-4, where estimates of the current spatial extent of drylands are provided. [Jean-Luc Chotte, France]	Accept. Reference to Ch3 added
16535	28	9	28	10	The sentence "a larger area of drylands are projected to dry earlier and more severely than humid areas" is unclear. [Siri Lie Olsen, Norway]	Noted. Section removed as the content is covered in Ch3.
6267	28	10	28	10	trailing underscore after "6.3" [Tristan Quaife, United Kingdom (of Great Britain and Northern Ireland)]	Reject. Could not find the referred to editorial error.
16537	28	11	28	12	This sentence seems misplaced. [Siri Lie Olsen, Norway]	Noted. Section removed as the content is covered in Ch3.
11533	28	13	28	13	Consider resulting instread of result [Lawrence Aribo, Uganda]	Noted. Section removed as the content is covered in Ch3.
6265	28	14	28	14	This will also lead to reduced soil organic carbon and hence a potentially significant flux of carbon to the atmosphere. [Tristan Quaife, United Kingdom (of Great Britain and Northern Ireland)]	Noted. Section removed as the content is covered in Ch3.
2803	28	18	28	18	please write "Earth" with capital letter [Bettina Weber, Germany]	Accept. Editorial
18091	28	18	28	20	This sentence is unclear to me. Does the "climate change rate lower than those projected" refer to past climate change? If so, this should be formulated more clearly [Clemens Schwingshackl, Switzerland]	Accept. Text revised
16539	28	23	28	23	Rephrase "sizes and locations of ranges". [Siri Lie Olsen, Norway]	Accept. Text revised

Comment No	From Page	From Line	To Page	To Line	Comment	Response
31889	28	25	28	25	add "Esquivel-Muelbert et al. 2019" (Esquivel-Muelbert, A., Baker, T.R., Dexter, K.G., Lewis, S.L., Brienen, R.J., Feldpausch, T.R., Lloyd, J., Monteagudo-Mendoza, A., Arroyo, L., Álvarez-Dávila, E. Higuchi, N., et al., 2019. Compositional response of Amazon forests to climate change. Global change biology, 25(1), pp.39-56.) and "Fadrique et al. 2018" (Fadrique, B., Báez, S., Duque, Á., Malizia, A., Blundo, C., Carilla, J., Osinaga-Acosta, O., Malizia, L., Silman, M., Farfán-Ríos, W. and Malhi, Y., 2018. Widespread but heterogeneous responses of Andean forests to climate change. Nature, 564(7735), p.207.) [Martijn Slot, Netherlands]	Accept. Citation added, thank you.
8927	28	27	28	27	Consider to include the reference Diffenbaugh and Field, 2013. It calculates velocity of climate change defined as distance per year that species would need to migrate to live in same temperature conditions. Citation: Diffenbaugh, N.S. and C.B. Field, 2013: Changes in Ecologically Critical Terrestrial Climate Conditions, Science, vol. 341 (6145), pp.486-492, doi: 10.1126/science.1237123. [Jean-Luc Chotte, France]	Accept. Citation added, thank you.
16543	28	27	28	29	This sentence is hard to follow without proper punctuation [Siri Lie Olsen, Norway]	Accept. Text revised
30899	28	29	28	30	there can also be range expansion at high latitudes as climate becomes newly suitable for species from lower latitudes - this is clearly happening. [Mike Morecroft, United Kingdom (of Great Britain and Northern Ireland)]	Accept. This type of range expansion is included in the paragraph.
329	28	29	28	31	this 2007 citation seems like a really old citation for this issue. Given the reductions in deforestation that have occurred in recent years in some tropical countries, like Brazil, combined with evidence fo large scale carbon fluxes related to climate related phenomenon like el nino/la nina, and other factors, it seems a strong statement to conclude that the largest effects in the tropics will be related to land use change Further, degradation need not be a land use change phenonmenon and could be really important for biodiversity. [Brent Sohngen, United States of America]	Accept. Sentence has been removed
38797	28	29	28	31	This 2007 citation seems really old for this issue. Given the reductions in deforestation that have occurred in recent years in some tropical countries, like Brazil, combined with evidence of large-scale carbon fluxes related to climate-related phenomenon like El Niño/La Nina, and other factors, it seems a strong statement to conclude that the largest effects in the tropics will be related to land-use change. Further, degradation need not be a land-use change phenomenon and could be really important for biodiversity. [, United States of America]	Accept. Sentence has been removed
30901	28	30	28	31	it is true that land conversion has had a bigger impact up to now, but this is not necessarily the case in future e.g. with desertification and sea level rise. Also land conversion depends on policy choices, [Mike Morecroft, United Kingdom (of Great Britain and Northern Ireland)]	Accept. Sentence has been removed
13413	28	31	28	34	This sentence should be split into two. The sentence is not logical. Abandoned land use is not favouring the progress of thermophilic species. Write two seperate sentences; One about forest expansion following abandoned land use and climate change (discusse by Bryn & Potter 2018 in Landscape Ecology: Elevational treeline and forest line dynamics..). And another sentence about climate change and expansion of thermophilic species. [Anders Bryn, Norway]	Accept. Text revised for clarity
24723	28	31	28	34	Speed, J.D.M., Austrheim, G., Hester, A.J. & Mysterud, A. (2010) Experimental evidence for herbivore limitation of the treeline. Ecology 91: 3414-3420. [gunnar austrheim, Norway]	Noted. However the reference to herbivore limitation of the tree line has been removed as this was not a climate limiting factor
24725	28	31	28	34	See line above; this study shows that the managment of livestock density also controls the forest expansion at higher elevation [gunnar austrheim, Norway]	Noted. However the reference to herbivore limittion of the tree line has been removed as this wisas not a climate limiting factor

Comment No	From Page	From Line	To Page	To Line	Comment	Response
17299	28	31	28	34	This sentence should also focus on polarward expansion of forest, not only on altitudinal expansion. [Jarle W. Bjerke, Norway]	Accept. Text revised to include this latitudinal aspect
16545	28	33	28	34	Consider citing Gottfried et al. (2012), Nature Climate Change, regarding thermophilization of vegetation at high elevations. [Siri Lie Olsen, Norway]	Accept. Citation added, thank you.
17301	28	34	28	36	Drought is only one of numerous potential stressful factors that can limit altitudinal and/or poleward expansion of forest. Increasing frequency of frost events during the growing season is one important factor. Snow ablation, heavy snow causing branch and crown break-off, other types of pests (see e.g. the many reports on defoliation caused by larvae of geometrid moths in the expanding birch forest of norhernmost Scandinavia), and herbivory from alpine mammalian herbivores, are other factors potentially reducing the expansion of forest. [Jarle W. Bjerke, Norway]	Noted. The sentence was refering to temperate drylands and not forest. This was unclear and has been changed to reflect this more clearly.
16547	28	34	28	36	As far as I understand, the Tietjen et al. (2017) paper only consider temperate drylands, which should be specified in this sentence. [Siri Lie Olsen, Norway]	Accept. Text revised for clarity as suggested
8399	28	38	28	42	This sounds strange in view of the large deforestation observed notably in Amazonia. It would maybe necessary to recall that refers only to the remaining forest and is totally independent of the forest surface decrease due to deforestation. [Marc Aubinet, Belgium]	Noted. However greening/browining is not only due to activities forested regions. New text that is based on a new study highlights this.
675	28	41	28	41	Here you could also reference to Forzieri et al. 2017 http://www.sciencemag.org/lookup/doi/10.1126/science.aal1727 [Anna Sörensson, Argentina]	Accept. Citation added, thank you.
17321	28	41	28	46	The CO2 fertilization hypothesis is challenged in a recent study that will appear in Nature Sustainability soon (early 2019). It shows that the two major reasons for an overall greening of the earth are afforestation programs in China and increasing use of fertilizers on croplands in India. When this study is published, it should be given much emphasis in this report [Jarle W. Bjerke, Norway]	Accept. With thanks. The results from this paper have been included in the text.
23741	28	42	28	42	As far as India is concerned there is no such study which highlighted the greening due to CO2 fertilisation, if there is any such study carried out with reference to India need to be mentioned . [, India]	Accept. Citation added, thank you.
19025	28	42	28	42	It is suggested a related study for India may be cited here: Revadekar et al. (2012) documented the significant impact of interannual variability of seasonal and monthly temperature and rainfall on the NDVI over the Indian region. The NDVI derived from the AVHRR during 1981–2000, and the MODIS Aqua data during 2000–2010) were used in this analysis (J. V. Revadekar, Yogesh K. Tiwari & K. Ravi Kumar (2012): Impact of climate variability on NDVI over the Indian region during 1981–2010, International Journal of Remote Sensing, 33:22, 7132-7150, http://dx.doi.org/10.1080/01431161.2012.697642) [Sanjay Jayanarayanan, India]	Accept. Citation added, thank you.
16541	28	43	28	45	This sentence should further emphasize that climate change is indeed the major driving force behind the greeing in the extensive high latitude areas. [Siri Lie Olsen, Norway]	Accept. Text revised for emphasis as suggested
18137	28	46	28	48	"Within the global greening trend […](browning)[…]largely a result of intensified drought stress" : add something about insects/diseases infestation + extreme weather events to explain browning (VERBYLA, David. The greening and browning of Alaska based on 1982–2003 satellite data. Global Ecology and Biogeography, 2008, vol. 17, no 4, p. 547-555.; EPSTEIN, Howard E., BHATT, Uma Suren, WALKER, Donald A., et al. Arctic Tundra Greening and Browning at Circumpolar and Regional Scales. In : AGU Fall Meeting Abstracts. 2017.) [Romain Courault, France]	Accept. Verbyla citation added, thank you. We cannot cite AGU abstracts.

Comment No	From Page	From Line	To Page	To Line	Comment	Response
17323	28	46	28	50	A topic with steadily new data appearing. In this context, the papers by de Jong et al. and Fensholt et al. from 2012 is almost outdated. For example, for the arctic regions, the section on tundra greenness in the annual Arctic Report Card should be cited. It shows that in recent years, the tundra has had years of declining NDVI. Extreme climatic events may be an important driver of this decline. A recent study, to be published soon in Nature Sustainability, will provide an update on global greening trends and reasons for this trend. Authors should check out this study as soon as it is published. [Jarle W. Bjerke, Norway]	Accept. With thanks. The results from this paper have been included in the text.
2223	28	18	29	15	It is suggested to include the latest research results about global vegetation greening and browning by Pan, et al., 2018, and add the following information to this part. Research based on the comparison of different methods revealed that the greening trends is turning weak since 1990s, and the vegetation growth increment decreased to 50% of that of 1980s or less; meanwhile, the browning speed up by two times from 1982 to 2013. (Pan, et al., 2018. Increasing global vegetation browning hidden in overall vegetation greening: Insights from time-varying trends. Remote Sensing of Environment, 214, 59-72) [Fei Lu, China]	Accept. The general theme of a slowdown in greening and a speed up of browning is conveyed in the text. A further sentence section has been added to convey the increased rate of browning. The section on greening/browning has been moved to section 2.2 as it is thought to fit more properly under the process section.
15807	28	38	29	4	Please add a comment about the fact that greening/browing, even if good indicators of carbon sequestration, are not, alone, especially greening, an indicator of ecosytems "heath". In Sahel, greening comes also with loss of tree diversity and sometimes also loss of tree cover. [Caroline Vincke, Belgium]	Accept. Information with citation added.
16653	28	48	29	4	The emphasis on browning in this paragraph and page 19, line 25-33 does not seem to match. [Siri Lie Olsen, Norway]	Noted. Text on the referred page and line refers to observed increases in global greening, which is also reported here. The text in this section notes regional browning increases, not global greening decreases.
14033	28	17			This section on climate effects on ecosystems should bring out the fact that ecosystems, especially range changes, can take many years to fully manifest for a given change in climate. Jones et al (2009; Nature Geosci.) introduced this concept of “committed ecosystem changes”, and showed in Jones et al (2010; Tellus) that the timescales differ for high and low latitudes. Recently Pugh et al. (2018; Earths Future) quantified the effect of this on carbon storage for a wide range of land models and future climates [Chris Jones, United Kingdom (of Great Britain and Northern Ireland)]	Accept. Text revised to include this longer-term aspect of climate change impact on ecosystems in the section on greening and browning.
3309	28	18			Change "Previous IPCC AR5 reported" to "Previously, the IPCC AR5 reported..." (?) [Viola Heinrich, United Kingdom (of Great Britain and Northern Ireland)]	Accept. Text revised.
13415	29	1	29	4	Strange conclusion. I would say that vegetation productivity would be expected to increase as a results first of all because of higher summer temperatures. These systems are regulated by summer temperature.... This has e.g. been shown for shrubs by Myers-Smith IH, Elmendorf SC, Beck PSA et al. (2015) Climate sensitivity of shrub growth across the tundra biome. Nature Climate Change, 5, 887–891. [Anders Bryn, Norway]	Noted. The conclusion is for lower latitude areas which was not clear in the text. The sentence has been clarified to reflect the different potential responses in different latitudinal bands.
16551	29	2	29	4	What about increased growing season temperatures? [Siri Lie Olsen, Norway]	Accept. Text revised to include this aspect
2805	29	6	29	7	"…in the atmosphere have both…". I.e., "have" instead of "has". [Bettina Weber, Germany]	Accept. Editorial

Comment No	From Page	From Line	To Page	To Line	Comment	Response
331	29	6	29	15	You are missing an important indirect effect related to forest management. If carbon fertilization enhances NPP, it will change growth rates and shift incentives for management. The resulting changes in prices will have effects on managed and unmanaged forests. These market level effects have been modeled in many economic studies, such as Tian et al (Environmental Research Letters, 2016) and Tian et al (Land Economics, 2018). [Brent Sohngen, United States of America]	Accept. We have added that forest management practices may be affected as a result of NPP change. We have not added the citation as it falls beyond the scope of this section and chapter.
38799	29	6	29	15	This paragraph (and throughout this chapter) the important role of forest management is omitted and should be included, with climate change enhancing carbon fertilization in increasing NPP and growth rate. All this in turn changes management incentives. Market and price changes affect forest management. These interactions have been evaluated in various economic studies, including Tian et al. (Environmental Research Letters, 2016) and Tian et al. (Land Economics, 2018). [, United States of America]	Accept. We have added that forest management practices may be affected as a result of NPP change. We have not added the citation as it falls beyond the scope of this section and chapter.
38801	29	6	29	15	An important indirect effect related to forest management is missing. If carbon fertilization enhances NPP, it will change growth rates and shift incentives for management. The resulting changes in prices will have effects on managed and unmanaged forests. These market level effects have been modeled in many economic studies, such as Tian et al. (Environmental Research Letters, 2016) and Tian et al. (Land Economics, 2018). [, United States of America]	Accept. We have added that forest management practices may be affected as a result of NPP change. We have not added the citation as it falls beyond the scope of this section and chapter.
6911	29	8	29	11	"rain-fed cropping systems will benefit from elevated atmospheric CO2 concentrations" ---> "rain-fed cropping systems and grasslands will benefit from elevated atmospheric CO2 concentrations" : Chang, J., P. Ciais, N. Viovy, J.-F. Soussana, K. Klumpp, and B. Sultan, 2017: Future productivity and phenology changes in European grasslands for different warming levels: implications for grassland management and carbon balance. Carbon Balance Manag., 12, 11, doi:10.1186/s13021-017-0079-8. http://cbmjournal.springeropen.com/articles/10.1186/s13021-017-0079-8 [Georgii Alexandrov, Russian Federation]	Accept. Text altered and citation added
34049	29	17	29	22	Specify here which aspects of food security are dealt here, and which ones elsewhere. It is unclear what is done here, what is done e.g. in 5.2.3.1 [Elke Stehfest, Netherlands]	Accept. As there is much overlap in this section with Chapter 5 we have reduced the overlapping content and focused on climate variables that impact food security. We now state this in the first paragraph of the section
5523	29	18	29	20	"is a function of:" I am not sure if we can separate these groups since they are liked, temperature, rainfall, soil fertility, crop, ..they are all dependent, why it said climatic factor? And non-climate factors? [Sanaz Moghim, Iran]	Noted. As a result of a restructuring of this section the sentence has been removed.
24737	29	24	29	25	Reference is needed [Mark Owidhi, Kenya]	Accept. Chapter 5 is referenced.
15269	29	28	29	32	it is northward expansion in the northern hemisphere [Joalane Marunye, Lesotho]	Accept. Thanks for catching this.
8401	29	29	29	29	Is it correct that lengthening of seasons reduces frost damages? In temperate regions, a more precocious vegetation start or flowering increases the risk of damages due to late frosts. Ref (among others) Meier, M., Fuhrer, J. & Holzkämper, A. Int J Biometeorol (2018) 62: 991. https://doi.org/10.1007/s00484-018-1501-y [Marc Aubinet, Belgium]	Accept. This has been clarified. Thank you.
15711	29	29	29	36	As a result of the ascending trend of temperature and the warming up, Failure to supply the chilling requirement is one of the main problems in horticultural crops in mid-latitudes [, Iran]	Accept. There is now a sentence that now mentions chill units

Comment No	From Page	From Line	To Page	To Line	Comment	Response
38803	29	38	29	41	"The negative impacts of climate change on crop yields may be particularly pronounced in the sub-tropics, tropics, and water-limited environments as rainfall variability increases, drought severity is enhanced, and growing season temperatures rise (Parry et al. 2004; IFPRI 2009; Schlenker and Lobell 2010; Müller 2011)." Consider whether high altitude environments may also experience pronounced negative impacts on crop yields. See Challinor et al. (2014) and Müller et al. (2017). [, United States of America]	Accept. This has been added to the sentence with citations
15713	29	32	30	34	Climate change is both spatially and temporally affecting the performance of crop products, thus causing spatial variations of the cultivated pattern (evaluation of the changes in planting pattern([, Iran]	Noted. The regional nature of the impact is mentioned here in the first paragraph as well as in Chapter 5.
30779	29	17	31	9	Here the authors need to add some cross-references to Section 3.4.6.1 and 3.4.6.2 of SR1.5, and they need to carefully cross-check the two sections for consistency. It is a concern that there are no cross-references to SR1.5 in this section, despite the author's intention (stated earlied in the Chapter) to do so. [Francois Engelbrecht, South Africa]	Accept. As there is much overlap in this section with Chapter 5 we have reduced the overlapping content and focused on climate variables that impact food security.
29023	29	17	31	9	Is section 2.3.4 needed here? (Given a separate chapter on this). Shorten? [Jan Fuglestvedt, Norway]	Accept. As there is much overlap in this section with Chapter 5 we have reduced the overlapping content and focused on climate variables that impact food security.
1675	29	17	31	9	This section described the individual impact of the increase in CO2 concentration, high temperature and drought on plant productivity in detail. However, there were no detail descriptions on the interaction of the increase in CO2 concentration, high temperature and drought. I suggested the authors should add the content. [Jing Wang, China]	Noted. This is addressed in Chapter 5 so we do not do this here.
30903	29	17	31	9	Food security should be covered in chapter 5 and simply cross referenced here [Mike Morecroft, United Kingdom (of Great Britain and Northern Ireland)]	Accept. As there is much overlap in this section with Chapter 5 we have reduced the overlapping content and focused on climate variables that impact food security.
12811	29	17	31	9	Should be embedded into Chapter 5 [Raden Susanto, United States of America]	Accept. As there is much overlap in this section with Chapter 5 we have reduced the overlapping content and focused on climate variables that impact food security.
26137	29	17	31	9	This section should include a discussion of the effects of higher CO2 levels on the nutritional value of crops - reflected elsewhere in this report. See the research by Myers et al., for example, at https://ccafs.cgiar.org/news/how-climate-change-impacts-concentration-key-nutrients-crops#.XDZldlxKiUk [Reid Detchon, United States of America]	Noted. This is addressed in Chapter 5.
17013	30	4	30	4	The term "outstanding" leads to an ambiguous meaning of the sentence. Could one replace it with another term, such as notable?.. [Roland Hiederer, Italy]	Noted. As there is much overlap in this section with Chapter 5 we have reduced the overlapping content and focused on climate variables that impact food security. This paragraph has been removed in the process of minimizing ovelap
16553	30	4	30	6	Are there any evidence suggesting to which degree CO2 fertilization may counteract temperature-driven yield losses? [Siri Lie Olsen, Norway]	Noted,. This is addressed in Chapter 5, Section 5.2.2.2.
3115	30	7	30	7	Here and throughout the chapter, temperature changes should be described more concrete, namely, annual, seasonal, etc. [, Russian Federation]	Accept. This has been done.
2523	30	17	30	17	"simulations" [Wei Li, France]	Accept. Editorial
3383	30	20	30	20	a consistent increase of SUHI has been confirmed-> A consistent increase of SUHI with urban growth [Yuyu Zhou, United States of America]	Reject. We could not find text this comment refers to
2807	30	22	30	22	"Climate change-induced temperature increase, water…". [Bettina Weber, Germany]	Noted. This section has substantial overlap with Chapter 5 and livestock is considered in a number of sections of this chapter. We therefore have removed the sentence this comment referes to.
22445	30	33	30	33	Not only animal species, also difference races of species differ [Anastasios Kentarchos, Belgium]	Noted. This section has substantial overlap with Chapter 5 and livestock is considered in a number of sections of this chapter. We therefore have removed the sentence this comment referes to.

Comment No	From Page	From Line	To Page	To Line	Comment	Response
3385	30	34	30	34	earth system models -> Earth system models [Yuyu Zhou, United States of America]	Reject. We could not find text this comment refers to
16555	30	38	30	41	But many areas are expected to become drier, not more humid? [Siri Lie Olsen, Norway]	Noted. As a result of a restructuring of this section the sentence has been removed.
3387	30	43	30	43	some -> some studies [Yuyu Zhou, United States of America]	Reject. We could not find text this comment refers to
3389	30	47	30	47	"increases in short-duration heavy rain is observed but less so compared to surrounding rural areas" not clear [Yuyu Zhou, United States of America]	Reject. We could not find text this comment refers to
7517	30	48	30	51	Maintaining cold chains is important to reduce food waste and promote food security; improving cold chains should involve promoting energy efficiency (and efficiency within the system) as well as limiting greenhouse gas emissions through utilizing low-GWP refrigerants. See Sustainable Energy for All (2018) Chilling Prospects: Providing Sustainable Cooling for All; and Birmingham Energy Institute, University of Birmingham (2018) A Cool World: Defining the Energy Conundrum of Cooling for All; see also Carvalho S., et al. (2014) Alternatives to High-GWP Hydrofluorocarbons. [Durwood Zaelke, United States of America]	Noted. However it is beyong the scope of this chapter to sidcuss cold chains.
7597	30	48	30	51	Maintaining cold chains is important to reduce food waste and promote food security; improving cold chains should involve promoting energy efficiency (and efficiency within the system) as well as limiting greenhouse gas emissions through utilizing low-GWP refrigerants. See Sustainable Energy for All (2018) Chilling Prospects: Providing Sustainable Cooling for All; and Birmingham Energy Institute, University of Birmingham (2018) A Cool World: Defining the Energy Conundrum of Cooling for All; see also Carvalho S., et al. (2014) Alternatives to High-GWP Hydrofluorocarbons. [Kristin Campbell, United States of America]	Noted. However it is beyong the scope of this chapter to sidcuss cold chains.
16557	30	48	30	51	it is not clear whether "increased adoption of cold chains" is considered a solution or a challenge. [Siri Lie Olsen, Norway]	Noted. We have removed the discussion of cold chains here as the subject is discussed in a number of sections of Chapter 5
23709	30	22	31	9	These paragraphs about climate change and livestock, food storage, trade, etc. are more like a framing of climate change and food security, rather than the physical process of climate and food. [Xiyan Xu, China]	Accept. This section has substantial overlap with Chapter 5 and livestock is considered in a number of sections of this chapter. We therefore have removed the sentence this comment referes to.
241	31	12	31	12	Recommend changing to: “upper or lower statistical extrema” [Matthew Petrie, United States of America]	Noted. "statistical tails" used instead of "statistical extrema"
1087	31	12	31	30	Consider citing Millar and Stepheson 2015 (doi/10.1126/science.aaa9933) in this section and its subsections. I consider this one of the more insightfull reviews on the topic. [Sebastiaan Luyssaert, Belgium]	Accept. Citation added with requisite text, thank you.
5525	31	14	31	15	why it said "relatively short-lived weather events" for instance, think about frost events [Sanaz Moghim, Iran]	Accept. "frost events" removed.
1013	31	15	31	15	I think it would be better say '... extreme thunderstorms and rain, frost events...' [Edson Leite, Brazil]	Accept. "frost events" has been removed.
30785	31	16	31	16	"Recent IPCC reports" - the authors need to be more specific and explicitly refer to the findings of Chapter 3 of SR1.5 [Francois Engelbrecht, South Africa]	Accept. Citation added, thank you.
17015	31	16	31	16	Not so recent reports. Suggested to remove the term "recent" or find suitable recently published articles. [Roland Hiederer, Italy]	Accept. Editorial
5527	31	16	31	16	why it said "non-extreme climate events like floods, heat waves, drought" they are extreme weather! [Sanaz Moghim, Iran]	Accept, these are removed
29025	31	16	31	18	Not very recent. I suggets you change to "previous". But you may add SR1.5 here. [Jan Fuglestvedt, Norway]	Accept. Citation added, thank you.
16559	31	19	31	19	Dense, long-lived networks of what? [Siri Lie Olsen, Norway]	Accept. Editorial

Comment No	From Page	From Line	To Page	To Line	Comment	Response
15809	31	23	31	24	See Gutschick and Bassirirad 2003 New Phytologist for a more complete definition of an Extreme event, either abiotic or biotic. [Caroline Vincke, Belgium]	Noted. We use standard climate definitions of extremes that have been used in previous IPCC reports such as the Special report on extremes (SREX - Managing the Risks of Extreme Events and Disasters to Advance Climate Change Adaptation) and AR5.
16561	31	24	31	29	It would be informative to provide an example of such a "compound event". [Siri Lie Olsen, Norway]	Accept. Example added.
15811	31	29	31	30	complete the sentence by "…and also because of the rarity of the extreme climatic event which renders the analysis of impacts difficult". [Caroline Vincke, Belgium]	Accept. Text added
29031	31	11	37	11	Past and future are discussed in a mix that is sometimes a bit confusing. Would be good if you could make the perspectives clearer. [Jan Fuglestvedt, Norway]	Accept. This is not always possible but we have tried to make it clearer when past and future are discussed.
40493	31		37		This section (2.3.5) could be more explicit about different scenarios and levels of warming, and associated changes in climate extremes (as hazards). It is important to check the coherency of this section with other chapters. A few elements on ENSO (in coherency with SROCC) and storms would be needed as different chapters repeat earlier assessments (cf SR15) and may not be consistent with SROCC. Could chapter 2 do that? I am not sure that Figure 2.6 is fully relevant for this report (please check). REfer to SROCC for marine heat waves. [Valerie Masson-Delmotte, France]	Accept. We have checked for consistency with SR15 and chapters within this special report (particularly chapters 3 and 5). Mention of marine heat waves have been removed and the section that talks about projected extreme ENSO events is a common message in the literature
3357	32	1	32	7	Fig.2.6 shows marine heatwave and SST anomalies in red color fonts, but the text does not tell anything about marine heatwave? As we know, the marine heatwave is different from heat wave in land. As for SST anomalies, the text mentions that link to remote SST forcing such as PDO, AMO, ENSO (Page 33, Line 15-18). How could we understand that this kind of natural variabilities of SST anomalies belong to Extreme climate events? The authors mention the extreme ENSO events such as 1997/1998 El Nino. I am wondering if the authors should give the definition of that? [Rongshuo Cai, China]	Noted. It is not the intension to discuss marine heat waves here as this phenomena is addressed in the IPCC Special report on Oceans and Cryosphere in a Changing Climate (SROCC).
16563	32	1	32	7	What does black labels (not red or blue) indicate, for instance "drought"? No change in frequency or intensity? [Siri Lie Olsen, Norway]	Accept. Non-bold black text like "drought" indicate there is low confidence in observed changes in these phenomena according to this paper. We make this more explicit in the caption.
3117	32	2	32	2	'Extreme climatic events' is slightly misleading term. Climate, by definition, reflects long-term (decades) statistical characteristics of weather. Therefore, hourly, daily and weekly extreme events cannot be considered as climatic, but just weather extremes. They become 'climaric', when we consider their frequency over long time periods. Suggestion: reconsider terminology. [, Russian Federation]	Accept. Terminology revised to "weather and climate event" as the time axis spans both weather and climate time scales. Furthermore, the term "extreme climate event" is used frequently within the applied ecology community so is retained here.
16565	32	10	32	11	What are considered "cold" and "warm" daysand nights? Colder and warmer than normal? [Siri Lie Olsen, Norway]	Noted. The citations, which include the IPCC Special Report on Extremes, unpack these meanings.
16567	32	13	32	16	This sentence is hard to follow. [Siri Lie Olsen, Norway]	Accept. Sentence modified for clarity.
31891	32	18	32	18	delete "global" [Martijn Slot, Netherlands]	Accept. Editorial
29027	32	20	32	27	I think this para needs to be more nuanced. And you need to say for which scenarios instead of just "projected" [Jan Fuglestvedt, Norway]	Noted. Sentence altered for clarity.

Comment No	From Page	From Line	To Page	To Line	Comment	Response
19003	32	29	32	30	Additional reference may be cited: Ramarao et al. (2016) showed that the intraseasonal variations of the Indian monsoon precipitation controlled the land-climate coupling by modulating the soil moisture variations, which resulted in sub-seasonal warmer surface air temperature anomalies during drier soil conditions associated with break spells in the Indian summer monsoon precipitation. This study used the multi-model analysis of land surface states and fluxes available from the Second Global Soil Wetness Project (GSWP-2) for understanding the mechanism for this soil moisture-temperature coupling on sub-seasonal timescales. Strong coupling mainly occurred during dry soil states within the summer monsoon season over the transition zones between wet and dry climates of central to north-west India. In contrast, the coupling was weak for constantly wet and energy-limited evaporative regimes over eastern India during the entire summer monsoon season. This observational based analysis provided a better understanding of the linkages between the sub-seasonal dry soil states and warm conditions during the Indian summer monsoon season (Ramarao, M.V.S., J. Sanjay and R. Krishnan, 2016, Modulation of summer monsoon sub-seasonal surface air temperature over India by soil moisture - temperature coupling. Mausam, 67, 53-66). [Sanjay Jayanarayanan, India]	Accept. Citation added, thank you.
23891	32	29	32	31	A related study may be cited here. Ramarao et al. (2016) showed that the intraseasonal variations of the Indian monsoon precipitation controlled the land-climate coupling by modulating the soil moisture variations, which resulted in sub-seasonal warmer surface air temperature anomalies during drier soil conditions associated with break spells in the Indian summer monsoon precipitation. This study used the multi-model analysis of land surface states and fluxes available from the Second Global Soil Wetness Project (GSWP-2) for understanding the mechanism for this soil moisture-temperature coupling on sub-seasonal timescales. Strong coupling mainly occurred during dry soil states within the summer monsoon season over the transition zones between wet and dry climates of central to north-west India. In contrast, the coupling was weak for constantly wet and energy-limited evaporative regimes over eastern India during the entire summer monsoon season. This observational based analysis provided a better understanding of the linkages between the sub-seasonal dry soil states and warm conditions during the Indian summer monsoon season (Ramarao, M.V.S., J. Sanjay and R. Krishnan, 2016, Modulation of summer monsoon sub-seasonal surface air temperature over India by soil moisture - temperature coupling. Mausam, 67, 53-66). [, India]	Accept. Citation added, thank you.
16569	33	1	33	2	Is this entire quote necessary? [Siri Lie Olsen, Norway]	Accept. Removed and citation added in the next sentence.
15813	33	11	33	13	add "…by muti year drought and their legacy effects". [Caroline Vincke, Belgium]	Accept. Added.
1639	33	16	33	16	Add 'sea-surface temperature before the acronym SST. [Edson Leite, Brazil]	Accept. Added.
6741	33	18	33	18	The widening of the dry season in southern Amazonia due to long term variability in the Atlantic could be taken into account : Espinoza JC., Ronchail J., Marengo JA., Segura H. 2018. Contrasting North–South changes in Amazon wet-day and dry-day frequency and related atmospheric features (1981–2017). Climate Dynamics. doi: 10.1007/s00382-018-4462-2 [Josyane Ronchail, France]	Accept. Citation added, thank you.

Comment No	From Page	From Line	To Page	To Line	Comment	Response
677	33	18	33	21	This sentence only mentions one study that attributes drought severity to anthropogenic factors, please consider the following studies showing anthropogenic influence on African droughts: Yuan et al (2018) doi:10.1175/BAMS-D-17-0118.1; Funk et al (2018), doi:10.1175/BAMS-D-17-0112.1 [Anna Sörensson, Argentina]	Accept. Citation added with requisite text, thank you.
8913	33	21	33	21	Clarify the term ''anthropogenic warming'' [Jean-Luc Chotte, France]	Accept. "due to greenhouse gas emissions" added.
11535	33	21	33	26	Revisit the sentence to improve under standing, especislly the last phrase [Lawrence Aribo, Uganda]	Accept. Sentence altered for clarity
22447	33	28	33	28	Sentence needs revision. "this" could be replaced by "the above factors". [Anastasios Kentarchos, Belgium]	Accept. "natural variability" added.
16571	33	28	33	28	What does "this" refer to? [Siri Lie Olsen, Norway]	Accept. "natural variability" added.
13767	33	28	33	31	This phrase is not clear [Moira Doyle, Argentina]	Accept. Sentence altered for clarity
681	33	31	33	36	There are also evidence of regional trends of longer dry periods in Southern Amazon during the last 35 years. Please see Espinoza et al. 2018 https://doi.org/10.1007/s00382-018-4462-2 and Fu et al. (2013) https://doi.org/10.1073/pnas.1302584110. Espinoza et al. (2018) also point at an increse in wet day frequency in northern Amazonia. [Anna Sörensson, Argentina]	Accept. Citation added with requisite text, thank you.
18267	33	31	33	40	I suggested to add some recents results showing the impact of NAO on the frequency and intensity of drought in Southern Europe and Northern Africa [khadija Kabidi, Morocco]	Accept. Citation added with requisite text, thank you.
23731	33	36	33	36	Ref: Ramarao M.V.S. et al. (2018): On observed aridity changes over the semiarid regions of India in a warming climate could be a relevant reference to include. The reference focusses on theoretical and Applied Climatology. https://doi.org/10.1007/s00704-018-2513. Ramarao et al. (2018) made quantitative assessment of observed aridity variations over the semiarid regions of India during the period 1951–2005 using multiple observed gridded precipitation data sets. They noted that precipitation variations over the semiarid regions of India are outpacing the changes in potential evapotranspiration, resulting in an expansion of the area of the semiarid regions by about 10% during recent decades relative to earlier decades. [, India]	Accept. Citation added with requisite text, thank you.
1397	33	36	33	36	Ramarao et al. (2018) made quantitative assessment of observed aridity variations over the semiarid regions of India during the period 1951–2005 using multiple observed gridded precipitation data sets. They noted that precipitation variations over the semiarid regions of India are outpacing the changes in potential evapotranspiration, resulting in an expansion of the area of the semiarid regions by about 10% during recent decades relative to earlier decades. Ref: Ramarao M.V.S. et al. (2018): On observed aridity changes over the semiarid regions of India in a warming climate. Theoretical and Applied Climatology. https://doi.org/10.1007/s00704-018-2513 [Krishnan Raghavan, India]	Accept. Citation added with requisite text, thank you.
679	33	36	33	40	In this sentence you present studies that attribute drought events to climate change. Why is this information not combined with the information given in the previous paragraph lines 18-33? As for now the two paragraphs (15-26 and 28-40) are giving the same message which seems a bit redundant. [Anna Sörensson, Argentina]	Accept. This information is now included in the previous paragraph
8915	33	37	33	37	Clarify or give examples realted to ''identified a climate change fingerprint in several regional droughts'' [Jean-Luc Chotte, France]	Accept. This section has been incorporated into a section above where there are refeences to a number of examples in which there has been reported a climate change fingerprint.
16573	33	39	33	40	Is it possible to provide a reference for the last statement? [Siri Lie Olsen, Norway]	Noted. This section has been incorporated into an above section where there are citations.

Comment No	From Page	From Line	To Page	To Line	Comment	Response
1405	33	40	33	40	Ramarao et al. (2015) Earth Syst. Dynam., 6, 569-582, 2015 https://doi.org/10.5194/esd-6-569-2015 would be a relevant reference. The authors reported that the land surface response to decrease of soil moisture and monsoon precipitation over the Indian region, in a changing climate, leads to detectable reductions in evapotranspiration and associated surface warming. This study is a climate change detection and attribution study using a high-resolution climate model. [Krishnan Raghavan, India]	Accept. Citation added with requisite text, thank you.
30781	33	42	33	44	Here the authors may want to reference a paper that demonstrates the same finding for Africa: ""Engelbrecht F., Adegoke J., Bopape M-J., Naidoo M., Garland R., Thatcher M., McGregor J., Katzfey J., Werner M., Ichoku C. and Gatebe C. (2015). Projections of rapidly rising surface temperatures over Africa under low mitigation. Env. Res. Letters. 10 085004."" [Francois Engelbrecht, South Africa]	Accept. Citation added, thank you.
23733	33	42	33	47	Ramarao et al. (2015) Earth Syst. Dynam., 6, 569-582, 2015 https://doi.org/10.5194/esd-6-569-2015 would be a relevant reference to include. The authors reported that the land surface response to decrease of soil moisture and monsoon precipitation over the Indian region, in a changing climate, leads to detectable reductions in evapotranspiration and associated surface warming. This study is a climate change detection and attribution study using a high-resolution climate model. [, India]	Accept. Citation added, thank you. Note this paragraph has undergone substantive revision.
465	33	42	33	52	First, please see Nature Climate Change volume 9, pages44–48 (2019) and in an associated News and Views in the same journal. Second, why would increasing the "heat from global warming" increase potential evporation? Pottential evaporation has little to do with temperature: its mainly energy and vapour pressure deficit and I do not see what an extra 1 or 2 W m-2 would cause drying even if an increase in POTENTIAL evaporation led to an increase in ACTUAL. Any you say above (page 1, line 40) that higher CO2 would increase water use efficiency. Might that not decrease actual evaoration? Next, I doubt any climate modeller believes the projections of drought by climate models. See Ukkola A.M., Pitman A.J., De Kauwe M.G., Abramowitz G., Herger N., Evans J., and Decker M., 2018, Evaluating CMIP5 model agreement for multiple drought metrics, J. Hydrometeorology, 19, 969-988, 10.1175/JHM-D-17-0099.1. Or see Ukkola, A.M., M.G. De Kauwe, A.J. Pitman, M.J. Best, G. Abramowitz, V. Haverd, M. Decker and N. Haughton, 2016, Land surface models systematically overestimate the intensity, duration and magnitude of seasonal-scale evaporative droughts, Environmental Research Letters, 11, 104012, doi:10.1088/1748-9326/11/10/104012. The summary here is that climate models do not simulate any of soil moisture, rainfall or runoff droughts consistently, the land models simulate drought terribly and there is far more evidence to suggest droughts are deeply uncertain in climate models than any evidence that they have skill. [Andrew Pitman, Australia]	Note this paragraph has undergone substantive revision.
30783	33	42	33	52	Here the authors need to refer to Section 3.3.4 of SR1.5, and carefully check for consistency. [Francois Engelbrecht, South Africa]	Accept. This has been done and there is better cohesion between the two assessments on drought. Note this paragraph has undergone substantive revision.

Comment No	From Page	From Line	To Page	To Line	Comment	Response
28845	33	42	33	52	Projections for Europe under RCP2.6 and RCP 6.0 show that unprecedented drought are expected to occur both in the near future as well as to the end of the century, regardless the degree of mitigation scenario that will be followed Grillakis (2019). Projections show that those events are expected to happen between 11 and 28 times more frequently with a 59% to 246% larger duration. Grillakis, M.G., 2019. Increase in severe and extreme soil moisture droughts for Europe under climate change. Science of The Total Environment. [Manolis Grillakis, Greece]	Accept. Citation added with requisite text, thank you. Note this paragraph has undergone substantive revision.
16575	33	45	33	45	The meaning of the term "natural drought" is unclear. [Siri Lie Olsen, Norway]	Accept. "Natural" removed. Note this paragraph has undergone substantive revision.
2525	33	46	33	46	"and become" [Wei Li, France]	Reject. Editorial. This is a separate idea from the next theme
16577	33	46	33	47	This sentence is hard to follow. [Siri Lie Olsen, Norway]	Accept. This paragraph has undergone substantive revision.
683	33	47	33	50	Please note that Lehner et al. (2017) use only one model. You should also look at multi-model studies, not only for the "Southwest and Central Plains" as at line 50. I understand thatlines 47-50 is the underlying information for the executive summary statement on page 3 lines 33-34 " medium confidence that drought risk will increase over the Mediterranean region, central Europe, the Amazon and southern Africa.", because I don't find any other material in the section about future drought increases. I don't think it is acceptable to base a medium confidence statement on only one paper that uses only one model. In particular, there are contrasting results for Amazonia: while Lehner et al (2017) project increased droughts over the whole Amazon region, in Guimberteau et al (2013) ,using a multimodel approach, the drought risk only increases in southern amazonia, while in northern Amazonia risk for flooding increases. I am not an expert on this issue on a global scale so the Amazon is only an example. [Anna Sörensson, Argentina]	Noted, thank you. The IPCC Special report on 1.5 and 2 degrees reports medium confidence in inceased dryness in the Mediterranean and South Africa. Recent literature for the Mediterranean supports a view of increased liklihood of drought, including unprecedented drought, in the region. Text has been altered to reflet this. Note also this paragraph has undergone substantive revision.
19033	33	47	33	50	the efect of additional 0.5 C is not clearly described and I do not understand the fragment about the USA [Joanna Wibig, Poland]	Accept. Sentence revised fro clarity and segment about the USA removed.
26957	33	47	33	52	The sentences seem to be incorrect or incomplete, the meaning does not become clear "Southwest and Central Plains a two-degree there are..." [, Germany]	Noted. This sentence has been removed
18269	33	47	33	52	i suggested to add results to clarify the impact of the frequency and persistence of teleconnections over North atlantic on the projected drought risk over the Mediterranean and North afica [khadija Kabidi, Morocco]	Noted. However, we have not mentioned regions in this section and will maintain this convention here. We do however now explicitly include North Africa in the text.
2527	33	47	33	52	break this long sentence and rephrase [Wei Li, France]	Accept. Editorial.
16579	33	50	33	50	This sentence needs editing. [Siri Lie Olsen, Norway]	Noted. This sentence has been removed
18093	33	50	33	51	There is a mistake in the sentence structure and the sentences are therefore not correct. [Clemens Schwingshackl, Switzerland]	Noted. This sentence has been removed
11537	33	50	33	51	Rephrase the statement for clarity [Lawrence Aribo, Uganda]	Noted. This sentence has been removed
19035	33	50	33	52	southwest and central plains a two degree - it is not clear. Does it concern potential warming? [Joanna Wibig, Poland]	Noted. This sentence has been removed
8403	33	50	33	52	Wrong sentence. Rephrase. [Marc Aubinet, Belgium]	Noted. This sentence has been removed
40495	33		33		Check detection results and attribution assessment for drought indices. Important, needs clarity. Government delegates expected more information on these issues during SR15 approval, and this is the place where it should be covered. Could literature on "flash drought" be also assessed? [Valerie Masson-Delmotte, France]	Noted. We have not assessed flash droughts.

Comment No	From Page	From Line	To Page	To Line	Comment	Response
38805	33	48	48	50	How do these statements agree or disagree with the IPCC 1.5°C Special Report? [, United States of America]	Accept. There is now better cohesion between the two assessments on drought. Note this paragraph has undergone substantive revision.
33025	33	36		40	the studies cited here are not detection and attribution studies but event attribution studies, which is quite different (more model based, not looking at long-term trend etc). They investigate to what extent recent extremes eg droughts are a stronger hazard than they would have been without human influences (ie if retern periods have changed) So you should call it event attribution studies. [Gabriele Hegerl, United Kingdom (of Great Britain and Northern Ireland)]	Accept. "Detection-attribution" changed to "event attribution"
33029	33	40			Here it could also be mentioned the droughts in reconstructions eg of the American West (e.g. Cook megadroughts; see recent papers also by Toby Ault) which are quite a bit larger than any drought encountered in the 20th century. These interestingly also had consequences on early societies but that may be outside the scope here [Gabriele Hegerl, United Kingdom (of Great Britain and Northern Ireland)]	Noted. The reference to most droughts being a result of natural variability has been included in text 2 paragraphs earlier and we have included mention of megadroughts here.
387	33	50			sentence incomplete [Tobias Rütting, Sweden]	Noted. This sentence has been removed
33027	33				Generally, it would be useful to relate here to some droughts in the past and particularly I think the dustbowl drought would be an excellent case study to include. There is quite a bit of literature, and the case is a remarkable interplay between SST forced drought, quite dramatic land surface changes, and heat extremes (eg paper by Donat et al but many previous papers too; and I am involved in a paper by Cowan et al 2017 J Climate on the dust howl. The dust bowl is fascinating because the dramatic change in land cover (see e.g. book by Worster) contributed to dust storms (whi in some papers is linked to intensifying drought and enhancing heat waves) and the land surface feedbacks on heat waves discussed above may also have been involvedin intensifying extreme heat (and possibly drought) through evaporation and devegetation 9e.g. Cook paper). The dust bowl is a very important warning note that could be highly relevant to the future [Gabriele Hegerl, United Kingdom (of Great Britain and Northern Ireland)]	Noted. This is mentioned in Chapter 5 (5.3.2) of the SOD, although not in as much detail as suggested by the reviewer. However, we now add a reference to the Dustbowl and include some of the suggested references with an additional reference to the text in Chapter 5.
18271	34	14	34	26	add results studing the impact of projected Saharian Low regimes on the projected heat extremes over the Mediterranean and North Africa under RCP4.5 and RCP8.5 scenarios. [khadija Kabidi, Morocco]	Noted. However, the section this comment referes to has been removed
5529	34	16	34	18	it is not clear what is the message, it needs more clarification. [Sanaz Moghim, Iran]	Noted. This paragraph has been restructured and the sentences referred to removed as it repeats in Section 2.6.
15271	34	20	34	20	the paragraph reads as if emphasis is on livestock productivity as opposed to the impacts of heat extremes on grazing forages and feed crops [Joalane Marunye, Lesotho]	Accept. Most of the paragraph is removed although the mention of feed in incorporated in the first paragraph.
33051	34	28	34	37	It is mentioned that the forests are more resilient to the stress caused by heat, however it is good to take into account the limit of the different types of forest (limit of spatial extention), ie as far as heat affects them. [Jesus Alejandro Prieto Amparan, Mexico]	Noted. We do describe the way two different types of forests that have different responses to heat and also stress the regional response of trees to heat
33053	34	28	34	37	Keep in mind that new reforestations for different types of forests have to migrate in the altitudinal gradient. [Jesus Alejandro Prieto Amparan, Mexico]	Noted. This section is concerned with extremes and the migration mentioned here is more of a response to altitudinal warming.
16581	34	30	34	30	Trees are more resilient to heat stress than what? [Siri Lie Olsen, Norway]	Accept. Grasslands added.
15817	34	30	34	32	Plea modify in "Although trees are more resilient to heat stress than grassland s(Teuling et al. 2010), it has been observed that different types of forest (e.g. needleleaf vs broadleaf and species specific characteristics) respond differently to drought and heat waves in terms of forest productivity (Babst et al. 2012). [Caroline Vincke, Belgium]	Accept.

Comment No	From Page	From Line	To Page	To Line	Comment	Response
14655	34	39	34	39	Human ignitions only dominate in equitorial and mediterranean areas; in the boreal forest (much of the world's annual forest area burned), lightning is the dominant ignition mechanism by area burned. [, Canada]	Noted. This information is now contained in the cross chapter box on fire.
5531	34	39	34	39	it is better to change "largely" here, replaced by something like "can be" [Sanaz Moghim, Iran]	Noted. This paragraph has been removed and is replaced entirely by the corss chapter box on fire
3259	34	42	34	43	"…anomalously active fire seasons also occur during non-drought years, for example in Indonesia and in the Amazon." <-- do we know why this is? Due to human activities? Not clear at the moment as to why, if the reason is known that is [Viola Heinrich, United Kingdom (of Great Britain and Northern Ireland)]	Noted. The sentence the review refers to has been discarded as this paragraph on fire has been removed as there is now in the final version of Chapter 2 a cross chapter box on fire.
38807	34	44	34	44	"… increases the risk of fire through increased evapotranspiration rates …" [, United States of America]	Noted. This paragraph hs been removed and is replaced entirely by the corss chapter box on fire
14657	34	52	34	52	This is debatable since there are few mechanisms in the below list that point to any ability to depress fire activity. Simply put, for the boreal, where fuel moisture is the primary variable and natural ignitions are common, increased temperature leads to decreased fuel moisture and increasing trends in fire activity. The exact magnitude and spatial pattern is the largest unknown. [, Canada]	Noted. The sentence the review refers to has been discarded as this paragraph on fire has been removed as there is now in the final version of Chapter 2 a cross chapter box on fire.
15815	34	3	35	22	This section focuses mainly on heat waves rather than on droughts, which are poorly documented (ex. climate-change type drought are not mentionned). [Caroline Vincke, Belgium]	Noted. Drought is addressed in the section prior to this one (new 2.2.5.1)
29029	34	3	35	22	I find this section very descriptive. More assessment is needed. [Jan Fuglestvedt, Norway]	Accept. Assessment is provided and the section has been shortened.
3381	34	4	35	22	Heat extremes have a major impact and many times cause of forest fire leading dissertatification, which is not mentioned. [Narendra Dalei, India]	Accept. Fire is now mentioned as an exacesserbating factor to drought and heat waves in 2.2.5.2
11539	34	44	54	44	increased instead of increase [Lawrence Aribo, Uganda]	Noted. This paragraph hs been removed and is replaced entirely by the corss chapter box on fire
33031	34	39			There are some nice papers from UVIC (PCIC) on attribution of fire activity to human forcing through temperatures; with an early paper by Nathan Gillett; and recent event attribution studies involving Francis Zwiers and Kirchmeier-Young if I remember correctly. this would be good to reference. [Gabriele Hegerl, United Kingdom (of Great Britain and Northern Ireland)]	Noted. This information is now contained in the cross chapter box on fire.
1089	35	4	25	4	Condiser adding a short paragraph on the effects of warm winters on insect populations (Climatic Change and Insect Outbreaks in Boreal Forests: The Role of Winter Temperatures. Seppo Neuvonen, Pekka Niemelä and Tarmo Virtanen. Ecological Bulletins. No. 47, Animal Responses to Global Change in the North (1999), pp. 63-67) and subsequent forest disturbances (Kurz et al 2008. doi:10.1038/nature06777). [Sebastiaan Luyssaert, Belgium]	Accept. This and other citations are added.
13363	35	9	35	9	Rephrase: "as gross primary production as (GPP)" [Gregory Duveiller, Italy]	Accept. Editorial
24347	35	9	35	9	"… carbon sink reduction compared to single-factor extremes as gross primary production as (GPP) is" – remove "as (GPP)", plus the acronym GPP should be used instead of repeating gross primary production (GPP). Acronyms should be introduced once at the beginning of the chapter and used throughout the text in substitution of the complete written term. [Renato Braghiere, France]	Accept. Editorial
38809	35	10	35	10	New sentence instead of fragment: "In forest biomes, GPP may increase temporarily ..." [, United States of America]	Accept. Editorial
2529	35	16	35	19	confusing sentence, rephrase [Wei Li, France]	Accept. Sentence has been modified for clarity
14121	35	17	35	17	"widesperad" rather than "wide spread" [David Taylor, Singapore]	Accept. Editorial
31893	35	19	35	19	There are some words missing in this sentence, probably at the end of L21, as a result of which the message is not clear [Martijn Slot, Netherlands]	Accept. Sentence has been modified for clarity

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15819	35	19	35	22	Projected changes in the frequency and intensity of extreme temperatures (and drought) as a result of climate change are expected to result in decreased carbon sequestration by ecosystems and degradation of ecosystems health, loss of resilience (Trumbore et al., 2015, Science), particularly in forests that due to their large carbon pools and fluxes, potentially large lagged impacts and long recovery times to regain lost stocks (Frank et al. 2015)(Section 2.4)". Add some words on forest decline?=> cf chapter 7 page 22. [Caroline Vincke, Belgium]	Accept: Additional text and citation . Noted: We were not sure how to relate changes in extreme heat to forest decline. The referenced Chapter 7, page 22 speaks about forest dieback in the con
18095	35	19	35	22	This sentence is long and unclear, especially towards the end. I would thus recommend to split it and rephrase it in a clearer way. [Clemens Schwingshackl, Switzerland]	Accept. Sentence has been modified for clarity
8405	35	19	35	22	Too long sentence. Too much information in one sentence. Rephrase. [Marc Aubinet, Belgium]	Accept. Sentence has been modified for clarity
11541	35	21	35	21	consider replacing that with than [Lawrence Aribo, Uganda]	Accept. Sentence has been modified for clarity
6743	35	25	35	27	Extreme in Amazonia can be added after Zilli et al 2017. See for instance Espinoza J.C., Marengo J., Ronchail J., Molina Carpio J., Noriega Flores L., Guyot J.L. 2014. The extreme 2014 flood in South-Western Amazon basin: The role of Tropical-Subtropical South Atlantic SST gradient. Environ. Res. Lett. 9 124007 doi:10.1088/1748-9326/9/12/124007 [Josyane Ronchail, France]	Accept. Reference added.
6745	35	28	35	28	About the shift in the trend distribution for precipition extremes in the Amazon basin, see also Espinoza JC., Ronchail J., Marengo JA., Segura H. 2018. Contrasting North–South changes in Amazon wet-day and dry-day frequency and related atmospheric features (1981–2017). Climate Dynamics. doi: 10.1007/s00382-018-4462-2 [Josyane Ronchail, France]	Accept. Citation added, thank you.
18097	35	28	35	32	This sentence is long and unclear. I would thus recommend to split it and rephrase it in a clearer way. [Clemens Schwingshackl, Switzerland]	Accept. Sentence has been modified for clarity
16583	35	29	35	31	This sentence should be rephrazed. [Siri Lie Olsen, Norway]	Accept. Sentence has been modified for clarity
19005	35	32	35	34	Additional reference may be cited: Krishnan et al. (2016) demonstrated using a global climate model (LMDZ4) with high-resolution zooming over South-Asia that a juxtaposition of regional land-use changes, anthropogenic-aerosol forcing and rapid warming of the Indian Ocean is crucial to produce the observed weakening of monsoon circulation and rainfall in recent decades. The results showed that the weakening of monsoonal response to regional-forcing significantly enhances the occurrences of localised intense precipitation events, as compared to the global-warming response. (Krishnan, R., T. P. Sabin, R. Vellore, M. Mujumdar, J. Sanjay, B. N. Goswami, F. Hourdin, J.‐L. Dufresne and P. Terray, 2016, Deciphering the desiccation trend of the South Asian monsoon hydroclimate in a warming world. Climate Dynamics, 47, 1007–1027, DOI 10.1007/s00382-015-2886-5) [Sanjay Jayanarayanan, India]	Accept. Citation added, thank you.
23893	35	32	35	35	A related study may be cited here. Krishnan et al. (2016) demonstrated using a global climate model (LMDZ4) with high-resolution zooming over South-Asia that a juxtaposition of regional land-use changes, anthropogenic-aerosol forcing and rapid warming of the Indian Ocean is crucial to produce the observed weakening of monsoon circulation and rainfall in recent decades. The results showed that the weakening of monsoonal response to regional-forcing significantly enhances the occurrences of localised intense precipitation events, as compared to the global-warming response. (Krishnan, R., T. P. Sabin, R. Vellore, M. Mujumdar, J. Sanjay, B. N. Goswami, F. Hourdin, J.‐L. Dufresne and P. Terray, 2016, Deciphering the desiccation trend of the South Asian monsoon hydroclimate in a warming world. Climate Dynamics, 47, 1007–1027, DOI 10.1007/s00382-015-2886-5) [, India]	Accept. Citation added, thank you.

Comment No	From Page	From Line	To Page	To Line	Comment	Response
29033	35	35	35	37	this is an important statement, but it is supported by only one ref. More studies? [Jan Fuglestvedt, Norway]	Noted. Sentence has been removed.
11543	35	43	35	43	consider using atmosphere instead of atmospheric or replace atmospheric with atmospheric flux [Lawrence Aribo, Uganda]	Accept. Editorial
8407	35	43	35	43	"atmosphere" rather than "atmospheric" [Marc Aubinet, Belgium]	Accept. Editorial
12843	35	43	35	43	atmospheric should be atmosphere [Robert Treuhaft, United States of America]	Accept. Editorial
1091	35	43	35	43	Replace "… the atmospheric amplify …" by "… the atmosphere amplify …" [Sebastiaan Luyssaert, Belgium]	Accept. Editorial
5533	35	44	35	44	"higher intensification rates" and "lower rates" occur in many regions not in tropic and drier subtropic, respectively, it is better to say in many regions [Sanaz Moghim, Iran]	Accept. Sentence segment has been removed
18101	35	49	35	52	There are studies that use regional climate models to explicitly resolve convection (e.g., Ban et al. 2015: Heavy precipitation in a changing climate: Does short-term summer precipitation increase faster?, GRL). However, their results are not always consistent. [Clemens Schwingshackl, Switzerland]	Accept. A sentence has been added to reflect the use of high resolution dynamical climate models
17077	35	52	35	52	I suggest adding: Larsen M.A.D., Christensen J.H., Drews M., Butts M. and Refsgaard J.C. (2016): Local control on precipitation in a fully coupled climate-hydrology model. Scientific Reports, Vol 6, doi: 10.1038/srep22927. [Morten Andreas Dahl Larsen, Denmark]	Accept. Citation added with requisite text, thank you.
40497	35		35		Do authors assess results of global or regional climate models here? E.g. lines 45-49. Please check carefully. Consistency with SR15 to check as well. [Valerie Masson-Delmotte, France]	Accept. Model type, whether GCM or RCM is now explicitly mentioned in the text. Acccept. Consistency with SR15 (Section 3.3.3) has been checked and modifications to text made as appropriate
30787	35	25	36	7	It is disappointing that the authors have not aligned this section (heavy precipitation) with section 3.3.3 of SR1.5 [Francois Engelbrecht, South Africa]	Accept. This has been done and is now better consistency between this report and SR15 on heavy precipitation
1335	35	39	36	7	At the regional scales comparison shows comparable intensity changes, ranging from below the Clausius–Clapeyron (CC) scaling to a 3 times CC increase per degree of warming: Manola, I., van den Hurk, B., De Moel, H., and Aerts, J. C. J. H.: Future extreme precipitation intensities based on a historic event, Hydrol. Earth Syst. Sci., 22, 3777-3788, https://doi.org/10.5194/hess-22-3777-2018, 2018. [Aristeidis Koutroulis, Greece]	Accept. Citation added to first sentence with mention of regional scales
18099	35	49	36	3	This sentence is long and unclear. I would thus strongly recommend to split it and rephrase it in a clearer way. [Clemens Schwingshackl, Switzerland]	Accept. Sentence has been split.
1677	35	24	37	11	This section described the impacts of drought and extreme rainfall in detail. However, I did not found the evaluation on the possible impacts of rainfall distribution on crop. Therefore, I suggested the authors should add the content. [Jing Wang, China]	Noted. This is dealt with in Chapter 5 in detail and not covered here to avoid repitition.
389	35	9			change "gross primary productivity as (GPP)" to "GPP" [Tobias Rütting, Sweden]	Accept. Editorial
18103	36	3	36	7	This sentence is long and unclear, especially towards the end. I would thus recommend to split it and rephrase it in a clearer way. [Clemens Schwingshackl, Switzerland]	Accept. Sentence split and made clearer.
31677	36	10	36	18	Include Chagas and Chaffe 2018 (https://doi.org/10.1029/2018WR022947). They have analysed the role of Land Cover in the propagation of rainfall into streamflow trends. The study provides evidence that agricultural basins are more sensitive to changes in the rainfall regime, corroborating therefore with the evidences provided in the reffered paragraph. [, Brazil]	Accept. Citation added,thank you.
2531	36	16	36	16	what is "land use and … impcated"? Not clear [Wei Li, France]	Accept. Sentence altered for clarity

Comment No	From Page	From Line	To Page	To Line	Comment	Response
2863	36	18	36	22	Reading the sentence it is not clear if the flooding due to tropical cyclones are related to precipitations or coastal [Luca Castrucci, United States of America]	Noted. Sentence has been altered for clarity.
17017	36	20	36	20	Remove "inundation". Heavy precipitation alone can cause the effects listed. [Roland Hiederer, Italy]	Noted. We wanted to present the idea of inundation so have added "and" between "heavy precipitation" and "inundation"
38811	36	21	36	21	New sentence from fragment: "In tropical regions flooding ..." [, United States of America]	Accept. Editorial
3469	36	22	36	24	Key wheat-growing regions are located at North China, and hence drought is main factor affecting the wheat yield. Please check whether the statement ("flooding can affect yield more than drought") is correct or not. [Jianqi Sun, China]	Noted. The Zampieri citation shows this to be the case. The sentence is caveated by the phrase "In some cases"
22449	36	24	36	24	Mentioning these regions become too specific, since this also applies to many other temperate regions [Anastasios Kentarchos, Belgium]	Noted. These regions are reported by Zampieri et al 2017 so we have decided to keep them in the text. Additionally the sentence has been altered to include regions the reviewer may be concerned about.
15821	36	24	36	24	"Flooding can be beneficial in drylands..." always? And what if water does not infiltrate the soil? [Caroline Vincke, Belgium]	Noted. "as" changed to "if" to convey the qualifier.
18105	36	24	36	24	To me it is astonishing that here effects in "China and parts of France" are mentioned in the same sentence. China is a very big country, and "parts of France" seems very localized to me. I would suppose that there are likely also effects in other parts of Europe, if effects in France are found. Is there evidence for that? [Clemens Schwingshackl, Switzerland]	Accept. Zampieri et al 2017 does show this and the text has been modified appropriately.
15823	36	29	36	30	"...the impact of extreme rainfall on agriculture is supposed to be less than that of..." [Caroline Vincke, Belgium]	Noted. More citations have been added to strengthen the statement and reduce the implicit uncertainty.
29035	36	29	36	30	Again, this is an importnat statement, but it is supported by only one ref. More studies? [Jan Fuglestvedt, Norway]	Accept. A second citation has been added with a a qualifier statement.
22451	36	30	36	30	It would be more relevant to mention drought rather than extreme temperatures [Anastasios Kentarchos, Belgium]	Accept. Drought added to extreme temperature as the Lesk et al 2016 citation mentions both.
29037	36	32	36	32	Re "the projected increase": What is meant here? Scenario? [Jan Fuglestvedt, Norway]	Accept. This was an observed, not projected phenomenon and the sentence has been changed to reflect this
38813	36	35	36	37	This sentence was not clear. Do the authors mean that surface flooding changes nutrient cycling by increasing faunal abundance, stimulating microbial growth and community composition? Flooding could also decrease microbial composition but it is not clear from the sentence what the conclusion is. [, United States of America]	Noted. The sentence has been restructured for clarity.
16585	36	36	36	36	This sentence is hard to follow. [Siri Lie Olsen, Norway]	Accept. The sentence has been restructured.
18107	36	37	36	37	What does "redox" mean or stand for? [Clemens Schwingshackl, Switzerland]	Noted. Oxidation and reduction processes in the soil.Sentence has been reworded for clarity and "redox" removed.
16587	36	39	36	41	Is it possible to provide a reference for the last statement? [Siri Lie Olsen, Norway]	Accept. Citation provided
15825	36	44	36	45	what about the role of forests on the prevention of floods? [Caroline Vincke, Belgium]	Accept. A sentence has been added to reflect this.
2865	36	44	36	45	I would rephase this senstance in something like: 'Even though dameges caused by flooding in forests have not been well studied yet, riparian forests showed to be exposed to this problem (Kramer et al. 2008). [Luca Castrucci, United States of America]	Noted. The text is modified for clarity
22453	36	47	36	50	Wet and saturated conditions not only affect plant growth. It more severely affects access to grassland thus compromising grazing and harvesting. There are recent examples of this from Ireland [Anastasios Kentarchos, Belgium]	Noted. This is mentioned in 2.3.5.2, paragraph 2.
25125	36	11			Liu J.*, and Yang H., 2010. Spatially explicit assessment of global consumptive water uses in cropland: green and blue water. Journal of Hydrology 384(3-4): 187-197. [Junguo Liu, China]	Accept. Citation added. Thank you

Comment No	From Page	From Line	To Page	To Line	Comment	Response
31895	37	8	37	8	The "dry season" vs "colder season" contrast needs to be explained to make sense [Martijn Slot, Netherlands]	Noted. However the sentence has been removed as it is not
26959	37	8	37	11	This statement is a bit contradictory to other statements in this sub-chapter: "long intra-seasonal dry periods that are interspersed with a few heavy rainfall events can result in increased productivity due to increased soil water availability". It refers to an increase in nutrients, which naturally need water to be available to plants. But normally one would expect that heavy single precipitation events on dry soils would be accompanied by more surface runoff and erosion. Or should this statement rather be coupled with the statement on inundation of floodplains in dry / arid areas (more water retention in soils)? [, Germany]	Accept. The sentence has been removed as the papers it cited were misinterpreted.
24349	37	10	37	11	References should be in chronological order from oldest to newest. [Renato Braghiere, France]	Noted. However, the sentence has been removed as the papers it cited were misinterpreted.
3261	37	11	37	14	Potentially might need a linking paragraph to get to the current first sentence in section 2.4. Suddenly talking about the Paris Agreement with no prior introduction? [Viola Heinrich, United Kingdom (of Great Britain and Northern Ireland)]	Accept. Sentence will be added
1641	37	14	37	14	Use 'gases' rather than 'gasses'. [Edson Leite, Brazil]	Editorial. "Gases" is used.
1769	37	14	37	14	gasses -> gases. And elsewhere. I have checked on the internet – there it states that the plural of the noun gas is gases. [William Lahoz, Norway]	Accepted editorial: "gases"
5019	37	14	37	15	"The Paris Agreement requires credible estimates..." Such statement appears neither in the reference (Fuglestvedt et al. 2018) nor in the Paris Agreement. This first sentence would be too subjective. [, Japan]	Accepted: reference to Paris Agreement deleted.
29039	37	14	37	15	This section has, in my view, a bit abrupt start. And I think you could also refer to the article in the Paris Agreement. [Jan Fuglestvedt, Norway]	Accepted: re-written
5021	37	18	37	18	The reference to "IPCC 2010", which is only a meeting report and does not provide the classification of carbon fluxes, should be changed to "IPCC 2003", which is the official publication below. Intergovernmental Panel on Climate Change (IPCC), 2003. Penman, J., et al. (Eds.), Good Practice Guidance for Land Use, Land-Use Change and Forestry. Institute for Global Environmental Strategies, Hayama, [, Japan]	Accepted: text revised.
13365	37	19	37	21	If the rate of natural disturbances (e.g. wildfires, pests, etc) increases due to anthropogenic environmental changes, would this count as category (2) or category (3)? [Gregory Duveiller, Italy]	No revision suggested.
38817	37	21	37	21	Replace "windrow" with "windthrow". [, United States of America]	Accepted: "windrow" deleted.
5023	37	21	37	25	"IPCC 2010" is a meeting report, and does not "note" this statement in the draft. Thus the entire sentence starting from "The IPCC (2010) ..." seems better to be removed from the text. Then, the next sentence should start as "A meeting report by the IPCC (2010) shows that different approached and methods ..." by removing "As a result," [, Japan]	Accepted: text revised.
33077	37	21	37	25	I do not understand the purpose/message of this sentence. The cited report (IPCC 2010) does not include this statement in its conclusions, suggesting that it is not one of its "key findings". What would be meant by "direct observation" ? Is it a problem to have different methods, given that for example Le Quéré et al. 2018 appear to be able to separate what is directly anthropogenic from what is not? [Philippe Marbaix, Belgium]	Accepted: text revised.
3119	37	27	37	32	Direct reference to the needs of political process (NDCs, Global Stocktake) is inappropriate in science assessment. Suggestion: to omit the para. [, Russian Federation]	Accepted: paragraph deleted.

Comment No	From Page	From Line	To Page	To Line	Comment	Response
15161	37	27	37	36	This paragraph makes a very useful and important point, that the sum total of land based emissions and removals reported in GHGIs, and as part of NDC achievemnet, will differ from AR5 estimates. It would be helpful to include a precise description or listing of the differences, and possibly a table, to highlight that AR5 only counts LULUCF mitigation from direct LUC, whereas GHGIs also include a component of mitigation on managed lands, which is captured as part of the residual sink only in AR5. It would also be useful to provide some helpful terminology here, such as clear use of terms, that might help the GHGI, NDC and AR communities speak the same language, in totalling up land based mitigation effects. [Maya Hunt, New Zealand]	Accepted: text revised.
5025	37	30	37	34	Two sentences starting from "It is expected that ..." and "This expectation implies ..." should be removed from the text. The modality of Global Stocktake will be negotiated under the UNFCCC, and the IPCC may not be better such make political statements to suggest the direction of negotiations. [, Japan]	Accepted: paragraph deleted.
5027	37	40	37	40	If the terminology of "AFOLU" is to be mentioned in the context of GHG inventory, the correct name of "Agriculture, Forestry and Other Land Use" should be used. ("Other" is missing). [, Japan]	Accepted: "Other" added to definition.
3121	37	40	37	41	25% : units should be specified, tons, CO2-eq, others. [, Russian Federation]	Accepted: See Table 2.4.1.
29041	37	40	37	41	I think aggregated GHG emissions shoudl be avoided, as agreed at LAM1, at least unit and conversion factor should be given. That can be done in a footnote. When such aggregations and contributions are given one shoudl be aware of how senstitive they are to choice of GHG (SAR, TAR,AR4, AR5) and time horizon. [Jan Fuglestvedt, Norway]	Accepted: See Table 2.4.1.
22457	37	40	37	43	These numbers for percent anthropogenic emissions deviate from the number on page 60 line 28 [Anastasios Kentarchos, Belgium]	Accepted: Revised in text.
30043	37	42	37	43	It reads: "...AFOLU, as estimated by global carbon models, contributed 26% of anthropogenic GHG emissions" but in Table 2.4, in the SPM, in the summary of chapter 2 and in other parts of chapter 2, a percentage of 24% is mentioned for the most recent data (i.e. the period 2003-2012). So, we think 26% should be changed to 24% here. [, Netherlands]	Accepted: text revised.
23713	37	43	37	43	In the ES(page 5, line 11), the frachtion of AFLOU contributed GHG is 24%. [Xiyan Xu, China]	Accepted: text revised.
1093	37	44	37	44	Replace "... sink" by "... sink." [Sebastiaan Luyssaert, Belgium]	Accepted: text revised.
7651	37	48	37	51	The term "land" should be described categorically as including or not including the ocean and fossil fuel fluxes respectively. [James Wafula, Kenya]	Rejected: The budget terms should make this clear.
24353	37	49	37	49	Do not forget to add GPP = 120 Pg C yr. The term GPP has been used throughout the text and should be put next to its global estimate. [Renato Braghiere, France]	Accepted: text revised; GPP does not appear.
1461	37	52	37	52	This could be clearer as to what "anthopogenic and non-anthopogenic processess..." covers. [William Collins, United Kingdom (of Great Britain and Northern Ireland)]	Accepted: text revised.
40499	37		37		Aspects of framing linked with UNFCCC and Paris Agreement may be provided in chapter 1, please coordinate on this. [Valerie Masson-Delmotte, France]	Accepted: text revised.
8419	37	27	38	27	The numbers presented in the table refer to the 2017 report. These numbers (especially the last column) have been updated since in the 2018 report (Le Quéré et al., 2018, Earth Syst. Sci. Data, 10, 2141–2194, 2018, https://doi.org/10.5194/essd-10-2141-2018) [Marc Aubinet, Belgium]	Accepted: text now includes values from the 217 budget.

Comment No	From Page	From Line	To Page	To Line	Comment	Response
26961	37	47	38	5	According to Section 2.4.1, natural fluxes in land are a net sink while human land use is a net source of emissions (roughly 25%). The net impact of natural and human impacts is still a sink of 5-8 Gt CO2 in 2007-2016. A more succinct message conveying this information should be stated at the beginning of this section in bold since it is policy relevant. It makes it clear that the human land use emissions are currently buffered and that there is large potential to reduce these emissions and strengthen the overall sink. [, Germany]	Accepted: text revised.
26963	37	47	38	27	The presentation of these numbers is difficult to follow. Please try to use the same expressions throughout the chapter (e.g., are estimates from the GCP the same as global model estimates and are these based on bookkeeping models mentioned in the ES?) Are the 5.1-8.4 GtCO2/y in line 1 of page 38 the same as the 6.3 Gt CO2/y in line 10 of the same page? How do these numbers compare to those given in the Table 2.1? In addition, please explain in more detail, why the land has turned from a net source to a net sink around 1950. [, Germany]	Accepted: text revised.
29043	37	47	38	27	It would be helpful for the reader if the nubers in the text can be easy to find in table 2.1. Same units would help. [Jan Fuglestvedt, Norway]	Accepted: text and Table revised.
29833	37	51	38	30	The net land-atmosphere CO2 removal and in line 30 land has been a net source of carbon emissions over recent decades contradict each other [Souparna Lahiri, India]	Accepted: text revised.
38815	37	14	41	40	Section 2.4 begins as highly relevant, discussing the importance of land GHG budgets in context of the Grassi paper, but then the section devolves into a lengthy discussion on the Global Carbon Budget and is challenging to follow. Is the text on the Global Carbon Budget essential here? [, United States of America]	Accepted: re-written
16863	37	14	45	32	There is a wide-spread habit in policy discussions to include all land sink on managed lands to net emissions calculations, which is giving a high bias for estimating anthropogenic removals of CO2. Then countries use those numbers to estimate their net-zero targets to be compatible with the 1.5-degree carbon budgets presented by IPCC and the goal of having net-zero emissions by 2050. This chapter scould address the topic of net emisions and net-zero emissions explicitly. The text should be more clear on how to estimate the land sink in a consistent way with e.g SR15 net emission definition. The text should be more clear on how to estimate the land sink in a consistent way with e.g SR15 net emission definition, and also provide some examples which sinks cannot be included in the calculations of anthropogenic carbon sink to be consistent with SR15 definitions. [Antti-Ilari Partanen, Finland]	Accepted: the revised text descibes discrepancies between country estimates and scientific estimates of emissions.
5029	37	46	46	43	Like the sections for methane and nitrous oxide, it would be more insightful if you could include the global scale estimation of carbon fluxes (not only the budget, but each flux). There are numerous studies on global scale flux scale up (e.g. GPP, soil respiration). It seems that this section for carbon dioxide focuses only on the budget and changes in carbon stock. [, Japan]	Rejected: Gross natural fluxes in the carbon cycle are distracting and inappropriate here.
186	37	46	46	43	Like the sections for methane and nitrous oxide, it is more insightful if you could include the global scale estimation of carbon fluxes (not only the budget, but each flux). There are numerous studies on global scale flux scale up (e.g. GPP, soil respiration). It seems that this section for carbon dioxide focuses only on the budget and changes in carbon stock. [Shoji Hashimoto, Japan]	Rejected: Gross natural fluxes in the carbon cycle are distracting and inappropriate here.
26741	37	46	46	45	Many carbon fluxes are reported in this section but this is quite hard to know exactly to what they are referring [Mathieu Jonard, Belgium]	Accepted: text revised.

Comment No	From Page	From Line	To Page	To Line	Comment	Response
26743	37	46	46	45	and to which extent the values can be compared. First, many different words are use to describe the C fluxes [Mathieu Jonard, Belgium]	Accepted: text revised.
26745	37	46	46	45	(uptake, release, removal, sink, source, total net flux, net emission). Second, the system to which the C fluxes relate [Mathieu Jonard, Belgium]	Accepted: text revised.
26747	37	46	46	45	varies (land-atmosphere, AFOLU, LUC) as well as the methodology to quantify them (modelling, remote sensing, [Mathieu Jonard, Belgium]	Accepted: text revised.
26749	37	46	46	45	GHG inventories,..). I suggest to reorganise the presentation of these fluxes per system and method [Mathieu Jonard, Belgium]	Accepted: text revised.
26751	37	46	46	45	in order to improve the readability. [Mathieu Jonard, Belgium]	Accepted: text revised.
8409	37	48	46	43	In the whole section there is a confusion of Units. Sometimes Pg are used, sometimes Gt. Worse: sometimes emissions are quantified in Gt C and sometimes in Gt CO2. This induces much confusion and makes all comparisons and links difficult. Please harmonize ! [Marc Aubinet, Belgium]	Accepted: text revised.
22455	37	13	61	10	(see also general comment above on fluxes in Ch2). This section needs a clear focused synthesis presented its key points before the gas-by-gas explanation of 2.4.1-2.4.3. These points should then be synthesised in the key findings at the start of the chapter and in the SPM. This material is highly policy relevant, as the chapter itself argues. It is therefore of vital importance that this complex information is simplified. Some suggestions: * The material currently in Section 2.4.4 should come at the start of the section: present the synthesis before the discussion of individual gases. * There are currently two different subsections on Land in the Global Carbon Budget (2.4.1.1 & p40-41). This is very confusing. The subsections should be combined. * Information about different types of source/sink should be strucutured more carefully. It is very difficult to keep track of the different CO2 estimates and differences between them. Could this be explained in a diagram? The chapter itself hints at this difficulty when it states "the wide range of estimates of net CO2 fluxes due to AFOLU may overestimate uncertainty". * the section makes some effort to explain direct and indirect anthropogenic effects but pays little attention to the 'natural' influences on fluxes mentioned on p37. Why is this? Surely natural fluxes are equally relevant in terms of 'what the atmosphere sees'. * There is no space devoted to the legacy effect of past forest management (age class distribution, recovery of forest stocking levels form past overuse), although it is a key driver of the land sink [Anastasios Kentarchos, Belgium]	Accepted. The section has been restructured and re-written to make clearer the different fluxes of CO2.
14123	37	13			Page 37, line 21 "windthrow" rather than "windrow". Page 37, line 44 missing full-stop at end of sentence. Page 38, line 5 "non-anthropogenic" not "non-antrhopogenic". Page 39, line 7 and page 39 line 13 parenthes around reference. Page 39 lines 36 to 39 sentence does not make sense. Also ", e.g. Grassi et al. 2018)." should presumably be "(e.g., Grassie et al. 2018)." Page 41, line 12, the introduction of the units "PgC" here is confusing when elsewhere in the paragraph GtC is used. Page 41, line 15, one too many full-stops at end of sentence. Page 44, lines 4 and 5, wrongly position parenthese - should enclose date of citation only. Page 49, lines 16 and 17, insert "to" between "way" and "understand". Page 49, line 40, should be "2000s" rather than "2000's". Page 57, lines 3 and 4 "2" in "N2O" should be subscript. [David Taylor, Singapore]	Accepted. "Windrow" no longer appears.
40307	38	1	38	1	FROM 2007 to 2017 [Thelma Krug, Brazil]	Accepted: text revised.
301	38	1	38	2	"based on direct atmospheric flux measuremenst" [George Burba, United States of America]	Accepted: text revised.

Comment No	From Page	From Line	To Page	To Line	Comment	Response
2039	38	3	38	3	I would recommend refering to some of the recent papers, i.e., synthesis (Peylin et al., BG, 2013), instead of individual inversions. For sure, the top-down and bottom-up estimations are not in good agreement (as in Ciais et al., 2013), but the situation is improving as you cite Saeki and Patra (2017), whch you may cite in line 5 on this page [Prabir Patra, Japan]	Accepted: references revised in text.
1771	38	5	38	5	non-anthropogenic. [William Lahoz, Norway]	Accepted: editorial
303	38	7	38	11	Entire paragraph is not clear and does not seem to match table 2.1 [George Burba, United States of America]	Accepted: text revised.
7649	38	7	38	11	The stated mean appears to be different from what is shown in table 2.1 [James Wafula, Kenya]	Accepted: text revised.
26735	38	7	38	27	The C fluxes are expressed in various units (GtCO2 yr-1, GtC yr-1, Pg C in 10 yr) which render the comparison between [Mathieu Jonard, Belgium]	Accepted: text revised.
26737	38	7	38	27	values quite complicate. I suggest to use always the same units, at least within a same section. In table 2.1, the units in [Mathieu Jonard, Belgium]	Accepted: text revised.
26739	38	7	38	27	the legend are not the same as in the table itself. [Mathieu Jonard, Belgium]	Accepted: text revised.
40309	38	8	38	8	suggest to change calculate to estimate [Thelma Krug, Brazil]	Accepted: text revised.
22459	38	9	38	10	It is not clear from the sentence whether the 6.3 refers to a net emission or a net sink. The phrasing of the following sentence adds to this confusion (although land has been a net sink since the middle of last century…) Importantly, if the 6.3 is a sink, then the sentence contradicts directly line 30 on the same page, which (wrongly) presents land as a net source. [Anastasios Kentarchos, Belgium]	Accepted: text revised.
30049	38	10	38	10	Typo: 6.3_±2.6 should be changed in -6.3±2.6 [, Netherlands]	Accepted: text revised.
24355	38	10	38	10	“6.3_” should be “6.3” [Renato Braghiere, France]	Accepted: text revised.
31041	38	10	38	30	Lines 10-11 state that "land has been a net sink for CO2 since around the middle of last century" and line 30 it is said that "land has bee a net source of carbon emissions due to AFOLU activities over recent decades". This "conflict" is of course explained by the fact that the first statement concerns all land, while the latter concerns the AFOLU sector. However, it could still be clarified that this is the case, otherwise these two statements on the same page may look like conflicting. [Annalea Lohila, Finland]	Accepted: text revised.
12845	38	11	38	11	Le Quere 2018 is not in the reference list [Robert Treuhaft, United States of America]	Accepted: reference added.
8413	38	13	38	13	This range is lower than in AR5 (450-650 Gt). I don't know what's the most correct number but the difference with AR5 should at least be mentioned. [Marc Aubinet, Belgium]	Accepted: paragraph deleted.
26965	38	13	38	23	These numbers are quite useful in communicating to policy makers, however can lead to misunderstandings in current form. We strongly encourage the authors to 1) give all numbers in the same unit, or at least give the equivalent in parenthesis for comparability 2) put these numbers together in a table so it is easier to compare estimates of potential stocks under natural conditions with estimates of current stocks and to compare biomass with soil as well as to see how much land use change has impacted stocks. [, Germany]	Accepted: paragraph deleted.
13367	38	13	38	23	Keep units in GtC to remain consistent (instead of introducing PgC twice) [Gregory Duveiller, Italy]	Accepted: paragraph deleted.
1463	38	13	38	23	Uncertainty ranges in soil carbon should be included. Use either Pg or Gt, but not both. [William Collins, United Kingdom (of Great Britain and Northern Ireland)]	Accepted: paragraph deleted.
25345	38	14	38	14	Could the standard deviation be also indicated with this figure? (And 4 significative digits seem bold...). [, France]	Accepted: paragraph deleted.

Comment No	From Page	From Line	To Page	To Line	Comment	Response
8411	38	14	38	14	More precisely, since the end of the sixties (after Le Quéré, Fig 6c) [Marc Aubinet, Belgium]	Accepted: paragraph deleted.
8415	38	14	38	14	Same remark as above : In AR5 the range was lower (1500-2400 GtC) but the soil depth was maybe lower…. [Marc Aubinet, Belgium]	Accepted: paragraph deleted.
6269	38	14	38	14	Suggest linking back here to the numbers quoted in section 2.2.6 for consistency (see page 21 lines 21-22). They are in the same range but accounted for over a different depth. [Tristan Quaife, United Kingdom (of Great Britain and Northern Ireland)]	Accepted: paragraph deleted.
40311	38	15	38	15	change Pg C to Gt C [Thelma Krug, Brazil]	Accepted: paragraph deleted.
5031	38	15	38	23	Although PgC is a unit commonly used in science, it is a little hard to compare other values immediately stated in GtC in this paragraph. Therefore, suggest using the unit GtC for vegetation carbon as well. [, Japan]	Accepted: paragraph deleted.
38819	38	18	38	19	A total loss of 582 GtC from vegetation and soils is higher than any credible estimate for either model or inventory-based anthropogenic land-use change emissions prior to Erb et al. (2018). Given reasonably certain estimates of fossil fuel emissions, this would require an extremely high ocean sink (or recent terrestrial uptake) to account for the current atmospheric CO2. The authors should emphasize the uncertainty of this particular estimate and the need to resolve discrepancies between this estimate and those derived using other methods. [, United States of America]	Accepted: paragraph deleted.
40313	38	21	38	21	include reference to Erb et al. 2018 after 42 - 47% [Thelma Krug, Brazil]	Accepted: paragraph deleted.
1095	38	21	38	23	Check font size. Seems larger than the default. [Sebastiaan Luyssaert, Belgium]	Accepted: paragraph deleted.
1465	38	21	38	23	As this is an assesmment it needs to be made clear whether the total loss (582 GtC) is your assessed best value since it lies outside the range 158-545 GtC [William Collins, United Kingdom (of Great Britain and Northern Ireland)]	Accepted: paragraph deleted.
30053	38	25	38	25	In the caption of Table 2.1, a unit of GtCO2/yr is given, but the numbers in the table are in GtC/yr. This is rather confusing. Since GtCO2/yr is used throughout the chapter, we would suggest to convert the table into GtCO2/yr (so multiply by 3.67). [, Netherlands]	Accepted: Table revised.
8417	38	25	38	25	The legend mentions units in GtCO2 yr-1 while the number (and table subtitle) are obviously in GtC yr-1. [Marc Aubinet, Belgium]	Accepted: Table revised.
6711	38	25	38	27	This table can be updated on the basis of Global Carbon Budget 2018, an undate from the 2017 report (Le Quéré et al. 2018) [Akihiko Ito, Japan]	Accepted: Table revised.
3123	38	25	38	27	Table 2.1: Is ELUC a net flux or gross flux? GATM is not concentration, it is burden. [, Russian Federation]	Accepted: Table revised.
24267	38	29	38	29	Please explain what are ''non-AFOLU'' land fluxes? [Francesco Tubiello, Italy]	Accepted: text revised.
24269	38	29	38	29	Footnote: ''land use change'' cannot correspond to LULUCF, for the simple reason that it lacks the ''land use'' component'', at least in the english language. [Francesco Tubiello, Italy]	Rejected: While the comment is strictly true, we use "land-use change" more broadly, for simplicity.
1097	38	29	38	29	Replace "… land fluxes 1" by "…land fluxes" [Sebastiaan Luyssaert, Belgium]	Rejected: "1" is a subscript.
3125	38	30	38	30	In lines 10-11 of this page, land is assessed as CO2 sink since the middle of 20th century. Probably, 'AFOLU activities on land lead to net source of carbon over recent decades'? [, Russian Federation]	Accepted: Text revised.
2533	38	30	38	30	Confused about "Land has been a net source..."; according to Line10-11, should be net sinks. [Wei Li, France]	Accepted: Text revised.
40315	38	31	38	31	This seems to be a contradiction with the text on page 5 (lines 33-34) stating that from 2007-2016 the land was a sink. Would be useful to clarify that there it refers to CO2 and here to CO2+CH4+N2O [Thelma Krug, Brazil]	Accepted: Text revised.
1099	38	36	38	36	the FOOTNOTE mentions "… across the whole special report, …". Is this chapter part of a special report? [Sebastiaan Luyssaert, Belgium]	Accepted: Text revised.

Comment No	From Page	From Line	To Page	To Line	Comment	Response
40317	38	38	38	38	replace monitoring to measuring, reporting and verifying (MRV) [Thelma Krug, Brazil]	Accepted: Text revised.
21037	38	41	38	41	The difference between satellite and ground inventory data is mentioned. It would be helpful to detail which/ if one of these methods is overestimating/ underestimating to give rise to the difference. [, United Kingdom (of Great Britain and Northern Ireland)]	Accepted: Text revised.
5033	38		38		On the foot note on AFOLU: it is more helpful for readers if the explanation on AFOLU appears in the early part of Chapter 2, because this term has been used repeatedly before the subsection 2.4.1.2. [, Japan]	Accepted: Text revised.
8443	38	29	46	44	As I understood, bookkeeping models considered that net emissions by AFOLU are exclusively linked with land use change and deforestation. The impact of agricultural practices is not considered. I don't know how robust is this hypothesis but I can say that, at Belgium level, this is incorrect. Due to current management, crops are con,tionuously loosing carbon and grasslands are continuoudsly gaining carbon. Ref : Goidts, E., van Wesemael, B., 2007. Regional assessment of soil organic carbon changes under agriculture in Southern Belgium (1955–2005). Geoderma 141, 341–354. [Marc Aubinet, Belgium]	Noted: This is an assumption of bookkeeping models. How do you know that the gains under grassland management are from management?
40507	38		47		Important section, conclusion to be clearly expressed, with level of confidence. To be conveyed at ES/SPM level. [Valerie Masson-Delmotte, France]	Accepted. Bullets are a part of the ES and SPM.
23657	38	10		28	I had trouble reconciling the text in lines 7-12 with the details in table 2.1. In line 10, the authors state that they sum of the modelled estimates gives a total flux of 6.3 GtCO2/year from 2007-2016, but I can't get that number out of the table. There needs to be better agreement between the text and the table [Kerri Finlay, Canada]	Accepted: text revised.
23659	38	25		27	Table 2.1 - What is "Partitioning" as a subheading? The section about is "emissions", so it seems like this shouldinstead by "Sinks"? Also, BIM is not defined - I assume this is the Budget Imbalance from above, but if so, Budget Imbalance needs (BIM) in parentheses for clarity. [Kerri Finlay, Canada]	Accepted: Table revised.

Comment No	From Page	From Line	To Page	To Line	Comment	Response
28541	39	1	39	40	This discussion is incomplete, as the issue of uncertainty in land cover/use data and how they are used differently among models and how this uncertainty contributes to the reported variability is not sufficiently discussed. This is relevant to GHGs and also to the biophysical section (2.6), particularly for regional results. So the GHG discussion may need to be included farther down when presenting DGVM results, as figure 2.9 and 2.10 highlight this issue. There is also repeated reference to this issue in subsequent sections, and so it merits specific discussion. This is because every process included in this chapter happens in a specific vegetation in a specific place and time, and in order to make accurate estimates at local/regional/global levels the vegetation distribution and extent needs to be accurate. There are several recent papers to draw from: Meiyappan, P., A. K. Jain, and J. I. House (2015), Increased influence of nitrogen limitation on CO2 emissions from future land use and land use change, Global Biogeochem. Cycles, 30, doi:10.1002/ 2015GB005086.; Peng, S., Ciais, P., Maignan, F., Li, W., Chang, J., Wang, T., & Yue, C. (2017). Sensitivity of land use change emission estimates to historical land use and land cover mapping. Global Biogeochemical Cycles, 31, 626–643. https://doi.org/10.1002/2015GB005360; ; Prestele, R., Arneth, A., Bondeau, A., de Noblety-Ducoudre, N., Pugh, T. A. M., Sitch, S., … Verburg, P. (2017). Current challenges of implementing anthropogenic land-use and land-cover change in models contributing to climate change assessments. Earth System Dynamics, 8(2), 369–386. https://doi.org/10.5194/esd-8-369-2017; Di Vittorio, A. V., Mao, J., Shi, X., Chini, L., Hurtt, G., & Collins, W. D. (2018). Quantifying the effects of historical land cover conversion uncertainty on global carbon and climate estimates. Geophysical Research Letters, 45, 974–982. https://doi.org/10.1002/ 2017GL075124 [Alan Di Vittorio, United States of America]	Noted: The discussion is indeed incomplete, but the length restrictions prohibit such elaboration.
22461	39	1	39	40	Place this material later. Present the main information and concepts that readers need to know before details about estimation and datasets. [Anastasios Kentarchos, Belgium]	Accepted: Text revised.
3263	39	2	39	2	Term "DGVM" not mentioned since page 5 of report (in Executive Summary) would be worth 'reintroducing' either here or on previous page (38) in line 9(?) "The sum of the modelled estimates" <- are these from the DGVMs or bookkeeping? Not entirely clear. [Viola Heinrich, United Kingdom (of Great Britain and Northern Ireland)]	Accepted: Text revised.
18215	39	2	39	7	To my knowledge several DGVMs used HYDE directly while others indeed used LUH2 [Julia Nabel, Germany]	Accepted: Text revised.
18217	39	2	39	7	the second bookkeeping model used - Blue (Hansis et al., 2015) - should be listed here, too, as it kind of bridges DGVMs and H&N: It used LUH2 as several DGVMs do and included peat burning and drainage as H&N [Julia Nabel, Germany]	Accepted: Text revised.
2535	39	3	39	3	"land-cover change" [Wei Li, France]	Accepted: Text revised.
2537	39	8	39	8	It is important to note here that these satellite-based estimates don't include soil organic carbon change [Wei Li, France]	Accepted: Text revised.

Comment No	From Page	From Line	To Page	To Line	Comment	Response
11545	39	12	39	12	why not remove brackets of (Tyukavina et al. 2015) in the phrase [Lawrence Aribo, Uganda]	Accepted: editorial
12751	39	13	39	13	The formulation "(except (Baccini et al. 2017)." is weird. The reviewer suggests to modify it [Tiziana Susca, United Kingdom (of Great Britain and Northern Ireland)]	Accepted: Text revised.
23715	39	22	39	23	Any references? [Xiyan Xu, China]	Rejected: References shouldn't be required for this observation.
33055	39	24	39	30	It would be important to define a worldwide reference base to define the different types of covers worldwide. This would help to generate studies of changes in land cover and land use regardless of the borders between countries, and not only large agencies are in charge of generating this information. [Jesus Alejandro Prieto Amparan, Mexico]	Agreed, but this definition of a worldwide reference system is beyond the scope of this chapter.
30965	39	24	39	30	It is good to see acknowledgement of methodological differences and differences in definitions which impact on the outcome of analyses. [Kelsey Perlman, France]	Noted.
17019	39	24	39	34	The paragraph seems to be at odds with the statement made in line 1, that "The DGVMs used spatially explicit, harmonised land-use change data". [Roland Hiederer, Italy]	Rejected. The data set used by most DGVMs suffers from most of the uncertainties listed here.
24271	39	27	39	28	It is improper to set on an equal footing, as apparently done here, internatoinally apporved definitions such as FAO --which incidentally are those uptaken by certain UNFCCC processes--with definitions ''made-up'' by academic authors for specific analysis purposes. [Francesco Tubiello, Italy]	Agreed, but nevertheless these differences in definition contribute to differences in estimates.
5037	39	29	39	29	We would suggest reconsidering the inclusion of "Legacy effect". Legacy effect would be misleading because it is used to address the effects of age-class structure in forests in the context of UNFCCC. [, Japan]	Rejected. Legacy effect refers to more than age structure. It refers here to time lags as a result of decomposition as well.
2539	39	30	39	32	Also, since AR5, more DGVMs took sub-grid gross land-use change into account; before only net LUC [Wei Li, France]	Agreed, but this detail seems unnecessary to include.
2037	39	31	39	31	'...to larger estimates...' [Edson Leite, Brazil]	Accepted.
1101	39	31	39	31	Replace "…estiamtes of …" by "…estimates of …" [Sebastiaan Luyssaert, Belgium]	Accepted.
1773	39	31	39	31	estimates. [William Lahoz, Norway]	Accepted.
24357	39	32	39	32	Remove one of the two periods at the end. [Renato Braghiere, France]	Accepted.
1103	39	32	39	32	Delete the citation of Luyssaert et al 2014. This paper is about biophysical effects instead of CO2 fluxes. [Sebastiaan Luyssaert, Belgium]	Accepted. Reference deleted.
6271	39	32	39	32	Double period ".." [Tristan Quaife, United Kingdom (of Great Britain and Northern Ireland)]	Accepted.
3265	39	32	39	32	Double full stop- remove one [Viola Heinrich, United Kingdom (of Great Britain and Northern Ireland)]	Accepted.
18219	39	34	39	34	Pongratz et al. 2018 [Julia Nabel, Germany]	Accepted.
1775	39	34	39	34	discrepancies [William Lahoz, Norway]	Accepted.
1777	39	34	39	34	The statement “other unexplained… regions” sounds vague. Could the authors makes this statement more specific? [William Lahoz, Norway]	Accepted. Sentence deleted.
311	39	36	39	39	Perhaps can add a recommendation here to measure CO2, CH4 and N2O fluxes in agricultural areas using direct micrometeorological techniques (eddy covariance, eddy accumulation, chambers) to build a defensible dataset. Presenaly natural systemns are covered by such measurements much-much better vs agrucultural systems. [George Burba, United States of America]	Rejected. I agree with the comment, but it is not appropriate to add the recommendation here.
18221	39	36	39	39	incomplete sentence? [Julia Nabel, Germany]	Accepted. Text revised.

Comment No	From Page	From Line	To Page	To Line	Comment	Response
3267	39	36	39	39	A long sentence which does not make grammatical sense as it stands at the moment. Consider: "The wide range of estimates of net fluxes of CO2 due to AFOLU may overestimate uncertainty. However, taking account of the different approaches sometimes identifies important processes and can help with transparency and credibility in monitoring, reporting and verifying GHG fluxes under the UNFCCC, e.g. (Grassi et al. 2018). " [Viola Heinrich, United Kingdom (of Great Britain and Northern Ireland)]	Accepted.
2541	39	36	39	39	Not understand why "may overestimate uncertainty" and the logic in this sentence. [Wei Li, France]	Accepted.
1467	39	36	39	39	I couldn't understand what this sentence is trying to say. [William Collins, United Kingdom (of Great Britain and Northern Ireland)]	Accepted. Sentence has been revised.
5035	39	1	40	12	From the point of view of GST under the Paris Agreement, evaluation of the results of actions tackling climate change in the AFOLU sector is very important. Section 2.4 and Figure 2.7 provide the time series trend of various estimates and this information is very useful. On the other hand, it could be understood that the sum of estimated GHG inventories for AFOLU sector is not appropriate to consider global pathways toward net-zero target under the Paris Agreement. It would be useful if there were some suggestions in this chapter how we could consider the progress of AFOLU mitigation results. [, Japan]	Rejected. Seems to prescriptive.
1779	40	2	40	2	Forestry. Please check the text for typos (e.g., caption for Fig. 2.8, and elsewhere). [William Lahoz, Norway]	Accepted.
15397	40	6	40	38	Suggest strengthening the language in this section, for example, by avoiding words such as 'perhaps' and 'on the other hand'. [, Australia]	Accepted. Text revised.
22463	40	14	40	26	The numbers and concepts explained here do not appear to match those of Table 2.1, despite coming from the same source. Please clarify. Also, it would be useful to explain the relationship between the 12% CO2 figure and the 24% GHG figure. This could be done at the start of section 2.4. [Anastasios Kentarchos, Belgium]	Accepted. Text revised.
3127	40	15	40	15	Suggestion: add 'anthropogenic' before 'net'. [, Russian Federation]	Rejected. Anthropogenic is only one component of the total net carbon flux. Text revised to make this clearer.
8421	40	15	40	15	The reference could be updated (2018 report) [Marc Aubinet, Belgium]	Accepted. Text and Table revised.
40319	40	15	40	19	This seems to be a contradiction with the text on page 5 (lines 33-34) stating that from 2007-2016 the land was a sink. Would be useful to clarify. [Thelma Krug, Brazil]	Accepted. Text revised.
33607	40	15	40	21	The Global Carbon project partitions the net land-atmosphere flux into two terms: “land use change” (considered anthropogenic CO2 fluxes due to AFOLU) and the “land sink” due to indirect anthropogenic effects. AFOLU fluxes are both emissions and removals. However, AFOLU sinks (like forest management and afforestation) are grouped together with land use change (e.g. deforestation). This might explain why e.g. forestry is illustrated as an source of emissions in figure 2.1. Please consider more explanation to how the Global Carbon project has defined this. [, Norway]	Accepted. Text revised.
5535	40	16	40	17	"land sink due to indirect anthropogenic effects" what it means, like what? [Sanaz Moghim, Iran]	Accepted. Text revised.
8423	40	17	40	17	Where does the number 4.9+/- 3 come from ? It could be the number corresponding to "Land-use change emission" for 2007-2016 in Table 2.1. But, (1) the difference of units makes this totally confusing, (2) the number have been reevaluated in the 2018 report of Le Quéré (5.5+/-2.5 GtCO2 yr-1; https://doi.org/10.5194/essd-10-2141-2018)), (3) this would suggest that AFOLU flux corresponds only to Land use change and that all other causes of emission/sequestration by AFOLU are ignored. This needs clarification ! [Marc Aubinet, Belgium]	Accepted. Text revised.

Comment No	From Page	From Line	To Page	To Line	Comment	Response
8427	40	17	40	17	The number 4.9 appears rather lower than suggested in Figure 2.7 [Marc Aubinet, Belgium]	4.9 seems correct for the last 1 years of the Figure.
1105	40	18	40	19	Replace "...((Le Quéré et al. 2018), Table 2.1)." by "...(Le Quéré et al. 2018, Table 2.1)." [Sebastiaan Luyssaert, Belgium]	Accepted.
33057	40	19	40	21	What about large areas of grassland and scrub? As for the carbon stores [Jesus Alejandro Prieto Amparan, Mexico]	Accepted. Text revised.
29835	40	20	40	21	Wood harvest cannot be treated as permanent carbon sink as after a decade or so the product starts releasing CO2 [Souparna Lahiri, India]	Agreed, but this sentence refers to a flux, not a sink.
22465	40	23	40	23	DGVMs should be defined earlier [Anastasios Kentarchos, Belgium]	Accepted. Defined when first used.
8425	40	23	40	23	"but is similar" appears misleading as, in Figure 2.7 the average estimates from DGVM(blue line) appear systematically larger than those by bookkeeping models (red line) [Marc Aubinet, Belgium]	Accepted. Text revised.
1107	40	24	40	24	Subscript in CO2 Is missing. [Sebastiaan Luyssaert, Belgium]	Accepted.
22467	40	28	40	36	The basis for the -11.6 Gt figure, and its relationship to the -6.3 Gt figure presented on p38 line 10 need to be explained in a more transparent manner (also, both numbers are very different from the Sland and Eluc figures in Table 2.1 - why is this?). The headline statements on p5 imply that this is rather simple: +4.9 from 'bookkeeping' models - 11.6 = -6.3. If it is this simple, please say so. The fact that both the -11.6 and the -6.3 are described as 'net sink' or 'net flux' is extremely confusing since one figure is the 'net' of the other two. Also please describe more precisely exactly what the -6.3 number contains. Page 5 describes it as the combined direct and indirect effects on managed and unmanaged lands. This implies that fluxes due to natural processes are not included. Why do we not seek to estimate that number as well? [Anastasios Kentarchos, Belgium]	Accepted. Text revised.
3129	40	29	40	29	LULUCF total emissions is a net flux, therefore it partly includes removals. Some clarification is needed. Once again, qualifiers (net, gross) are needed when emissions/removals are discussed. [, Russian Federation]	Accepted. Text revised.
18223	40	34	40	34	might allow (see Buermann et al. 2018) [Julia Nabel, Germany]	Accepted.
5537	40	34	40	35	"indirect effects of environmental change" I don'y know how the authors define "direct and indirect effect", it needs to be defined! [Sanaz Moghim, Iran]	Accepted. The terms are defined at the start of Section 2.4.
25347	40	34	40	36	Would it not be clearer to refer to CO2 emissions only, leading to 28% (SPM Box 1.3) instead of 22%? [, France]	Accepted. Text revised.
8431	40	35	40	35	How can it be stated that "indirest effects of environmental change" are the cause the net land sink. See additional comment on this point on P41 L8 - 16 [Marc Aubinet, Belgium]	In theory, AFOLU includes all management. CO2 fluxes not caused by management must be environmentally driven. See 3 fluxes decribed at start of Section 2.4.
8433	40	35	40	35	Why "environmental change" and not "climate change " ? [Marc Aubinet, Belgium]	Environmental change is broader, including increaing CO2 concentrations as well as temperature and moisture.
2543	40	35	40	35	Please use consistent signs across the text [Wei Li, France]	Accepted.
8429	40	35	40	36	11.2 Gt CO2 yr-1 corresponds to 28 % and not 22% after the Le Quéré report for 2006-2017. In addition, these numbers may be updated, using the 2018 report : rather -13.5 Gt CO2 yr-1 corresponding to 33% during the period 2008-2017. [Marc Aubinet, Belgium]	Accepted. Updated in revised text.

Comment No	From Page	From Line	To Page	To Line	Comment	Response
8435	40	38	41	2	I was puzzled by this assertion. It seems in contradiction with Le Quéré et al 2018 (Figure 6b) for which no clear change in acceleration appears between these periods. Apparently, in another paper, Ballantyne et al (Ballantyne, A. et al. Audit of the global carbon budget: estimate errors and their impact on uptake uncertainty. Biogeosciences 12, 25652584 (2015).) criticizes the approach of Le Quéré. Anyway, in the 2018 report of the Global Carbon project (Le Quéré et al, 2018, Earth Syst. Sci. Data, 10, 2141–2194, 2018) there is mention neither of this paper nor of any different tendencies between warming hiatus and following period. Is there a disagreement between scientists on this point ? If yes, I think that citing only one paper and ignoring the continuous work of the global carbon project would be misleading. [Marc Aubinet, Belgium]	Rejected. the Ballantyne et al. you cite (215) is not the one cited here (217).
31049	40	38	41	16	Units GtC yr-2. (wrong Would be helpful for the reader to have same units as elsewhere, i.e. Gt CO2 yr-1 [Annalea Lohila, Finland]	Rejected. Yr-2 refers to a trend in a rate.
391	40	39	41	2	these fluxes are two orders of magnitude lower than in the previous paragraph (p. 40, line 35) [Tobias Rütting, Sweden]	Noted. The lower fluxes are not comparable to the budget values. Instead they suggest slight changes in response to rates of warming.
23661	40	3		12	Define the ranges included in Fig 2.7. The coloured lines are identified, but not what the ranges represent in the figure caption. [Kerri Finlay, Canada]	Accepted. Text revised.
22469	41	1	41	6	This section is largely speculation and should be reduced or omitted [Anastasios Kentarchos, Belgium]	Rejected. Not speculation, but uncertainties in alternative explanations for observations.
1469	41	3	41	3	"may have resulted" - surely there is information e.g. from Global Carbon Budget to determine whether this is the case. At an rate, an assessment needs to be stated here as to whether this is known or unknown. [William Collins, United Kingdom (of Great Britain and Northern Ireland)]	Rejected. These slight variations are open to alternative explations.
643	41	5	41	5	There is a misuse of literature here. Piao et al. 2018 refers to "Piao, S., and Coauthors, 2018b: Lower land-use emissions responsible for increased net land carbon sink during the slow warming period. Nat. Geosci., 11, 739-743, doi:10.1038/s41561-018-0204-7." rather than the reference in the original chapter. [Shilong Piao, China]	Accepted.
1109	41	6	41	6	Subscript in CO2 Is missing. [Sebastiaan Luyssaert, Belgium]	Accepted.
26967	41	8	41	11	To avoid confusion more consistency with terms is needed. In line 10, "found that CO2 alone" should be "found that CO2 fertilization alone" and in line 11 "while climate alone" should be "while climate variability alone". [, Germany]	Accepted. Text revised.
8441	41	8	41	16	These results could be biased as most of the models ignore the limitation due to nutrients (N, notably but also P, K). The three models that consider N uptake (but never P or K to my knowledge) (CLM4-CN, OCN and SDGVM) have also those who have the least significant trend (Sitch paper, Table S2 last column). [Marc Aubinet, Belgium]	Noted. Elsewhere the chapter addresses biases of models.
8437	41	10	41	11	The numbers do not correspond to Sitch paper (-2.875 +/-1.003 Gt/yr trend : -0.061+/-0.04 Gt/yr2) [Marc Aubinet, Belgium]	Checked and verified
8439	41	11	41	12	The numbers do not correspond to Sitch paper: Table S3 : Trend of climate effect : 0.006+/-0.044 Gt/yr2 [Marc Aubinet, Belgium]	Checked and verified
22471	41	12	41	12	Change "00." to "0." [Anastasios Kentarchos, Belgium]	Accepted.
22473	41	14	41	14	explain "residual sink" terminology (this is the only place it is used in the chapter) [Anastasios Kentarchos, Belgium]	Rejected. The definition follows the term in the same sentence.
1111	41	15	41	15	Delete " ." [Sebastiaan Luyssaert, Belgium]	Accepted.
6275	41	15	41	15	Rogue period near end of line. [Tristan Quaife, United Kingdom (of Great Britain and Northern Ireland)]	Accepted.

Comment No	From Page	From Line	To Page	To Line	Comment	Response
1781	41	15	41	15	Superfluous full stop. Check for similar typos elsewhere in the text. [William Lahoz, Norway]	Accepted.
1783	41	19	41	19	I suggest "…calculated by differences…". [William Lahoz, Norway]	Rejected. Many terms sum to a difference.
18225	41	20	41	20	2.2 GtCO2? GCB 2017 states "The budget imbalance was 0.6 GtC yr−1 on average over 2007–2016" [Julia Nabel, Germany]	Noted. The two are equivalent (CO2 versus C).
15623	41	22	41	24	I don't understand this. Should be clarified. [Tuomo Kalliokoski, Finland]	Accepted. Clarification added.
33079	41	23	41	24	Kelly et al. 2013 appears missing in the list of references. [Philippe Marbaix, Belgium]	Need a reference: Kelly et al., 213
1113	41	26	41	26	Check citation format (Wang instead of WANG) [Sebastiaan Luyssaert, Belgium]	Accepted.
2545	41	35	41	35	I think it should be "land use", not "land cover" here. The satellite data reflects the physical land cover type while the statistics from FAO sometimes are more about land use. For example, the wood harvest in Canada is land cover change from satellite data but not "deforestation" in FAO-FRA because the land-use is not changed (still forest). [Wei Li, France]	Accepted.
2547	41	38	41	38	Not very clear what the "real differences" mean, even with the example shown below. [Wei Li, France]	Accepted. Text revised.
1115	41	41	41	41	There is an extensive literature and lively debate on the GHG-effects of different types of forest management (see references in the introduction of Valade et al. 2018 doi/10.1186/s13021-018-0113-5). On top of this discussion Valade et al 2018 showed that it matters for the GHG-balance which tree are harvested. These are advances in the field since AR5 which are not at all mentioned in the report. [Sebastiaan Luyssaert, Belgium]	Accepted. Text revised. Valade et al. 218 doi/1.1186/s1321-18-113-5)
33059	42	1	41	1	The map should include the names of the oceans, the rose of the winds, improve the cartographic quality [Jesus Alejandro Prieto Amparan, Mexico]	Rejected for ease of readability
22475	42	1	42	1	Thjere is no reason to repeat legend for each region [Anastasios Kentarchos, Belgium]	Rejected for ease of readability
26969	42	1	42	1	Table 2.8, please check explanations of symbols (e.g. no green circles but triangles) [, Germany]	Accepted and revised
15625	42	3	42	3	Figure 2.8 Map does have only marginal role in this figure. By removing it you could have larger subfigures. Also no need for repeating symbol legends in every figure if they are same in each of them. [Tuomo Kalliokoski, Finland]	Figure redrawn for ease of readability
941	42	3	42	4	CO2: use subscript [Nocera Francesco, Italy]	Editorial
3131	42	3	42	11	Color symbols are hardly distinguishable. [, Russian Federation]	Figure redrawn for ease of readability
11549	42	4	42	4	(in GtCO2 yr-1) use superscript to correctly represent the formular [Lawrence Aribo, Uganda]	Editorial
8445	42	8	42	8	No yellow circle in the figure. Do you mean yellow triangle ? [Marc Aubinet, Belgium]	Figure redrawn for ease of readability
2549	42	14	42	14	which estimates? GHG emissions or land sinks? [Wei Li, France]	Accepted. Text revised.
38821	42	14	42	15	This must refer to models having fixed C:N ratios, since plant C:N ratios can vary. [, United States of America]	Noted.
15163	42	13	44	31	The section on "Nationally Reported GHGI values versus Global Model Estimates" provides very valuable clarification of an important issue to for global aggregation of land-based mitigation, and should be retained. Figure 2.9 is especially helpful and useful. [Maya Hunt, New Zealand]	Noted.
25349	42	3			This synthetic figure is very useful. Its readability should be improved by enlarging the fonts and improving the resolution. Would it also be possible to add an insert for the whole world? [, France]	Figure redrawn for ease of readability
6973	42				Figure 2.8: Caption - There are no green or yellow circles, open or closed. Perhaps triangles? [Debra Roberts, South Africa]	Caption revised
33081	43	1	43	2	I do not understand the relation between that sentence and the paper Tanaka and O'Neill 2018. [Philippe Marbaix, Belgium]	Accepted. Reference deleted.

Comment No	From Page	From Line	To Page	To Line	Comment	Response
29045	43	2	43	2	Not sure if Tanaka and O'Neill is the right ref here. Please check. [Jan Fuglestvedt, Norway]	Accepted. Reference deleted.
29047	43	2	43	22	This discussions and fig 2.9 are very important. Can you add more about implications, solutions etc? [Jan Fuglestvedt, Norway]	Accepted. Text describes the implications.
3269	43	7	43	7	Suggestion: instead of simply using 'runs' consider using "model runs/simulations" [Viola Heinrich, United Kingdom (of Great Britain and Northern Ireland)]	Accepted. Text revised.
5539	43	7	43	9	"Indirect effects on other land are part of the “land sink”. This sentence followed by previous one needs to be more described. [Sanaz Moghim, Iran]	Accepted. Text revised.
33083	43	12	43	22	Figure 2.9: I have difficulties understanding the area covered by the two parts of panel d), and thus think that it needs a clarification. What is included in the "indirect human induced effects" in the left column of panel d)? Only the small part that is related to actual change in LUC (and perhaps management change), which would mean that the main effects of environmental change on managed land are not included in the left column of panel d) (but rather in the right column, even if they occur on land that is actually used for human activities?). The use of the term "managed land" would then appear to deviate from the definition given in the glossary. Please clarify, and check that it is consistent. [Philippe Marbaix, Belgium]	Figure completely redrawn
943	43	13	43	13	CO2: use subscript [Nocera Francesco, Italy]	Accepted.
29049	43	22	43	31	Very importat and interesting para. Can this be lifted up and made more visible? [Jan Fuglestvedt, Norway]	Comment doesn't match line numbers.
6975	43				Fig 2.9: is the size of the boxes indicative of something? If not, it might be better to make them all the same size to avoid this misunderstanding. [Debra Roberts, South Africa]	Figure completely redrawn
11551	44	1	44	1	Upper part of the lengenf is not clear. May be use colors filled colors for all [Lawrence Aribo, Uganda]	Accepted. Figure deleted.
697	44	1	44	1	The captions of Primary forest bookkeeping model, Primary forest DGVMs, and Unmanaged forest GHGIs are not readable. Please enlarge. [Merja Tölle, Germany]	Accepted. Figure deleted.
2551	44	3	44	3	symbols in the legend is not clear [Wei Li, France]	Accepted. Figure deleted.
23717	44	3	44	3	The top 3 legends need very careful look to distinguish. [Xiyan Xu, China]	Accepted. Figure deleted.
3133	44	3	44	7	Figure 2.10 also shows differencies between primary and secondary forests, not just between managed and unmanaged forests. [, Russian Federation]	Accepted. Figure deleted.
18259	44	5	44	5	the GCB -> 2017 <- (since in 2018 two budgets were published) [Julia Nabel, Germany]	Accepted. Text revised.
3271	44	8	44	12	Do you mean DGVMs when you say 'global models'? If so, might be clearer to use DGVM as this is also consistent with terms used in Figure 2.10. Otherwise I'm not sure I follow what "global models" are. [Viola Heinrich, United Kingdom (of Great Britain and Northern Ireland)]	Accepted. Text revised.
2553	44	10	44	10	maybe "land-use" than "land-cover" [Wei Li, France]	Accepted. Text revised.
1117	44	11	44	11	Check citation format (brackets should be around the years, not around the author name) [Sebastiaan Luyssaert, Belgium]	Accepted. Text revised.
18261	44	14	44	14	maybe forest management instead of land management [Julia Nabel, Germany]	Accepted. Text revised.
2555	44	15	44	16	what "activities"? Please give some examples [Wei Li, France]	Accepted. Text revised.
18263	44	18	44	18	which GCB - 2017?! [Julia Nabel, Germany]	Accepted. Text revised.
2557	44	20	44	20	which bookkeeping model or "bookkeeping models"? [Wei Li, France]	Accepted. Text revised.

Comment No	From Page	From Line	To Page	To Line	Comment	Response
29837	44	22	44	27	The correctness of the data also depends on the data as reported by the countries. In the absence of any groundtoothing and independent verification of country level data, incorrect data submitted can change the scenario, say, if the baseline data of forest cover is changed in the submission to UNFCCC or FAO. This has happened recently as reported in the case of BUR submitted by India in 2018 where UNFCCC has raised questions aorund data submitted for forest cover. [Souparna Lahiri, India]	Accepted. Text revised.
5039	44	22	44	31	This entire paragraph is based on the discussion of a single study, Grassi et al. 2018. We would like to ask clarification why the only study is appropriate for describing future research orientations. [, Japan]	Accepted. Text revised.
5041	44	23	44	23	We would suggest reconsidering the appropriateness of inclusion of the reference to "Fuglestvedt et al. 2018" as it does neither deal with Global Stocktake nor the differences in global estimations. The article rather discusses the implications of different Global Warming Potentials of several GHGs. [, Japan]	Accepted. Text revised.
2559	44	23	44	23	verb? [Wei Li, France]	Accepted. Text revised.
23719	44	23	44	23	be possible [Xiyan Xu, China]	Accepted. Text revised.
11553	44	23	44	25	The sentence looks incomplete. May be Considr replacing by in line 23 with be [Lawrence Aribo, Uganda]	Accepted. Text revised.
3273	44	23	44	25	Sentence starting on line 23 (to 25) begins with the word "And". Consider using: "Additionally" or "Moreover". [Viola Heinrich, United Kingdom (of Great Britain and Northern Ireland)]	Accepted. Text revised.
3275	44	23	44	25	Spelling error: change "would by" to "would be" [Viola Heinrich, United Kingdom (of Great Britain and Northern Ireland)]	Accepted. Text revised.
2561	44	26	44	26	Models don't use FAO directly. I think it needs to acknowledge the work from HYDE and LUH somewhere. [Wei Li, France]	Accepted. Text revised.
38823	44	28	44	31	This objective, to align models and model experiments to historical GHG, is doable but very challenging for modeling groups. This is because, at least in the case of the U.S. GHGI, the inventory values are updated each year with new methods and the numbers from 1990 onwards are recalculated, which sometimes lead to very different estimates each year. It is really impossible at this point in time for models/modelers to recreate models/reinsert new data sets each year to accommodate these different data sets as they are constanting changes. A push for better GHGI estimates needs to also take place. It is not just a need for the modeling communities to do better. [, United States of America]	Accepted. Text revised.
3277	44	36	44	36	Random fullstop midsentance [Viola Heinrich, United Kingdom (of Great Britain and Northern Ireland)]	Accepted. Text revised.
24273	44	38	44	38	Please pay due attenion, throughout the text, to differences between land use change and land cover change. As an example, those reported here as land cover change data from FAO are in actuality land use change statistics. It's not the same thing! [Francesco Tubiello, Italy]	Accepted. Text revised.
40505	44		44		Figure legend hard to read. [Valerie Masson-Delmotte, France]	Accepted. Figure deleted.
23663	44	3		7	Figure needs some clarification. Include y-axis label of "Forest Area (M ha)", and the legend for the patterned bars is impossible to interpret (use different colours/ shades, rather than the pattern). Is the "global" bar just the sum of developed and developing? If so, I don't think these should be separate bars on the graph - the same data are presented twice in the same figure. I think the "global" bars should be removed. [Kerri Finlay, Canada]	Accepted. Figure deleted.

Comment No	From Page	From Line	To Page	To Line	Comment	Response
7005	44	9			What assumptions do models make regarding carbon fluxes in new/managed vs old unmanaged forests? ftp://ftp.bgc-jena.mpg.de/pub/outgoing/athuille/CE_booklet_final_packed/CE_booklet_Stand_02-03-09_screen.pdf - see page 21 "It is generally thought that with ageing, old-growth forests ...cease to accumulate carbon and are therefore carbon-neutral. For that reason they are not yet included in international treaties. But evidence examined by CarboEurope-IP suggests that these forests continue to remove carbon dioxide ...in forests between 15 and 800 years of age, biomass continues to increase with age and the ratio of respiration over growth does not approach an equilibrium with age" - please, this evidence is extremely important to include in this report, from a mitigation and a biodiversity/conservation perspective. [Debra Roberts, South Africa]	Accepted. Text revised.
393	44	23			"would be possible" [Tobias Rütting, Sweden]	Accepted. Text revised.
6977	44				Fig 2.10: in the legend the patterns (blue/orange/green dots) in the open squares are not visible. [Debra Roberts, South Africa]	Accepted. Figure deleted.
23577	44				The legend in Figure 2.10 indicates that it is not clear [Huai Jianjun, China]	Accepted. Figure deleted.
26971	45	3	5	45	The information provided on the CO2 fluxes from land is very difficult to understand. Please revise the structure and presentation of the findings, possibly using a table showing the numbers in a more comprehensive way. In addition, please explain "global models", "bookkeeping models" and "global vegetation models", "DGVM" and briefly explain their differences for the reader to understand the differences in estimated CO2-fluxes. If the paragraph from line 18-26 refers to net emissions from managed land (estimated by bookkeeping models) while the next paragraph from line 28-32 refers to net emissions from unmanaged land (estimated from DVGMs) this should be expressed in a clearer manner, in particular the last sentence of this paragraph that refers to DVGMs is confusing. The second half of the latter paragraph that combines the two and provides a figure for the total land sink (-6.3 Gt CO2/y) should be its own paragraph. The paragraph rom line 38-45 reports the CO2 flux from GHG-inventories (+0.1Gt CO2/y). The difference between the two is 6.2 not 4.7 Gt CO2/y)? [, Germany]	Rejected. I think the reviewer is referring to the Figure on page 43.
5541	45	2	45	3	it may need a reference [Sanaz Moghim, Iran]	Rejected. The revised text should not require a reference.
3135	45	2	45	11	Left-hand bottom captions, the third one: should it be 'net land sink AFOLU removals'? Or in line 18 the second ' AFOLU' is to delete? [, Russian Federation]	Accepted. Figure revised.
5543	45	5	45	6	any reference! [Sanaz Moghim, Iran]	Accepted. Text revised.
19037	45	12	45	13	what was observed and observations or a range of observed values were too large? [Joanna Wibig, Poland]	Accepted. Text revised.
2563	45	13	45	14	Not really consistent, see Earth Syst. Sci. Data, 10, 219-234, 2018 https://doi.org/10.5194/essd-10-219-2018 [Wei Li, France]	Rejected. The paper by Houghton & Nassikas (218) claimed this consistency.
5361	45	14	45	20	The figure needs to be adequately referenced. [Helmut Haberl, Austria]	Accepted. Values referenced in the Fig. legend.
8447	45	15	45	15	Colour of bars should be different in the left and right part as their meaning is different [Marc Aubinet, Belgium]	Accepted. Figure revised.
8449	45	15	45	15	Error bars and numbers could be added in the figure (this would facilitate the comparison with text in pages 40-41. [Marc Aubinet, Belgium]	Wants error bars.
13369	45	29	45	29	incorrect parenthesis, but also perhaps the reference to the section, since it is refering to the present section: "...by even larger removals (driven, as discussed in section 2.4.1.2) by ..." [Gregory Duveiller, Italy]	Accepted. Text revised.
29051	45	32	45	32	What are te implciations of this last statement? [Jan Fuglestvedt, Norway]	Accepted. One implication is addressed in the next paragraph.

Comment No	From Page	From Line	To Page	To Line	Comment	Response
23665	45	15		20	Fig 2.11 is confusing. I don't think these data benefit from being presented as a figure, given how many labels are required. A table or just moving these values into the text might be better. [Kerri Finlay, Canada]	Accepted. Figure has been revised.
25351	45	17			It would be a good idea to have a presentation similar to Figure 2.8, with in addition to this global figures, some regional figures. [, France]	Rejected. Only the AFOLU fluxes can be distributed geographically, and the Figure would not handle this level of detail.
6979	45				Fig 2.11: so the centre bar on the left is the same as the left bar on the right? It takes a long time to understand this point. Suggest rearranging the figure as follows: Bar 1 - AFOLU emissions, 2 - AFOLU sinks, 3 - Net AFOLU emissions. Gap. Bar 4 - Net AFOLU emissions in same colour as bar 3. Bar 5 - Net land sink in new colour. Bar 6 - Total net land flux in yet another colour. Now there is a logical flow. Remove legend, and rather label bars on X axis. Are there no "All land emissions"? Since AFOLU is a sub-category of All Land? For actual values of the bars, the Y-axis is not detailed enough. Consider including the actual values on each bar? Or including minor markers on the Y-axis. [Debra Roberts, South Africa]	Accepted in part. The Figure has been revised.
31051	46	1	46	43	The section 2.4.1.3 does not inclulde any assessment [Annalea Lohila, Finland]	Accepted. Text has been revised.
333	46	1	46	43	This section needs to include references to integrated assessment analyses of climate effects on ecosystems. The problem is that management can have discernable influences on carbon fluxes so you cannot model carbon fluxes without modeling land use and managemeht. The following integrated assessments do that: Tian et al. (Env. Res. Letters, 2016 -- note this is a different set of authors from the Tian et al. already cited in this section) calculate the effect of climate change on forest ecosystems using a DGVM linked to a global forest and land use model. Tian et al. (Land Economics, 2018) conduct a similar analysis with a wider range of models. Favero et al. (2018; Can the Global Forest Sector Survive 11° C Warming? Agricultural and Resource Economics Review. 47(2): 388-413) use a different set of models including the models by Prentice cited in this section, to assess large-scale warming. [Brent Sohngen, United States of America]	Accepted. Text has been revised.
38825	46	1	46	43	This section needs to include references to integrated assessment analyses of climate effects on ecosystems. The problem is that management can have discernible influences on carbon fluxes so one cannot model carbon fluxes without modeling land use and management. The following integrated assessments do that. Tian et al. (Env. Res. Letters, 2016 -- note this is a different set of authors from the Tian et al. already cited in this section) calculate the effect of climate change on forest ecosystems using a DGVM linked to a global forest and land use model. Tian et al. (Land Economics, 2018) conduct a similar analysis with a wider range of models. Favero et al. (2018; Can the Global Forest Sector Survive 11Degrees C Warming? Agricultural and Resource Economics Review. 47(2): 388-413) use a different set of models including the models by Prentice cited in this section, to assess large-scale warming. [, United States of America]	Accepted. Text has been revised.
18265	46	1	46	43	no statements on evidence/agreement/confidence [Julia Nabel, Germany]	Accepted. Text has been revised.

Comment No	From Page	From Line	To Page	To Line	Comment	Response
33085	46	1	46	43	Section 2.4.1.3: the title is about impact of climate change on future fluxes, but the texts refers a lot to the fertilization effects. It looks like all scenarios project an increased atmospheric CO2 concentration. However, stopping CO2 emissions implies declining concentrations in the atmosphere, and in the case of 1.5°C scenarios, this need to happen quickly. Thus, what would happen to the CO2 fertilization effect in 1.5°C scenarios? This does not seem to be considered here. A relevant paper could be Rockström et al 2017 « A Roadmap for Rapid Decarbonization ». Science 355, n° 6331 https://doi.org/10/gc2g2s. (see the change in sinks in the top land of the figure - the indirect sinks, even in oceans, are strongly decreasing; ignoring this here could send a confusing message to policymakers). [Philippe Marbaix, Belgium]	Accepted. Text revised.
11555	46	4	46	4	CMIP4 instead of C4MIP [Lawrence Aribo, Uganda]	Accepted.
38827	46	4	46	44	Light of references here and can add references to IA analyses of climate effects on ecosystems and the role of management decisions on LU and carbon fluxes, which is currently absent. Tian et al. (Env. Res. Letters, 2016 paper on climate change impacts on forest ecosystems using a DGVM linked to a global forest model. Tian et al. (Land Economics, 2018). Favero et al. (2018; Can the Global Forest Sector Survive 11Degrees C Warming? Agricultural and Resource Economics Review. 47(2): 388-413). [, United States of America]	Accepted. Text has been revised.
33061	46	5	46	5	Why AR5, CMIP5, C4MIP, and not MIROC5 or others? What vias of representative concentrations were used? [Jesus Alejandro Prieto Amparan, Mexico]	Accepted. Text has been revised.
12847	46	5	46	5	C4MIP is not defined [Robert Treuhaft, United States of America]	Accepted.
5043	46	8	46	9	Regarding "on the sign of change" mentioned, it might be better to specify what change. For instance, Wider et al., 2015, Nature geo., DOI: 10.1038/NGEO2413 shows AGREEMENT on the sign of NPP (Net Primary Production) change, and also shows DISAGREEMENT on the sign of total land carbon change. [, Japan]	Another reference suggested.
11557	46	10	46	10	Remove lack of [Lawrence Aribo, Uganda]	Accepted.
14125	46	10	46	25	Prentice et al 2015a and 2015b references are metioned in the text but not in the reference list. [David Taylor, Singapore]	Accepted and edited
8451	46	13	46	14	At several reprises in the text, it is alluded that decrease in stomatal conductance could lead to an increase in productivity. I don't understand this point and I'm quite skeptical. Stomaral closure may increase water use efficiency (which is largely aknowledged) but mainly through transpiration decrease. This does not change productivity. [Marc Aubinet, Belgium]	Accepted. We've added a Box on CO2 fertilisation.
14659	46	13	46	18	This is somewhat repetitive since it was also covered in 2.2.3. Though 2.2.3 had less content on the modelling side. [, Canada]	Accepted. Section 2 deleted in revision.
1119	46	15	46	15	Replace "However, given that plant biomass has fixed C:N ratios (although they vary by plant and soil type), the magnitude ..." by "However, given that plant the C:N ratios of plant biomass are constrainted by biogeochemical processes, the magnitude …". C:N ratios are dynamic and not at all fixed but I agree they have to stay within rather narrow bounds. [Sebastiaan Luyssaert, Belgium]	Accepted. Text revised.
8453	46	16	46	16	Not only N but also P, K, Mg availaibility may be limiting [Marc Aubinet, Belgium]	Accepted. Text revised.
5045	46	17	46	18	Instead of describing "which is not yet well represented in many Earth system models," it may be better to specify as "CMIP5 Earth system model," because many of the current version of ESMs are now implementing the Nitrogen cycle. （MEXT) [, Japan]	Accepted. Text revised.

Comment No	From Page	From Line	To Page	To Line	Comment	Response
8455	46	19	46	19	Could be important to recall that the fertilisation effect is different for C3 and C4 plants [Marc Aubinet, Belgium]	Accepted. See new Box on CO2 fertilisation.
1715	46	20	46	23	Comyn-Platt et al. Nature Geoscience volume 11, pages568–573 (2018) Calculate an emission of 40-72 GtC from permafrost for temperature changes between 1.5 and 2.0 degrees. [William Collins, United Kingdom (of Great Britain and Northern Ireland)]	Accepted.
1471	46	25	46	39	This section should also cite the feedback analysis in AR5 Ciais et al. [William Collins, United Kingdom (of Great Britain and Northern Ireland)]	Add reference.
11559	46	26	46	26	CMIP4 instead of F C4MIP [Lawrence Aribo, Uganda]	Accepted.
29053	46	27	46	29	Re "-.017 to -0.19 Wm-2": What time period? Or per K? Please explain better. [Jan Fuglestvedt, Norway]	Paragraph deleted.
14661	46	28	46	28	This is the first time that radiative forcing units are used in the document, though it is unecessary since the topic is still talking about CO2 fertilizaition and not a purely radiative process like albedo or longwave radiation. [, Canada]	Accepted. Paragraph deleted.
8457	46	28	46	31	Wm-2 is not a proper unit for a feedback. Should be expressesd in Wm-2°K-1. [Marc Aubinet, Belgium]	Accepted. Paragraph deleted.
22477	46	29	46	29	Not clear what the meaning is of positive feedback here, since it refers to both positive and negative numbers [Anastasios Kentarchos, Belgium]	Paragraph deleted.
8459	46	29	46	29	I don't understand: what do you consider in the "positive feedbacks" [Marc Aubinet, Belgium]	Paragraph deleted.
31053	46	31	46	31	"feedbacks decreased"; isn't it rather a decrease in the range than in absolute value? -0.8 is larger than -1.9. [Annalea Lohila, Finland]	Accepted. Paragraph deleted.
3137	46	34	46	34	Units W/(m2K) is not correct for radiative forcing. [, Russian Federation]	Accepted. Paragraph deleted.
1473	46	34	46	37	Note the Tian et al. 2016 study used the GWP100 metric to relate methane and N2O to CO2. Using a different metric (e.g. GTP100) would make the CO2 fertilisation more important and hence change the mitigation emphasis. [William Collins, United Kingdom (of Great Britain and Northern Ireland)]	Accepted, but initial paragraph deleted.
31055	46	34	46	39	When speaking about the Tian et al, 2016 paper and respective mitigation efforts, it is important to mention that the warming effect of 3 GHG's mentioned in Tian et al. 2016 is attributed to AFOLU sector, and does not include for example the CH4 emissions from natural wetlands. [Annalea Lohila, Finland]	Accepted. Paragraph deleted.
22479	46	35	46	35	What is the source of these methane and nitrous oxide emissions [Anastasios Kentarchos, Belgium]	Accepted. Paragraph deleted.
3139	46	36	46	37	This report is not about mitigation options. Suggestion: delete the phrase. [, Russian Federation]	Accepted. Paragraph deleted.
38829	46	36	46	37	This should be rephrased from a management recommendation to a more factual statement about the relative role of addressing different GHGs. [, United States of America]	Accepted. Paragraph deleted.
29055	46	36	46	37	re the sentence "If so, mitigation efforts should…": This is policy prescriptive and should be deleted or reworded. [Jan Fuglestvedt, Norway]	Accepted. Paragraph deleted.
8461	46	38	46	39	This is a key point. Unfortunately it appears a little bit late in the text. [Marc Aubinet, Belgium]	Noted.
31057	46	41	46	43	References and uncertainty language missing [Annalea Lohila, Finland]	Accepted. Text revised.
1121	46	41	46	43	References are missing [Sebastiaan Luyssaert, Belgium]	Accepeted. Text revised.
1123	46	41	46	43	This paragrpahs need to be further developed. A concluding remark is missing. Tropics are more likley to see an increase in photosynthesis? Temperate and boreal regions are more lokley to see an increase in soil respiration? [Sebastiaan Luyssaert, Belgium]	Accepted. Text revised.

Comment No	From Page	From Line	To Page	To Line	Comment	Response
4039	46	41	46	43	This statement is very interesting, however without some quantification it is not very helpful. How large are the stocks in vegetation and soil in different regions? I assume the lierature used to make this statement (there are no citations) could provide some numbers. [Vassilis Daioglou, Netherlands]	Accepted. Text revised.
6713	46	46	46	46	"4" in CH4 should be in lowercase. [Akihiko Ito, Japan]	Editorial, accepted
307	46	46	46	46	Similar to CO2 section, CH4 methods section seem to rely on older less defensinle methods. Perhaps can add a recommendation here to measure CO2, CH4 and N2O fluxes in agricultural areas using direct micrometeorological techniques (eddy covariance, eddy accumulation, chambers) to build a defensible dataset. Presenaly natural systemns are covered by such measurements much-much better vs agrucultural systems. [George Burba, United States of America]	Rejected: We are describing the methods in the literature that are used to produce global estiates, not field methods for site specific estimates here. Wea re not making recommendations, simply explaining what methods are currently in use.
11707	46	49	46	49	Would not it be 'complemented' instead of 'complimented'? [Edson Leite, Brazil]	Editorial, accepted
2041	46	47	47	12	It is important that global total OH is contrained and also the relative abundances in the two hemispheres, which are important for the global toal CH4 emission estimation and the ratio of emissions of CH4 (and other reactive spacies) in the two hemispheres. I think benchmarking for these OH properties is now well established (Patra et al., 2014) [Prabir Patra, Japan]	Noted
31047	46	45	60	7	The sections for CH4 and N2O are no quite "imbalanced": the CH4 section is very much concentrating on the atmospheric observations, trends and processes. CH4 section begins wit an overview of the methods for estimating fluxes or balances, while this is missing from the N2O. For CO2, the atmospheric part is missing almost totally, which is acceptable as this is a land report. What I am missing is a bit more balanced way to discuss the three gases so that the structure of the different sections (gases) would be more similar. [Annalea Lohila, Finland]	Accepted. The three gases are very different. CH4 is much more reactive in the atmoosphere than CO2 and N2O, and CH4 cannot be understood without exploring some aspects of atmospheric chemistry. However,I have decreased this section in favor or agraeater focus on land related issues.
395	46	9			it is not clear if nitrogen will limit CO2 fertilization (see previous discussions in the chapter). Therefore sugest "which might limit". Why is Phosphorus not mentioned? [Tobias Rütting, Sweden]	Accepted. Text revised.
29057	47	5	47	7	Please check if you can use more recent papers on this issue. [Jan Fuglestvedt, Norway]	Accepted: We now cite Turneretal.,217 and Rigbyetal.,217
22481	47	21	47	21	Spelling of atmospheric [Anastasios Kentarchos, Belgium]	Editorial,accepted
31043	47	21	47	23	Would be good to have a reference here, and to explain shortly how decreasing delta13-CH4 values and biogenic sources are linked [Annalea Lohila, Finland]	Accepted, the reference is in the figure caption
22483	47	23	47	23	Should this be ethane or methane [Anastasios Kentarchos, Belgium]	Noted, yes ethane is correct. In shortening the section, this part was cut.
13371	47	23	47	23	is "ethane" correct? Or should it be "methane"? [Gregory Duveiller, Italy]	Noted, yes ethane is correct. In shortening the section, this part was cut.
29059	47	23	47	23	Would be useful if you could explain why ethane is relevant here as indicator. [Jan Fuglestvedt, Norway]	Noted, yes ethane is correct. In shortening the section, this part was cut.
31897	47	23	47	23	Is this indeed "ethane", or should this be "methane", the subject of this section? [Martijn Slot, Netherlands]	Noted, yes ethane is correct. In shortening the section, this part was cut.
15021	47	23	47	25	This can be correlated to the same time frackinng started to ramp up. [William Lorenz, Australia]	Accepted, are ference to this has been added in the text
6277	48	1	48	1	In the y-label of the lowest sub-figure there is a missing symbol (showing up as a box). [Tristan Quaife, United Kingdom (of Great Britain and Northern Ireland)]	Accepted
3141	48	4	48	5	isotope signature ' shoud be explained. [, Russian Federation]	Accepted, the term signature has been removed.
38831	48	10	48	10	Should read ENVISAT not ENVIROSAT. [, United States of America]	Accepted
13373	48	10	48	10	the satellite is "ENVISAT" and not "Envirosat" [Gregory Duveiller, Italy]	Accepted

Comment No	From Page	From Line	To Page	To Line	Comment	Response
1785	48	10	48	10	Envisat (generally described with this name in the literature). [William Lahoz, Norway]	Accepted
5279	48	12	48	12	emission -> emission increase [Ragnhild Bieltvedt Skeie, Norway]	Noted, section has been significantly revised
24275	48	12	48	12	The statement "emissions between 2007 and 2010 was between 16 and 20 Tg/yr" does not make sense. Global emissions are of the order 500 Tg/yr. Does this mean that the emissions were enhanced by 16-20 Tg/yr over this period? [Terje Berntsen, Norway]	Accepted, the section has been significantly revised and shortened
5281	48	14	48	14	Please specify time period of the 30% of the increase [Ragnhild Bieltvedt Skeie, Norway]	Accepted, the section has been significantly revised and shortened
3433	48	14	48	17	Due to the substantial difference in data from different literatures on China's contribution to global carbon emissions and the inconsistency of 1.7 Tg with data from the national emission inventory, it is suggested to delete “Almost 30% of the increase in anthropogenic emissions in the Emissions Database for Global Atmospheric Research (EDGAR) v4.3.2 dataset was attributed to China – 6Tg from coal mining and 1.7 Tg from agriculture (primarily rice cultivation and enteric fermentation). The inversion estimate by Bergamaschi et al. (2013) attributed about one third less emissions to China.” [, China]	Accepted, the statement has been deleted
5277	48	17	48	17	From the first order draft, the EDGAR emissions described in the previous lines has been updated. But this sentence has not changed. Please check. Chinese emissions updated from EDGAR v4.2 to EDGAR v,4.3.2. Also please spesify if this is total emissions, or emission increase, and time period considered. [Ragnhild Bieltvedt Skeie, Norway]	Accepted
5545	49	29	40	30	what it means "Lower fire emissions" and "higher tropical wetland emissions", they need to be explained more, has the fire emission decreased? [Sanaz Moghim, Iran]	Accepted. I have tried to clarify this. We are discussing the change in the direction of the isotopica bundance in the atmosphere and the factors that coulde plaint his. Decreased fire emissions and increased tropical wetland emissions relative to the earlier decade could explain this.
31045	49	3	49	57	At line 3-5 it is stated that "several studies suggested that IAV of CH4 growth was driven mostly by variations in natural emissions from wetlands". At line 53-54 it is however assessed that "wetlands are not the primary drivers of the IAV…". This is a bit confusing: the first statement is followed by several references while the latter is not. What is the main message here? [Annalea Lohila, Finland]	The section has been revised and I have clarified the thinking on wetlands
1125	49	8	49	8	Replace "… reprise …" by something more modern. This is an archaic word and I doubt it is correctly used in this context. Seems to be the French word for the English "recovery". [Sebastiaan Luyssaert, Belgium]	Accepted
2565	49	10	49	10	"ORCHIDEE land surface model" [Wei Li, France]	Noted, I am not sure I understand what is intended here, but ORCHIDEE is a global digital vegetatio nmodel
23721	49	12	49	12	The wetland area in Poulter et al. (2017) is a combination of satellite data (SWAMPS) and inventory data (GLWD). [Xiyan Xu, China]	Noted
11561	49	16	49	17	introduce ' to ' [Lawrence Aribo, Uganda]	Accepted, the section has been significantly revised and shortened
22485	49	24	49	25	What is the balance here between decrease in CH4 emissions and OH sink? [Anastasios Kentarchos, Belgium]	Accepted, there are a few new papers that have come out and assessed in the report
29061	49	27	49	28	Please reconsider the wording ("suggests") and the use of the uncertainty language [Jan Fuglestvedt, Norway]	Accepted, use of uncertainty language has been expanded throughout the text.
2043	49	34	49	35	I do no think the model employed by Schaefer et al., and many other box models cited earlier involving isotopic analysis have any means of separating the tropics vs the rest of the world. The synthesis report should not give a false impression of the results achieved. It is also more difficult say anything about wetlands, rice cultivationor animals from just the 13C isotope data. [Prabir Patra, Japan]	Modified the text to soften the conclusion, in light of this comment and some new data.

Comment No	From Page	From Line	To Page	To Line	Comment	Response
2045	49	36	49	37	Please read the paper carefully. Suggest to reformuate as Patra et al. (2016) suggested that the renewed growth was associated with increases in emissions from livestock herds as per the FAO statistics and anthropogenic emissions from China/East Asia. [Prabir Patra, Japan]	Accepted
29063	49	39	49	40	Please reconsider the wording ("appears") and the use of the uncertainty language [Jan Fuglestvedt, Norway]	Accepted
3143	49	42	49	42	D/H : to explain. [, Russian Federation]	Accepted, the text has been removed
40509	49		49		Last paragraph, example of how a conclusion should look like. To be captured in ES/ SPM (new knowledge since AR5, relevant). But… "significant and ongoing accumulation" lacks information (why significant, what is new). The SPM should convey a sense of trends in GHG emissions due to the land sector, gas by gas, very explicitely (in text / box). [Valerie Masson-Delmotte, France]	Noted
397	49	16			"way to" [Tobias Rütting, Sweden]	Accepted, the section has been significantly revised and shortened
30045	50	8	50	8	Typo: "Table 2.1" should be "Table 2.2". [, Netherlands]	Accepted
3145	50	8	50	8	Table 2.2, not 2.1 [, Russian Federation]	Accepted
31059	50	12	50	14	I would suggest to remove this sentence. This kind of comparison is not meaningful using the CO2 equivalent metrics. You can compare the ghg emissions from the AFOLU sector but for example comparing the global CO2 sink to the global wetland CH4 emissions (using a 100 year time horizon) is just simply wrong. The wetlands have been cooling the climate for thousands of year, and therefore assuming a pulse emission and using the 100 yr time horizon does not work for them, it gives CH4 far too great role. See for example Frolking et al. 2006, JGR. [Annalea Lohila, Finland]	Accepted, the sentence has been removed
1475	50	14	50	14	This value of 28 is the GWP(100) - this needs to be stated explicilty. However using a different metric - for instance the GTP(100) of 4 - would make these sources less important than the net land sink in CO2 equivalents. [William Collins, United Kingdom (of Great Britain and Northern Ireland)]	Accepted, the section has been significantly revised and shortened
29069	50	20	50	20	possible to be clearer and more nuanced than "appears to" ? [Jan Fuglestvedt, Norway]	Accepted
29067	50	24	50	27	You do NOT need to use CO2-Equiavelnt emissions when you dsicuss only methane and its budget. Please have a critical and conscious look at how you use CO2 equivalents,, and as mentioned before, aggregates like this hampers transparency and causes confusion. At LAM1 it was agreed to avid that to the extent possible and use pure mass units. [Jan Fuglestvedt, Norway]	Accepted
1717	51	7	51	7	Are there any estimates of methane emissions due to flooding valleys for hydropower or water reservoirs? [William Collins, United Kingdom (of Great Britain and Northern Ireland)]	Noted, not at the global scale to my knowledge
38833	51	8	51	16	Work of Wolf et al. should be included DOI 10.1186/s13021-017-0084-y [, United States of America]	Accepted
1787	51	12	51	13	Have you defined what Annex 1 and non-Annex 1 countries are? [William Lahoz, Norway]	Eliminated the Annex I non-Annex I division at the request of other reviewers.
29071	51	13	51	13	please reconsider the use of "Annex 1 countries" [Jan Fuglestvedt, Norway]	Accepted, removed this division
8463	51	13	51	13	I'm wondering about the relevance of a comparison between Annex 1 and non-Annex 1 countries . Total emissions depend their surface and populations of these countries. Absolute value, not estimated in reference to a surface or to population is irrelevant to my opinion. Besides, the difference in tendencies may be more relevant. [Marc Aubinet, Belgium]	Accepted, removed this division
31063	51	7	55	18	Sections 2.4.2.4 and 2.4.2.5 there is hardly any assessment [Annalea Lohila, Finland]	Accepted. Increased the assessment approach and added some data from meta analyses to strengthen this.

Comment No	From Page	From Line	To Page	To Line	Comment	Response
25353	51	1			In Table 2,2, "waste" (« Anthropogenic sources », « agriculture and waste ») should be replaced with "agricultural waste". [, France]	Accepted, the table has been removed
31061	52	1	52	1	Fig 2.13: The reference time period for which the CO2-eqs have been determined should be given [Annalea Lohila, Finland]	Noted, converted these back to the original gas as requested by other reviwers
8465	52	1	52	1	Simulations with EDGAR differ strongly of the others for Non-Annex 1 countries. Is there an explanation for that ? [Marc Aubinet, Belgium]	Noted. Calculations redone and aoided the Annex divisions and the numbers come out closer
29073	52	3	52	4	You do NOT need to use CO2-Equivalent emissions when you show numbers only for CH4. Better to use pure mass units (as agreed at LAM1) [Jan Fuglestvedt, Norway]	Accepted, units changed
5547	52	10	52	15	add the year, (any specific year or since a year)! [Sanaz Moghim, Iran]	Accepted, text has been added to clarify this.
5549	52	14	52	14	"are decreasing by about 1.5% per year", since what year? [Sanaz Moghim, Iran]	Accepted, text has been added to clarify this.
5551	52	15	52	15	"increasing by 0.9% per year", since what year? [Sanaz Moghim, Iran]	Accepted, text has been added to clarify this.
1477	53	4	50	15	I don't think this paragraph on the details of methanogenic and methanotrophic zones is necessary. [William Collins, United Kingdom (of Great Britain and Northern Ireland)]	Accepted, paragraph deleted
4041	53	1	53	2	Please mention in the caption that there are global emissions. It might be interesting to add a line on a secondary axis showing the fraction (%) that the displayed emissions account in total anthropogenic GHG emissions. [Vassilis Daioglou, Netherlands]	Rejected. The idea is interesting but since emissions are growing in other sectors morer apidly than in agriculture, it is not a1:1 scaling across time periods.
31899	53	15	53	15	A recent paper by Angle et al 2018 reports on methanogenesis in oxygenated soils. This novel discovery may need to be mentioned here as it may have consequences for how methanogenesis and the methane cycle are studied in years to come: Angle, J.C., Morin, T.H., Solden, L.M., Narrowe, A.B., Smith, G.J., Borton, M.A., Rey-Sanchez, C., Daly, R.A., Mirfenderesgi, G., Hoyt, D.W. and Riley, W.J., 2017. Methanogenesis in oxygenated soils is a substantial fraction of wetland methane emissions. Nature Communications, 8(1), p.1567. [Martijn Slot, Netherlands]	Noted, paragraph has been deleted
2567	53	23	53	23	remove the second "that" [Wei Li, France]	Accepted
22487	53	23	53	25	What is the reason for increase methane consumption, when there is increasing N deposition? [Anastasios Kentarchos, Belgium]	Accepted, the N stimulates an N limited microbial community. Text has been added.
2569	53	33	53	33	"alters" [Wei Li, France]	Noted,the sentence has been removed
31065	53	27	54	12	The whole paragraph here can be easily understood in a way which would support draining all the peatlands. First it tells how northern peatlands are a significant source of CH4, and continues with describing how these emissions are greatly reduced by draining. Finally it is told how restoration 1) increase fluxes 146% from the pre-drainage level and 2) how the higher-than-original emissions can sustain >30 yrs. There is a feeling of a kind of selective bias here. First, if you read through the paper Abdalla et al. it says in the results that "rewetting increased methane flux by an average of 1.3 ± 6.5 g C m−2 year−1 (46%). However, a paired t-test showed that the change in CH4 flux due to rewetting was not statistically significant...". First of all, I would like to see a mentioning that although restoration decreases CH4 emissions, it greatly increases CO2 emissions and C and nutrient losses. Also I would like to see a more objective assessment of the restoration impacts, if there needs to be one. The overall assessment is missing in this section. [Annalea Lohila, Finland]	Accepted, however there is no selective bias here. Several studies indicae higher emissions than predrainage levels and these have been added. The text has been modified to give a more balanced impression.
399	53	11			methanogeniesis in upland soils might in additon occur in deeper soil layers, that are waterlogged [Tobias Rütting, Sweden]	Noted, paragraph has been deleted
401	53	31			"Under climate" [Tobias Rütting, Sweden]	Accepted, the sentence has been removed
22489	54	8	54	12	Drained peatlands may very well emit little CH4, but they have large CO2 emissions. This should be commented. [Anastasios Kentarchos, Belgium]	Accepted, text has been added to clarify this.

Comment No	From Page	From Line	To Page	To Line	Comment	Response
31073	54	16	54	17	What is after the plus-minus sign? Please indicate in text. [Annalea Lohila, Finland]	Accepted, the numbers have been removed
31067	54	23	54	25	In section 2.2 and 2.3 many feedbacks have been described but they do not mention CH4 or N2O. [Annalea Lohila, Finland]	Noted, this doesnot require change shere.
2809	54	23	54	31	This section refers to future trends of both CH4 and N2O emissions, but N2O has not been treated, yet. As discussions on N2O start in the following chapter, it would be better to treat the future development of N2O emissions there and constrain on CH4 in this section. [Bettina Weber, Germany]	Accepted, this section was miscompiled in the SOD and belongs in an earlier section
14035	54	23	54	31	This paragraph is out of place – the section is on CH4 not carbon feedbacks. You have already discussed this on p.46, so suggest cutting this paragraph [Chris Jones, United Kingdom (of Great Britain and Northern Ireland)]	Accepted, this section was miscompiled in the SOD and belongs in an earlier section
5049	54	23	54	31	This paragraph is likely copied from the head paragraph of 2.4.1.3 (p46 line2-11), and then rewording "CO2" to "CH4 and N2O". Thus, the suitability of references is suggested to be rechecked. In addition, the messages starting from line 25 "Estimations from climate models … by the lack of observational constraints (Prentice et al. 2015a)" may not be appropriate as the introduction of 2.4.2.5 and rephrasing is suggested. [, Japan]	Accepted, this section was miscompiled in the SOD and belongs in an earlier section
13769	54	23	54	31	This paragraph is identical to page 46 lines 2 to 11 [Moira Doyle, Argentina]	Accepted, this section was miscompiled in the SOD and belongs in an earlier section
403	54	23	54	31	repetition from p. 46, line 2-11 [Tobias Rütting, Sweden]	Accepted, this section was miscompiled in the SOD and belongs in an earlier section
29383	54	33	54	50	This para contains potentially important material but is not presented in a coherent way. [Jan Fuglestvedt, Norway]	Noted
1479	54	37	54	38	The Holmes et al. 2013 study looked only at one scenario (RCP 8.5) in which methane increase strongly. The Voulgarakis et al. 2013 study is a better reference as it used more models and looked at more scenarios. [William Collins, United Kingdom (of Great Britain and Northern Ireland)]	Noted, this section has been cut due to space limitations
29075	54	39	54	40	The sentence on GWP does not fit in here. I suggest delete. Or explain more context and relevance. [Jan Fuglestvedt, Norway]	Noted, this section has been cut due to space limitations
8467	54	39	54	40	I don't understand how a shorter lifetime could lead to a larger GWP. This appears contradictory. [Marc Aubinet, Belgium]	Noted, this section has been cut due to space limitations
1481	54	39	54	40	100-yr GWP. Unless you are going to do a thorough literature review of climate metrics here, you should not simply pick one metric from one study. I suggest deleting the sentence. [William Collins, United Kingdom (of Great Britain and Northern Ireland)]	Noted, this section has been cut due to space limitations
1483	54	44	54	44	The model lifetimes (Voulgarakis) are indeed lower than the observationally-constrained lifetime (see AR5 8.2.3.3) for discussion. However a single sentence on this here causes more confusion than clarification. This sentence either needs to be removed or a fuller discussion provided. [William Collins, United Kingdom (of Great Britain and Northern Ireland)]	Noted, this section has been cut due to space limitations
15339	54	45	54	45	Suggest the text explain the acronym RCP - it is first used on page 4, but spelt out on page 54. [, Australia]	Noted, this section has been cut due to space limitations
1485	54	45	54	50	This explanation of the lifetime changes could be made much clearer. They are largely dependent on the CH4 concentrations, rather than the level of radiative forcing. The whole of this paragraph could be condensed, as the only points you need to make are: that climate change (temperature and water vapour) will reduce the methane lifetime; and increased levels of methane will increase the lifetime. The references you already have Meinshausen et al., Holmes et al., Voulgarakis et al., can all be cited to support that. [William Collins, United Kingdom (of Great Britain and Northern Ireland)]	Noted, this section has been cut due to space limitations

Comment No	From Page	From Line	To Page	To Line	Comment	Response
15273	54	46	54	47	The decrease in global methane lifetime projections for RCP2.6 and RCP8.5 . [Joalane Marunye, Lesotho]	Noted, this section has been cut due to space limitations
3315	54	22	55	18	Reads well, but rather brief - more on direct and indirects effects of precip and temp change on rice and livestock CH4 would be useful. Increased NPP, precip change, warming and enhanced organic C entering reservoirs - leading to increased CH4 production - also likley to be important (see review of 'Methane and Global Environmental Change' by Reay et al. 2018) - these kind of effects are covered later for CO2 but the CH4 story could be important as well. Finally, some comment on impact of any future scenario of large scale BECCS on the soil CH4 sink/CH4 emission from incomplete combustion (i.e. large scale land use change) might be useful too. [Dave Reay, United Kingdom (of Great Britain and Northern Ireland)]	Acepted
5047	54	22	55	18	We would suggest citing effects of climate change on CH4 emission from the paddy fields: Tokida, T., Fumoto, T., Cheng, W., Matsunami, T., Adachi, M., Katayanagi, N., Matsushima, M., Okawara, Y., Nakamura, H., Okada, M., Sameshima, R. and Hasegawa, T. (2010) 'Effects of free-air CO2 enrichment (FACE) and soil warming on CH4 emission from a rice paddy field: impact assessment and stoichiometric evaluation', Biogeosciences. Copernicus GmbH, 7(9), pp. 2639–2653. doi: 10.5194/bg-7-2639-2010. The involvement of plant originated methane also needs attention: Tokida, T., Adachi, M., Cheng, W., Nakajima, Y., Fumoto, T., Matsushima, M., Nakamura, H., Okada, M., Sameshima, R. and Hasegawa, T. (2011) 'Methane and soil CO2 production from current-season photosynthetic in a rice paddy exposed to elevated CO2 concentration and soil temperature', Global Change Biology, 17(11), pp. 3327–3337. doi: 10.1111/j.1365-2486.2011.02475.x. [, Japan]	Noted, we are constrained for space and actually need to reduce the length.
31075	54	23	55	18	The order of presenting the contributions of different sectors to the future trends could better highlight the importance of these processes/sectors. Now it seems that OH sink is the most influencial regarding feedbacks. If this is the case, would be good to have assesment and use uncertainty language. Presenting the feedback process of soil CH4 sink after that, and far before the wetland CH4 emission is a bit misleading since soil CH4 sink is much smaller in absolute number as compared to wetland CH4 emission. [Annalea Lohila, Finland]	Accepted, this section was miscompiled in the SOD and blelongs in a nearlier section
14037	54	22			This section on future CH4 needs some work I think. You have defended that [OH] drives interannual variability, but it is certainly not true that it is the main driver of future trends. There may be some changes in [OH] in the future (e.g. Johnson et al., 2001, GRL) but the numbers you quote for methane lifetime changes (order 5-10%) are small compared with the increases in anthropogenic and natural emissions – which can more than double. Atmospheric chemistry and oxidizing power is a small component of future trends. See O'Connor et al (2010; Reviews of Geophysics) [Chris Jones, United Kingdom (of Great Britain and Northern Ireland)]	Noted, we are constrained for space and actually need to reduce the length.
405	54	30			it is not clear if nitrogen will limit CO2 fertilization (see previous discussions in the chapter). Therefore sugest "which might limit". Why is Phosphorus not mentioned? [Tobias Rütting, Sweden]	Accepted, this section was miscompiled in the SOD and blelongs in a nearlier section

Comment No	From Page	From Line	To Page	To Line	Comment	Response
14039	54	51			It's not true to say there is little literature on future CH4 sources/sinks. Gedney (2004; GRL) look at changes in wetland emissions, as does Ringeval et al (2011; Biogeosciences). A multi-model activity, "WETCHIMP" (Meton et al., 2013; Biogeosciences) looked at the response to future changes in temperature and rainfall. See AR5; fig 6.37. Burke et al (2012; The Cryosphere) has assessed changes in CH4 from permafrost, and Comyn-Platt (2018; Nature Geosci.) has extended this to consider both wetlands and permafrost and their role in achievability/or not/ of 1.5 degrees [Chris Jones, United Kingdom (of Great Britain and Northern Ireland)]	Noted, this section has been cut due to space limitations
38835	55	1	55	1	Wetland warming studies indicate a potential increase in CH4 emissions which may be worth noting here. See Gill et al. (GCB, 2017). [, United States of America]	Noted, this section has been cut due to space limitations
7519	55	4	55	11	Note that the Arctic could transition from a carbon sink to a carbon source as soon as the mid-2020s; see Schaefer K., et al. (2011) Amount and timing of permafrost carbon release in response to climate warming, TELLUS SERIES B CHEMICAL & PHYSICAL METEOROLOGY 63(2):165–180, 165 ("We predict that the [permafrost carbon feedback (PCF)] will change the arctic from a carbon sink to a source after the mid-2020s and is strong enough to cancel 42–88% of the total global land sink. The thaw and decay of permafrost carbon is irreversible and accounting for the PCF will require larger reductions in fossil fuel emissions to reach a target atmospheric CO2 concentration."). [Durwood Zaelke, United States of America]	Noted, this section has been cut due to space limitations
7599	55	4	55	11	Note that the Arctic could transition from a carbon sink to a carbon source as soon as the mid-2020s; see Schaefer K., et al. (2011) Amount and timing of permafrost carbon release in response to climate warming, TELLUS SERIES B CHEMICAL & PHYSICAL METEOROLOGY 63(2):165–180. [Kristin Campbell, United States of America]	Noted, this section has been cut due to space limitations
1719	55	9	55	9	Comyn-Platt et al. Nature Geoscience volume 11, pages568–573 (2018) Calculate an increase in methane from 3-15% from wetlands for temperature changes between 1.5 and 2.0 degrees. [William Collins, United Kingdom (of Great Britain and Northern Ireland)]	Noted, this section has been cut due to space limitations
31069	55	9	55	11	Again it is stated that wetlands are responsible of "much of the annual variability". How does this fit to the statements given on page 49 ("wetlands are not primary drivers of IAV") [Annalea Lohila, Finland]	Noted, this section has been cut due to space limitations
2571	55	13	55	14	please give the reference for this sentence [Wei Li, France]	Noted, this section has been cut due to space limitations
22491	55	13	55	18	This is largely speculative and can be omitted [Anastasios Kentarchos, Belgium]	Noted, this section has been cut due to space limitations
31071	55	13	55	18	How is this paragraph related to CH4? What are the impacts of these variables and processes on CH4 emissions? [Annalea Lohila, Finland]	Noted, this section has been cut due to space limitations
29077	55	13	55	18	This para is an example of too much review and not enough assessmment in the chapter. [Jan Fuglestvedt, Norway]	Noted, this section has been cut due to space limitations
8469	55	16	55	16	What does mean "benefit" in this context? Does it mean that productivity will increase or that digestibility will increase ? [Marc Aubinet, Belgium]	Noted, this section has been cut due to space limitations
24197	55	26	55	29	This sentence is unclear. Do the authors refer to a decrease in the 14N/15N ratio in atmospheric N2O? [Maria Luz Cayuela, Spain]	Accepted, the text has been clarified
2811	55	30	55	30	Please insert space after "1980". [Bettina Weber, Germany]	Noted, the text has been revised
309	55	31	55	31	space is missing between 1980 and (Tian [George Burba, United States of America]	Noted, the text has been revised
5553	55	27	56	3	I suggest re-write this sentence, it is not clear [Sanaz Moghim, Iran]	Accepted, text has been added to clarify this.
5555	56	3	56	4	what the authors want to say! [Sanaz Moghim, Iran]	Accepted, the text has been revised

Comment No	From Page	From Line	To Page	To Line	Comment	Response
2047	56	7	56	22	It is better to use the results from a multi-model intercomparison project (Thompson et al., Atmos. Chem. Phys., 14, 6177-6194, 2014) [Prabir Patra, Japan]	Accepted
8471	56	16	56	16	Do you mean Table 2.3 ? [Marc Aubinet, Belgium]	Accepted, the table numbering has been resolved
2573	56	16	56	16	Table 2.2 is for CH4 [Wei Li, France]	Accepted, the table has been removed and we no longer present the budget, for space reasons.
6715	56	16	56	22	Recently, a multi-model study on terrestrial N2O emission was published: Tian, H., Yang, J., Lu, C., Xu, R., Canadell, J.G., Jackson, R.B., Arneth, A., Chang, J., Chen, G., Ciais, P., Gerber, S., Ito, A., Huang, Y., Joos, F., Lienert, S., Messina, P., Olin, S., Pan, S., Peng, C., Saikawa, E., Thompson, R.L., Vuichard, N., Winiwarter, W., Zaehle, S., Zhang, B., Zhang, K., Zhu, Q., 2018. The global N2O Model Intercomparison Project. Bulletin of the American Meteorological Society 99, 1231–1251. [Akihiko Ito, Japan]	Accepted, the table numbering has been resolved
19039	56	19	56	22	3.8 Tg is not in the range 2.5 +/- 0.8 Tg [Joanna Wibig, Poland]	Accepted, the section has been significantly revised and shortened
5559	56	21	56	21	it is good to define "unmanaged land" clearly, in page 52 it said "remote areas" and in page 55 it said "primary land"! [Sanaz Moghim, Iran]	Rejected: I think there is a mistake.We do not discuss unmanaged land shere. IPCC has a definition of managed lands
5557	56	21	56	22	what it means: "unmanaged land" is "non-anthropogenic"? [Sanaz Moghim, Iran]	Rejected: I think there is a mistake.We do not discuss unmanaged land shere. IPCC has a definition of managed lands
407	56	16			this is not shown in Table 2.2 (also not in any other table) [Tobias Rütting, Sweden]	Noted, actually this paper announces the initiative. It does not provide new numbers.
22493	57	1	57	1	Unclear what the unit of N2O is here [Anastasios Kentarchos, Belgium]	Accepted, the table has been removed.
3147	57	1	57	1	Suggestion: add 'emissions ' after ' N2O' [, Russian Federation]	Accepted, the table has been removed.
8473	57	1	57	1	Better specifiy unit : Tg N-N2O [Marc Aubinet, Belgium]	Accepted, the table has been removed.
2575	57	1	57	1	very confusing hierarchy in the first column of Table 2.3 [Wei Li, France]	Accepted, all figures are now cited, tables have been removed because of space limitations.
8475	57	2	57	2	The table is not clear: it contains sub sums, that could highlighted (refer to the original that is better represented) [Marc Aubinet, Belgium]	Accepted, the table has been removed.
8477	57	2	57	2	Last line : what is the meaning of the "total" ? The numbers do not correspond to the numbers presented by Davidson and Kanter ((no sum for FAO, 6.8 for EDGAR, 7.6 for EPA2012) [Marc Aubinet, Belgium]	Accepted, the table has been removed.
1127	57	3	57	3	Subscript in N2O Is missing. [Sebastiaan Luyssaert, Belgium]	Accepted
11587	57	3	57	4	consider changing N2O to scientific formula for nitrous oxide using a subscript for 2 [Lawrence Aribo, Uganda]	Accepted
1129	57	4	57	4	Subscript in N2O Is missing. [Sebastiaan Luyssaert, Belgium]	Accepted
8479	57	11	57	11	This number is in contradiction with Table 2.3 but (as said above, numbesr of Table 2.3 are debatable). Anyway, 5.3 is the lower limit of the range proposed by Davidson and Kanter, which is 5.3-8.4. [Marc Aubinet, Belgium]	Accepted, the section has been significantly revised and shortened
1131	57	11	57	11	The sentence reads "lower tropical [Sebastiaan Luyssaert, Belgium]	Accepted, the section has been significantly revised and shortened
22495	57	20	57	20	Biological N fixation is not a source of N2O according to IPCC methodology [Anastasios Kentarchos, Belgium]	Accepted, partially. IPCC does recognize inorganic-N inputs through BNF. The statement has been clarified.
2577	57	29	57	29	Figure 2.1 is nothing to do with this sentence. [Wei Li, France]	Accepted
409	57	1			this table is not cited in the text and unclear where the data are discussed. Also, what is meant by "Total", as it is not the sum of the emission in the table. Some data are sums of other data in table (e.g. agriculture), but this is not made clear. The table needs reformatting and clarifications [Tobias Rütting, Sweden]	Accepted, the table has been removed.
31077	58	5	58	8	Fig 2.16: The reference time period for which the CO2-eqs have been determined should be given [Annalea Lohila, Finland]	Accepted, CO2-eqs are not used now

Comment No	From Page	From Line	To Page	To Line	Comment	Response
29079	58	7	58	8	You do NOT need to use CO2-Equivalent emissions when you show numbers only for N2O. Better to use pure mass units (as agreed at LAM1) [Jan Fuglestvedt, Norway]	Accepted, numbers are now interms of N2O
29839	58	26	58	28	In the conclusion cannot exclude N2O emissions from industrial and fossil fuel combustion. [Souparna Lahiri, India]	Rejected, this report focuses on land use.
3149	58	35	58	35	Tier 1: a reference is needed. [, Russian Federation]	Accepted
33971	58	36	58	36	Animal manure is a more important spource of N2O than direct emission from fertiliser. Suggest to include commentary on effect of N application rate on emissions from manure. Include 'and a 1-2% EF applied to animal manure' before the fullstop. [Cecile de Klein, New Zealand]	Accepted. Discussion greatly expanded
6717	58	33	59	16	In terms of N2O budget, East Asia is one of the focal regions, because of increasing N fertilizer use. Ito et al. (2018) assessed the historical change in soil N2O emission from East Asia using a process-based model and evaluated the effects of climate, land-use, and fertilizer/manure use. Ito, A., Nishina, K., Ishijima, K., Hashimoto, S., Inatomi, M., 2018. Emissions of nitrous oxide (N2O) from soil surfaces and their historical changes in East Asia: a model-based assessment. Progress in Earth and Planetary Science 5, doi:10.1186/s40645-40018-40215-40644. [Akihiko Ito, Japan]	Noted, different assessments break up the world differently. We used the MIP results in this section and highlighted the increasinge missions from southern Asia.
411	58	5			the Figure is not cited in text nor are the data presented discussed. [Tobias Rütting, Sweden]	Accepted partially. Another reviewer requested that we not express these values in terms of CO2e, so we now present N2O numbers.
1377	59	1	59	5	Study by Shcherbak et al (2014) is not a meta-analysis, since there are no effect size estimates, no weighting procedure. There is also problem with non-independence; since 233 observations were extracted from 78 published studies. In contrast, study by Van Lent et al. (2015) is correctly performed meta-analysis. [Elena Valkama, Finland]	Accepted
33973	59	1	59	17	Further to comment on effect of animal manure rates on N2O Efs (page 58 line 36), some references that could be included here are D. Chadwick et al 2018 STOTEN 635:607; L.M. Cardenas et al 2016 AEE 235:229; CAM de Klein et al (2014) AEE 188:85 [Cecile de Klein, New Zealand]	Accepted, but the study is not completely invalid.However we will give greater weight to vanLent
15341	59	3	59	8	Suggest using a diagram to further explain the example. [, Australia]	Accepted, a figure from van Lent has been redrawn and added to address this point.
26139	59	8	59	11	This statement is not self-evident without further elaboration. It may be that high levels of N fertilizer use, even where low N rates dominate, will be excessive and lead to N runoff. [Reid Detchon, United States of America]	Accepted, clarification added to improve understanding
24199	59	11	59	14	The use or not of irrigation and the type of irrigation (sprinkle, flooding, drip) is also a very relevant determining the EFs in areas with low precipitation (Cayuela et al., 2017) [Maria Luz Cayuela, Spain]	Noted. While I agree, this is not currently integrated into national assesments, as far as I am aware. We are also not aware of a large enough body of work to provide a full assessment here. Therefore we did not make any changes to the text.
15343	59	21	59	21	Suggest clarifying the term 'stream hierarchy'. [, Australia]	Accepted, the text has been significantly revised and this reference has been dropped.
29081	59	26	59	29	More of this is needed (assessment) [Jan Fuglestvedt, Norway]	Accepted
3317	59	31	59	48	Here or elsewhere some comment on changing trends of atmospheric deposition on Nr and resulting N2O fluxes would be useful - aquatic N losses are mentioned but little here that I can see on atmospheric losses and re-deposition (e.g. NH3). Likewise, some comment on N dep on C sinks (given much of the Nr is coming from agro sector) would be worth mentioning. [Dave Reay, United Kingdom (of Great Britain and Northern Ireland)]	Accepted, note we had to cut this section because of space limitations
29083	59	38	59	38	what is meant by "projected" ? Which scenario? What level fo warming? [Jan Fuglestvedt, Norway]	Accepted, note we had to cut this section because of space limitations

Comment No	From Page	From Line	To Page	To Line	Comment	Response
3471	59	40	59	41	References supporting the statement (i.e., “a similar dynamic is expected in regions with high N consumption and projected increases in precipitation, such as China, India, and Southeast Asia”) are missing. We suggest to delete “such as China, India, and Southeast Asia”. [Jianqi Sun, China]	Accepted, note we had to cut this section because of space limitations
29085	59	56	59	56	Re "-.4 to -0.8 Wm-2": What time period? Or per K? Please explain better. [Jan Fuglestvedt, Norway]	Accepted, note we had to cut this section because of space limitations
28569	59	50	60	7	This is duplicated text from page 46 lines 25-39 [Alan Di Vittorio, United States of America]	Accepted, note we had to cut this section because of space limitations
31079	59	50	60	7	The text is identical to that on page 46 [Annalea Lohila, Finland]	Accepted, noted we had cut due to space limitations
15275	59	50	60	7	same as what appears under2.4.1.3 Impact of climate change on future fluxes pg 46 lines 25 - 39 [Joalane Marunye, Lesotho]	Accepted, note we had to cut this section because of space limitations
8481	59	50	60	7	This section is a copy paste of P46 L25-39. Avois redundancies. [Marc Aubinet, Belgium]	Noted, this section has been cut due to space limitations
2579	59	50	60	7	duplicate paragraph of p46 L29 [Wei Li, France]	Accepted, note we had to cut this section because of space limitations
1487	59	50	60	7	This paragraph repeats exactly the paragrah at the end of section 2.4.1.3. [William Collins, United Kingdom (of Great Britain and Northern Ireland)]	Accepted, note we had to cut this section because of space limitations
413	59	5			reference for "meta-analysis" missing [Tobias Rütting, Sweden]	Rejected: it's a standard statistical technique. We donot reference ANOVAs,e.g.
11589	59	51			CMIP4 for C4MIP [Lawrence Aribo, Uganda]	Accepted, note we had to cut this section because of space limitations
38837	60	1	60	1	Section on N2O is comprehensive and covers all relevant literature. [, United States of America]	Accepted, note we had to cut this section because of space limitations
29087	60	2	60	2	whay is meant by "cumulative warming effec of methane"? Please reword to clearer sentence [Jan Fuglestvedt, Norway]	Accepted, note we had to cut this section because of space limitations
29089	60	4	60	5	re the sentence "....mitigation efforts should...": This is policy prescriptive and should be deleted or reworded. [Jan Fuglestvedt, Norway]	Accepted, note we had to cut this section because of space limitations
38839	60	9	60	32	Looking at future trends/projections without considering the important role of management/markets paints an incomplete picture of possible future outcomes. Market forces greatly influence LU decisions and related GHG flux/c storage outcomes. Be sure to add text and literature regarding this key aspect, as it is currently omitted. [, United States of America]	Accepted, economics is beyond the scope of this chapter and this discussion has been removed.
29091	60	10	60	10	"large" is ambiguous. Possible to indicate magnitude? [Jan Fuglestvedt, Norway]	Accepted, the section has been significantly revised and shortened
5561	60	10	60	11	is it by the same reference "McNorton et al.", I am also not sure if we can say this statement! If you decide to keep this sentence, it needs to be more clear, like "minor contributions to inter-annual variability " of what? [Sanaz Moghim, Iran]	Accepted, the section has been significantly revised and shortened
38841	60	10	60	15	The 'rebound effect' section is left with little context or conclusion. It seems this section is left hanging and that some sort of wrapup is needed to bring it back to the climate-land connection and feedback. [, United States of America]	Accepted, the section has been significantly revised and shortened
335	60	10	60	32	The authors need to acknowledge management here. In fact throughout this document the role of management in forests and its effect on fluxes is ignored. None of the studies cited here addresses the role of forest and other land use management. To achieve a lower level of atmospheric carbon will require enormous shifts in demand in the economy, which will have effects on ecosystems and carbon storage. These changes have not been addressed, so cannot be cited, but the role of management and markets must be acknowledged here. Tian et al. (Land Economics, 2018) recently showed the important role that management plays on carbon fluxes. [Brent Sohngen, United States of America]	Accepcted, economics is beyond the scope of this chapter and this discussion has been removed.

Comment No	From Page	From Line	To Page	To Line	Comment	Response
38843	60	10	60	32	The authors need to acknowledge management here. In fact, throughout this document, the role of management in forests and its effect on fluxes is ignored. None of the studies cited here address the role of forest and other land-use management. To achieve a lower level of atmospheric carbon will require enormous shifts in demand in the economy, which will have effects on ecosystems and carbon storage. These changes have not been addressed, so cannot be cited, but the role of management and markets must be acknowledged here. Tian et al. (Land Economics, 2018) recently showed the important role that management plays on carbon fluxes. [, United States of America]	Accepted, economics is beyond the scope of this chapter and this discussion has been removed.
29093	60	15	60	18	This is importnat and I think the report needs more assessment of this [Jan Fuglestvedt, Norway]	Noted
5563	60	16	60	17	the reference is Turner et al. (2017)? [Sanaz Moghim, Iran]	Rejected.
1489	60	20	60	32	This needs to be rewritten to be an assessment. It should not describe what you have done (this is not a research paper), but what you assess to be the state of scientific knowledge. [William Collins, United Kingdom (of Great Britain and Northern Ireland)]	Accepted, the section has been revised and moved, in accordance witho ther comments.
29095	60	28	60	28	re "24% of totall": Aggergated emissions should in my view be avoided. If you refer to use aggregated GHG emisisons, plesae specify how this is calculated. [Jan Fuglestvedt, Norway]	Rejected. We need to tell the aggregate story of land based emissions to allow for proper comparisons.
1133	60	28	60	28	Here it is said to be 24%, I think I have seen also 26% mentioned in this chapter (page 37 line 43). Replace by 24 to 26 % (although that may give a false sense of certainty). [Sebastiaan Luyssaert, Belgium]	Accepted, the references in the chapter have been harmonized. Note this is a direct calculation based on sevral data sets as outlined in the text. It is not an assessment that is represetative of a literature summary.
40513	60		60		This notion of "rebound effect" is important. IS there new knowledge? Coherency with SR15? Consider carefully what you want to communicate on this. [Valerie Masson-Delmotte, France]	Accepted, the newest information on this is from the Jackson et al. and Jones et al.papers.
8483	60	9	61	10	Mitigation of carbon sources in agriculture are always calculated in absolute values (Gt CO2 yr-1) which is irrelevant.For example, a country that would reduce its emissions by reducing its herd size and pastures areas would see the impact of its agriculture decrease but it should compensate by importing meat and milk from foreign countries which is ninsense at global scale. To avoid this, mitigation should be computed in terms of emissions per unit of food (mass or energy) produced. [Marc Aubinet, Belgium]	Rejected, revising GHG inventory methods this is beyond the scope of this chapter.
28643	60	10		18	Impacts of mitigation on carbon sink; This goes a long way in relation with atmospheric carbon dioxide concentration both on land and in the ocean. Can we keep the emissions the same ? Yes is the answer if only an integrated technology techniques and implementation of four world cardinal data sets on land, ocean and air. An updated and upgraded data sets techniques must be implemented. [Abiodun Adegoke, Nigeria]	Noted, no action isrequired.
11591	60	21			correct chemical formular of carbondioxide CO2 (use subscript may be) [Lawrence Aribo, Uganda]	Accepted
3151	61	1	61	2	Is it annual or decadal totals? Net fluxes? Check the units, please. [, Russian Federation]	The table has been calculated in annual averages per decade. We have made this more apparent in the title and by presenting estimates from two (overlapping) decades. We hope this is clearer now.
29097	61	2	61	10	If you prefer to use aggregated GHG emissions it should be clearly stated how this is done; metric type and time horizon. [Jan Fuglestvedt, Norway]	The table has been calculated in annual averages per decade.We have made this more apparent in the title and by presenting estimates from two (overlapping) decades.We hope this is clearer now.

Comment No	From Page	From Line	To Page	To Line	Comment	Response
7521	61	13	61	19	Reduction of anthropogenic aerosols will contribute additional warming by way of unmasking warming that is presently being offset by the reflective properties of aerosols. Aerosols from air pollution will decline in the coming years as a means for preserving air quality and promoting healthier air conditions, but their removal will lead to additional warming of 0.3 ºC in 2050 and 0.6 ºC in 2100. See Xu and Ramanathan (2017) Well below 2 °C: Mitigation strategies for avoiding dangerous to catastrophic climate changes, Proc. Natl. Acad. Sci., doi: 10.1073/pnas.1618481114; Ramanathan and Xu (2010) The Copenhagen Accord for limiting global warming: Criteria, constraints, and available avenues, Proc. Natl. Acad. Sci., doi: 10.1073/pnas.1002293107; Ramanathan and Feng (2008) On avoiding dangerous anthropogenic interference with the climate system: Formidable challenges ahead, Proc. Natl. Acad. Sci., doi: 10.1073/pnas.0803838105. [Durwood Zaelke, United States of America]	Done in the introduction (2.5)
7601	61	13	61	19	Reduction of anthropogenic aerosols will contribute additional warming by way of unmasking warming that is presently being offset by the reflective properties of aerosols. Aerosols from air pollution will decline in the coming years as a means for preserving air quality and promoting healthier air conditions, but their removal will lead to additional warming of 0.3 ºC in 2050 and 0.6 ºC in 2100. See Xu and Ramanathan (2017) Well below 2 °C: Mitigation strategies for avoiding dangerous to catastrophic climate changes, Proc. Natl. Acad. Sci. 114(39):10315–10323; Ramanathan and Xu (2010) The Copenhagen Accord for limiting global warming: Criteria, constraints, and available avenues, Proc. Natl. Acad. Sci. 107(18):8055–8062; Ramanathan and Feng (2008) On avoiding dangerous anthropogenic interference with the climate system: Formidable challenges ahead, Proc. Natl. Acad. Sci. 105(38):14245–14250. [Kristin Campbell, United States of America]	Included in the instroductionof 2.5
29099	61	16	61	16	More refs are needed here, and please check if Rogelj et al is relevant here [Jan Fuglestvedt, Norway]	We already have 2 good references Boucher and Kok. Rogelj reference (Disentangling the effects of CO 2 and short-lived climate forcer mitigation) is also a very good one.
24277	61	17	61	17	Replace was by has been. [Terje Berntsen, Norway]	Done
29101	61	19	61	19	Please check more recent papers, e.g. by Zig Klimont , Steve Smith and others. [Jan Fuglestvedt, Norway]	Included Klimont
8307	61	19	61	19	Add thew following sentence to end of the sentence“For instance, the surface incident solar radiation has significantly decreased in North China Plain and South China, which caused the cooling trend of the daily maximum land surface and near surface air temperature from 1960 to 2003 under the global warming conditions(Du et al., 2017).” Du, J., Wang, K., Wang, J., and Ma, Q.: Contributions of surface solar radiation and precipitation to the spatiotemporal patterns of surface and air warming in China from 1960 to 2003, Atmos. Chem. Phys., 17, 4931-4944, https://doi.org/10.5194/acp-17-4931-2017, 2017. [kaicun Wang, China]	This comment makes a too specidic issue to show up rigth at the first paragraph of the section. It is relevant, but too specificic.
12659	61	21	61	21	'scattered' rather than 'scatted'. [Edson Leite, Brazil]	Done
5843	61	22	61	22	"thus change" implies that aerosols always influence precipitation, which they do not. I suggest changing "thus change" to "can also influence". [Camilla Stjern, Norway]	Done
5845	61	22	61	23	The Suni et al. (2015) reference is perhaps not the most relevant here. I suggest changing to Fan et al, 2016 (https://journals.ametsoc.org/doi/abs/10.1175/JAS-D-16-0037.1) which is a good review on aerosol-cloud interactions, and Rosenfeld et al., 2014 (https://agupubs.onlinelibrary.wiley.com/doi/full/10.1002/2013RG000441) on precipitation interactions. [Camilla Stjern, Norway]	Text changed and references are OK. Do not need an extra reference

Comment No	From Page	From Line	To Page	To Line	Comment	Response
5847	61	23	61	23	After "snow" I suggest adding a reference on effects of light-absorbing aerosols on snow/ice, i.e. Qian et al., 2015 (https://link.springer.com/article/10.1007/s00376-014-0010-0). [Camilla Stjern, Norway]	Changed text to explicitly mention change albedo with BC deposition in snow.
40515	61		61		Missing unit (emissions per year?). [Valerie Masson-Delmotte, France]	that refers to Table 2.4, a previous section. Emissions are Gtonnes CO2e agregated from 2003 to 2012
24295	61	11	62	13	Changes in emissions/fluxes can either be due external forcing or through a feedback in the system. It seems that section 2.5 would benefit from making this distinction when changes in the fluxes are assessed. E.g. enhanced dust emissions due to reduced vegetation could be a forcing if e.g. over grazing is the cause or a feedback if dryer climate is the cause. In terms of policy relevance for potential mitigation measures this is an importnat distinction. [Terje Berntsen, Norway]	You are right in making clear the policy relevant issues associated with external forcings or climate feedback. This was not mentioned previously in the document and it was integrated now. Added a new paragraph in the introduction (2.5) exactly saying that.
7523	61	20	62	5	Deposition of aerosols—especially black carbon—on snow and ice surfaces can reduce albedo and increase warming as a self-reinforcing feedback. See Tedesco M., et al. (2016) The darkening of the Greenland ice sheet: trends, drivers, and projections (1981–2100), THE CRYOSPHERE 10:477–496, 478 ("The presence of LAI such as soot (black carbon, BC), dust, organic matter, algae, and other biological material in snow or ice also reduces the albedo, mostly in the visible and ultraviolet regions (Warren, 1982). Such impurities are deposited through dry and wet deposition, and their mixing ratios are enhanced through snow water loss in sublimation and melting (Conway et al., 1996; Flanner et al., 2007; Doherty et al., 2013). Besides grain growth and LAI, another cause of albedo reduction over the GrIS is the exposure of bare ice: once layers of snow or firn are removed through ablation, the exposure of the underlying bare ice will further reduce surface albedo, as does the presence of melt pools on the ice surface (e.g. Tedesco et al., 2011)."); World Bank & International Cryosphere Climate Initiative (2013) ON THIN ICE: HOW CUTTING POLLUTION CAN SLOW WARMING AND SAVE LIVES, 2 ("Climate benefits for cryosphere regions from black carbon reductions carry less uncertainty than they would in other parts of the globe and are sometimes very large. This is because emissions from sources that emit black carbon—even with other pollutants—almost always lead to warming over reflective ice and snow."); Arctic Monitoring and Assessment Programme (AMAP) (2017) ADAPTATION ACTIONS FOR A CHANGING ARCTIC: PERSPECTIVES FROM THE BARENTS AREA, 72 ("Highly reflective surfaces, such as snow and ice in the Arctic increase light absorption by BC particles in the atmosphere. BC also absorbs light after deposition onto (and then into) snow and ice, where it accelerates the melt process (Pedersen et al., 2015). BC has made an important contribution to the observed rise in Arctic surface temperature through the 20th century (although carbon dioxide is still the major factor driving the rise in Arctic temperature) (Quinn et al., 2008; Koch et al., 2011; AMAP, 2015a). It may be technically possible to reduce global anthropogenic BC emissions by up to 75% by 2030 (Shindell et al., 2012; AMAP, 2015a; Stohl et al., 2015). As well as helping to slow warming, BC emission reductions would also have significant health benefits (Anenberg et al., 2012; Shindell et al., 2012)."). [Durwood Zaelke, United States of America]	Noted and part of the text was included in the albedo changes of BC deposition in snow.

Comment No	From Page	From Line	To Page	To Line	Comment	Response
7603	61	20	62	5	Deposition of aerosols—especially black carbon—on snow and ice surfaces can reduce albedo and increase warming as a self-reinforcing feedback. See Tedesco M., et al. (2016) The darkening of the Greenland ice sheet: trends, drivers, and projections (1981–2100), THE CRYOSPHERE 10:477–496; World Bank & International Cryosphere Climate Initiative (2013) ON THIN ICE: HOW CUTTING POLLUTION CAN SLOW WARMING AND SAVE LIVES; Arctic Monitoring and Assessment Programme (AMAP) (2017) ADAPTATION ACTIONS FOR A CHANGING ARCTIC: PERSPECTIVES FROM THE BARENTS AREA. [Kristin Campbell, United States of America]	added to the text
14127	61	11	72	12	Page 63, line 19 "component" rather than "components"/ Page 63, line 25 "proxies" rather than "proxies'". Page 64, line 5 missing "The" before "Chohen". Page 63, line 6 missing parentheses around "2014". Page 63, lines 6 and 7 parentheses around Bond and der Werf references need correcting. Page 63 lines 7 and 8, is there a difference between "Southern East Asia" and "Southeast Asia" (and note elsewhere in this chapter "Southeast Asia" is referred to as "South-East Asia").Page 65, lines 45 and 46 - note that here the different (and in my view correct) use of parentheses around a reference that is included in an already bracketed statement, in this case %s. However, check the actual % values - are both really 13%? Page 70, line 17, missing full-stop before "However". Page 70, line 21, seems odd to start a sentence with "(Goldstein et al. 2009)" - presumably should be "Goldstein et al. (2009)" (I note that this error is common throughout the chapter). [David Taylor, Singapore]	Corrections done, and some of them the text has changed.
24291	61	11	72	12	The Top Heading for section 2.5 indicates that it is about fluxes, while a lot of the section is about response. I suggest to change the heading to better reflect the content [Terje Berntsen, Norway]	Done - Non-GHGs fluxes and responses to changes in precursors of short-lived species from unmanaged and managed land
24279	61	11	72	15	From the heading of Section 2.5 I expected all relevant non-GHGs fluxes to be adressed. It seems that biogenic emissions of NOx (a precursor of ozone and nitrate aerosols) have not been included. There are some new litterature available e.g. Vinken, G. C. M., Boersma, K. F., Maasakkers, J. D., Adon, M., & Martin, R. V. (2014). Worldwide biogenic soil NOx emissions inferred from OMI NO2 observations. Atmospheric Chemistry and Physics, 14(18), 10363-10381. DOI: 10.5194/acp-14-10363-2014 [Terje Berntsen, Norway]	There is a new paragraph on section 2.5.1.3 dealing with biogenic Nox emissions…
24281	62	5	62	5	Remove "from land emissions ". The sentence is general for secondary aerosols. [Terje Berntsen, Norway]	Correction done
2581	62	5	62	5	"account" [Wei Li, France]	Correction done
8933	62	7	62	49	In section “Mineral dust” consider to include discussion about high latitude dust, Dust in these regions is not much studied until recently. It may have very different composition than dust in dry dust belt, impacts weather, albedo, etc. Citation: Bullard, J. E. et al. High-latitude dust in the Earth system. Rev. Geophys. 54, 447–485, 2016. [Jean-Luc Chotte, France]	Done
8935	62	7	62	49	In section “Mineral dust” consider to mention indirect impact of deposited mineral dust over ocean on sea surface temperature, and thereby the atmosphere and climate. This is maybe already included in Chapter 3, because in SOM it is mentioned in A5.5. Following reference shows impact of dust on sea surface temperature, which is also important constituent of dust-energy cycles interaction, citation: Singh, R. P., Prasad, A. K., Kayetha, V. K., and Kafatos, M.: Enhancement of oceanic parameters associated with dust storms using satellite data, J. Geophys. Res., 113, C11008, doi: 10.1029/2008JC004815, 2008. [Jean-Luc Chotte, France]	It is discussed in Chapter 3

Comment No	From Page	From Line	To Page	To Line	Comment	Response
8937	62	7	62	49	In section “Mineral dust” consider to mention significant potential impact of deposited dust on snow and glaciers albedo. Citation: Prasad et al., 2011: Melting of Major Glaciers in Himalayas: Role of Desert Dust and Anthropogenic Aerosols, in book: Planet Earth 2011 - Global Warming Challenges and Opportunities for Policy and Practice, doi: 10.5772/23235. [Jean-Luc Chotte, France]	Done
8939	62	7	62	49	In section “Mineral dust” consider to mention following report related to dust role in climate system and its quantification, observation, modeling, etc. It may also be mentioned in 2.1.2 Recap of previous IPCC and other relevant reports as baselines (page 10). This report summarizes important references and current knowledge related to mineral dust. citation: UNEP, WMO, UNCCD (2016). Global Assessment of Sand and Dust Storms. United Nations Environment Programme, Nairobi. ISBN: 978-92-807-3551-2 http://catalogue.unccd.int/765_Global_assessment_sand_dust_storms_2016.pdf [Jean-Luc Chotte, France]	We included new papers. This UNEP Report is more on the gray literature category…
8943	62	7	62	49	In section “Mineral dust” consider to mention programme WMO SDS-WAS (https://www.wmo.int/pages/prog/arep/wwrp/new/Sand_and_Dust_Storm.html) It gathers dust researchers worldwide in their research, provide information about current events and projects, operational forecast, collected knowledge on airborne mineral dust (provides good material for interested party). [Jean-Luc Chotte, France]	We included new papers. This UNEP Report is more on the gray literature category…
8931	62	9	62	9	Consider changing the sentence to “from arid and semi-arid regions of different origin (Ginoux et al. 2012)”. This reference describes recognition of different origin (antropogenic and natural) of airborne mineral dust, derived using MODIS data. Data from this paper have been used in as very important because it has been used as the main source of information for global dust distribution in recent years. Big part of Global Sand and Dust Assessment report relies on this data, also they are used in Atlas of Desertification, etc. Citation: Ginoux, P., Prospero, M.J. Gill, T.E., Hsu, C. and Zhao, M.: Global scale attribution of anthropogenic and natural dust sources and their emission rates based on MODIS Deep Blue aerosol products. Reviews of Geophysics, 50, RG3005, doi: 10.1029/2012RG000388, 2012. [Jean-Luc Chotte, France]	Done and reference included (Ginoux 2012)
8929	62	10	62	10	Consider to include the statement which comprehend the whole airborne mineral dust cycle, since it is recognized as an important constituent of Earth’s climate system and climate itself – “Dust cycle, which consist of mineral dust emission, transport, deposition and stabilization, have multiple interaction with other climate system cycles (Shao et al. 2011).” In this reference is recognized that "dust cycle" has important role in climate system, and discuss its interaction with other climate system cycles (energy and carbon cycle). Citation: Shao, Y., Wyrwoll, K-H, Chappell, A., Huang, J., Lin, Z., McTainsh, G.H., Mikami, M., Tanaka, T.Y., Wang, X., and Yoon, S.: Dust cycle: an emerging core theme in Earth system science, Aeolian Research 2011, 2, 181–204. doi: 10.1016/j.aeolia.2011.02.001, 2011. [Jean-Luc Chotte, France]	Text added
5849	62	11	62	11	"served" --> "can serve", "incluences" --> "influence" [Camilla Stjern, Norway]	Done
15277	62	11	62	11	it is cloud condensation nuclei and ice nuclei not not cloud and ice condensation nulcei [Joalane Marunye, Lesotho]	Corrections done, and some of them the text has changed.
24283	62	11	62	11	Change served to serve [Terje Berntsen, Norway]	Correction done

Comment No	From Page	From Line	To Page	To Line	Comment	Response
5851	62	11	62	12	There are still much uncertainty regarding how dust influences clouds and precipitation. I suggest a more careful wording here, and also more relevant references, as Kok et al (2018) is a study of aerosol-radiation effects from dust. I suggest to change the sentence starting with "Dust particles.." to "Dust particles can serve as cloud and ice condensation nuclei, and may influence the microphysial and macrophysical properties of clouds, and possibly also precipitation (Yin and Chen, 2007 https://www.atmos-chem-phys.net/7/3497/2007/, Karydis et al, 2017 https://www.atmos-chem-phys.net/17/5601/2017/). [Camilla Stjern, Norway]	Correction done. More careful wording
5853	62	12	62	14	I suggest deleting the sentence that starts with "In addition..", as the mention of cloud burnoff is perhaps more detailed that it needs to be. Also I believe more work is done on the influence of black carbon on cloud burnoff, and so it should be mentioned in the next subsection instead. [Camilla Stjern, Norway]	Correction done.
24285	62	18	62	23	The text from " which were initially derived … " and the remaining of the paragraph is mainly a review statement and not needed for the assessment. The next paragraph describes the state of the art. [Terje Berntsen, Norway]	Text changed
5855	62	27	62	27	"2013))." --> "2013). [Camilla Stjern, Norway]	Text changed
1135	62	27	62	27	Replace "... Richard 2013))" by "… Richard 2013)". [Sebastiaan Luyssaert, Belgium]	Text changed
6279	62	27	62	27	Extra ")" at end of citation [Tristan Quaife, United Kingdom (of Great Britain and Northern Ireland)]	Text changed
5857	62	33	62	33	"(i.e., spring-summer, Wang et al. 2015) and how" --> "(i.e., spring-summer, Wang et al. 2015)) and how" [Camilla Stjern, Norway]	Text changed
13375	62	33	62	33	Parenthesis is opened but not closed [Gregory Duveiller, Italy]	Text changed
6281	62	33	62	33	Unbalanced "(" [Tristan Quaife, United Kingdom (of Great Britain and Northern Ireland)]	Text changed
24293	62	33	62	35	There seems to be an inconsitency between the conclusion in section 2.5.1.1 and section 2.5.3 (page 69, line 12-) about the understanding of trends in dust emissions [Terje Berntsen, Norway]	The wording has changed to reflect better the consistency
1789	62	37	62	37	Perhaps authors could include examples of the surface observation platforms. [William Lahoz, Norway]	Too much detail
8941	62	42	62	42	Consider to include the following reference, besides Journet et al. and Perlwitz et al. It represents first open access global 1km gridded database of mineral composition of dust productive regions, and it is used in further dust modeling developments. Citation: Nickovic, S., Vukovic, A., Vujadinovic, M., Djurdjevic, V., and Pejanovic, G.: Technical note: High-resolution mineralogical database of dust-productive soils for atmospheric dust modeling, Atmos. Chem. Phys., 12, 845–855, doi: 10.5194/acp-12-845- 2012, 2012 [Jean-Luc Chotte, France]	Noted. We have already too many good references on dust
11593	62	42	62	48	cross chek line 42, 43, 48 [Lawrence Aribo, Uganda]	Done
1137	62	43	62	43	Replace "… have produce …" by "…have produced …" [Sebastiaan Luyssaert, Belgium]	done
5859	62	44	62	44	"role of dust in climate system" --> "the role of dust in the climate system" [Camilla Stjern, Norway]	Done
31901	62	48	62	48	"iii)" instead of "ii)" [Martijn Slot, Netherlands]	Done
2583	62	48	62	48	"iii)" [Wei Li, France]	Done
24287	62	36	63	1	There should be some kind of assessment statement from what has been the outcome of these campaigns. E.g. how are their ability to act as IN and CCN (lines 49 and 1)? [Terje Berntsen, Norway]	It was removed part of the text for the campaigns since it was too much details. Describing their results would be too much space
2813	62	42	63	1	Please check this sentence for language errors. [Bettina Weber, Germany]	done

Comment No	From Page	From Line	To Page	To Line	Comment	Response
40517	62		63		Missing information on confidence in these two pages. Lack of info on mineral dust in SPM. [Valerie Masson-Delmotte, France]	Added confidence info when necessary
28639	62	7		49	Mineral dust are extremely dangerous when transported over a long distance to non dryland regions where agriculture practice is extremely high.Most importantly; whenthe chemical composition of the atmospheric aerosols are broken down ,it can be disastrous to agriculture,farm land and the soil.The atmospheric aerosols are not only helpful in absorbing and reflectivity of solar radiation but they play an important role in precipitation, cloud cover, weather patterns and Air quality. For example on the 12 September 2009, an heavy dust moving frlm the northern part pf Nigeria to south-west Nigeria, the dust is so heavy causing breathing for several hours difficult, polluting the air and poor inter-visibility was felt at Ile-ife, Osun state Nigeria and view areas in the south-west of Nigeria. Cleaner Air is very important in describing and combating mineral dust which is a front runner in Climate change impacts on land and Air. I recommend an integrated comprehensive Atmospheric aerosols analysis in relation with mineral dust and Air quality. [Abiodun Adegoke, Nigeria]	There is an extensive discussion on aerosols and air quality already. Not specifically to dust, but more general discussion on air quality
5861	63	4	63	4	I suggest rewording the start of this sentence as the first sentence in Section 2.5.1.1. starts in a very similar way. [Camilla Stjern, Norway]	Done
7525	63	4	63	21	These particles can reduce the albedo of snow and ice, which can magnify local warming. See Tedesco M., et al. (2016) The darkening of the Greenland ice sheet: trends, drivers, and projections (1981–2100), THE CRYOSPHERE 10:477–496, 478 ("The presence of LAI such as soot (black carbon, BC), dust, organic matter, algae, and other biological material in snow or ice also reduces the albedo, mostly in the visible and ultraviolet regions (Warren, 1982). Such impurities are deposited through dry and wet deposition, and their mixing ratios are enhanced through snow water loss in sublimation and melting (Conway et al., 1996; Flanner et al., 2007; Doherty et al., 2013). Besides grain growth and LAI, another cause of albedo reduction over the GrIS is the exposure of bare ice: once layers of snow or firn are removed through ablation, the exposure of the underlying bare ice will further reduce surface albedo, as does the presence of melt pools on the ice surface (e.g. Tedesco et al., 2011)."); World Bank & International Cryosphere Climate Initiative (2013) ON THIN ICE: HOW CUTTING POLLUTION CAN SLOW WARMING AND SAVE LIVES, 2 ("Climate benefits for cryosphere regions from black carbon reductions carry less uncertainty than they would in other parts of the globe and are sometimes very large. This is because emissions from sources that emit black carbon—even with other pollutants—almost always lead to warming over reflective ice and snow."); Arctic Monitoring and Assessment Programme (AMAP) (2017) ADAPTATION ACTIONS FOR A CHANGING ARCTIC: PERSPECTIVES FROM THE BARENTS AREA, 72 ("Highly reflective surfaces, such as snow and ice in the Arctic increase light absorption by BC particles in the atmosphere. BC also absorbs light after deposition onto (and then into) snow and ice, where it accelerates the melt process (Pedersen et al., 2015). BC has made an important contribution to the observed rise in Arctic surface temperature through the 20th century (although carbon dioxide is still the major factor driving the rise in Arctic temperature) (Quinn et al., 2008; Koch et al., 2011; AMAP, 2015a). It may be technically possible to reduce global anthropogenic BC emissions by up to 75% by 2030 (Shindell et al., 2012; AMAP, 2015a; Stohl et al., 2015). As well as helping to slow warming, BC emission reductions would also have significant health benefits (Anenberg et al., 2012; Shindell et al., 2012)."). [Durwood Zaelke, United States of America]	Original text was changed significantly also to include some of these proposed topics in the description of carbonaceous aerosols

Comment No	From Page	From Line	To Page	To Line	Comment	Response
7527	63	4	63	21	While organic carbon is reflective, the warming effect of the black and brown carbon components overall amplify warming. See Feng Y., et al. (2013) Brown carbon: a significant atmospheric absorber of solar radiation?, ATMOS. CHEM. PHYSICS 13:8607–8621. [Durwood Zaelke, United States of America]	Phrase added
7605	63	4	63	21	These particles can reduce the albedo of snow and ice, which can magnify local warming. See Tedesco M., et al. (2016) The darkening of the Greenland ice sheet: trends, drivers, and projections (1981–2100), THE CRYOSPHERE 10:477–496; World Bank & International Cryosphere Climate Initiative (2013) ON THIN ICE: HOW CUTTING POLLUTION CAN SLOW WARMING AND SAVE LIVES; Arctic Monitoring and Assessment Programme (AMAP) (2017) ADAPTATION ACTIONS FOR A CHANGING ARCTIC: PERSPECTIVES FROM THE BARENTS AREA. While organic carbon is reflective, the warming effect of the black and brown carbon components overall amplify warming. See Feng Y., et al. (2013) Brown carbon: a significant atmospheric absorber of solar radiation?, ATMOS. CHEM. PHYSICS 13:8607–8621. [Kristin Campbell, United States of America]	text added on this issue
5863	63	5	63	5	"It can comprise about 60-80%" --> "They can make up about 60-80%" [Camilla Stjern, Norway]	Done like suggested
5865	63	6	63	6	Consider deleting "in urban and remote atmosphere", as the meaning is unclear here - do they make up 60% in remote and 80% in urban atmospheres? [Camilla Stjern, Norway]	Done like suggested
5867	63	6	63	7	"It comprises of an organic" --> "Carbonaceous aerosols comprise a mosttly scattering organic" [Camilla Stjern, Norway]	Done
5869	63	17	63	17	The wording "OC is imporant for the scattering properties of aerosols" sounds a bit strange. Also, this would be a good place to add a sentence or two on how OC and EC influence clouds. For instance something like "OC and EC have distrinctly different optical properties, with OC being mainly scattering (your references) and EC being mianly absorbing (your references). This means that their radiative influence in the atmosphere is also different. While OC has shown abilities to function as both condensation and ice nuclei in cloud formation (Kuwati et al, 2013 https://www.atmos-chem-phys.net/13/5309/2013/acp-13-5309-2013.html, Liu et al., 2018 https://www.nature.com/articles/s41467-018-06622-2), the influence of EC on ice clouds is a much discussed albeit still hihgly uncertain effect (Storelvmo, 2017, https://www.annualreviews.org/doi/full/10.1146/annurev-earth-060115-012240). In addition, the strong absorptive capacity of EC may alter atmospheric stability in such a way as to influence clouds (Koch and delGenio, 2010 https://www.atmos-chem-phys.net/10/7685/2010/acp-10-7685-2010.html, Booth and Bellouin, 2015 https://www.nature.com/articles/519167a)." [Camilla Stjern, Norway]	Text changed to include this issue
1139	63	28	63	28	Check citation format (brackets should be around the years, not around the author name) [Sebastiaan Luyssaert, Belgium]	done
3153	63	30	63	30	BC : please, give in full. [, Russian Federation]	done
13377	63	30	63	30	I suppose 'BC' stands for black carbon, but I am not sure I has been defined before. [Gregory Duveiller, Italy]	Done
6283	63	30	63	30	The acronym BC (which I assume is Black Carbon) has not been expanded previously as far as I can tell. All the other acronyms used here have been. [Tristan Quaife, United Kingdom (of Great Britain and Northern Ireland)]	Done
1141	63	31	63	31	Replace "...et al. 2014))" by "...et al. 2014)". [Sebastiaan Luyssaert, Belgium]	Done
8309	64	2	64	2	This figure is too small, larger is better. [kaicun Wang, China]	Figure will be redraw
24297	64	9	64	9	Ozone is not emitted - it is a secondary species. Please correct. [Terje Berntsen, Norway]	now mention ozone precursors

Comment No	From Page	From Line	To Page	To Line	Comment	Response
1143	64	15	64	15	This far all surface areas has been expressed in Mha this is the first time km2 is used. Consider using the same unit for surface area throughout this chapter. [Sebastiaan Luyssaert, Belgium]	As the original estimates is done in KM2, we prefer to keep this unit
1145	64	16	64	16	This far all surface areas has been expressed in Mha. Consider using the same unit for surface area throughout this chapter. [Sebastiaan Luyssaert, Belgium]	As the original estimates is done in KM2, we prefer to keep this unit
22497	64	17	64	17	This subsection goes in too much detail and does not focus on main effects [Anastasios Kentarchos, Belgium]	We removed many detais to focus in the key issues
1147	64	18	64	19	The sentence is correct but confusing because it duplicates the general introduction of 2.5. Delete it here. [Sebastiaan Luyssaert, Belgium]	Removed
8485	64	20	64	20	Recent studies showed that crops are significant methanol emitters. Reference : [Marc Aubinet, Belgium]	True, but too much detail and confidence low.
24299	64	20	64	20	It is true that broadleaf forests emitts the largest quantities (mainly isoprene). However, monoterpenes from needel leaf boreal forest are much mor eefficient in forming SOAs [Terje Berntsen, Norway]	Yes, info included in the new text
8487	64	27	64	28	This comparison is irrelevant : photosynthesis may drop to zero in stressfull conditions. A more realistic estimate is less than 1% of net ecosystem exchange (0.1% of assimilation). See Réf Portillo-Estrada et al, Bioenergy, (2018) https://doi.org/10.1111/gcbb.12506 for a review of orders of magnitude. [Marc Aubinet, Belgium]	It is important to mention that BVOC emissions can be significant in terms of photosynthesis
24301	64	38	64	38	Is this increase per unit area of forest or does it also take into account deforestation and thus reduced forest area? Since pre-industrial reduced forest area may be more important? Ensure consistency with statement on page 65, lines 42 and following. [Terje Berntsen, Norway]	Only because of the increase in temperature… Reworded…
28281	64	17	66	30	The role of BVOcs/oxidative capacity in tropical, boreal and temperate environment in future climate need to be assessed. Oxidative capacity/lifetime of CH4 interaction need to be assessed, [Noureddine Yassaa, Algeria]	We had try to simplify the text, keeping the critical issues
1271	65	1	65	3	This statement is about the future. There is a separate section (2.5.1.4) that deals with the future. Consider move this sentence to section 2.5.1.4? [Sebastiaan Luyssaert, Belgium]	Yes, we moved this to the future section
29103	65	2	65	2	Please check literature for more recent papers than one from 1991. [Jan Fuglestvedt, Norway]	Reference removed. Phrase moved and changed
531	65	6	65	9	I think the CO2 inhibition effect on isoprene (and possably monoterpene emissions) should be mentioned here as a factor that will affect BVOC emissions in the future. [Moa Sporre, Sweden]	Maybe is too much details on the mechanisms. We would like to reduce the size and scope of the BVOC section that is already too large.
1149	65	9	65	9	Mention the effect of changes in BVOC emissions due to climate-driven changes in species composition. Also mention that an increase in croplands at the expense of the forest area (as mention in this chapter) would result in a substantial decrease of the BVOC emissions. [Sebastiaan Luyssaert, Belgium]	Done
533	65	11	65	11	Remove the word "also". [Moa Sporre, Sweden]	Done
29105	65	16	65	16	I dont think you need " (from all sources) " [Jan Fuglestvedt, Norway]	Done
535	65	20	65	20	"are mostly originated from" should be changed to "mostly originate from" [Moa Sporre, Sweden]	Done
537	65	21	65	23	The sentence is written confusingly. At the moment it is written as if the BVOC form particles and then are oxidised which reduces the volatility of the particles. This is not true and should be changed. BVOCs are oxidised which reduces their volatility and then they can form particles. [Moa Sporre, Sweden]	Accepted, phrase was confusing and was rewritten.
29107	65	36	65	36	Please check literature for more recent papers. (Unger?) [Jan Fuglestvedt, Norway]	Added Unger 2017 that deals with the same issue

Comment No	From Page	From Line	To Page	To Line	Comment	Response
8489	65	50	66	1	Awkward writing. [Marc Aubinet, Belgium]	Phrase changed
31903	66	1	66	1	delete "by" at the start of this line [Martijn Slot, Netherlands]	Phrase changed
539	66	1	66	1	Remove the word by just before the reference to (Scott et al. 2017) [Moa Sporre, Sweden]	Phrase changed
1151	66	1	66	1	Check citation format (brackets should be around the years, not around the author name) [Sebastiaan Luyssaert, Belgium]	Editorial
22499	66	4	66	15	This text is largely speculation and can be reduced or omitted [Anastasios Kentarchos, Belgium]	Changed text to reflect know science
13379	66	17	66	17	Extra "the" in "the reduced the atmospheric lifetime" [Gregory Duveiller, Italy]	Phrase changed
24303	66	27	66	30	This paragraph does not belong in section2.5.1.3 [Terje Berntsen, Norway]	Agree figure removed
29109	66	27	66	31	There is a lot of new research avaiable on BC. You need to take into account more recent studes. [Jan Fuglestvedt, Norway]	paragraph removed, because similar BC discussion is on other part of the section.
22501	67	1	67	1	Some of the values presented in this graph is not in agreement with other sections of the chapter [Anastasios Kentarchos, Belgium]	Figure removed
8491	67	1	67	1	Coherence of methane figure with Table 2.2 ? [Marc Aubinet, Belgium]	Figure removed
38845	67	2	67	2	Why does the CH4 trend decrease in the Lamarque figure? This is contrary to observed CH4 concentration/emissions. [, United States of America]	Figure removed
29111	67	2	67	3	More recent data available ? [Jan Fuglestvedt, Norway]	Figure removed
5275	67	2	67	4	Instead of the emissions from Lamarque, I will suggest to update this figure with the CEDS emissions published here: https://www.geosci-model-dev.net/11/369/2018/ [Ragnhild Bieltvedt Skeie, Norway]	Figure removed
24305	67	6	67	6	To me the heading of section 2.5.1.4. indicates that only the impacts of forcing through land use change will be adressed. [Terje Berntsen, Norway]	Figure removed
541	67	11	67	11	The word "reflecting" should be changed to "reflection by". [Moa Sporre, Sweden]	Done
5565	67	12	67	13	"N deposition into the ocean … increase the source"! Deposition in the ocean is not sink? [Sanaz Moghim, Iran]	I could not find this phrase on page 67 line 12
8493	67	13	67	13	It's strange to hear about BVOC emission increase here as it was shown above that BVOC emission nare expect to decrease . [Marc Aubinet, Belgium]	BVOC emissions should increase with increased temperature.
8495	67	25	67	25	what does mean a gain of 1.07 ? A 7% increase ? Clarify. [Marc Aubinet, Belgium]	It is an incrase of 7%. This was corrected.
40519	67		67		Is that the key figure capturing the outcomes of the assessment of this chapter? No update? Recent trends in methane shown here do not seem consistent with earlier chapter text. Check carefully. [Valerie Masson-Delmotte, France]	Removed the phrase on methane. It is misleading since this is only CH4 change due to ozone changes
14041	67	8			Limited studies, yes. But some possibly useful additional ones include: Ashworth et al (2012; ACP); Pacifico et al (2012; JGR), Sanderson et al (2003; GRL). [Chris Jones, United Kingdom (of Great Britain and Northern Ireland)]	Added references Pacifico and Ashworth
22503	68	3	68	3	Use the term CMIP5 here [Anastasios Kentarchos, Belgium]	Done
5567	68	6	68	7	"which in addition to a …an increase in …" is it right?, any reference! [Sanaz Moghim, Iran]	Done
5871	68	8	68	8	"difficulties in properly model" --> "difficulties in properly modelling" [Camilla Stjern, Norway]	Done
5873	68	8	68	8	"all CMIP5-class ESM did not" --> "none of the CMIP5-class EMSs" [Camilla Stjern, Norway]	Done
12849	68	8	68	8	have difficulties in properly modelling [Robert Treuhaft, United States of America]	Done
1791	68	8	68	8	model -> modelling (or modeling). [William Lahoz, Norway]	Done

Comment No	From Page	From Line	To Page	To Line	Comment	Response
543	68	8	68	9	"Actually all CMIP5-class ESM did not include explicitly" should be changed to "Actually, none of the CMIP5-class ESM explicitly included" [Moa Sporre, Sweden]	Done
5875	68	9	68	9	"diversity of process that depends" --> "diversity of processes that depend" [Camilla Stjern, Norway]	Done
24307	68	10	68	12	Since CMIP5 there has been simulations with coupled ESMs using MEAGN and CLM4.5 (e.g. Sporre et al., 2018) using teh BGC option in CLM (i.e. plant growth respond to CO2 and climate, but distribution of plant functional types are fixed. With this setup BVOC-climate-co2 coupling and feedbacks can be quantified. [Terje Berntsen, Norway]	Done
22505	68	11	68	15	These are technical issues, not relevant here [Anastasios Kentarchos, Belgium]	simplified
5877	68	12	68	12	"been incorporated" --> "have been incorporated" [Camilla Stjern, Norway]	Done
545	68	12	68	13	It is written that MEGAN is too computentionllly intensive to be included in ESM. This is not quite true. MEGAN is nowadays included in ESMs, for example NorESM (which includes CLM). [Moa Sporre, Sweden]	Corrected
5879	68	26	68	26	The subsection headline says that this should also contain something on how BC is modelled in ESMs, which it does not. A paragraph on this should be added. For instance: ESMs most likely underestimate globally averaged EC emissions (Bond et al., 2013 https://agupubs.onlinelibrary.wiley.com/doi/full/10.1002/jgrd.50171 , Cohen and Wang, 2014 https://agupubs.onlinelibrary.wiley.com/doi/full/10.1002/2013JD019912), although recent emission inventories have included an upwards adjustment in these numbers (Hoesly et al., 2017 https://www.geosci-model-dev.net/11/369/2018/gmd-11-369-2018.html). Vertical EC profiles have also been shown to be poorly constrained (Samset et al., 2014 https://www.atmos-chem-phys.net/14/12465/2014/; Wang et al., 2014 https://agupubs.onlinelibrary.wiley.com/doi/full/10.1002/2013JD020824), with a general tendency of too much EC at high altitudes. Models differ strongly in the magnitude and importance of the coating-enhancement.of ambient EC absorption (Boucher et al., 2016 https://www.pnas.org/content/113/35/E5092; Gustafsson & Ramanathan, 2016 https://www.pnas.org/content/113/16/4243), in their estimated lifetime of these particles, as well as in dry and wet removal efficiency (Mahmood et al., 2016 https://agupubs.onlinelibrary.wiley.com/doi/full/10.1002/2016JD024849). [Camilla Stjern, Norway]	Paragraph added as recommended
3155	68	29	68	29	Fig. 2.19 caption is incomplete, e.g., does not explain the difference between a) and b) frames. [, Russian Federation]	Figure removed
5569	68	37	68	38	"These conditions", which ones? Why it is indirect emissions? [Sanaz Moghim, Iran]	phrase modified
6983	68				Figure 68: please define a) and b) and explain. [Debra Roberts, South Africa]	Figure removed
23579	68				Figure 2.19 is not clear [Huai Jianjun, China]	Figure removed
23835	69	2	69	2	practices. Stanelle et al. (2014) (correct) [, India]	Will be fixed at final editing by TSU
33073	69	2	69	2	How is the state of agricultural expansion worldwide? and in the main regions with the use of agriculture? [Jesus Alejandro Prieto Amparan, Mexico]	Modified the whole phrase in the final version
6285	69	10	69	10	Extra space: "- 0.14" [Tristan Quaife, United Kingdom (of Great Britain and Northern Ireland)]	Corrected
12805	69	11	69	11	It should be 'from' rather than 'form'. [Edson Leite, Brazil]	Corrected

Comment No	From Page	From Line	To Page	To Line	Comment	Response
3473	69	15	69	20	Here discuss the variations of dust storms over China, but the relevant literatures are missing. Please add the related references. [Jianqi Sun, China]	Phrase simplified and there is no more such section on China
2815	69	25	69	27	"New prognostic dust emission models are now…". I.e. delete plural "s" from "emission" and insert "are". [Bettina Weber, Germany]	Corrected
8497	69	26	69	26	stem, not steam ! [Marc Aubinet, Belgium]	Corrected
23895	69	31	69	34	It may be noted that the cited paper (Solmon et al. 2015) concludes that the study did not demonstrate the entire feedback loop because forced emission trends were used. Also this study did not consider any decadal trends in anthropogenic aerosol emissions. Further it may be noted that this study using the RegCM4 regional climate model did neither follow the standard CORDEX experiment framework nor was a contribution to this WCRP regional activity, as reported in the paper. [, India]	paragraph removed
19007	69	31	69	34	It may be noted that the cited paper (Solmon et al. 2015) concludes that the study did not demonstrate the entire feedback loop because forced emission trends were used. Also this study did not consider any decadal trends in anthropogenic aerosol emissions. Further it may be noted that this study using the RegCM4 regional climate model did neither follow the standard CORDEX experiment framework nor was a contribution to this WCRP regional activity, as reported in the paper. [Sanjay Jayanarayanan, India]	paragraph removed
19041	69	48	69	49	the sentence is not finished [Joanna Wibig, Poland]	Sentence changed completelly.
5881	69	49	69	49	"influence directly the radiative" --> Not sure her, but should it be "influence the direct radiative forcing"? [Camilla Stjern, Norway]	Sentence changed completelly.
8499	69	49	69	49	Missing word (forcing ?) [Marc Aubinet, Belgium]	Sentence changed completelly.
29113	69	35	70	7	this feels like much repetition. Make it more distinct from 2.5.1.2 [Jan Fuglestvedt, Norway]	Removed
12919	70	4	70	4	It is 'archaea'. [Edson Leite, Brazil]	Corrected
40521	70	37	70	37	"need for new research" = prescriptive. Capture in knowldge gaps at the end and reformulate. [Valerie Masson-Delmotte, France]	Section modified significantly
29115	70	8	71	20	this feels like much repetition. Make it more distcinct from 2.5.1.3 [Jan Fuglestvedt, Norway]	Section modified significantly
8501	70	8	71	21	This section is redundant with 2.5.1.3 [Marc Aubinet, Belgium]	Section modified significantly
28583	70	4	82	44	this section is not clear, which makes it difficult to evaluate the substance [Alan Di Vittorio, United States of America]	Section modified significantly
15627	71	1	71	2	Reference missing. [Tuomo Kalliokoski, Finland]	Section modified significantly
29117	71	9	71	10	this is rather obvious [Jan Fuglestvedt, Norway]	Section modified significantly
5571	71	18	71	18	no need for "in the troposphere" [Sanaz Moghim, Iran]	Section modified significantly
5573	71	19	71	19	"and thus change pricipitation", wht the author means? Precipitation type, distribution, … [Sanaz Moghim, Iran]	Section modified significantly
5575	71	19	71	20	" in addition, …deposition". "implication for reflectance, particularly snow"? it needs modification [Sanaz Moghim, Iran]	Section modified significantly
30789	71	23	71	23	t is very odd to have a sub-section "changes in the hydrological cycle" within section 2.5, that deals with emissions from the land-surface. One can understand a subsection on aerosol-cloud interaction being placed here, but the hydrological cycle involves much more than this. My suggestion is to focus purely on aerosol-cloud interactions in this subsection, and to move the discussion on the hydrological cycle elsewhere. [Francois Engelbrecht, South Africa]	Section 2.5.4 removed
5885	71	24	71	26	The first sentence of this subsection is a bit awkward - I suggest deleting "from the point of view of precipitation and also from the radiative balance". [Camilla Stjern, Norway]	The section was removed from the final version.

Comment No	From Page	From Line	To Page	To Line	Comment	Response
30791	71	24	71	26	I think the statement that cloud-aerosol interactions is the greatest source of uncertainy in terms of the understanding of anthropogenic forcing is an over-statement. Other factos, such as cloud dynamics and thermodynamics (and even large-scale atmospheric and ocean dynamics) are probably just as important. I would suggest stating that cloud-aerosol interactions is an important source of uncertainty, but to refrain from stating that it is the biggest single source of uncertainty. [Francois Engelbrecht, South Africa]	Accepted, we agree with your observation, but the section was removed from the final version due to size limitations and also several reviewers suggested the removal of this section.
5883	71	26	71	26	I reccommend changing the Fan et al. 2012 reference to Fan et al. 2016 (https://journals.ametsoc.org/doi/abs/10.1175/JAS-D-16-0037.1), and the Rosenfeld 200 reference could perhaps be omitted.. [Camilla Stjern, Norway]	Text was changed and the reference was not needed any more.
5887	71	27	71	27	How much aerosols influences precipitation through microphysical interactions are still very uncertain, and there are other, potentially just as efficient paths towards precipitation changes. I suggest changing the sentence starting with "The ability of atmospheric particles to.." to "Aerosols have the ability to influence terrestrial ecosystems, most prominently through their influence on precipitation. This can happen through ther microphysical interaction with clouds, through which they can suppress or enhance precipitation formation, depending on atmospheric conditions (Michibata et al, 2016 https://www.atmos-chem-phys.net/16/15413/2016/acp-16-15413-2016.pdf, Koren et al., 2014 http://science.sciencemag.org/content/344/6188/1143, Lebo and Feingold, 2014 https://www.atmos-chem-phys.net/14/11817/2014/acp-14-11817-2014.html), but it can also be a result of aerosol-induced changes to atmospheric circulation (e.g., Yang, 2016 https://journals.ametsoc.org/doi/10.1175/JAS-D-15-0233.1, Bollasina et al., 2011 http://science.sciencemag.org/content/334/6055/502).". [Camilla Stjern, Norway]	The paragraph was completely rewritten.
24359	71	32	71	32	Double brackets. [Renato Braghiere, France]	Done.
1153	71	32	71	32	Replace "... ((Boucher et al. 2013)." by "... (Boucher et al. 2013)." [Sebastiaan Luyssaert, Belgium]	Done.
8503	71	35	71	35	what do you mean by "warm" ? "Liquid"? [Marc Aubinet, Belgium]	Yes, in the cloud jargon, warm clouds mean liquid water clouds, not the ice phase.
1155	71	39	71	39	Replace " … Freud et al. 2008) For …" by " … Freud et al. 2008). For …" [Sebastiaan Luyssaert, Belgium]	Done.
30793	71	39	71	41	Expand the qualification "For the assumption of constant liquid water content" to "For the assumption of constant liquid water content and cloud dynamics and thermodynamics". Also, please add a reference to back-up the statement. [Francois Engelbrecht, South Africa]	This subsection was removed from the final version, because of size limitation and recommendations from reviewers.
30795	71	41	71	42	"It should be noted that the uncertainties associated with mixed- and ice-cloud microphysics remain significant". Please add supporting references. [Francois Engelbrecht, South Africa]	The section was changed significantly, and this phrase do not exist anymore.
30797	71	41	71	42	"The current global and regional climate models have important limitations in the parameterisation of convective clouds, do not normally include convective cloud microphysics and hence lack the ability to represent the majority of the effects proposed to be of importance for the aerosol effects on clouds and precipitation". This statement is strong an should be backed up bu some references. Most GCMs and RCMs parameterises both convection and cloud microphysics, so the statement seems wrong. It should rather be stated that convective cloud dynamics and associated microphysics can not be explicitly be resolved in most GCMs and RCMs, and thus need to be parameterised. [Francois Engelbrecht, South Africa]	The section was changed significantly, and this phrase do not exist any more.

Comment No	From Page	From Line	To Page	To Line	Comment	Response
5889	71	42	71	42	Add a reference to Storelvmo, 2017 (https://www.annualreviews.org/doi/full/10.1146/annurev-earth-060115-012240) at the end of this sentence. [Camilla Stjern, Norway]	The sub-section was removed from the final version.
30799	71	45	71	47	"However, both recent development of advanced aerosol-aware convection parameterisations as well as the increasing availability of (near) global cloud resolving modelling will help to close this gap in the medium to long-term." This is yet another strong statement for which no supporting references is provided. What are the "recent aerosol-aware convection parameterisations" the authors are referring to? Such schemes have been available for at least 20 years. e.g. Lin and Colle (2001) Mon. Wea. Rev. - just one of hundreds of examples. Cloud-resolving models are also very far away, perhaps decades away, of being applied at climate change time-scales. Not a single CMIP6 model even comes close to this aspiration. Please add some references to this statement, and explain what is meant with "medium to long term". [Francois Engelbrecht, South Africa]	The sub-section was removed from the final version.
3159	71	49	71	51	TWS: is it annual mean? Other? Specify, please. [, Russian Federation]	The term does not appear any more, since the subsection was completely rewritten.
7607	71	23	72	7	Projections of changes to clouds—and recent observations that confirm the mechanism—lead to shifting cloud tracks poleward that leads to a positive feedback associated with clouds. See Boucher O., et al. (2013) CHAPTER 7:CLOUDS AND AEROSOLS, in IPCC (2013) CLIMATE CHANGE 2013: THE PHYSICAL SCIENCE BASIS, Working Group I Contribution to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change; see also Norris J. R., et al. (2016) Evidence for climate change in the satellite cloud record, NATURE 536:72–75; Bender F. A.-M., et al. (2012) Changes in extratropical storm track cloudiness 1983–2008: observational support for a poleward shift, CLIMATE DYNAMICS 38(9–10):2037–2053; and Committee to Prevent Extreme Climate Change (2017) Well Under 2 Degrees Celsius: Fast Action Policies to Protect People and the Planet from Extreme Climate Change. [Kristin Campbell, United States of America]	Section 2.5.4 removed

Comment No	From Page	From Line	To Page	To Line	Comment	Response
7529	71	23	72	12	Projections of changes to clouds—and recent observations that confirm the mechanism—lead to shifting cloud tracks poleward that leads to a positive feedback associated with clouds. See Boucher O., et al. (2013) CHAPTER 7:CLOUDS AND AEROSOLS, in IPCC (2013) CLIMATE CHANGE 2013: THE PHYSICAL SCIENCE BASIS, Working Group I Contribution to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change, 580 ("The effect of clouds on the Earth's present-day top of the atmosphere (TOA) radiation budget, or cloud radiative effect (CRE), can be inferred from satellite data by comparing upwelling radiation in cloudy and non-cloudy conditions (Ramanathan et al., 1989). By enhancing the planetary albedo, cloudy conditions exert a global and annual shortwave cloud radiative effect (SWCRE) of approximately –50 W m–2 and, by contributing to the greenhouse effect, exert a mean longwave effect (LWCRE) of approximately +30 W m–2, with a range of 10% or less between published satellite estimates (Loeb et al., 2009). Some of the apparent LWCRE comes from the enhanced water vapour coinciding with the natural cloud fluctuations used to measure the effect, so the true cloud LWCRE is about 10% smaller (Sohn et al., 2010). The net global mean CRE of approximately –20 W m–2 implies a net cooling with a range of 10% or less between published satellite estimates (Loeb et al., 2009). Some of the apparent LWCRE comes from the enhanced water vapour coinciding with the natural cloud fluctuations used to measure the effect, so the true cloud LWCRE is about 10% smaller (Sohn et al., 2010). The net global mean CRE of approximately –20 W m–2 implies a net cooling effect of clouds on the current climate. Owing to the large magnitudes of the SWCRE and LWCRE, clouds have the potential to cause significant climate feedback (Section 7.2.5). The sign of this feedback on climate change cannot be determined from the sign of CRE in the current climate, but depends instead on how climate-sensitive the properties are that govern the LWCRE and SWCRE."); see also Norris J. R., et al. (2016) Evidence for climate change in the satellite cloud record, NATURE 536:72–75, 72 ("Here we show that several independent, empirically corrected satellite records exhibit large-scale patterns of cloud change between the 1980s and the 2000s that are similar to those produced by model simulations of climate with recent historical external radiative forcing. Observed and simulated cloud change patterns are consistent with poleward retreat of mid-latitude storm tracks, expansion of subtropical dry zones, and increasing height of the highest cloud tops at all latitudes. The primary drivers of these cloud changes appear to be increasing greenhouse gas concentrations and a recovery from volcanic radiative cooling. These results indicate that the cloud changes most consistently predicted by global climate models are currently occurring in nature."); Bender F. A.-M., et al. (2012) Changes in extratropical storm	Section 2.5.4 removed
29119	71	23	72	12	Uncelar section. About H2O as such, or about the relation aerosols - H2O ? [Jan Fuglestvedt, Norway]	Section removed
29121	71	23	72	12	more recent literature is needed here. (Hodnebrog, Myhre, Forster, Samset and others have studies that may be relevant) [Jan Fuglestvedt, Norway]	Section removed. We had to reduce the size of the section, so this subsection was removed from final version
30801	71	49	72	7	After discussing cloud microphysics, the subsection unexpectedly spends about 10 lines on discussing fresh water availability, based on a single remote-sensing techniques. Thrends are presented for a very short 2002-2016 period. I suggest that these 10 lines are removed. How can trends be presented for only a 14-year period, given that pronounced climate variability can be completely dominating for such a short period? For a discussion on fresh water availability to be robust, towards making a well-respected IPCC assessment, one also needs to consider numerous other independent data sources, such as direct measurements of streamflow and ground water. [Francois Engelbrecht, South Africa]	The whole subsection was removed.
29123	71	49	72	7	Not sure if this fits in here. [Jan Fuglestvedt, Norway]	Subsection removed from final version
8505	71	49	72	12	I don't see the relevance of this section in the present chapter. [Marc Aubinet, Belgium]	The whole subsection was removed
1157	71	51	72	1	Part of this sentence is missing. [Sebastiaan Luyssaert, Belgium]	The text was rewritten

Comment No	From Page	From Line	To Page	To Line	Comment	Response
14043	71	23			Section on aerosols and the hydrological cycle. I think this would benefit from splitting into the aerosol-cloud interactions (which affect climate and rainfall) and direct effects of aerosols on evaporation ("global dimming"). They're both important but rather different mechanisms. There is a large body of literature on global dimming, but it was first seen in pan evaporation measurements and is clearly a big driver of hydrology – see, e.g., Gedney et al (2014; Nature Geosci.) who found a detectable signal in global river flow. [Chris Jones, United Kingdom (of Great Britain and Northern Ireland)]	The section on aerosols and the hydrological cycle was removed from chapter 2. Several reviewers have suggested the removal Personally I was in favor of keeping and even expanding the section 2.5 to include effects on hydrological cycle, but we were pressed to reduce space and follow reviewers' comments.
5577	72	6	72	10	" The Dust Emission Index …" any reference! [Sanaz Moghim, Iran]	The expression has been deleted
3161	72	15	72	15	Perhaps, 'influence' is needed after ' changes' [, Russian Federation]	Editorial. The title of the section has now been changed. However, adding 'influence' would have changed the meaning of the title
1793	72	17	72	17	I think this reads better: "The evidence that…has long…". Consider changing similar text elsewhere. [William Lahoz, Norway]	Editorial. Thank you. The text has been moved to section 2.1
30803	72	20	72	24	Such a powerful statement needs more explanation than provided. The paper by Kageyama (2004) seems to state that ice sheet feedbacks, not vegetation change, was critical in reaching the tipping point towards glaciation. Orbital changes are generally regarded as the key factor inducing periods of glaciation, if the authors want to claim that vegetation changes is the main trigger, they need to elaborate to make this dubious statement more defensible. [Francois Engelbrecht, South Africa]	Rejected. There is a misinterpretation of your understanding of Kageyama paper. Yes glacial inception is triggered by ice-feedbacks but they precisely show that ice sheet feedbacks are really small if there is not interactive vegetation
30805	72	24	72	25	A dubious and incomplete statement is also provided to link the desirtification of the Sahara to a vegeration trigger. If the green Saharrah maintained the monsoon, as the author's seem to claim, how did the monsoon weaken in the first place? Something must have triggered the desirtification of the Saharah. [Francois Engelbrecht, South Africa]	Taken into account. References to the Holocene has been removed and this part of the text has been moved to section 2.1. However, to answer your question, there has long been a questioning about why the Sahara was remaining green for so long while the response of african monsoon to orbital forcing would suggest a much drier Sahara. Many modelling studies have shown that this green Sahara was maintained for some time by vegetation feedbacks
22507	72	15	73	28	This is a well-written introduction, but it can be reduced in length [Anastasios Kentarchos, Belgium]	Accepted. The introduction to the section has been reduced and the part that was more general has been moved to section 2.1 as an introduction to our chapter
32551	72	17	73	10	This material is old and regurgitated from old ARs. I suggest cutting it. [Helene Muri, Norway]	Taken into account. The text has been slightly revised and moved to the introductory section. It is not correct that is was present in previous ARX reports and such work has been the foundation of Land-Atmosphere interactions that need to be introduced
24309	72	26	73	1	There is now also compelling evidence from climate models that anthropogenic emissions causing cooling aerosols (i.e. sulphate) mainly in the northern hemisphere lead to a southward shift in the ITZC and thus reduced rainfall in the Sahel. [Terje Berntsen, Norway]	Taken into account. References to the Holocene has been removed and this part of the text has been moved to section 2.1. However, to answer your question, what you say is correct but does not discard what we wrote. It is another phenomenon that is complementary
281	72		91		The section talks of land systems, dynamics of changing land use, land cover, utilisation and thereby induced changes on climate and weather - needs to revise headings, table of content and content in the section [Mahak Agrawal, India]	Noted but unfortunately not clear what the comment suggests

Comment No	From Page	From Line	To Page	To Line	Comment	Response
14129	72	15	93	17	Page 72, line 17, I don't think there is such a word as "evidences". The plural of evidence is evidence, so "evidence" rather than "evidences" and "has" rather than "have". Page 72, line 21 "that occurred 115000 years ago" - this assertion needs a reference to substantiate it. I suspect that in reality the onset of the last glaciation is not known to the indicated precision, and that there is more uncertainty than is suggested in the statement. Page 72, line 27, should be "Charney (1975)" not "(Charney 1975)". Page 73, line 11, insert "in" between "summarized" and "Figure".Page 73, line 16, "presents effects of" does not seem correct in the context. Page 75 lines 23 and 24 use of parentheses around the two separate references is wrong. Page 75, line 27, replace "evidences" with "evidence". Page 76, line 24, should be "Lejeune et al. (2018)" rather than "(Lejeune et al. 2018)". Page 77, line 8, should be "Hurtt et al. (2001)" rather than "(Hurtt et al. 2001)". Page 77, line 14 should be "five" not "5" and "two" not "2". Page 77, line 23, why use "[" and "]" when not used previously? Page 77, lines 45-47, sentence does not make sense. Page 80, iine 13, see earlier comment about references to "Southeast Asia", here referred to as "South-East Asia" (and on lines 19 and 24). Page 80, lines 16 and 19, why use of "[" and "]"? Page 80, line 28, is there a difference between "South America" and "Southern America", the latter referred to on Page 80, line 30? Page 80, line 29, should be "farther away" rather than "further away". Page 80, line 32, presumably should be "southern part" rather than "sou part"? Page 80, line 39, "compared" rather than "compare". Page 80, lines 40 and 41, should be "Arora and Montenegro (2011)". Page 81, line 20, missing space between "latutudes" and "(". Page 81, line 21, should be "Alkama and Cescatti (2016)". Page 81, line 40, missing space between "observations" and "(". Page 81,line 48, substitute "heat; (Anav" for "heat, Anav". Page 82, lines 4--5, citing of refereces here is wrong - see previous comments about starting a sentence with "(". Also presumably should be "Chen et al. (2012) and Galos et al. (2011, 2013)". Page 82, lines 7 and 8, should be "Galos et al. (2013)" and missing comma between "(SRES A2)" and what should be "Galos et al. (2013)". Page 82, line 12, "and" not "&". Page 82, lines 38 and 39, either "net impact ... was" or "net impacts ... were". Page 82, lines 43-44, this sentence is repeated from page 80, lines 42-43. Page 84, line 14, should be "Seneviratne et al. (2018)". Page 84, line 15, should be "greenhouses, as in Campra et al (2008).". Page 88, lines 9-10, this sentence does not make sense - is there something missing? Also the parentheses around the references are wrongly located. And ditto the reference on page 88, line 20. Page 88, lines 28 and 29, "resp." is not defined. Page 89, line 4, "is" rather than "in". Page 89, line 23, "decreases" rather than "decrease". Page 89, lines 27 and 31, parentheses around the references are wrongly located. Page 90, line 4, sometimes "e.g.," is	Editorial
467	73	3	73	3	The reference here is a review paper - and I do not recall this paper talking about weather patterns … [Andrew Pitman, Australia]	Noted. The paper discusses changes in convection, storminess, monsoons … which is what we refer as 'weather systems' … may be the wrong word?
1273	73	3	73	7	This statement could be backed-up by the review of Pongratz et al 2017 (doi/10.1111/gcb.13988) [Sebastiaan Luyssaert, Belgium]	Noted. This introductory section has been moved to section 2.1. It was not meant to be the assessment at this stage, just an introduction showing that land-atmopshere interactions have long been studied although not yet included in IPCC assessments
41503	73	4	73	4	nice to know that there are more publications, but what do they tell us? Some aspects need to be placed in a final section on knowlege gaps. [Valerie Masson-Delmotte, France]	Noted. This paragraph is just introducing what will be further discussed in section 2.5. We did not feel there was need to go deeper in this quick introduction. The paragraph has been moved to section 2.1 and shortened, hoping it would better scope what follows in the chapter
6289	73	8	73	8	Unbalanced "(" [Tristan Quaife, United Kingdom (of Great Britain and Northern Ireland)]	Editorial

Comment No	From Page	From Line	To Page	To Line	Comment	Response
653	73	8	73	10	We suggest that one may additionally cite the reference Peng et al. (2014) because this study also applied the satellite-observed data to reveal the cooling effects of afforestation on local surface temperature in China. Ref: Peng, S.-S., and Coauthors, 2014: Afforestation in China cools local land surface temperature. Proc. Natl. Acad. Sci. U.S.A., 111, 2915-2919, doi:10.1073/pnas.1315126111. [Shilong Piao, China]	Noted. We do cite this paper further in the section. Here we just selected a sample to introduce the following discussion. This whole paragraph however has been moved in section 2.1
1159	73	9	73	9	Add Luyssaert et al. 2014 (doi/10.1038/NCLIMATE2196), Teuling et al. 2017 (doi/10.1038/ncomms14065), Campioli et al. 2015 (doi/10.1038/NGEO2553), O'Halloran et al. 2012 (doi/doi: 10.1111/j.1365-2486.2011.02577.x), Beringer et al. 2005 (doi/:10.1016/j.agrformet.2005.05.006) to the list of observational evidence. [Sebastiaan Luyssaert, Belgium]	Noted. All those references are discussed further in the section. The introductory paragraph was not meant to be exhaustive.
1795	73	11	73	11	"…is summarised in…". [William Lahoz, Norway]	Editorial
29129	73	12	73	13	Biogeochemical effects only refers to CO2 from land: Please check for consistency with other parts of the chapter and report [Jan Fuglestvedt, Norway]	Noted. That is correct and we announce this focus on CO2 only at the beginning of the section
29125	73	16	73	16	History is not a scenario. Please re-word. [Jan Fuglestvedt, Norway]	Noted. Well in the IPCC world about land-use changes we generally talk about historical and future scenarios. We have not changed this sentence (sorry) but have changed the rest of the text and do not refer anymore to scenarios
12753	73	20	73	20	Figure 2.2.1 should be graphically enhanced [Tiziana Susca, United Kingdom (of Great Britain and Northern Ireland)]	Taken into account. The figure has been redrawn and hopefully clarified.
8507	73	21	73	21	The figure is not drawn in an intuitive way. Unneccessarily complicated. [Marc Aubinet, Belgium]	Taken into account. The figure has been redrawn and hopefully clarified.
23723	73	22	73	27	This figure can be modified without line crossing: for example, the red and blue lines connecting global and regional changes can be parallel. The grey line connecting changes in land functioning and changes in atmosphere CO2 can be linked through the left.The topic of this section is the global changes and regional changes in atmospheric variable, thus, these two octagons can be more highlighted. [Xiyan Xu, China]	Taken into account. The figure has been redrawn and hopefully clarified.
29127	73	30	73	30	History is not a scenario. Please re-word. [Jan Fuglestvedt, Norway]	Accepted. Although the historical land use changes are often referred to as "Historical land use scenarios" (see for example https://cdm.unfccc.int/Reference/Guidclarif/pdd/PDD_guid16.pdf), we have updated the title. We're now only referring to historical and future land use changes in the title
17115	73	20	74	21	In Figure 2.21, I would suggest to replace "Land cover" in the grey box in the bottom of the figure by "Land cover and land use" [Eric Ceschia, France]	Rejected. If you look carefully, land use is in a green box in the upper right of the figure as it is a forcing
32217	73	20	74	21	In Figure 2.21, I would suggest to replace "Land cover" in the grey box in the bottom of the figure by "Land cover and land use" [, France]	Rejected. If you look carefully, land use is in a green box in the upper right of the figure as it is a forcing
33035	73		74		I wonder if the global section is that useful or if it wouldn't be better integrated into the regional one - all the global effects are sums of diverging regional effects and here the regions are the drivers - so I would think it suits better to first discuss regional effects and effects on extremes, and then discuss if and how much possible global effect these add up to. (this is opposite greenhouse warming which is best seen globally with impact on regions - here it is a local driver right:?) [Gabriele Hegerl, United Kingdom (of Great Britain and Northern Ireland)]	Noted. From first order to second order drafts we have considerably reduced the place occupied by global scale studies but decided to keep a discussion on global historical reconstructions and future scenarios. This allows a parallel and continuation between ARx reports and this one. But we agree that regional aspects are far more important for this report

Comment No	From Page	From Line	To Page	To Line	Comment	Response
28543	73	30	78	29	Here the issue of land cover/use data is very prominent in the uncertainties and the lower agreement statements, but it is not discussed, largely because there are less studies related to climate. But widely cited papers for both the historical and future periods claim that disagreement among land cover/use data and how they are implemented in each model is a primary source of the disagreement in model results. See Brovkin, V., Boysen, L., Arora, V. K., Boisier, J. P., Cadule, P., Chini, L., … Weiss, M. (2013). Effect of anthropogenic land-use and land-cover changes on climate and land carbon storage in CMIP5 and Pitman, A. J., de Noblet-Ducoudré, N., Cruz, F. T., Davin, E. L., Bonan, G. B., Brovkin, V.,…Voldoire, A. (2009). Uncertainties in climate responses to past land cover change: First results from the LUCID intercomparison study. Geophysical Research Letters, 36, L14814. https://doi.org/ 10.1029/2009GL039076. There is also a historical study showing the local/regional uncertainty in surface temperature due to different land conversion assumptions: Di Vittorio, A. V., Mao, J., Shi, X., Chini, L., Hurtt, G., & Collins, W. D. (2018). Quantifying the effects of historical land cover conversion uncertainty on global carbon and climate estimates. Geophysical Research Letters, 45, 974–982. https://doi.org/10.1002/ 2017GL075124 to past land cover change: First results from the LUCID intercomparison study. Geophysical Research Letters, 36, L14814. https://doi.org/ 10.1029/2009GL039076rojections for the twenty-first century. Journal of Climate, 26(18), 6859–6881. https://doi.org/10.1175/jcli-d-12-00623.1 and [Alan Di Vittorio, United States of America]	Noted. Uncertainties related to reconstructions explain 1/3rd maximum of the discrepancies between the model results. Most of what is discussed herein is larger than this uncertainty. We feel that for this specific report it was not that useful to bring this discussion forward
951	73	21			Figure should be revised in terms of layout, e.g. red and blue arrow in the centre should not cross (this will enhance readability in bw) [Tobias Rütting, Sweden]	Taken into account. The figure has been redrawn and hopefully clarified.
26973	73	30			The IPCC does not develop scenarios nor pathways, please see http://sedac.ipcc-data.org/ddc/ar5_scenario_process/index.html and amend the expression "IPCC land use scenarios" accordingly. [, Germany]	Accepted. We were referring to the land use scenarios used for CMIP exercises that support the IPCC reports but we understand the langage may be misinterpreted. We have changed the title of the section and now refer to historical and future land use changes
6985	73				Figure 2.21: This figure could do with a clearer caption. Suggestion: "This figure illustrates the focus areas of this section. Changes in atmospheric CO2, caused by human-induced changes in land cover or uses (colour arrow), result in global (colour arrow) and then regional/local changes in atmospheric variables (red arrow). Regional/local atmospheric variables in turn cause changes in land functioning and cover, and also feed back into global climate (blue arrows). Changes in land cover are also caused directly by atmospheric CO2 and human activities (green arrows), and have feedback effects (grey arrows)." Suggest changing the colour of arrows so that they can be referred to as in suggested legend. What does 'imposed changes' mean and is it relevant? Can the boxes be the same shape? The different shapes don't seem to add information. The text colours also don't seem to add information, but just look confusing. Similar question for Figures 2.28, 27, 29 [Debra Roberts, South Africa]	Taken into account. The figure has been redrawn and hopefully clarified.
469	74	4	74	51	A lot of this section seems very carefully written and (in myt view) robust [Andrew Pitman, Australia]	Noted. Thank you very much

Comment No	From Page	From Line	To Page	To Line	Comment	Response
713	74	5	74	5	The whole section of 2.6.1.1.1 reads bad and is not well structured. Please revise. [Merja Tölle, Germany]	Noted. The coherence of our structure is based on a consensus among authors and as follows : net effects (1st paragraph), biophysical effects (2nd paragraph), biogeochemical effects (3rd paragraph), other effects and limitation.
701	74	6	74	6	With land use changes do you mean afforestation or deforestation or urbanisation or what? Please be more clear about what you want to say. [Merja Tölle, Germany]	Noted. This whole sub-section is dealing with global human-induced land-cover reconstructions. So it does include all the ones you cited (see the cross chapter box on scenarios in this report). We are now cautious in this report to disentangle land use, and, land cover changes impacts more clearly and precisely. Note that modelling estimates mostly assess land cover changes impacts.
15345	74	6	74	7	Suggest removing the sentence - particularly if there is limited evidence and no agreement. [, Australia]	Taken into account. We have revised this short paragraph. We have chosen to keep this information as there is a substantial amount of scientists and policy-makers who worry about knowing whether there is a clear global signal from anthrpogneic land cover changes. We feel that it is important to let them know that there are some estimates
22509	74	6	74	11	"Change in global annual surface temperature ranges from -0,05°C between years 1850 and 2000 (Brovkin et al. 2004), to 0.13°C –0.15°C for the 20th century (Pongratz et al. 2010)." Presumably this refers only temperature changes attributed to land cover change? 20th century temperature change in general is discussed extensively, for example in SR1.5. Clarify [Anastasios Kentarchos, Belgium]	Noted. Rephrasing has been done
19043	74	6	74	11	it concerns total changes or only changes because of historical land use changes? [Joanna Wibig, Poland]	Noted. Rephrasing has been done. Changes in temperature are in response to anthropogenic changes in land cover since the pre-industrial period
699	74	7	74	9	This sentence is incomplete. Change due to what? Please be more specific. [Merja Tölle, Germany]	Noted. Rephrasing has been done
2585	74	8	74	8	"0.05" [Wei Li, France]	Editorial. Corrected, thank you
703	74	9	74	9	-0.15°C: is this a minus or a hyphen? [Merja Tölle, Germany]	Editorial. It is not a cooling but a dash : "0.13-0.15°C". We have hopefully clarified that by writing "+0.13°C/+0.15°C"
705	74	9	74	11	Please remove "also". You are describing changes since 1700. In the previous sentence you are describing changes between 1850 and 2000. Again: what are those land use changes? Deforestation? Please also state in the paragraph that the temperature differences are global averages, even if the subtitle is stating "At the global level" already. [Merja Tölle, Germany]	Noted. We have removed 'also'. We've tried to make more explicit that the entire 2.6.1 section deals with effects of global anthropogenic land cover changes. It thus encompass all changes that have occurred since pre-industrial: deforestation, afforestation, urbanization, cropland encroaching on prairies, ...
29131	74	13	74	13	Only CO2? [Jan Fuglestvedt, Norway]	Noted. Yes this section concentrates on modelling estimates of land cover changes, including biophysical effects and CO2 changes. Other land-use induced non-CO2 emissions and land management processes are also further assessed.
1797	74	16	74	16	You write “modelled” here; elsewhere it is “modeled” or variants. Please be consistent. [William Lahoz, Norway]	Editorial. Thank you
707	74	17	74	19	Again changes in surface albedo due to what? Deforestation? Please be more clear about what you want to say. [Merja Tölle, Germany]	Noted. This sub-section deals with all land-use changes at the global scale so what is discussed herein is the net changes in various characteristics, combining all land-use changes
711	74	25	74	25	Describe what changes are meant by "historical land use changes". [Merja Tölle, Germany]	Taken into account. Some information has been added in introduction of section 2.6.1 explaining that we are dealing with all anthropogenic changes in land cover, for both historical reconstructions and future scenarios
709	74	26	74	26	"Only four modeling studies": this is a repetition of line 7 on page 74. Please avoid words like "also" or "only". This makes bad reading. [Merja Tölle, Germany]	Taken into account. We have added a substantial number of studies.

Comment No	From Page	From Line	To Page	To Line	Comment	Response
29133	74	29	74	32	Here you refer to more components than only CO2. The defnition of biogeochemical on previous page may be confusing. [Jan Fuglestvedt, Norway]	Noted. The biogeochemical effect is at all times calculated from the net change in atmospheric CO2. However, this net CO2 sink/source does not always account for e.g. nitrogen changes in land models.
1161	74	32	74	32	Replace "… emsissions(Ward …" by "… emissions (Ward …". [Sebastiaan Luyssaert, Belgium]	Editorial. Thank you
6287	74	32	74	32	Missing space before parenthesis [Tristan Quaife, United Kingdom (of Great Britain and Northern Ireland)]	Editorial. Thank you
13381	74	34	74	34	unclosed parenthesis [Gregory Duveiller, Italy]	Editorial. Thank you
19045	74	43	74	45	how increased photosyntesis and increase in CO2 sink can enhance global warming [Joanna Wibig, Poland]	Accepted. The sentence now reads: "This greening enhances global warming via a reduction of surface albedo (due to more vegetation density and to a winter darkening of the land through the snow-albedo feedbacks (Forzieri et al. 2017)). At the same time, cooling occurs due to increased evapotranspiration during the growing season along with enhanced photosynthesis, i.e. increased CO2 sink (Qian et al. 2010)."
8509	74	44	74	44	Why "together with" ? These effects are oppoosite ! [Marc Aubinet, Belgium]	Accepted. The sentence now reads: "This greening enhances global warming via a reduction of surface albedo (due to more vegetation density and to a winter darkening of the land through the snow-albedo feedbacks (Forzieri et al. 2017)). At the same time, cooling occurs due to increased evapotranspiration during the growing season along with enhanced photosynthesis, i.e. increased CO2 sink (Qian et al. 2010)."
715	74	50	74	51	their versus this? Reads not good. [Merja Tölle, Germany]	Editorial. Thank you
33033	74		75		(sorry self serving): there are attribution papers on land use on extreme: Christidis, N., Stott, P.A., Hegerl G.C. and Betts R. (2013): The role of land use change in the recent warming of daily extreme temperatures. GRL, 40, 1–6, doi:10.1002/grl.50159. although this might be getting a bit old by nnow [Gabriele Hegerl, United Kingdom (of Great Britain and Northern Ireland)]	Accepted. There is a specific section on extremes where the paper is referred to
953	74	8			dot in numbers as decimal seperator [Tobias Rütting, Sweden]	Editorial. Corrected, thank you
23727	75	1	75	7	Is temperature change due to different forest deforestation from historical simulations? [Xiyan Xu, China]	Noted. Sorry the table was confusing. It has been removed and replaced with a figure that shows the effects og anthropogenic land cover (historical and future scenarios) on mean annual global ambient air temperature
26975	75	1	75	8	This table provides interesting information. However, the time frames to which these numbers refer are unclear: per year, but for current conditions, averaged from preindustrial up to present in the first four rows, what does historical and future mean in the last two rows? Please do not present RCP8.5 as this pathway is not relevant for the Paris Agreement nor for the projections of current NDC but more RCPs 1.9, 2.5 and 4.5 please. [, Germany]	Noted. Sorry the table was confusing. It has been removed and replaced with a figure that shows the effects og anthropogenic land cover (historical and future scenarios) on mean annual global ambient air temperature
29135	75	1	75	8	Make distinction between historical and future more clear. And what is the color code for? [Jan Fuglestvedt, Norway]	Noted. Sorry the table was confusing. It has been removed and replaced with a figure that shows the effects og anthropogenic land cover (historical and future scenarios) on mean annual global ambient air temperature
18227	75	11	75	11	September-October-November (DJF) --> (SON) [Julia Nabel, Germany]	This comment surely refers to page 76 - line 11, mistake in the legend was corrected (2nd occurrence DJF incorrect ->SON)
17743	75	12	75	13	Concerning "… due to snow and sea ice albedo feedback." - it might be better to refer to "Arctic amplicication" as the high-latitude enchanced warming is more complicated than just about albedo. [, Sweden]	Accepted. Text revised

Comment No	From Page	From Line	To Page	To Line	Comment	Response
3491	75	12	75	13	"… due to snow and sea ice albedo feedback." Maybe better to just call in "Arctic Amplicication" as the effect is more complicated than just albedo effects, energy transports and heat fluxes also play a role. [Gustav Strandberg, Sweden]	Accepted. Text revised
17745	75	14	75	16	Biophysical processes have not only cooling effects, but also warming effects (e.g. due to reduced evapotranspiration with less vegetation). Please consider rephrasing, as appropriate. [, Sweden]	Accepted. Text revised
3493	75	14	75	16	This sentence seems to build on the assumption that the biophysical processes only cool, which is not the case. Consider rephrasing to something like: "Very contrasted surface temperature changes can thus result depending if the biophysical effects dampen or exacerbate the biogeochemical effect. [Gustav Strandberg, Sweden]	Accepted. Text revised
3163	75	19	75	20	+0.15C ' is not cooling: editing is needed [, Russian Federation]	Accepted. Text revised
3165	75	24	75	24	Russian climate monitoring data show substantial warming in the European part of Russia in the 20th century, not cooling (http://climatechange.igce.ru/index.php?option=com_docman&Itemid=73&gid=27&lang=ru). This means that GHG warming substantially exceeded biophysical cooling, was about few Celsius degrees. Is it consistent with results of greenhouse effect modelling? [, Russian Federation]	Noted. It is not incompatible because on average, models simulate that greenhouses gases impact on temperature (light grey) outweights biophysical effects of LCC (dark grey). Note also that in the corresponding paper, Eurasia region covers more land toward western areas until middle of Russia.
1163	75	25	75	25	Consider discussing the results of Naudts et al 2016 (doi/10.1126/science.aad7270). The paper reports a modelling study to show that show that since 1750, in spite of considerable afforestation,wood extraction has led to Europe's forests accumulating a carbon debt of 3.1 petagrams of carbon.We found that afforestation is responsible for an increase of 0.12 watts per square meter in the radiative imbalance at the top of the atmosphere, whereas an increase of 0.12 kelvin in summertime atmospheric boundary layer temperature was mainly caused by species conversion. Thus, two and a half centuries of forest management in Europe have not cooled the climate. [Sebastiaan Luyssaert, Belgium]	Rejected. The signal we are reporting on a very large area (Eurasia) is dominated by land cover (not management) change. We are not addressing here the subtle changes in already forested areas the paper you're referring to addresses. However the study you mention is discussed in section 2.6.2.2 devoted to the effects of land management
33063	75	26	75	26	To solve this, it is recommended to generate scenarios of changes in land cover, land use to the past and its relationship with Worldclim data (also from the past). [Jesus Alejandro Prieto Amparan, Mexico]	Rejected. We are reporting here only about the historical reconstructions that have been carried out for the CMIP5 exercise
17747	75	29	75	29	Here, results on regional climate vegetation interactions in paleoclimate could also be considered - deforestation over the last 6 000 years would have had a significant impact on seasonal temperature in Europe, 1-3°C in summer and winter. Reference: Strandberg, G. et al. (2014): Regional climate model simulations for Europe at 6 and 0.2 k BP: sensitivity to changes in anthropogenic deforestation, Clim. Past, 10, 661-680. [, Sweden]	Rejected. You are correct but we try to focus on the historical time period
3495	75	29	75	29	There is actually one study of regional climate vegetation interactions in paleo climate. Strandberg et al. (2014) show that the deforestation in Europé over the last 6 000 years would have had a significant impact on seasonal temperature; 1-3°C in summer and winter. Strandberg, G., Kjellström, E., Poska, A., Wagner, S., Gaillard, M.-J., Trondman, A.-K., Mauri, A., Davis, B. A. S., Kaplan, J. O., Birks, H. J. B., Bjune, A. E., Fyfe, R., Giesecke, T., Kalnina, L., Kangur, M., van der Knaap, W. O., Kokfelt, U., Kuneš, P., Latalowa, M., Marquer, L., Mazier, F., Nielsen, A. B., Smith, B., Seppä, H., and Sugita, S.: Regional climate model simulations for Europe at 6 and 0.2 k BP: sensitivity to changes in anthropogenic deforestation, Clim. Past, 10, 661-680, doi:10.5194/cp-10-661-2014, 2014. [Gustav Strandberg, Sweden]	Rejected. You are correct but we try to focus on the historical time period
5579	75	30	75	30	this paragraph needs reference [Sanaz Moghim, Iran]	Noted. The paragraph does include references

Comment No	From Page	From Line	To Page	To Line	Comment	Response
955	75	21			does this mean that warming without biophysical cooling would be double as high as observed? As the legend Fig. 2.22 states, light grey is GHG related warming, dark grey is biophysical cooling. This can be interpreted as that the warming is the sum of both (hence, no warming), which contrasts the observation of warming. I understand that the ligh grey is observation (hence sum of biogeochemical and biophysical effects). If so, this needs to be made more clear [Tobias Rütting, Sweden]	Taken into account. No, the net temperature changes correspond to the sum of light grey and dark grey bars, that is with an average of 0 as also discussed for the net change at the global level. The light grey boxes include the effect of all anthropogenic GHG (industrial + land use), while the dark grey boxes correspond only to the biophysical effects of anthropogenic land cove change
2587	76	2	76	2	"1900-1970" [Wei Li, France]	Editorial. It is indeed 1870-1900; thanks
3167	76	2	76	15	Fig. 2.22 caption: should time spans in lines 1-2 be given consistently with those and in line 22 on page 75? Some edition of the whole caption is needed (e.g.. second DJF should be replaced with SON). [, Russian Federation]	Editorial. The legend has been updated, thank you
13337	76	11	76	11	The period September-October-November should be 'SON' and not 'DJF'. [Edson Leite, Brazil]	Editorial. The legend has been updated, thank you
717	76	12	76	12	large and largest in the same sentence reads bad. [Merja Tölle, Germany]	Editorial. The legend has been updated, thank you
471	76	17	76	36	One of the first appers to look at this was Avila, F.B., A.J. Pitman, M.G. Donat, L.V. Alexander and G. Abramowitz, 2012, Climate model simulated changes in temperature extremes due to land cover change, J. Geophys. Res., 117, D04108, doi:10.1029/2011JD016382. [Andrew Pitman, Australia]	Accepted. You are right, reference to the paper has been added
3169	76	25	76	25	hot temperatures': jargon [, Russian Federation]	Editorial. We've change 'hot' for 'the warmest
33065	76	29	76	29	For this, it is recommended to work with changes in land use cover and its relationship to evapotranspiration, trying to understand if there is a change in local temperature. [Jesus Alejandro Prieto Amparan, Mexico]	Noted. We do not further explain what are the mechanisms behind the large increase in temperature as those have been explicited in previous sections and will also be in 2.6.2.1
3171	76	30	76	30	Why mean climate conditions': the discussion is about temperatures only, not precipitation, not pressure… [, Russian Federation]	Editorial. "climate conditions" were replaced by "values"
5581	76	42	76	43	I believe we cannot say that "an increase in aerosols…cooling effect" it depends on size and composition of different aerosols [Sanaz Moghim, Iran]	The comment does not seem to relate to section 2.6 as the referenced line does not exist and the section does not discuss aerosols
16193	76	36	77	1	Veighand et al (2017), (Vaighan, A.A., Talebbeydokhti, N. & Bavani, A.M. Environ Earth Sci (2017) 76: 543. https://doi.org/10.1007/s12665-017-6880-6), The results revealed that projected climate change impacts include an increase in streamflow (maximum increases of 52% under RCP 2.6 in December and 170% under RCP 8.5). Projected sediment concentrations under climate change scenarios showed a monthly average decrease of 10%. For land use change scenarios, agricultural development scenario indicated an opposite direction of changes in orthophosphate (increases in all months with an average increase of 6% under agricultural development scenario), leading to the conclusion that land use change is the dominant factor in nutrient concentration changes. Combined impacts results indicated that streamflows in late fall and winter months increased while in summer and early fall decreased. Suspended sediment and orthophosphate concentrations were decreased in all months except for increases in suspended sediment concentrations in September and October and orthophosphate concentrations in late winter and early spring due to the impact of land use change scenarios. [Hamidreza Solaymani Osbooei, Iran]	Rejected. You're right but section 2.6 as a whole does not discuss how land and climate changes affect land processes, but how they affect climate [atmospheric processes]
957	76	2			1870-1900 [Tobias Rütting, Sweden]	Editorial. The legend has been updated, thank you

Comment No	From Page	From Line	To Page	To Line	Comment	Response
6987	76				Figure 2.22: Would not call it "present day" but "the period 1972-2002". Is (1970-1900) supposed to be (1870-1900?). Wording could be improved, suggest: " Simulated changes in surface air temperature anomaly between the pre-industrial period (1870–1900) and the period 1972–2002, for four seasons and for a) North America and b) Eurasia. The graphs summarize results from seven climate models, and ensembles of ten simulations per model per time period. Simulations indicate warming in response to increased atmospheric greenhouse gas content and subsequent changes in sea-surface temperature and sea-ice extent (light grey bars) and cooling in response to biophysical effects of historical land use changes (dark grey bars). The box plots show the 25th and 75th percentiles (bar), the median (horizonal line in bar), and the ensemble maximum and minimum values (whiskers)...." [Debra Roberts, South Africa]	Editorial. The legend has been updated.
26977	77	2	77	38	The IPCC does not develop scenarios nor pathways anymore, please see http://sedac.ipcc-data.org/ddc/ar5_scenario_process/index.html and amend the expression "previous IPCC scenarios" in line 18 accordingly. [, Germany]	Noted. You are correct, SSP/RCPs (for AR5), SRES (for AR4) are not developped by IPCC although they are developped for the CMIP exercises that then produce analysis used in IPCC reports. In the literature they are commonly referred to as as "IPCC scenarios." We have corrected that formulation in the updated text
33067	77	5	77	5	The work by the authors has already been done, however, because it is based on standards that used RCP8.5 and RCP2.6, it is known that RCP8.5 is unstable and RCP2.6 possibly we are already in this situation, because we do not use literature that is based on RCP4.5 and 6.0. [Jesus Alejandro Prieto Amparan, Mexico]	Noted. We do not understand what the comment is about. We are just citing and trying to assess information that exist in the literature. The updated version include reference to 3 RCPs. RCP6.0 has not been discussed in the literature to assess the effect of land on climate this is why we do not report on it
29137	77	6	77	7	the ranges given are confusing [Jan Fuglestvedt, Norway]	Taken into account. We have included more estimates and now provide a mean value and its standard deviation. The range of values can be seen on the associated figure
5583	77	6	77	8	why and how "decrease in future cloud cover" causes no additional cooling? It is not just cloud cover that affects positive or negative feedbacks, other factors are thickness, cloud content (ice, water vapor, liquid), .. [Sanaz Moghim, Iran]	Taken inot account. There is very little information in the papers selected about the detailed processes explaining the warming or cooling. Generally it is a competition between albedo and turbulent heat fluxes (latent and sensible). This sub-section on future scenarios does not focus too much on processes that will be more detailed in 2.6.2.
2589	77	8	77	8	which future period does the "net future changes" refer to [Wei Li, France]	Taken into account. Thank you the time periods considered have been added
3173	77	13	77	13	little evidence': please, check against the IPCC calibrated uncertainty language [, Russian Federation]	Noted. The entire sentence has been reformulated and does not include the evidence statement any more
13383	77	13	77	17	It should also be specified that a recent evaluation of land surface models compared against remote sensing estimates show that their capacity to represent the biophysical effects of land cover change is poor (see Duveiller et al. 2018, ESSD, https://doi.org/10.5194/essd-10-1265-2018) [Gregory Duveiller, Italy]	Noted. Thank you for the suggestion. We feel this reference better fits in section 2.6.2.1 where we discuss the processes through which afforestation/deforestation impact climate
29139	77	20	77	20	which year are the temp changes given for? [Jan Fuglestvedt, Norway]	Noted. All changes discussed in this sub-section are between the end of the 20th and the end of the 21st century. We have made this clear in the introduction of the sub-section
29141	77	31	77	32	relate this to climate sensitivity [Jan Fuglestvedt, Norway]	Taken into account. This is a very interesting remark. We have added on Figure 2.22 and in the text what the global warming ΔT is to measure the relative importance of land. We hope this is answering your request
719	77	36	77	36	Delete the bland between + and 0.5 [Merja Tölle, Germany]	Editorial. Corrected, thank you
721	77	37	77	37	Add a blank between 0.25 and mm [Merja Tölle, Germany]	Editorial. Corrected, thank you

Comment No	From Page	From Line	To Page	To Line	Comment	Response
29143	77	39	77	39	Hodnebrog et al may have a relevant paper here. Bollasina Massimo too [Jan Fuglestvedt, Norway]	Noted. Thank you for the suggestion but as we do not have the fll references we are not in a position to see whether the recommended papers are relevant or not
15629	77	40	77	41	Naudts et al. 2017, DOI: 10.1126/science.aad7270 [Tuomo Kalliokoski, Finland]	Noted. The Naudts et al. paper is used in support of section 2.6.2.2 where we discuss the impact of forest management. In addition the Naudts paper discusses historical changes and not projected future ones
723	77	46	77	46	Please correct: many regions northern boreal regions [Merja Tölle, Germany]	Editorial. Corrected, thank you
13771	77	46	77	46	There is a reference to boreal regions in two continents, which continents are you referring to? [Moira Doyle, Argentina]	Taken into account. We were refering to America and Eurasia but we have removed 'both continents' and only kept 'boreal regions'
959	77	46	77	47	"many regions nortehrn boreal regions" and "western south tropical Africa" [Tobias Rütting, Sweden]	Editorial. Corrected, thank you
725	77	48	77	48	Please add "the" infront of diurnal [Merja Tölle, Germany]	Editorial. Corrected, thank you
1165	78	1	78	1	Consider discussing the results of Luyssaert et al 2018 (doi/10.1038/s41586-018-0577-1). The paper reports a modeling study that shows that over Europe forest management could offset CO2 emissions without halting climate change. Even optimized forest management portfolios would fail to affect the TOA and/or near-surface temperatures. A small insignificant decrease in precipitation was simulated. [Sebastiaan Luyssaert, Belgium]	Rejected. Modelling studies under global LCC scenario (coupled runs including simulations of remote effects) are privileged here. Land management impacts are discussed in sections 2.6.2.2 and 2.7.1
22511	78	8	78	8	This should be Figure 2.23 [Anastasios Kentarchos, Belgium]	Editorial. Figure numbering has been updated and corrected, thank you
2591	78	8	78	8	Figure 2.23 [Wei Li, France]	Editorial. Figure numbering has been updated and corrected, thank you
28571	78	8	78	14	This is confusing. It isn't clear that the non-land-use-change versions project increasing rainfall, and that the land-use scenarios all show less increases in projected rainfall [Alan Di Vittorio, United States of America]	Noted. We have tried to clarify the legend and the text. We hope the message is improved now
1167	78	11	78	11	Check citation format (brackets should be around the years, not around the author name) [Sebastiaan Luyssaert, Belgium]	Editorial. Thank you
24137	78	16	78	16	Krishnan et al. (2016) Clim Dyn, 47:1007–1027.. DOI 10.1007/s00382-015-2886-5 would be a relevant reference to include. This is a detection and attribution study on the observed decreasing trend of South Asian monsoon rainfall during the post-1950s using a high-resolution climate model. The results suggest that the combined influence of regional land-use change, anthropogenic aerosol forcing and rapid warming of the equatorial Indian Ocean have driven the decreasing trend of the South Asian monsoon rainfall during recent decades. This study further noted that increases in surface temperatures and humidity in response to GHG forcing in an environment of weakening large-scale monsoon circulation can significantly enhance the propensity of extreme rainfall events over the Indian region. [, India]	Rejected. This sub-section only deals with future scenarios and not historical ones. Moreover the suggested paper does look at combined regional forcings and not 'just' land use
1407	78	16	78	16	Krishnan et al. (2016) Clim Dyn, 47:1007–1027.. DOI 10.1007/s00382-015-2886-5 would be a relevant reference to include. This is a detection and attribution study on the observed decreasing trend of South Asian monsoon rainfall during the post-1950s using a high-resolution climate model. The results suggest that the combined influence of regional land-use change, anthropogenic aerosol forcing and rapid warming of the equatorial Indian Ocean have driven the decreasing trend of the South Asian monsoon rainfall during recent decades. This study further noted that increases in surface temperatures and humidity in response to GHG forcing in an environment of weakening large-scale monsoon circulation can significantly enhance the propensity of extreme rainfall events over the Indian region. [Krishnan Raghavan, India]	Rejected. This sub-section only deals with future scenarios and not historical ones. Moreover the suggested paper does look at combined regional forcings and not 'just' land use

Comment No	From Page	From Line	To Page	To Line	Comment	Response
33069	78	17	78	17	The quality of the figure must be improved [Jesus Alejandro Prieto Amparan, Mexico]	Editorial. All figures will be finalized for the final draft
727	78	17	78	17	The figure 2.23 has a bad quality. Please revise. [Merja Tölle, Germany]	Editorial. All figures will be finalized for the final draft
3175	78	24	78	26	Negative values for South America should be explained in brief to prevent misunderstanding. [, Russian Federation]	Accepted. The following sentence is added to the legend: "Note that future LCC impacts on South American monsoon are not significant nor robust among models, along with very small future projected changes in South American monsoon rainfall"
961	78	8			Fig. 2.23 [Tobias Rütting, Sweden]	Editorial. Figure numbering has been updated and corrected, thank you
29145	79	4	79	15	Useful presentation; a) - e). Can this be used more? [Jan Fuglestvedt, Norway]	Noted. Thank you very much
1169	79	4	79	31	The subsequent sections focus on hypothetical studies of 25, 50 or 100% afforestation. Those studies are interesting from an academic point of view but I think that within the context of the IPCC it would be good to make an effort to place those studies into focus by mentioning the realistic afforestation potential for the tropics/temperate and boreal zone in the subsequent sections. I think the global net afforestation potential is zero. A stand still would be an amazing achievement but we are more likley to see a net deforestation unless we adopt a vegan diet (see Erb et al 2016 "Exploring the biophysical option space for feeding the world without deforestation. doi/10.1038/ncomms11382). We also have a pretty good idea where deforestation will occur. So, why not refining this discussion by moving beyond highlighting hypothetical results? [Sebastiaan Luyssaert, Belgium]	Noted. This section details deforestation and afforestation, idealized global and regional experiments. Section 2.6.1 details realistic scenarios of land cover change under SRES and RCPs. Afforestation potential and associated mitigation are discussed further in the Chapter (e.g. section 2.7.1.2.2).
33609	79	7	79	15	The idea that deforestation influences presence/amount of water vapor in the atmosphere and thereby cloudiness (letter c) and incoming radiation (letter e) is logical. Similarly, I would expect that irrigation would work the opposite way from deforestation. However, letter c and e seems to contrast AR5, as I believe AR5 concluded that levels of water vapor in atmosphere is a consequence of atmospheric temperatures, and not emissions. [, Norway]	Noted. The discussion here is not relative to global warming but only discusses the various effects deforestation can have on climate. Irrigation is dealt with in section 2.6.2.2
33071	79	21	79	21	And the superficial extension? [Jesus Alejandro Prieto Amparan, Mexico]	Noted. This paragraph has been removed and hopefully the synthesis in section 2.6.2.1.5 is clear
17117	79	22	79	26	consider refering to Rotenberg and Yakir (2010) concerning the effect of afforestation and to O'Halloran et al. 2012 comparing the effect of forest disturbanced on C fluxes and albedo effect : O'Halloran, Thomas L., Beverly E. Law, Michael L. Goulden, Zhuosen Wang, Jordan G. Barr, Crystal Schaaf, Mathew Brown, et al. 2012. "Radiative Forcing of Natural Forest Disturbances." Global Change Biology 18 (2): 555–65. doi:10.1111/j.1365-2486.2011.02577.x. Rotenberg, Eyal, and Dan Yakir. 2010. "Contribution of Semi-Arid Forests to the Climate System." Science 327 (5964): 451–54. doi:10.1126/science.1179998. [Eric Ceschia, France]	Taken into account. The study from Rotenberg & Yakir is indeed interesting but it relates to a very specific spot and did not bring any additional information to the messages we put forward. The paper from O'hallaran on the contrary was very useful as a conclusion of our section on afforestation/deforestation, thank you

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32219	79	22	79	26	consider refering to Rotenberg and Yakir (2010) concerning the effect of afforestation and to O'Halloran et al. 2012 comparing the effect of forest disturbanced on C fluxes and albedo effect : O'Halloran, Thomas L., Beverly E. Law, Michael L. Goulden, Zhuosen Wang, Jordan G. Barr, Crystal Schaaf, Mathew Brown, et al. 2012. "Radiative Forcing of Natural Forest Disturbances." Global Change Biology 18 (2): 555–65. doi:10.1111/j.1365-2486.2011.02577.x. Rotenberg, Eyal, and Dan Yakir. 2010. "Contribution of Semi-Arid Forests to the Climate System." Science 327 (5964): 451–54. doi:10.1126/science.1179998. [, France]	Taken into account. The study from Rotenberg & Yakir is indeed interesting but it relates to a very specific spot and did not bring any additional information to the messages we put forward. The paper from O'hallaran on the contrary was very useful as a conclusion of our section on afforestation/deforestation, thank you
33611	79	22	79	26	The reasoning goes that biogeophysical effects are more important than biogeochemical effects at the local level. While the opposite is true for the global level. However, climate change is related to the global effects which also are a sum of local effects. Thus, if all gross effects at the local level were summarised, the biogeophysical effects may dominate the biogeochemical ones? I believe the original statements should be presented as a net-net comparison. Further, you should add a reflection similar to ch.2, p 45, line 2-6 (and in figure 2.11), noting that gross amounts can be of high interest as these are the subjects of decision making at the management level. [, Norway]	Noted. You're correct in the reasoning. However the literature shows that rather than summing up, biophysical effects cancel out at the global scale and thus are not 'visible'. On the contrary net CO2 changes at the local effects sum up at the global scale.
29147	79	22	79	26	The difference in timescales between the mechansims should be mentioned [Jan Fuglestvedt, Norway]	Noted. This paragraph has been removed
3393	79	26	79	26	deforestation projected in the SRES -> is this projected or assumed in integrated assessment models? [Yuyu Zhou, United States of America]	Noted. I'm not sure I understand the comment. In SRES changes in land uses are simulated by IAMs and provided to global climate models. Does this answer your question?
15827	79	27	79	31	this is too general. What about the effect of the time since afforestation/reforestation, the type of species, the surface concerned, in size and whether or not fragmented? [Caroline Vincke, Belgium]	Noted. I understand your concern. However in most studies reported herein, that are essentially modeling studies, afforestation means putting mature tree where previously we had no tree. There is no time lag accounted for.
3215	79	28	79	28	add "short-term" before climatic response…. [Maria Ulrika Johansson, Sweden]	Noted. You're correct. However we have substantially revised this section and the paragraph is not longer here
17307	79	33	79	33	Why uppercase first letter in "Tropical"? It is not a place name. [Jarle W. Bjerke, Norway]	Editorial. Corrected, thank you
473	79	35	79	38	Yes ! A fair statement. "Modesl hardly agree on the SIGN and magnitide of … " I think this is true. This statement contradicts many earlier statements that are more condfident. [Andrew Pitman, Australia]	Noted. Thank you. We've kept the message but substantially revised the text
11685	79	40	79	42	Warming in the tropics from widespread deforestation in models without coupled oceans lead to the warming as indicated, but in coupled models cooling has been found (see: https://doi.org/10.1002/2015JD024013 Fig 2). This was the first published tropical deforestation study with a fully coupled climate model, showing the importance of ocean feedbacks, and cool. [Paul Dirmeyer, United States of America]	Noted. You're correct but this is true in idealized extreme deforestation/afforestation experiments. We've tried to focus in this new version of the text on what we learn from models that is supported by observation. The role of ocean and the long distance influence is discussed in section 2.6.4

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17855	79	33	81	5	This reference can also be very hepful here: The Effects of Tropical Vegetation on Rainfall, D.V. Spracklen, J.C.A. Baker, L. Garcia-Carreras, J.H. Marsham, Annual Review of Environment and Resources 2018 43:1, 193-218 It states that small patches of deforestation (~100km or less) in the tropics lead to redistribution of rainfall locally, with deforested patches seeming to benefit from increased rainfall at the expense of forested ones. It also clearly indicates that large-scale tropical deforestation (hundreds to thousands of kilometers) would lead to largely decreased rainfall (up to 40%) due to reduced moisture recycling according to most model studies. [Quentin Lejeune, Germany]	Taken into acocunt. Thank you very much for the reference that is now cite in section 2.6.4 where we think it is more appropriate
7531	79	4	82	44	On §2.6.2.1, a summary table of the cooling or warming and the range for each region would be helpful in comparing the different regions. [Durwood Zaelke, United States of America]	Taken into account. We have now included in the appendix a table that shows all the simulations used and the temperature change associated. A synthetic view of those results can also be found in figure 2.25. We have decided not to show regional values however as they would only come from regional studies that are not at all comparable.
18229	79	4	82	44	section might gain from slight restructurings: particularly in the subsections about temperate and boral afforestation, the cited literature often refers to global studies, these studies could be described in the general part of section 2.6.2.1 [Julia Nabel, Germany]	Taken into account. The afforestation and deforestation are now discussed together. However we have decided to keep the tropical/temperate/boreal discussions isolated as we thought it would help the readers. We have tried to avoid repetitions
7609	79	4	82	44	For §2.6.2.1, summary table of the cooling or warming and the range for each region would be helpful in comparing the different regions. [Kristin Campbell, United States of America]	Taken into account. We have now included in the appendix a table that shows all the simulations used and the temperature change associated. A synthetic view of those results can also be found in figure 2.25. We have decided not to show regional values however as they would only come from regional studies that are not at all comparable.
3497	79	3	86	33	I think the whole section 2.6.2 would be better if it included also something about other effects that temperature, e.g. precipitation, wind. Now it's only a small part about tropical precipitation. Sure, there are fewer studies about e.g precipitation and the effect is not strong, but also that could be worth mentioning. [Gustav Strandberg, Sweden]	Noted. There are some but few papers that discuss changes in rainfall. We have added a few, specially for the tropics and for future scenarios and temperate regions but this unfortunatly remains modest
14045	79	4			Betts (2001; Nature) quantified the tradeoff between biophysical and biogeochemical effects of reforestation at a grid-point level. He found, as you say, biggest trade-off in snow covered mid-to-high latitudes [Chris Jones, United Kingdom (of Great Britain and Northern Ireland)]	Noted. There are many more papers that have been published since then and that go more specifically into the seasonal variations. We have chosen the most recent ones
5585	80	2	80	5	it said that "over the deforested regions, arming wasa predicted" and then "deforestation-induced coolinf of the upper atemosphere" it is right and has high confidence! [Sanaz Moghim, Iran]	Noted. This is true for one model and has not been sufficiently demonstrated. We prefered to keep modest
23837	80	4	80	4	Perugini et al.(2017) reported (correct) ; (Perugini et al. 2017) (incorrect) [, India]	Editorial
1171	80	4	80	4	Check citation format (brackets should be around the years, not around the author name) [Sebastiaan Luyssaert, Belgium]	Editorial
729	80	10	80	10	Please revise the citation to Kendra et al. 2013. [Merja Tölle, Germany]	Rejected. This is how this paper shall be referred to
3395	80	15	80	15	RCP scenarios project relatively small FLULCC -> it is better to make sure "project" or "design" in integrated assessment models? [Yuyu Zhou, United States of America]	Noted
1173	80	18	80	19	Check citation format (brackets should be around the years, not around the author name) [Sebastiaan Luyssaert, Belgium]	Editorial
22513	80	32	80	32	Change "sou" to "southern" [Anastasios Kentarchos, Belgium]	Editorial. Thank you
29149	80	32	80	32	Possible to have a kind of conclusion here? [Jan Fuglestvedt, Norway]	Taken into account. We have added a conclusion for the entire section 2.6.2.1 as many features discussed per latitudinal band are coherent and can be grouped

Comment No	From Page	From Line	To Page	To Line	Comment	Response
8511	80	32	80	32	Typo. "Southern" ? [Marc Aubinet, Belgium]	Editorial. Thank you
31905	80	32	80	32	"southern" instead of "sou" [Martijn Slot, Netherlands]	Editorial. Thank you
731	80	32	80	32	Please change sou to south. [Merja Tölle, Germany]	Editorial. Thank you
2593	80	32	80	32	"sou"? [Wei Li, France]	Editorial. Thank you
1799	80	32	80	32	"…sou part…". There must be a typo. [William Lahoz, Norway]	Editorial. Thank you
19047	80	35	80	37	A temporal perspective should be given: how old should be new forest to give such result? [Joanna Wibig, Poland]	Noted. This is a very interesting question that has never been addressed. Observation-based studies do not isolate sites as a function of the age of the forest while modelling studies consider trees that are alrealy mature.
28575	80	38	80	38	should this be afforestation? [Alan Di Vittorio, United States of America]	Editorial. Yes thank you
13775	80	38	80	38	I understand it should be afforestation instead of deforestation [Moira Doyle, Argentina]	Editorial. Yes thank you
17757	80	40	80	40	There are additional important effects of afforestation/reforestation and forest restoration projects. These are are often allocated to land previously used as grazing land, often with a long history of anthropogenic and natural fire (Bowman et al. 2011, Parr et al. 2014). To achieve tree regeneration, exclusion of livestock and traditional fire management is often necessary. This can cause loss of biodiversity and food security (Smith et al. 2013, Parr et al. 2014) and an increase in surface fuel quantity and connectivity, leading to increased risk of large high-intensity wildfires (Barlow et al. 2012). Cf. Barlow, et al. (2012): The critical importance of considering fire in REDD+ programs. Biological Conservation 154:1-8; Bowman et al. (2011): The human dimension of fire regimes on Earth. Journal of Biogeography 38:2223-2236; Parr, C. L., et al. (2014): Tropical grassy biomes: misunderstood, neglected, and under threat. Trends in Ecology & Evolution 29:205-213; Smith, P. et al. (2013): How much land-based greenhouse gas mitigation can be achieved without compromising food security and environmental goals? Global Change Biology 19:2285-2302. [, Sweden]	Noted. You're absolutely right of course. However this is not the objective of this section and of this chapter. In chapter 2 we look at how land changes affect the overlying atmosphere and thus climate, not how they affect other land processes
3217	80	40	80	40	add: and the shorter time frame it has ocurred [Maria Ulrika Johansson, Sweden]	Noted. The studies reported here do not account for the timing of the perturbation, nor of the response. So we cannot include a note in this part of the text regarding time frame
13417	80	41	80	43	Sentence misleading, since it has been shown that afforestation in boreal regions in fact is not cooling down climate (e.g. Bonan 2016, de Wit et al. 2014 GCB etc etc) [Anders Bryn, Norway]	Noted. The section you are referring to does not discuss boreal deforestation but tropical ones. However you're correct that our text was not clear enough regarding the net effect. We have now included a new figure (2.25) and table that shows the biophysical and biogeochemical effects from which net effects can be estimated
3219	80	43	80	43	Afforestation/reforestation and forest restoration projects are often allocated to land previously used as grazing land, often with a long history of anthropogenic and natural fire (Bowman et al. 2011, Parr et al. 2014). To achieve tree regeneration, exclusion of livestock and traditional fire management is often necessary. This can cause loss of biodiversity and food security (Smith et al. 2013, Parr et al. 2014) and an increase in surface fuel quantity and connectivity, leading to increased risk of large high-intensity wildfires (Barlow et al. 2012). (details on mechanism: Young planted forests are more fire-prone than old standing forests, because of: 1) increased quantity of flammable surface fuels between young trees, 2) a vertical continuity between surface fuels and canopy fuels, 3) surface fuels dry out quicker due to lack of a high closed tree canopy, 4) the higher flammability of the tree species commonly planted, 5) possible land use conflicts.) [Maria Ulrika Johansson, Sweden]	Noted. You're absolutely right of course. However this is not the objective of this section and of this chapter. In chapter 2 we look at how land changes affect the overlying atmosphere and thus climate, not how they affect other land processes

Comment No	From Page	From Line	To Page	To Line	Comment	Response
655	80	48	80	48	Afforestation in China should be mentioned because it is one of the largest afforestation programme in the world. We suggest that one may add the following sentence: "The simulated cooling of afforestation in eastern China is partly supported by the observation evidence (Peng et al. 2014)." Ref: Peng, S.-S., and Coauthors, 2014: Afforestation in China cools local land surface temperature. Proc. Natl. Acad. Sci. U.S.A., 111, 2915-2919, doi:10.1073/pnas.1315126111. [Shilong Piao, China]	Taken into account. The section has been substantially rewritten
40523	80		80		check coherency with x chapter box on afforestation in ch 1 [Valerie Masson-Delmotte, France]	Taken into account. We have made sure our conclusions agreed with one another, thank you
17303	80	34	81	5	Also here, the important study by Bright et al. 2017 on the cooling effect from evapotranspiration should be described and cited. [Jarle W. Bjerke, Norway]	Accepted. We have included reference to this paper in our conclusion of the deforestation/forestation sub-section, thank you
963	80	21			suggest: "Specific modelling studies have been carried out for deforestation in Africa". There has not been a physical deforestation been carried out [Tobias Rütting, Sweden]	Taken into account. We are now specifying 'model-based' deforestation studies
965	80	30			"… oceanic influx, resulting in …" [Tobias Rütting, Sweden]	Noted. Thank you but the paragraph has been substantially revised
11687	80	32			change "sou" to "southern" [Paul Dirmeyer, United States of America]	Editorial. Thank you
17309	81	7	81	7	Why uppercase first letter in "Temperate"? It is not a place name. [Jarle W. Bjerke, Norway]	Editorial. Thank you
12851	81	8	81	36	Can the disagreement be boiled down to one or two sentences saying how hypotheses or inputs or model dynamics are different? To say that models don't agree on the sign begs the question of why not. Just saying they disagree doesn't really tell the reader anything except insight is not deep enough. How do we iimprove that situation? A simple 1-2 sentence explanation would be helpful if possible. [Robert Treuhaft, United States of America]	Noted. This is not a disagreement but how changes differ from one continent to another
11689	81	9	81	11	Should include: https://doi.org/10.1007/s00382-018-4250-z [Paul Dirmeyer, United States of America]	Rejected. This paper refers to past land use changes, and compares what happened between 1850 and 2005 to land cover in 850. It is also devoted to extremes which we do not discuss here
15631	81	9	81	14	Do any of these studies include BVOC and SOA effects? [Tuomo Kalliokoski, Finland]	Noted. No they do not. That is a real gap in most studies published so far. IPCC reports only discuss what exists.
23839	81	20	81	20	temperate latitudes (Alkama and Cescatti 2016; (Correct); needs a space before bracket [, India]	Editorial. Thank you
1175	81	20	81	20	Replace "…latitudes(Alkame …) by "…latitudes (Alkame …" [Sebastiaan Luyssaert, Belgium]	Editorial. Thank you
1265	81	20	81	20	Replace "…latitudes(Alkame …)" by "…latitudes (Alkame …" [Sebastiaan Luyssaert, Belgium]	Editorial. Thank you
1177	81	21	81	21	Check citation format (brackets should be around the years, not around the author name) [Sebastiaan Luyssaert, Belgium]	Editorial. Thank you
13385	81	25	81	26	"Disagreement between models and observations" , and also amogst models, appears to be more important for the turbulent fluxes than for albedo (see Duveiller et al. 2018, ESSD, https://doi.org/10.5194/essd-10-1265-2018) [Gregory Duveiller, Italy]	Noted. You are right but the way the section has been re-written does not necessitate citing a paper that shows such disagreement.
733	81	26	81	26	A recent study explored the sensitivity to albedo parameterizations in a regional climate model showing either a cooling or warming depending on the [Merja Tölle, Germany]	Noted. The sentence is not complete so I do not know what the reviewer had to say .. Sorry

Comment No	From Page	From Line	To Page	To Line	Comment	Response
1179	81	27	81	27	Consider to mention the "transitional latitude" as discussed in for example Li et al 2015 (doi/10.1038/ncomms7603). If we forget about the exact background climate at which deforestation results in a cooling, the agreement between the models is much larger. Most models simulate the same response to deforestation for deforestation in the higher latitudes of the temperate zone. Likewise most models agree on the response to deforestation at the lower latitudes in the temperate zone. When an average response for the temperate zone is calculated, the position of the transitional latitude becomes important. My interpretation of the current literature is that the models disagree on the exact location of the transitional latitude but that the models agree it is located in the temperate zone. [Sebastiaan Luyssaert, Belgium]	Noted. You're correct and we've now included a conclusion to section 2.6.2.1 that forgets about the exact positioning and discusses the background climate instead
735	81	39	81	42	This sentence is too long, please shorten. Pleae also make the sentence readable. Like this the reader does not get the point you want to make. [Merja Tölle, Germany]	Editorial. Thank you
657	81	40	81	41	We suggest that one may additionally cite the reference Peng et al. (2014) because this study also applied the satellite-observed data to reveal the cooling effects of afforestation on local surface temperature in China. Ref: Peng, S.-S., and Coauthors, 2014: Afforestation in China cools local land surface temperature. Proc. Natl. Acad. Sci. U.S.A., 111, 2915-2919, doi:10.1073/pnas.1315126111. [Shilong Piao, China]	Accepted. The paper was already included
6227	81	42	81	42	In the sentence starting "those results" it is not clear immediately clear what you are refering to in the "discussion above." I suggest modifying this so that it says "based on the observations discussed above" for clarity. [Tristan Quaife, United Kingdom (of Great Britain and Northern Ireland)]	Noted. The section has been substantially revised
28577	81	47	81	47	shouldn’t cooling result from increase in lost energy? Especailly from latent heat flux? [Alan Di Vittorio, United States of America]	Noted. You were correct but the sentence no longer exists
13387	81	47	81	47	unclosed parenthesis [Gregory Duveiller, Italy]	Editorial. Thank you
8513	81	47	81	47	Illogical : would you mean "increase in the loss of energy" ? [Marc Aubinet, Belgium]	Noted. You were correct but the sentence no longer exists
1275	81	47	81	47	Check "decrease in the loss".Should this be "increase in the loss"? [Sebastiaan Luyssaert, Belgium]	Noted. You were correct but the sentence no longer exists
15829	81	34	82	5	In those simulations, do they include the risk of forest decline and mortality linked with climate change? If not, this should be enhanced in the text. [Caroline Vincke, Belgium]	Noted. Such simulations do not account for the processes you refer to. However given the restructuration of our section we feel there is no use of writing what you suggest
17305	81	38	82	6	It is surprising to see that the very important and timely paper by Naudts et al. (2016; Science 351: 597-599) is not cited at all in this draft. It shows that afforestation programs in Europe have led to regional warming, because governments have allowed evergreen needleleafs to expand at the costs of deciduous forest. Cherubini et al. (2018; Environ. Res. Lett. 13: 074002) largely confirm the results by Naudts et al., showing that afforestation of Europe lead to warming through decreased albedo, while deforestation leads to cooling, especially in northern regions, due to increased albedo. These two studies should be cited to contrast to what is already said in this section. Moreover, it would be good to add a paragraph on what type of trees (evergreens, deciduous, etc.) that lead to warming and cooling in any given region. This comment also applies to section 2.6.2.1.3 [Jarle W. Bjerke, Norway]	Noted. The paper you mention is referred to later on when we discuss changes in forest management. We have already a large number of papers both observation and model based that is sufficient to make a robust statement

Comment No	From Page	From Line	To Page	To Line	Comment	Response
739	81	49	82	1	I do not agree. There is also no reference to this conclusion. I suppose it is based on modelling studies. A recent regional climate modelling study examined different albedo parameterizations in the model combined with the effect of deforestation and afforestation. It is found that the temperature discrepanies between afforestation and deforestation in southern Europe stem primarily from differences in evapotranspiration rather than from the albedo effect. Please refer to Tölle et al. 2018 (see comment above). [Merja Tölle, Germany]	Noted. I think you did not understand the statement and we're hoping that the substantial revision made now will have clarified it. If soil moisture is not supporting increases in evapotranspiration then albedo and sensible heat will be the drivers of temperature change
967	81	22			add "that" before biophysical [Tobias Rütting, Sweden]	Editorial. Thank you, but this sub-section has been substantially rewritten
737	82	2	82	3	Please add references for reports of winter warming. For example in Tölle et al. 2018 the winter warming effect is clearly visible over Europe based on idealized cases. Here is the reference: Tölle, M. H., M. Breil, K. Radtke, H.-J. Panitz, 2018: Sensitivity of European temperature to albedo parameterization in the regional climate model COSMO-CLM linked to extreme land use changes, Frontiers Environmental Science, DOI:10.3389/fenvs.2018.00123, and please also include Cherubini et al. 2018. [Merja Tölle, Germany]	Noted. There are many references including from observation-based estimates of winter warming
659	82	3	82	5	Except for the USA and Europe, the precipitation feedback from afforestation and vegetation greening in China should also be mentioned here. We suggest that one may add the following sentence: "In comparison, precipitation response to large-scale afforestation and vegetation greening was found to be spatially heterogenic from 1982 to 2011 in China (Li et al., 2018b)." Ref: Li, Y., and Coauthors, 2018b: Divergent hydrological response to large-scale afforestation and vegetation greening in China. Sci. Adv., 4, eaar4182, doi:10.1126/sciadv.aar4182. [Shilong Piao, China]	Noted. Including more reference to rainfall was a harder task than we thought and we did not have enough material to make an assessment so we decided to leave this out
29151	82	7	82	13	year? Time period? [Jan Fuglestvedt, Norway]	Accepted. This study compares the end of the 21st century with its start. We've added this clarification
741	82	7	82	13	Please add references. [Merja Tölle, Germany]	Noted. The references are already cited
18231	82	16	82	16	Sonntag et al. 2018 [Julia Nabel, Germany]	Editorial. Thank you
2595	82	16	82	16	confusing, RCP 4.5 or 8.5? [Wei Li, France]	Noted. The global warming follows RCP8.5 scenario while the imposed land use change comes from RCP4.5. We have tried to make this clearer

Comment No	From Page	From Line	To Page	To Line	Comment	Response
3499	82	21	82	21	Consider adding something about precipitation like: Precipitation response depends on local/regional characteristics such as length of snow season, the amount of water available for evapotranspiration and time of the year (Wramneby et al., 2010; Strandberg et al., 2014; Alexandru and Sushama, 2016). Generally the effect on precipitation is small and seemingly not directly connected to land-cover changes, despite relatively large changes in ET and temperature precipitation, probably because precipitation to a large extent is controlled by large scale atmospheric circulation (e.g. Gálos et al. 2011; Gao et al. 2014; Perugini et al. 2017; Strandberg and Kjellström 2018). However, comparison to observations suggest climate models are not able to fully reproduce the soil-moisture precipitation feedback (Taylor et al., 2012); Alexandru, A. and L. Sushama, 2016: Impact of land-use and land-cover changes on CRCM5 climate projections over North America for the twenty-first century. Climate Dyn. 47, 1197–1209, doi: 10.1007/s00382-015-2896-3. Gálos, B., C. Mátyás, and D. Jacob, 2011: Regional characteristics of climate change altering effects of afforestation. Environ. Res. Lett., 6. Gao, Y., T. Markkanen, L. Backman, H. M. Henttonen, J.-P. Pietikäinen, H. M. Mäkelä and A. Laaksonen, 2014: Biogeophysical impacts of peatland forestation on regional climate changes in Finland. Biogeosciences, 11, 7251–7267. Lucia Perugini, L., Caporaso, L., Marconi, S., Cescatti, A., Quesada, B., Noblet-Ducoudré, N., House, J, I, and Arneth, A.: Biophysical effects on temperature and precipitation due to land cover change. Environ. Res. Lett. 12 (2017) 053002 Strandberg, G. and Coauthors, 2014: Regional climate model simulations for Europe at 6 and 0.2 k BP: sensitivity to changes in anthropogenic deforestation. Climate Past, 10, 661-680, doi:10.5194/cp-10-661-2014. Strandberg, G. and E. Kjellström, 2018: Climate impacts from afforestation and deforestation in Europe. EI-D-17-0033.1 pp. http://journals.ametsoc.org/doi/10.1175/EI-D-17-0033.1. Taylor, C. M., R. A. M. de Jeu, F. Guichard, P. P. Harris, W. A. Dorigo, 2012: Afternoon rain more likely over drier soils, Nature, 489, 423–426. Wramneby, A., B. Smith, P. Samuelsson, 2010: Hot spots of vegetation-climate feedbacks under future green-house forcing in Europe. J. Geophys. Res., 115, D21119, doi: 10.1029/2010JD014307. [Gustav Strandberg, Sweden]	Rejected. This is a very interesting statement but there is no assessment that can be made. We do not want to add confusion
17311	82	23	82	23	Why uppercase first letter in "Boreal"? It is not a place name. [Jarle W. Bjerke, Norway]	Editorial. Thank you
40339	82	23	82	23	Chapter 7 in SR 1.5 ?? [Thelma Krug, Brazil]	Noted. I do not understand. The remark is probably not pointing to the right page nor line?
17749	82	23	82	44	Section 2.6.2.1.3 would benefit from some expanding when it comes to regional impacts of de/afforestation in Boreal regions. For example, (1) Gao et al. show that Boreal afforestation leads to warming in spring and cooling in summer, see Gao, Y., et al. (2014): Biogeophysical impacts of peatland forestation on regional climate changes in Finland. Biogeosciences, 11, 7251–7267. (2) Strandberg and Kjellström show that complete deforestation in Boreal Europe would lead to a warming in summer due to decreased evapotranspiration, see Strandberg, G. and E. Kjellström (2018): Climate impacts from afforestation and deforestation in Europe. EI-D-17-0033.1. [, Sweden]	Noted. Although we have substantially revised this section, there is still less to be said regarding boreal regions that has not been said previously. However we think the imbalance is not as exaggerated now as it was in SOD
3503	82	23	82	44	Section 2.6.2.1.3 Should be expanded quiet a bit. Almost nothing is said about regional impacts of de/afforestation in Boreal regions [Gustav Strandberg, Sweden]	Noted. Although we have substantially revised this section, there is still less to be said regarding boreal regions that has not been said previously. However we think the imbalance is not as exaggerated now as it was in SOD

Comment No	From Page	From Line	To Page	To Line	Comment	Response
14663	82	25	82	29	This deforestation cooling is contingent on the removal of conifer forest, and the cooling may be much smaller if deciduous of mixed forests are deforested rather than conifer. [, Canada]	Noted. You're correct although there is not many publications to refer to. We have however added a sentence that explicitely says that the amplitude of the change depends on the specie.
15633	82	25	82	32	Do any of these studies include BVOC and SOA effects? [Tuomo Kalliokoski, Finland]	Noted. No they do not. That is a real gap in most studies published so far. IPCC reports only discuss what exists.
15279	82	29	82	29	the sentence is incomplete [Joalane Marunye, Lesotho]	Noted. The section has been rewritten
8515	82	29	82	29	end of sentence missing [Marc Aubinet, Belgium]	Noted. The section has been rewritten
3501	82	31	82	31	Should be "… experienceing a local biophysical …"? [Gustav Strandberg, Sweden]	Editorial
28579	82	31	82	32	what is this? It is disconnected and different from the preceding sentences [Alan Di Vittorio, United States of America]	Noted. The section has been rewritten
22515	82	31	82	32	Not clear which biophysical aspects this refers to [Anastasios Kentarchos, Belgium]	Noted. The section has been rewritten
18233	82	31	82	32	sentence incomplete? Due to what? [Julia Nabel, Germany]	Noted. The section has been rewritten
8517	82	31	82	32	In what this affirmation differs from those in the preceding section ? Do you oppose global vs regional cooling ? Not clear ! [Marc Aubinet, Belgium]	Noted. The section has been rewritten
1181	82	31	82	32	This sentence doesn't make any sense. The previous paragraph is about biophysical cooling so the start of the sentence "in addition … are also experiencing biophsyical cooling … " makes a wrong contrast. Also the value of the cooling itself differs from the value reported in the previous paragraph. [Sebastiaan Luyssaert, Belgium]	Noted. The section has been rewritten
2597	82	31	82	32	Why this paragraph pop up? How it related to previous content? [Wei Li, France]	Noted. The section has been rewritten
3509	82	32	82	32	Consider adding: Strandberg and Kjellström (2018) show that complete deforestation in Boreal Europe would lead to a warming in summer due to decreased evapotranspiration. Strandberg, G. and E. Kjellström, 2018: Climate impacts from afforestation and deforestation in Europe. EI-D-17-0033.1 pp. http://journals.ametsoc.org/doi/10.1175/EI-D-17-0033.1. [Gustav Strandberg, Sweden]	Accepted. Reference to this paper has been added
18235	82	34	82	34	evidence/agreement? [Julia Nabel, Germany]	Noted. There is no agreement here as this is an example and not an assessment. The assessment is now made in a supplementary sub-section (conclusion)
28581	82	34	82	44	this is the boreal section. The other zones have already been discussed [Alan Di Vittorio, United States of America]	Noted. We have substantially revise all sub-sections and although still imbalanced we feel it is acceptable now
3505	82	34	82	44	This section is not about global and regional impacts of afforestation in Boreal regions. A completely new paragraph is needed. [Gustav Strandberg, Sweden]	Noted. It is not about 100% boreal but it does compare boreal changes to tropical and temperate ones
18237	82	34	82	44	section structured differently than comparable sections for temprate and tropical. might enhance understanding of differences in biophysics if paragraph would follow same logic than for tropics and temperate [Julia Nabel, Germany]	Noted. We have substantially revise all sub-sections and although still imbalanced we feel it is acceptable now
743	82	35	82	35	Reference is missing [Merja Tölle, Germany]	Noted. No the reference is provided
18239	82	38	82	41	"but was indeed the expected cooling" - maybe add "globally", to pronounce again that the global afforestation led to a cooling (i.e. that its not about the boreal zone alone, as the placement in section 2.6.1.2.3 might imply on first gaze) [Julia Nabel, Germany]	Noted. The paragraph has been rewritten
18241	82	40	82	40	but was indeed the expected cooling - who expected a cooling - Arora and Montenegro 2011? [Julia Nabel, Germany]	Noted. The paragraph has been rewritten

Comment No	From Page	From Line	To Page	To Line	Comment	Response
3507	82	44	82	44	Consider adding: Gao et al. (2014) show that Boreal afforestation leads to warming in spring and cooling in summer. Gao, Y., T. Markkanen, L. Backman, H. M. Henttonen, J.-P. Pietikäinen, H. M. Mäkelä and A. Laaksonen, 2014: Biogeophysical impacts of peatland forestation on regional climate changes in Finland. Biogeosciences, 11, 7251–7267. [Gustav Strandberg, Sweden]	Accepted. Reference to this paper has been added
1183	82	45	82	45	Since AR5 some progress has been made on understanding the effects of forest management (= wood harvest and tree species changes). Consider adding a paragraph on this topic. For an example of the content of such a section see Erb et al 2016 (doi/10.1111/gcb.13443). Erb et al 2016 discusses the biogeochemical and biophysical effects of "forestry harvest" as well as of "tree species selection". Regional results are reported in Naudts et al 2016 (doi/10.1126/science.aad7270) and Luyssaert et al 2018 (doi/10.1038/s41586-018-0577-1). Local effect have been reported in Luyssaert et al 2014 (doi/10.1038/NCLIMATE2196). See also references in Ellison et al 2017. (doi//10.1016/j.gloenvcha.2017.01.002). [Sebastiaan Luyssaert, Belgium]	Noted. This section describes more idealized experiments while realistic land management strategies are discussed in section 2.6.2.2
1267	82	45	82	45	Since AR5 some progress has been made on understanding the effects of forest management (= wood harvest and tree species changes). Consider adding a paragraph on this topic. For an example of the content of such a section see Erb et al 2016 (doi/10.1111/gcb.13443). Erb et al 2016 discusses the biogeochemical and biophysical effects of "forestry harvest" as well as of "tree species selection". [Sebastiaan Luyssaert, Belgium]	Noted. This section describes more idealized experiments while realistic land management strategies are discussed in section 2.6.2.2
1269	82	45	82	45	Regional results are reported in Naudts et al 2016 (doi/10.1126/science.aad7270) and Luyssaert et al 2018 (doi/10.1038/s41586-018-0577-1). Local effect have been reported in Luyssaert et al 2014 (doi/10.1038/NCLIMATE2196). See also references in Ellison et al 2017. (doi//10.1016/j.gloenvcha.2017.01.002). [Sebastiaan Luyssaert, Belgium]	Noted. This section describes more idealized experiments while realistic land management strategies are discussed in section 2.6.2.2
1185	82	49	82	50	Check citation format (brackets should be around the years, not around the author name) [Sebastiaan Luyssaert, Belgium]	Editorial
1187	82	50	82	50	Check "Wilfert et al 2016)" the bibliography refers to a paper on honey bees and deformed wings. Seems out of context. [Sebastiaan Luyssaert, Belgium]	Accepted. Indeed we have no idea where this reference comes from! We're now citing Seneviratne et al. (2018)
22517	82	47	83	5	There has been a great intensification in agricultural pratices, in particulare with nitrogen use, which should be mentioned [Anastasios Kentarchos, Belgium]	Noted. That is correct but their effects on climate via biophysical processes or CO2 processes are not found in the literature
25355	82	46	86	46	A similar subsection could be prepared on the impacts of changes in forest management (besides afforestation/reforestation). Some references: - Luyssaert, S., Marie, G., Valade, A., Chen, Y. Y., Djomo, S. N., Ryder, J., ... & McGrath, M. J. (2018). Trade-offs in using European forests to meet climate objectives. Nature, 562(7726), 259. - Anderson, R. G., Canadell, J. G., Randerson, J. T., Jackson, R. B., Hungate, B. A., Baldocchi, D. D., ... & Diffenbaugh, N. S. (2011). Biophysical considerations in forestry for climate protection. Frontiers in Ecology and the Environment, 9(3), 174-182. - Li, Y., Zhao, M., Motesharrei, S., Mu, Q., Kalnay, E., & Li, S. (2015). Local cooling and warming effects of forests based on satellite observations. Nature communications, 6, 6603. - Bright, R. M., Zhao, K., Jackson, R. B., & Cherubini, F. (2015). Quantifying surface albedo and other direct biogeophysical climate forcings of forestry activities. Global Change Biology, 21(9), 3246-3266. [, France]	Taken into account. We have added a small paragraph on the effects of forest management (choice of species and harvesting strategies). Some of the suggested papers are already cited in section 2.6.2.1 as they essentially refer to afforestation. The amount of available papers that discuss climatic effects of forest management on climate via biophysical effects, in addition to biogeochemical ones, is too small to deserve an entire subsection and to be turned into an assessment
969	82	26			use "°C" for consistency with rest of document (note, it should ne K not °K) [Tobias Rütting, Sweden]	Editorial. Thank you

Comment No	From Page	From Line	To Page	To Line	Comment	Response
29153	83	1	83	1	I think you should do more than "report". You should do an assessment [Jan Fuglestvedt, Norway]	Accepted. You're right. Hopefully this is indeed what we've done
26141	83	3	83	4	There are many papers from Lal et al. about the effects of land management practices on soil organic carbon - e.g., through cover crops, reduced tillage, etc. While the relationship between increased SOC and climate is not linear (due to permanence issues), the potential value of these practices could be noted here, with reference to further discussion below in 2.7.1.1. [Reid Detchon, United States of America]	Noted. We have added reference to section 2.7 and chapter 6 for more information regarding mitigation potential
1189	83	3	83	4	Consider expanding the number of examples based on Erb et al 2016(doi/10.1111/gcb.13443). Erb et al discusses the biogeochemical and biophysical effects of eight common land uses in agriculture. It would be refreshing to give the message that there is more than irrigation and albedo management. Simply species choice could be a key driver because it affects growing season, lai, water use, albedo all at once. [Sebastiaan Luyssaert, Belgium]	Accepted. Reference to the paper was included but you cannot ignore that even if this review paper lists a number of features and results, they remain very scarce per land management change. Thus there is no assessment that can be made from such studies. This is a pity but results cannot be invented.
1191	83	3	83	4	Consider expanding the number of examples based on Erb et al 2016 (doi/10.1111/gcb.13443). Erb et al discusses the biogeochemical and biophysical effects of eight common land uses in agriculture. It would be refreshing to see also grazing being mentioned here. It is much more common than irrigation and likley to be much more influential than "albedo management" and has a strong link with GHG emissions. [Sebastiaan Luyssaert, Belgium]	Accepted. Reference to the paper was included but you cannot ignore that even if this review paper lists a number of features and results, they remain very scarce per land management change. Thus there is no assessment that can be made from such studies. This is a pity but results cannot be invented.
8735	83	6	83	27	Format is inconsistent with other sections. [Changxiao Li, China]	Noted
8519	83	17	83	18	Incorrect ! Over land, both latent and sensible heat remove the heat brought by solar radiation. If latent heat increases, surface temperature decreases which leads to a sensible heat decrease. [Marc Aubinet, Belgium]	Noted. We're sorry but your comment is not 100% correct. Latent and sensible heat remove energy (and thus cool) the land but not always the ambient air above. We have anyway simplified the sentence for the reader
8521	83	18	83	18	It is not correct that "less heat is brought to the atmosphere through convection". Latent heat is also a form of energy ! [Marc Aubinet, Belgium]	Noted. You're partially correct and partially incorrect: this energy is brought to the upper atmosphere, not to the ambient air which is what we're talking about here
31907	83	20	83	20	"Wim et al" should be "Thiery et al" Wim is the first name here. [Martijn Slot, Netherlands]	Editorial. The reference came out wrongly from the automated formatting. Thanks
745	83	20	83	20	Please change Wim to Thierry. Wim is the first name. [Merja Tölle, Germany]	Editorial. The reference came out wrongly from the automated formatting. Thanks
8523	83	23	83	23	no nightime warming appears in the figure 2.24. [Marc Aubinet, Belgium]	Noted. What is named Tmin is the nighttime temperature. We've clarified this in the text and legend.
17751	83	28	83	37	Also, studies of changes in the available water at the surface or in the soil show that such changes affect precipitation and circulation on the local/convective scale, but mostly the timing and location of precipitation rather than the total precipitation within a larger area, cf. A. Quintanar and R. Mahmood (2012): Ensemble forecast spread induced by soil moisture changes over mid-south and neighbouring mid-western region of the USA. Tellus A, 64, 17156; Roy, S. et al. (2007): Impacts of the agricultural Green Revolution–induced land use changes on air temperatures in India. J. Geophys. Res., 112, D21108; Seneviratne, S. I. et al. (2013): Impact of soil moisture-climate feedbacks on CMIP5 projections: First results from the GLACE-CMIP5 experiment. Geophys. Res. Lett., 40, 19, 5212-5217; Winchester, J., et al. (2017): A Model-Based Assessment of Potential Impacts of Man-Made Reservoirs on Precipitation. Earth Int. 21, 9. [, Sweden]	Noted. You are correct and some of those are being reported in section 2.6.3.3. In this specific section we only report about irrigation studies and not soil moisture in a more general sense

Comment No	From Page	From Line	To Page	To Line	Comment	Response
23735	83	34	83	37	How certain and robust are these results ? What is magnitude of cooling induced by irrigation during the pre-monsoon season over the Indian region ? Is it strong enough to alter the large-scale land-sea contrast and delay the monsoon onset? Uncertainties in the model simulation may be provided. [, India]	Noted. This is a difficult question as it depends on the magnitude of irrigation and on the sensitivity of the climate model. All those studies are model-based. We have made this clear in the text and we have added a sentence at the end of the paragraph about robustness
1399	83	34	83	37	How certain and robust are these results ? What is magnitude of cooling induced by irrigation during the pre-monsoon season over the Indian region ? Is it strong enough to alter the large-scale land-sea contrast and delay the monsoon onset? Uncertainties in the model simulation may be provided. [Krishnan Raghavan, India]	Noted. This is a difficult question as it depends on the magnitude of irrigation and on the sensitivity of the climate model. All those studies are model-based. We have made this clear in the text and we have added a sentence at the end of the paragraph about robustness
23897	83	37	83	37	Please change “eastward” to “westward” [, India]	Accepted. Yes thank you
3511	83	37	83	37	Consider adding something about precipitation, like: Studies of changes in the available water at the surface or in the soil show that such changes affect precipitation and circulation on the local/convective scale, but mostly the timing and location of precipitation rather than the total precipitation within a larger area (e.g. Roy et al., 2007; Quintanar and Mahmood, 2012; Seneviratne et al., 2013; Winchester et al., 2017). A. Quintanar and R. Mahmood, 2012: Ensemble forecast spread induced by soil moisture changes over mid-south and neighbouring mid-western region of the USA. Tellus A, 64, 17156, DOI: 10.3402/tellusa.v64i0.17156 Roy, S. S, R. Mahmood, D. Niyogi, M. Lei, S. A. Foster, K. G. Hubbard, E. Douglas and R. Pielke Sr., 2007: Impacts of the agricultural Green Revolution–induced land use changes on air temperatures in India. J. Geophys. Res., 112, D21108, doi:10.1029/2007JD008834 Seneviratne, S. I. and Coatuthors, 2013: Impact of soil moisture-climate feedbacks on CMIP5 projections: First results from the GLACE-CMIP5 experiment. Geophys. Res. Lett., 40, 19, 5212-5217. Winchester, J., R. Mahmood, W. Rodgers, F. Hossain, E. Rappin, J. Durkee, T. Chronis, 2017: A Model-Based Assessment of Potential Impacts of Man-Made Reservoirs on Precipitation. Earth Int. 21, 9. [Gustav Strandberg, Sweden]	Noted. You are correct and some of those are being reported in section 2.6.3.3. In this specific section we only report about irrigation studies and not soil moisture in a more general sense
19009	83	37	83	37	Please change “eastward” to “westward”. [Sanjay Jayanarayanan, India]	Accepted. Yes thank you
40525	83		83		information on irrgation and urban aspects are distributed across different sections in this chapter and repeated or complementary of other sections in other chapters. Could x chapter boxes on irrgation and on urban aspects be used to sharpen / integrate the assessment of these aspects? [Valerie Masson-Delmotte, France]	Taken into account. A specific cross-chapter box on urbanization has been created and all text has been removed from chapter 2. Irrigation is now only discussed in section 2.6 and has been removed from section 2.1 & 2.2
17119	83	2			replace crop by cropland as what was studied is not the effect of increasing the albedo of the vegetation itself but of the plot by coverng the soil with vegetation (cover crops) during fallow periods. [Eric Ceschia, France]	Accepted and corrected
32221	83	2			replace crop by cropland as what was studied is not the effect of increasing the albedo of the vegetation itself but of the plot by coverng the soil with vegetation (cover crops) during fallow periods. [, France]	Accepted and corrected

Comment No	From Page	From Line	To Page	To Line	Comment	Response
971	83	28			What is meant with "allowing"? Seems not the right word here (maybe consucting or implementing) [Tobias Rütting, Sweden]	Accepted. We've used the word 'implementing' irrigation which is a better choice
747	84	1	84	1	Figure quality needs improvement. [Merja Tölle, Germany]	Noted. Figures will be updated thanks
3177	84	2	84	7	Uncertainty qualifiers would be appropriate for the changes displayed in the figure 2.24. [, Russian Federation]	Noted. This is impossible for 2 reasons: 1) the figure is coming from a published paper; 2) each number is an isolated study. The robustness essentially comes from the fact that each single study gives the same sign of change and magnitude; otherwise there is no robustness
33613	84	10	84	23	Consider to point out that effects of (avoided) tillage will depend on the duration of bare soils. Logically, longer duration hampers carbon sequestration, as soil degrading processes become more dominant over soil generative processes. Further, bare soils during boreal winters reduces albedo, as bare soil will resist snow. Thus, avoided tillage may hold a mitigation potential beyond the immediate level (contrary to line 21-23). [, Norway]	Noted. The point about duration was already there but we tried to make it more visible. The point about carbon sequestration is detailed in chapter 6
8529	84	10	84	23	The impact of these approaches on crop productivity should also be analysed. If this impact is negative, the measure risks to be counter productive. [Marc Aubinet, Belgium]	Noted. You are perfectly right. We have added a sentence stating that the modeling experiments reported here have not addressed the potential impacts on productivity. However such discussion belongs to chapter 6. In chapter 2 we only deal with impacts on overlying atmosphere/climate

Comment No	From Page	From Line	To Page	To Line	Comment	Response
17121	84	15	84	17	replace "In addition and depending on the location, Carrer et al. (2018) have suggested that intercropping may also have a brightening effect in Europe where soils are darker than any cultivated plant." by "In addition and depending on the location, Carrer et al. (2018) have suggested that cover crops may also have a cooling effect in Europe in areas where vegetation has a higher albedo than soil." Also I would suggest to add the following sentences after this one : "The difference between this management practice (cover crops) and the three previous ones is that it also allows to store C in the soil (Poeplau & Don 2015), it can reduce both direct and indirect N2O emissions (Basche et al. 2014 ; Kaye & Quemada, 2017), in particular if fertilisation is modulated based on the N input in the soil following crop incorporation (Constantin et al., 2010 ; Cohan et al., 2011a ; Cohan et al., 2011b ; Constantin et al., 2011 ; Cohan et al., 2013). Considering all those effects combined it improves substantially the GHG budget of croplands (Justes et al., 2013; Kaye and Quemada, 2017 ; Tribouillois et al. 2018). Finally it reduces soil temperature through increase in evapotranspiration compared to bare soil (Ceschia et al, 2017). Note however that part of the albedo cooling effect could be lost during snow periods if cover crops are not buried by snow (Kaye and Quemada, 2017 ; Lombardozzi et al. 2018)." Worth mentionning that the C storage effect of cover crops stops after approx 50 years becauses soil reaches a new equilibrium (Tribouillois et al. 2018) while their albedo effect will last as long as they are maintained. For France, considering a 100 yr time horizon, the albedo effect of cover crops would be 1.7 time larger than their C storage effect (Tribouillois et al 2018 ; Carrer et al 2018 considering a similar surface area for their development in both studies). ref : Basche A., Miguez F.E., Kaspar T., Castellano M.J., 2014. Do cover crops increase or decrease nitrous oxide emissions? A meta-analysis. J Soil Water Conserv 69, 471–482. doi:10.2489/jswc.69.6.471 Ceschia E., Mary B., Ferlicoq M., Pique G., Carrer D., Dejoux J.-F., Dedieu G., 2017. Potentiel d'atténuation des changements climatiques par les couverts intermédiaires. Innovations Agronomiques 62, 43-58. Cohan J.P., Labreuche J., Bouthier A., 2011a. Orge de printemps : tenir compte de la culture intermédiaire dans le calcul de la fertilisation azotée. Perspectives Agricoles, 383 (novembre),	Accepted. Thank you very much for the suggestion and the references. We've included them except the technical reports that are not allowed in such IPCC report

Comment No	From Page	From Line	To Page	To Line	Comment	Response
32223	84	15	84	17	replace "In addition and depending on the location, Carrer et al. (2018) have suggested that intercropping may also have a brightening effect in Europe where soils are darker than any cultivated plant." by "In addition and depending on the location, Carrer et al. (2018) have suggested that cover crops may also have a cooling effect in Europe in areas where vegetation has a higher albedo than soil." Also I would suggest to add the following sentences after this one : "The difference between this management practice (cover crops) and the three previous ones is that it also allows to store C in the soil (Poeplau & Don 2015), it can reduce both direct and indirect N2O emissions (Basche et al. 2014 ; Kaye & Quemada, 2017), in particular if fertilisation is modulated based on the N input in the soil following crop incorporation (Constantin et al., 2010 ; Cohan et al., 2011a ; Cohan et al., 2011b ; Constantin et al., 2011 ; Cohan et al., 2013). Considering all those effects combined it improves substantially the GHG budget of croplands (Justes et al., 2013; Kaye and Quemada, 2017 ; Tribouillois et al. 2018). Finally it reduces soil temperature through increase in evapotranspiration compared to bare soil (Ceschia et al, 2017). Note however that part of the albedo cooling effect could be lost during snow periods if cover crops are not buried by snow (Kaye and Quemada, 2017 ; Lombardozzi et al. 2018)." Worth mentionning that the C storage effect of cover crops stops after approx 50 years becauses soil reaches a new equilibrium (Tribouillois et al. 2018) while their albedo effect will last as long as they are maintained. For France, considering a 100 yr time horizon, the albedo effect of cover crops would be 1.7 time larger than their C storage effect (Tribouillois et al 2018 ; Carrer et al 2018 considering a similar surface area for their development in both studies). ref : Basche A., Miguez F.E., Kaspar T., Castellano M.J., 2014. Do cover crops increase or decrease nitrous oxide emissions? A meta-analysis. J Soil Water Conserv 69, 471–482. doi:10.2489/jswc.69.6.471 Ceschia E., Mary B., Ferlicoq M., Pique G., Carrer D., Dejoux J.-F., Dedieu G., 2017. Potentiel d'atténuation des changements climatiques par les couverts intermédiaires. Innovations Agronomiques 62, 43-58. Cohan J.P., Labreuche J., Bouthier A., 2011a. Orge de printemps : tenir compte de la culture intermédiaire dans le calcul de la fertilisation azotée. Perspectives Agricoles, 383 (novembre),	Accepted. Thank you very much for the suggestion and the references. We've included them except the technical reports that are not allowed in such IPCC report

Comment No	From Page	From Line	To Page	To Line	Comment	Response
17123	84	18	84	19	move lines 18 and 19 before "In addition and depending on the location..." as this sentence is not valid for the study of Carrer et al 2018. Also the sentence line 18-19 gives the impressions that all those changes in cropland management result in equivalent net climate effects, which would not be true (even if the changes in albedo were similar) because they will affect in different ways (and with different intensities) evapotranspiration, energy partitioning at the surface, CO2 fluxes and soil carbon/GHG budgets. For instance the effect of no till (in Davin et al., 2014), on soil C storage is highly context-specific; many studies (e.g. Paustian et al., 2000; Six et al., 2004; van Kessel et al., 2013) demonstrate increased carbon storage, while others show the opposite effect (Sisti et al. 2004; Álvaro- Fuentes et al. 2008; Christopher et al. 2009). Meta-analyses (Haddaway et al. 2017; Luo et al. 2010) also show mixed responses. I would suggest to mention that in the study by Davin et al (2014), abandoning tillage causes a decreases in soil evaporation (because crop residues cover the soil surface).This decrease in soil evaporation causes a 80% loss in the climate cooling benefit due to the albedo effect. This is why the net cooling effect of no tillage is limited to specific conditions as shown in fig 2.25. Maybe it is worth mentioning also why there is an increase in albedo with abandoned tillage = because crop residues remain at soil surface and their have a higher albedo than bare soil. [Eric Ceschia, France]	Taken into account. The sentence has been moved upward as you were right about mispositioning. The figure here does not mix up albedo and evapotranspiration effects but looks at the sole albedo effect.
32225	84	18	84	19	move lines 18 and 19 before "In addition and depending on the location..." as this sentence is not valid for the study of Carrer et al 2018. Also the sentence line 18-19 gives the impressions that all those changes in cropland management result in equivalent net climate effects, which would not be true (even if the changes in albedo were similar) because they will affect in different ways (and with different intensities) evapotranspiration, energy partitioning at the surface, CO2 fluxes and soil carbon/GHG budgets. For instance the effect of no till (in Davin et al., 2014), on soil C storage is highly context-specific; many studies (e.g. Paustian et al., 2000; Six et al., 2004; van Kessel et al., 2013) demonstrate increased carbon storage, while others show the opposite effect (Sisti et al. 2004; Álvaro- Fuentes et al. 2008; Christopher et al. 2009). Meta-analyses (Haddaway et al. 2017; Luo et al. 2010) also show mixed responses. I would suggest to mention that in the study by Davin et al (2014), abandoning tillage causes a decreases in soil evaporation (because crop residues cover the soil surface).This decrease in soil evaporation causes a 80% loss in the climate cooling benefit due to the albedo effect. This is why the net cooling effect of no tillage is limited to specific conditions as shown in fig 2.25. Maybe it is worth mentioning also why there is an increase in albedo with abandoned tillage = because crop residues remain at soil surface and their have a higher albedo than bare soil. [, France]	Taken into account. The sentence has been moved upward as you were right about mispositionning. The figure here does not mix up albedo and evapotranspiration effects but looks at the sole albedo effect.

Comment No	From Page	From Line	To Page	To Line	Comment	Response
17127	84	21	84	23	I stongly disagree with this sentence. First it is refering to "This solar radiation management", but to which of the four solar radiation management that are reported above is this "This" refering to ? Also even if albedo is increased only part of the year, it reduces the total amount of energy in the system (and sometimes for longer than during the cover crop development period or longer than during the time that crop residues are maintained at the soil surface because less energy is stored in the ground and then restituted to the atmosphere). Then considering cover crops, in addition of increasing albedo, they allows storing C, they have the potential to reduces N2O emissions, they improve the GHG budgets, they reduce soil surface temperature and increase evapotranspiration (see previous coments & references). All those effects go in the same direction of a cooling (which differs from the 3 other methods listed above). Of course coupled surface-climate modelling exercices are needed to estimate the net climatic effect of cover crops and to analyse retroactions (it hasn't been done yet), but still, considering all the biogeochemical and biogeophysical effects of cover crops (and their potential synergies), they surely represent one of the best solutions for climate mitigation in agriculture !!! Last cover crops can be grown at any time of the year : 1) in summer/fall/winter/early spring after a winter crop and before a summer crop, 2) in winter/early spring between two summer crops. It is widely accepted that permanent soil coverage (with cover crops) would allow to enhance C storage in agricultural soils. It could also increase cropland surface albedo all along the year (alone or when combined with no till that allows maintaining crop residues at the soil surface : crop residues usually have a higher albedo than soil, see Davin et al. 2014). [Eric Ceschia, France]	Taken into account. The sentence has been revised as it was obviously not well understood.
32229	84	21	84	23	Considering cover crops, in addition of increasing albedo, they allows storing C, they have the potential to reduce N2O emissions, they improve the GHG budgets, they reduce soil surface temperature and increase evapotranspiration (see previous coments & references). All those effects go in the same direction of a cooling (which differs from the 3 other methods listed above). Of course coupled surface-climate modelling exercices are needed to estimate the net climatic effect of cover crops and to analyse retroactions (it hasn't been done yet), but still, considering all the biogeochemical and biogeophysical effects of cover crops (and their potential synergies), they surely represent one of the best solutions for climate mitigation in agriculture. Second, cover crops can be grown at any time of the year : 1) in summer/fall/winter after a winter crop and before a summer crop, 2) in winter between two summer crops. It is widely accepted that permanent soil coverage (with cover crops) would allow to enhance C storage in agricultural soils. It could also increase cropland surface albedo all along the year (alone or when combined with no till that allows maintaining crop residues at the soil surface : crop residues usually have a higher albedo than soil, see Davin et al. 2014). [, France]	Taken into account. Text revised
29155	84	21	84	23	I think this statment is too unnuanced for such a complex issue, and given what you have written on this [Jan Fuglestvedt, Norway]	Accepted. You are correct the sentence is hopefully now more nuanced

Comment No	From Page	From Line	To Page	To Line	Comment	Response
23899	84	24	84	27	It may be noted that the proposed regional land radiative management measure in the cited paper (Seneviratne et al. 2018) may not be suitable for India as the results of their regional-scale experiments with fully coupled GCMs to investigate the extent to which the climate response to enhanced CO2 forcing is offset through increases in the land surface albedo by 0.1 over the agriculture and densely populated regions in India-China-Southeast Asia, led to substantial reduction in precipitation in these monsoon-prone tropical regions. [, India]	Noted. We would be happy to say so but why isn't such albedo change suitable for India? It is not clear why India would not try to grow brighter crops in the future.
19011	84	24	84	27	It may be noted that the proposed regional land radiative management measure in the cited paper (Seneviratne et al. 2018) may not be suitable for India as the results of their regional-scale experiments with fully coupled GCMs to investigate the extent to which the climate response to enhanced CO2 forcing is offset through increases in the land surface albedo by 0.1 over the agriculture and densely populated regions in India-China-Southeast Asia, led to substantial reduction in precipitation in these monsoon-prone tropical regions. [Sanjay Jayanarayanan, India]	Noted. We would be happy to say so but why isn't such albedo change suitable for India? It is not clear why India would not try to grow brighter crops in the future.
749	84	25	84	25	Change indian to Indian and asian to Asian [Merja Tölle, Germany]	Accepted and corrected thank you
23737	84	26	84	27	Krishnan et al. (2016) Clim Dyn, 47:1007–1027 can be included. Land-use changes based on the Hurtt et al. (2011) dataset following the CMIP5 protocols were used in the high-resolution climate model experiments. Land use land cover changes over the Indian region during 1886-2005 showed an increase of crop fraction by 45% and a decline of tree-fraction by about 30% during the same period. The model simulations showed that the regional planetary albedo (including cloud effects) increased by about 9% during 1886-2005 and a significant declining trend of monsoon precipitation over the Indian region during the second half of the 20th century. [, India]	Noted. This is an interesting study. However it does not support the discussion in this sub-section that illustrates how increasing surface albedo in cropland can reduce surface temperature
1401	84	26	84	27	Krishnan et al. (2016) Clim Dyn, 47:1007–1027. Land-use changes based on the Hurtt et al. (2011) dataset following the CMIP5 protocols were used in the high-resolution climate model experiments. Land use land cover changes over the Indian region during 1886-2005 showed an increase of crop fraction by 45% and a decline of tree-fraction by about 30% during the same period. The model simulations showed that the regional planetary albedo (including cloud effects) increased by about 9% during 1886-2005 and a significant declining trend of monsoon precipitation over the Indian region during the second half of the 20th century. [Krishnan Raghavan, India]	Noted. This is an interesting study. However it does not support the discussion in this sub-section that illustrates how increasing surface albedo in cropland can reduce surface temperature
17125	84	21			replace "intercropping by "cover crop" (more accurate and consistent with the rest of the Chapter). [Eric Ceschia, France]	Accepted and corrected thank you
32227	84	21			replace "intercropping" by "cover crop" (more accurate and consistent with the rest of the Chapter). [, France]	Accepted and corrected thank you
6989	84				Figure 2.24 Suggest rewording: "Global map of areas equipped for irrigation, expressed as a percentage of total area, or irrigation fraction (Siebert et al. 2013). Numbered boxes show regions where irrigation causes cooling (down arrow) of surface mean, maximum or minimum temperature, or else no significant effect (right arrow) or where the effect is uncertain (question mark), based on observational studies as reviewed in (Chen and Jeong 2018). References are..." Do these references refer to the numbers on the boxes? Include the numbers perhaps? [Debra Roberts, South Africa]	Accepted. The legend of the figure has been revised
751	85	1	85	1	Quality of figure needs to be improved. [Merja Tölle, Germany]	Noted.
29157	85	14	85	14	"3-D urban…" may be confusing for readers [Jan Fuglestvedt, Norway]	Accepted. This was indeed difficult and we have rephrased the sentence. All text related to urbanization has been moved into a cross-chapter box

Comment No	From Page	From Line	To Page	To Line	Comment	Response
19049	85	23	85	24	it is Chen 2016a not Chen 2016b who reported negligible response of global air temperature to urbanization [Joanna Wibig, Poland]	Accepted. We had some mismatches with references when merging all pieces of text so thanks!
24313	85	26	85	28	Do I interpret this statement correctly that as much as 1 deg C of the enhanced warming of the Arctic during winter and autumn could be due to direct emissions of heat from anthropogenic sources? [Terje Berntsen, Norway]	Noted. No both global studies mentioned in the text did not find any effect on the Arctic but only on North America and Eurasia. We have revised the text to improve clarity.
19051	85	26	85	29	This time it is Chen 2016b (instread of a) and Lamptey 2010 (innstead of 2009 - it should be improved in references also). However the increase of air temperature of order of 1 K is not suggested in any of these two papers for the whole mid latitude winter in the North America and Eurasia, but only in the vicinity of urban areas. [Joanna Wibig, Poland]	Taken into account. The reference Lamptey 2010 has been removed since it did not fit here but the other reference is Chen et al 2016a and not b.
3179	85	29	85	29	What about agreement? [, Russian Federation]	Taken into account: "Low agreement" was added to the text
945	85	38	85	38	Evola, G., Gagliano, A., Fichera, A., Marletta, L., Martinico, F., Nocera, F., Pagano, A. UHI effects and strategies to improve outdoor thermal comfort in dense and old neighbourhoods (2017) Energy Procedia, 134, pp. 692-701. [Nocera Francesco, Italy]	Rejected. The suggested reference did not fit with the purpose of the paragraph which is on the impact of historical urbanization on minimum temperature more than on maximum temperature and not on local options to reduce human discomfort.
17753	85	11	86	33	Here, the role of vegetation in urban landscapes and the importance of green infrastructure could also be addressed, in terms of their impact on local climate scale. [, Sweden]	Accepted. Discussion on urbanization has now been moved in a cross-chapter box and includes the effects of urban green infrastructure
3513	85	11	86	33	Here, I think it would be interesting to add something about the role of vegetation in the urban landscape and how green infra structure is important for local/micro climate. [Gustav Strandberg, Sweden]	Accepted. Discussion on urbanization has now been moved in a cross-chapter box and includes the effects of urban green infrastructure
15525	85	22	86	24	Sodoudi et al (2014), DOI: 10.1155/2014/547974, show that the climate change projections also indicate increase in the frequency and intensity of heat waves, which will intensify the UHI effect. As megacity Tehran is affected by severe heatwaves in summer, this study investigates its UHI characteristics and suggests some feasible mitigation strategies in order to reduce the air temperature and save energy. Temperaturemonitoring in Tehran shows clear evidence of the occurrence of the UHI effect, with a peak in July, where the urban area is circa 6K warmer than the surrounding areas. The mobile measurements show a park cool island of 6-7K in 2 central parks, which is also confirmed by satellite images.The effectiveness of three UHI mitigation strategies high albedo material (HAM), greenery on the surface and on the roofs (VEG), and a combination of them (HYBRID) has been studied using simulation with the microscale model ENVI-met. All three strategies show higher cooling effect in the daytime. The average nocturnal cooling effect of VEG and HYBRID (0.92, 1.10 K) is much higher than HAM (0.16K), although high-density trees show a negative effect on nocturnal cooling. [Hamidreza Solaymani Osbooei, Iran]	Rejected. The suggested paper is not on the intensification of the UHI under heat wave period and thus does not fit with the purpose of the text.

Comment No	From Page	From Line	To Page	To Line	Comment	Response
16191	85	22	86	24	Sodoudi et al (2014), DOI: 10.1155/2014/547974, show that the climate change projections also indicate increase in the frequency and intensity of heat waves, which will intensify the UHI effect. As megacity Tehran is affected by severe heatwaves in summer, this study investigates its UHI characteristics and suggests some feasible mitigation strategies in order to reduce the air temperature and save energy. Temperaturemonitoring in Tehran shows clear evidence of the occurrence of the UHI effect, with a peak in July, where the urban area is circa 6K warmer than the surrounding areas. The mobile measurements show a park cool island of 6-7K in 2 central parks, which is also confirmed by satellite images.The effectiveness of three UHI mitigation strategies high albedo material (HAM), greenery on the surface and on the roofs (VEG), and a combination of them (HYBRID) has been studied using simulation with the microscale model ENVI-met. All three strategies show higher cooling effect in the daytime. The average nocturnal cooling effect of VEG and HYBRID (0.92, 1.10 K) is much higher than HAM (0.16K), although high-density trees show a negative effect on nocturnal cooling. [Hamidreza Solaymani Osbooei, Iran]	Rejected. The suggested paper is not on the intensification of the UHI under heat wave period and thus does not fit with the purpose of the text.
7533	85	30	86	3	With expanded urbanization (and in existing urban areas), small-scale albedo modification can be a fast method of localized cooling, including through simple alterations like white roofs. [Durwood Zaelke, United States of America]	Rejected. The suggested text did not fit with the purpose of the paragraph which is on the intensification of UHI under heat wave and not on local mitigations options.
6991	85				Figure 2.25: What is Q1? The hottest 1% part of the day? The hottest 1% of summer days? Or the coolest? It seems to be the coolest, from the text. Caption wording is awkward. Suggest "Change in summer (July-August) daily maximum temperature (K) resulting from increased surface albedo in unploughed versus ploughed land, in (A) Southern and (B) Northern Europe, during the period 1986–2009. Changes are simulated for different quantiles of the daily maximum temperature distribution, where Q1 represents the coolest 1% and Q99 the warmest 1% of summer days. Only grid cells with more than 60% of cropland are included. The dashed lines... " [Debra Roberts, South Africa]	Taken into account. The legend of the figure has been updated and is hopefully clearer
14665	86	3	86	3	It is unclear what exact geographic area is being referenced next to the text "DJF" in Alaska in Figure 2.26. There are no cities of any appreciable size in the area. Perhaps this is a North America-wide value? It is currently unclear. [, Canada]	Noted. The value is for a village called Barrow, and only for a specific season (winter) while other values reported on the map are for annual changes
28585	86	4	86	4	why is china completely colored? [Alan Di Vittorio, United States of America]	Taken into account. China was abusively colored from few values representing few cities. The figure has been revised
29159	86	5	86	8	Unclear what area/region circles represent in fig 2.26 and why China has full color [Jan Fuglestvedt, Norway]	Taken into account. China was abusively colored from few values representing few cities. The figure has been revised
3435	86	5	86	9	Figure 2.2.6 is difficult to understand. The figure uses dots of different colors and sizes as a sign of the urban warming effect, with the space of China being all pink, which is confusing. So it is suggested to delete Figure 2.2.6. [, China]	Taken into account. China was abusively colored from few values representing few cities. The figure has been revised
3181	86	5	86	9	The caption to figure 2.26 is not fully clear: a) if colors refer to the magnitude, what does circle size mean?; b) the whole Chine is given in pink, what it means? [, Russian Federation]	Taken into account. China was abusively colored from few values representing few cities. The figure has been revised
1193	86	17	86	17	Replace "...Atlanta(Haberlie..." by "...Atlanta (Haberlie ..." [Sebastiaan Luyssaert, Belgium]	Editorial
22519	86	24	86	33	It would be relevant to mention how urban design could reduce UHI effects. This is missing in section 2.6.3 [Anastasios Kentarchos, Belgium]	Taken into account. The sub-section that discusses urbanization has been moved to a cross-chapter box in which some aspects of urban design have been incorporated (essentially urban green infrastructure)

Comment No	From Page	From Line	To Page	To Line	Comment	Response
8531	86	26	86	26	What does mean decreasing UHI ? UHI surface ? Intensity ? [Marc Aubinet, Belgium]	Noted. It is the changes in intensity of the Urban Heat Island in response to climate change
6993	86				Figure 2.26: why are China and Japan coloured? [Debra Roberts, South Africa]	Taken into account. China was abusively colored from few values representing few cities. The figure has been revised
29161	87	1	87	2	year? Time period? [Jan Fuglestvedt, Norway]	Taken into account. The requested Information has been added
11691	87	4	87	13	https://doi.org/10.1007/s00382-018-4250-z shows that the land use change signal dominates the spatial pattern of temperature change responses over land whereas the GHG signal os more large-scale. Thus it is more than a mere moderator of GHG cliamte change signals but an independent climate change driver in its own right. [Paul Dirmeyer, United States of America]	Noted. Thank you for the reference but we believe it is better placed in section 2.6.1
25357	87	7	87	22	It is strange that the presentation of the content of sections 2.2. to 2.6 is in subsection 2.6.3. Could you check the consistency of this structure? [, France]	Noted. There is no inconsistency but we're showing, in this sub-section, how everything that has been discussed earlier comes together to address the specific issues of amplifying/dampening climate change. However we've moved upward in the introduction to 2.6.3 the item discussion 2.4
18109	87	12	87	12	Instead of "and not only via" maybe "in addition to" could be used [Clemens Schwingshackl, Switzerland]	Accepted; text revised
6229	87	14	87	19	To list here only dynamic vegetation is misleading. I would argue, strongly, that it is also necessary to have nutrient cycles and disturbance dynamics (including the representation of fire) to assess these feedbacks. It is also necessary here to mention something about timescales. Changes to the snow regime, for example, are much faster than vegetation dynamics. [Tristan Quaife, United Kingdom (of Great Britain and Northern Ireland)]	Accepted. You are right of course.We initially only discussed the processes that exist in some models and that have been used to explore feedbacks. We have now changed this sentence and discussed the various processes in a more general way to alert on the missing feedbacks and thus on the difficulty to make an assessment here.
17313	87	23	87	25	Figure 2.27: "Northward" should be replaced by "Polarward and upward". "Land" should be written with lowercase "l". [Jarle W. Bjerke, Norway]	Accepted; thank you
29163	87	23	87	29	Fig 2.27: A potentially useful fig but somewhat confusing. If main purpose is to show damping and amplifyng factors then at least the font should not have grey color but something more visible. Please also consdier structure and flow. [Jan Fuglestvedt, Norway]	Accepted. The figure has been redrawn
8525	87	24	87	24	The figure is not drawn in an intuitive way. Unneccessarily complicated. [Marc Aubinet, Belgium]	Taken into account. The figure has been redrawn
15831	87	25	87	25	correct in the Figure 2.27 "northward migration of tree line". [Caroline Vincke, Belgium]	Accepted; thank you
3183	87	25	87	29	Very informative picture. However: a) why about CO2 only; b) ' initial climate change' is slightly misleading; perhaps, ' greenhouse warming' would be more appropriate. [, Russian Federation]	Accepted. CO2 is the only forcing listed as it is the one considered as the initial driver of all changes discussed. 'Initial climate change' has been changed into 'initial greenhouse warming' following your suggestion
17315	87	25	87	29	It is problematic that the literature supporting this figure is not cited. If it builds on the sections of this subchapter, then this should be clearly stated in the figure caption. Is last part of figure legend missing? An explanation for the difference between stippled and whole arrows is not provided. Grey boxes are stated to be "responses" If so, arrows should go to, not from, grey boxes. When arrow goes from grey box to green box, as is the case here, the grey box is a driver or pressure, not a response, while the green box represents the response. So, there are some conceptual problems with this figure. [Jarle W. Bjerke, Norway]	Noted. This is a schematic figure that builds on various papers discussed in the section and in previous sub-sections as well. It would considerably enhance the length of the legend to cite all attached papers
3397	87	26	87	26	Urban-induced climate and weather changes -> urbanization-induced [Yuyu Zhou, United States of America]	Not understood. This comment does not refer to this part of the text as far as I can tell
3399	87	27	87	27	Cities affect the local -> urbanization affects [Yuyu Zhou, United States of America]	Not understood. This comment does not refer to this part of the text as far as I can tell

Comment No	From Page	From Line	To Page	To Line	Comment	Response
3403	87	41	87	42	since the cities cover only 0.2% of the world's land area-> it is not accurate and no reference. It was found urban area increasesfr from 0.2% to 0.5% during 1992 to 2013. (Zhou, Y., X. Li, G. R. Asrar, S. J. Smith and M. Imhoff (2018). A global record of annual urban dynamics (1992–2013) from nighttime lights. Remote Sensing of Environment 219: 206-220.) [Yuyu Zhou, United States of America]	Not understood. This comment does not refer to this part of the text as far as I can tell
40529	87		87		Please make sure that information from this chapter is used in chapters 6 and 7 in a coherent way [Valerie Masson-Delmotte, France]	Noted
40533	87		88		Figures 2.26 to 2.29 : three case studies. Could they be put together in one figure (three panels) with text describing the case studies more explicitely? [Valerie Masson-Delmotte, France]	Taken into account. Figure 2.26 is different as it does not relate to feedbacks. Figure 2.28 & 2.29 have indeed been combined as 2 case studies as one is devoted to boreal regions and the other to tropical ones. Figure 2.27 however is a stand-alone one that is a generic figure illustrating how global and regional feedbacks are triggered.
14047	87	4			This section (2.6.3) discusses regional aspects – but tropics begin on page 88, line 27 without a new sub-section, yet high-latitudes get their own sub-section (2.6.3.2). Why is this? Also, given tropics are discussed before high-latitudes in this section, you should swap figures 2.28 and 2.29 which put boreal changes before tropics [Chris Jones, United Kingdom (of Great Britain and Northern Ireland)]	Taken into account. There is few literature on the full chain: from climate effects on land to feedbacks on climate in the literature for the tropics. Most available studies discuss either the impacts on land OR the effects of land changes on climate and those have been reported in previous sections.
24311	87	4			Section 2.6.3 and BVOC. The impact of enhanced BVOC emissions as a response to climate change is discussed in section 2.5.3.3, (e.g. Sporre et al., 2018). Since BVOC emissions change both due to alnd use change and feedbacks it might be OK to discuss the processes in section 2.5. But there needs to be at least one sentence and a cross reference in section 2.6.3 [Terje Berntsen, Norway]	Noted. We are now explicitiing, in the introduction of this section, that there are many processes that are not yet accounted for in coupled climate models and thus are not discussed in this sub-section
23625	87	23			This figure uses the term "global warming" a few times - should this all be "climate change"? [Kerri Finlay, Canada]	Noted. The effects that we're discussing are a response to warming and not to the more general climate change.
23581	87				Figure 2.27 suggests that the lines are sharper and the path analysis is confusing. [Huai Jianjun, China]	Taken into account. The figure has been redrawn and hopefully clarified.
26979	88	1	88	5	A bit confusing: browning of tropical forest decreases evapotranspiration and atmospheric humidity, ok. But why does this have opposite effects on surface warming (meaning cooling)? I understood from the former statements that decreased evapotranspiration in the Amazon leads to warming. Also the term "evapotranspiration-induced" or "snow-albedo-induced warming" seems to be used for expressing that reduced evapotranspiration or snow lead to warming (one would expect that evapotranspiration induced means that ET leads to cooling). Please check. [, Germany]	Noted. I'm not sure I understand the comment as you're referring to tropical issues while the lines and page to which your comment point to refer to boreal issues. As for tropical regions, decreased evapotranspiration indeed leads to warming, while the associated decline in atmospheric water vapor reduces the greenhouse in the atmosphere.
3401	88	6	88	6	(Hausfather et al. 2013) found -> Hausfather et al. (2013) found [Yuyu Zhou, United States of America]	I do not think this comment relates to the referred line as there is no reference to this author

Comment No	From Page	From Line	To Page	To Line	Comment	Response
663	88	6	88	8	The LAI contribution to boreal warming revealed by Forzieri et al. (2017) based on statistical regression has been criticized by a technical comment by Li et al. (2018). Li et al. (2018) show that the positive sensitivity of temperature to the boreal greening can be derived from the positive response of vegetation to boreal warming, which indicates that results from a statistical regression with satellite data should be carefully interpreted." We suggest that one may add the following sentence at the end of Line 8: "However, the conclusion from the statistical regression in the analysis of satellite observations should be carefully interpreted due to the causality between boreal vegetation growth and climate warming being hardly separated (Li et al., 2018a)." Ref: Li, Y., Z. Zeng, L. Huang, X. Lian, and S. Piao, 2018a: Comment on "Satellites reveal contrasting responses of regional climate to the widespread greening of Earth". Science, 360, eaap7950, doi:10.1126/science.aap7950. [Shilong Piao, China]	Accepted. You are correct the Forzieri et al. paper only proves correlation between warming and greening and not causality. As the paper is discussed in previous sections we have removed references to it in this section.
2599	88	9	88	9	"found"? [Wei Li, France]	Editorial. Thank you
1195	88	9	88	10	The verb is missing in this sentence. [Sebastiaan Luyssaert, Belgium]	Editorial. Thank you
973	88	9	88	10	Sentence needs rephrasing, unclear and incomplete [Tobias Rütting, Sweden]	Editorial. Thank you
3515	88	9	88	18	I think most of the effects are already explained in earlier sections. Consider removing these explanations for brevity. [Gustav Strandberg, Sweden]	Accepted. The paragraph has been removed and the citations combined with the ones discussed in 2.6.2.1.3
25359	88	12	88	13	"winter" to be replaced with "late winter" according to 2.6.3.1 page 88 line 10 and Figure 2.28. [, France]	Noted. Following another reviewer's suggestion this paragraph has been moved updards in 2.6.2.1 and merged with previous text
3185	88	19	88	19	Coupling spatial and temporal scales in one statement is a bit misleading. [, Russian Federation]	Accepted. The sentence has been revised.
29167	88	19	88	19	Something wrong with language [Jan Fuglestvedt, Norway]	Noted. The sentence however has been moved earlier in section 2.6.2.1 and combined with text on boreal regions
1197	88	19	88	20	Difficult beginning of this sentence "At the annual as at the global … ". Start the sentence with "Snow-albedo-induced warming … ". [Sebastiaan Luyssaert, Belgium]	Noted. The sentence however has been moved earlier in section 2.6.2.1 and combined with text on boreal regions
29169	88	20	88	20	Strange language: "warned the community". Please consider rewording [Jan Fuglestvedt, Norway]	Accepted. The sentence however has been moved earlier in section 2.6.2.1 and combined with text on boreal regions
1199	88	20	88	20	Check citation format (brackets should be around the years, not around the author name) [Sebastiaan Luyssaert, Belgium]	Editorial
15833	88	20	88	21	this uncertainty about the positive feedback should be said before. [Caroline Vincke, Belgium]	Accepted. The sentence and the uncertainty has been moved earlier in section 2.6.2.1 and combined with text on boreal regions
8527	88	22	88	23	The figure is not drawn in an intuitive way. Unneccessarily complicated. [Marc Aubinet, Belgium]	Accepted. The figure has been redrawn and combined with the one on tropical regions to illustrate 2 case studies as suggested by another reviewer.
29165	88	22	88	26	Fig 2.28: A potentailly useful fig but somehwta confusing. If main puprose is to show daming and amplifyng factors then at least the font should not have grey color but something more visible. Please also consdier structure and flow. [Jan Fuglestvedt, Norway]	Accepted. The figure has been redrawn and combined with the one on tropical regions to illustrate 2 case studies as suggested by another reviewer.
3187	88	24	88	26	Probably, a reference is needed. [, Russian Federation]	Noted. Your comment is echoing one from another reviewer. However as all references are cited in the text in this section as well as in 2.6.2.1 we have decided to avoid citations in the legend to limit the length

Comment No	From Page	From Line	To Page	To Line	Comment	Response
3189	88	1	89	19	Both figures include CO2 only. If any information about CH4 and N2O exists, it would by much helpful to add to the text. [, Russian Federation]	Noted. This is not what we are meant to illustrate in section 2.6. We have indeed explained that this section focuses on biophysical effects of land on climate and also on effects mediated via changes in CO2 only. Other GHG and components are dealt with in other sections.
753	89	3	89	5	Please revise. [Merja Tölle, Germany]	The comment is not very helpful as we do not know what needs to be revised.
28587	89	4	89	5	these effects are in the same direction, not opposite. The opposing effect comes from less downward radiation due to less vapor [Alan Di Vittorio, United States of America]	Noted. Yes indeed this is what we meant: less evapotranspiration ==> warming, less water vapor ==> less IR downward radiation ==> cooling. We have revised the sentence hoping to clarify it
1201	89	4	89	5	Replace "…warming in enhanced …" by "… warming enhanced …". [Sebastiaan Luyssaert, Belgium]	Editorial
15835	89	16	89	16	Please insist that this Figure 2.29 is qualitative, and about processes. [Caroline Vincke, Belgium]	Accepted. The legend of both this figure and figure 2.28 have been updated to include the term 'processes'. We believe the word 'schematic' is sufficient to explain the 'qualitative apect' of the figure
1203	89	27	89	27	Check citation format (brackets should be around the years, not around the author name) [Sebastiaan Luyssaert, Belgium]	Editorial
8533	89	28	89	31	What is the meaning of these numbers? Do they correspond to radiative forcings ? Why don't they add (antartic contribution larger than the sum of all)? [Marc Aubinet, Belgium]	Noted. There is a mixture of snow and ice albedo feedbacks in the sentence, and all numbers refer to shortwave radiative forcing. We have tried to clarify the sentence
1205	89	31	89	31	Check citation format (brackets should be around the years, not around the author name) [Sebastiaan Luyssaert, Belgium]	Editorial
975	89	15			the arrow from "Increased atm. CO2" to "Reduced precip." in misleading, as it implies a direct effect of CO2 conc. on precipitation, which is not the case. Consider redrawing figure [Tobias Rütting, Sweden]	Accepted. The figure now starts from the 'greenhouse gas induced global climate change' instead of 'increased atmospheric CO2'
3191	90	23	90	27	This offset is possible for CO2 only, not for methane that is also released by terrestrial permafrost. Suggestion: to mention this in brief. [, Russian Federation]	Accepted and corrected thank you
15837	90	31	90	31	"…magnitude of extremes such as drought and heat waves". [Caroline Vincke, Belgium]	Accepted.
475	90	35	90	42	Two newer papers that examine CMIP5 in this contact are: 3. Donat, M.G., Pitman, A.J., Angelil, O., 2018, Understanding and reducing future uncertainty in mid-latitude daily heat extremes via land surface feedback constraints, Geophysical Research Letters, 45, 10,627-10,636, 10.1029/2018GL079128. *** 1. Ukkola, A. M., Pitman, A. J., Donat, M. G., De Kauwe, M. G., & Angélil, O. (2018), Evaluating the contribution of land-atmosphere coupling to heat extremes in CMIP5 models. Geophysical Research Letters, 45, 9003–9012, doi: 10.1029/2018GL079102. [Andrew Pitman, Australia]	Accepted. Thank you we've added reference to those relevant papers
15839	90	35	90	42	This is highly relevant as water is THE limiting factor for plant growth. [Caroline Vincke, Belgium]	Noted. Thank you. What is not clear to me is whether we would like some additional text?
18111	90	35	90	42	The regions, in which soil moisture affects heat extremes might also change in the future. In particular, in Central Europe soil moisture might play an important role in the development of heat waves in the future (Seneviratne et al., 2006: Land–atmosphere coupling and climate change in Europe, Nature; Fischer et al. 2012: Changes in European summer temperaturevariability revisited, GRL) [Clemens Schwingshackl, Switzerland]	Accepted. Thank you very much for this very relevant remark. We have added a sentence to state this fact and cited the two references suggested

Comment No	From Page	From Line	To Page	To Line	Comment	Response
23901	90	43	90	45	A related study may be cited here. Ramarao et al. (2015) revealed that the land surface response to the post 1950s anthropogenically induced decreases in summer monsoon precipitation and soil moisture is associated with significant reduction in evapotranspiration over the Indian land region. A future climate projection based on RCP4.5 scenario indicated the possibility for detecting the summer-time soil drying signal over the Indian region during the 21st century in response to climate change. (Ramarao, M.V.S., Krishnan, R., Sanjay, J., and Sabin, T. P., 2015, Understanding land surface response to changing South Asian monsoon in a warming climate, Earth Syst. Dynam., 6, 569–582, doi: 10.5194/esd-6-569-2015). [, India]	Rejected. The paper referred to does not discuss potential amplification of the monsoon system via decreased soil moisture but points to a correlation between soil moisture and monsoon intensity, both being forced by changes in anthropogenic GHG and land-use changes. We thus feel it is not relevant for this sub-section
19013	90	43	90	45	Additional reference may be cited: Ramarao et al. (2015) revealed that the land surface response to the post 1950s anthropogenically induced decreases in summer monsoon precipitation and soil moisture is associated with significant reduction in evapotranspiration over the Indian land region. A future climate projection based on RCP4.5 scenario indicated the possibility for detecting the summer-time soil drying signal over the Indian region during the 21st century in response to climate change. (Ramarao, M.V.S., Krishnan, R., Sanjay, J., and Sabin, T. P., 2015, Understanding land surface response to changing South Asian monsoon in a warming climate, Earth Syst. Dynam., 6, 569–582, doi: 10.5194/esd-6-569-2015). [Sanjay Jayanarayanan, India]	Rejected. The paper referred to does not discuss potential amplification of the monsoon system via decreased soil moisture but points to a correlation between soil moisture and monsoon intensity, both being forced by changes in anthropogenic GHG and land-use changes. We thus feel it is not relevant for this sub-section
6291	90	46	90	46	"Such feature" -> "Such a feature" [Tristan Quaife, United Kingdom (of Great Britain and Northern Ireland)]	Editorial
15841	90	49	90	50	For forests please insist here about the increasing vulnerability to climate extremes and real risk of loss of resilience, legacy effects etc. [Caroline Vincke, Belgium]	This is something that needs to be discussed in section 2.3 as this is where we discuss how climate change affects land
11693	91	5	91	27	https://doi.org/10.1007/s00382-015-2752-5 focuses on remote responses to Amazon deforestation; teleconnections to other parts of the Americas and Africa are significant, and depend on the distribution of deforestation. Use of a fully coupled climate model is a unique aspect of this study, which also showed changes in El Niño statistics as a result of large-scale Amazon deforestation. [Paul Dirmeyer, United States of America]	Taken into account. The reference has been included thank you.
477	91	6	91	13	There is not robust evidence of remote impacts from land use change. There is evidence from models for it, and evidence form models against it. See Lorenz, R., A.J. Pitman, and S.A. Sisson, 2016, Does Amazonian deforestation cause global effects; can we be sure?, J. Geophysical Research, 121, 5567-5584, doi:10.1002/2015JD024357. I would further note that where we have evidence of remote impacts, the scale of the pertubation used to generate that impact is not plausible. [Andrew Pitman, Australia]	Accepted. The section has been revised. Confidence is now only found for neighbouring regions and not for very remote areas.
1207	91	6	91	13	Consider mentioning the work of Winckler et al 2017 (doi/10.1175/JCLI-D-16-0067.1) [Sebastiaan Luyssaert, Belgium]	Rejected. This paper does not really fit in this section about teleconnections although it talks about non-local effects.
15843	91	9	91	10	Ellison et al. 2017, Keys et al. 2012 [Caroline Vincke, Belgium]	Taken into account. Thank you for the references (even if hard to find as you did not provide the full reference). Ellison (2017) is not useful in this specific context as it does not discuss teleconnections at length. It does however provide useful literature. Keys (2012) is now being cited
29171	91	11	91	13	the sentence "Evidence…." is confusing [Jan Fuglestvedt, Norway]	Taken into account
8535	91	11	91	13	Awkward writing. [Marc Aubinet, Belgium]	Taken into account
11573	91	12	91	12	could you introduce full stop after worldwide [Lawrence Aribo, Uganda]	Taken into account. Thank you.

Comment No	From Page	From Line	To Page	To Line	Comment	Response
26981	91	21	91	21	We suggest adding another reference ("Ringgaard et al. 2014"): Ringgaard R, Herbst M, Friborg T (2014) Partitioning forest evapotranspiration: Interception evaporation and the impact of canopy structure, local and regional advection. Journal of Hydrology 517, 677-690. [, Germany]	Rejected. This paper does not discuss how a specific forest influences its neighbours but how it is influenced by them. It is thus not the purpose of our section.
1209	91	33	91	33	Check citation format (brackets should be around the years, not around the author name) [Sebastiaan Luyssaert, Belgium]	Editorial
11575	91	41	91	42	Which format: In (Cowling et al. 2009) or In Cowling et al. (2009) and In (Laguë and Swann 2016) or In Laguë and Swann (2016) [Lawrence Aribo, Uganda]	Editorial
11577	92	19	19	21	The statement seems not to be comple/clear towards the end and the flow is not well linked to beginning of page 93 [Lawrence Aribo, Uganda]	Editorial
479	92	10	92	10	I would recommend the authors examined this paper to see if the methodology and statistics used to reach this concludion were robust. I am very unhappy with an IPCC report providing details on a single paper and saying "if the results are robust". Well, the authors of Chapter 2 are world class. It is not the task of the authors to REVIEW, it is the task to assess. If your assessment is this is robust sceince then say so, if it is not robust it should not be included. [Andrew Pitman, Australia]	Taken into account. Statistics have been checked and the meteorological mechanisms to explain those changes are realistic. In any case this does not contribute to increase the confidence statement.
11695	92	10	92	16	Irrigation is its own unique climate change driver, deserving of its own section: for starters: https://doi.org/10.1029/2010JD014122 https://doi.org/10.1007/s00382-011-1252-5 https://doi.org/10.1175/JHM-D-13-078.1 https://doi.org/10.1175/JHM-D-12-079.1 https://doi.org/10.5194/hess-19-4547-2015 and references therein. [Paul Dirmeyer, United States of America]	Noted. You're correct and there is an entire section devoted to irrigation (now it's a cross-chapter box). However there is also a need to cite this paper in this subsection and it explains how the combined effects of afforestation and irrigation and transported downwind
1211	92	18	92	18	Check citation format (brackets should be around the years, not around the author name) [Sebastiaan Luyssaert, Belgium]	Editorial
8537	92	22	92	22	figure 2.31 [Marc Aubinet, Belgium]	Taken into account. Thank you.
2601	92	22	92	22	Figure 2.31? [Wei Li, France]	Taken into account. Thank you.
1213	92	23	92	23	Consider mentioning the work of Garcia et al 2016 (doi/10.1371/journal.pone.0165042) [Sebastiaan Luyssaert, Belgium]	Taken into account. The reference has been included thank you.
29173	93	6	93	6	Strange language: "warned the community". Please consdier rewording [Jan Fuglestvedt, Norway]	Taken into account. The sentence has been revised thank you.
481	93	11	93	11	Quesada produced a nice paper but it did not tackle the caveats in Lorenz. You do not get robustness in this way. It may very well be that Quesada believe there are teleconnections from biophysical changes, but there are other papers - many other papers that do not find this. You need to be balanced in my view until there is a consensus. Quesada used 5 climate models and did not test for model independence. They used student t-tests with account for autocorreeation but not field significance. It is a nice study, but it does not resolve the problem that if you apply field significance tests you do not find remote impacts from biophysics. [Andrew Pitman, Australia]	Accepted. The section has been revised and the paper cited for a different purpose.
34067	93	20	93	21	In this strangely labelled section, a wide range of response options are presented/. The section is labelled "climate consequences of …." but it largely deals with GHG mitigation potentials, just like also chapter 5 and 6. [Elke Stehfest, Netherlands]	Accept with modifcation. Most of the impacts of the response options in the literature focus on greenhouse gases. We do have biophysics consequences as well , but thse are covered in more detail in section 2.6. We have edited to thext to make sure we make these references clear.
25361	93	20	93	21	We suggest to use "options" or “land-based options” instead of "response options" in order to avoid a confusion with the term "response measures" used in the climate negociations. [, France]	reject, we appreciate the comment but the terminoogy has been decided across chapters. The main thing is we make clear in the text what the options are. "Repsosne " is because they are in reposnse to co,aitme chang e and it enables us to refer to them in short hand as "response options". We have avoided the term "measures" to avoid confusion with negotiations.

Comment No	From Page	From Line	To Page	To Line	Comment	Response
17129	93	23	93	24	Why should climate mitigation in the land sector be limited to reduce GHG emissions, enhance GHG removals and protect or enhance carbon stocks ? Why not considering land albedo management as a serious strategy for climate mitigation (see previous comments and references to Akbari et al. 2009 ; Davin et al., 2014 ; Carrer et al., 2018...) ? [Eric Ceschia, France]	Accept, text deleted
38847	93	32	93	33	"The Paris Agreement requires reaching a 'balance between anthropogenic emissions by sources and removals by sinks of greenhouse gases'." Be careful in framing UNFCCC or Paris Agreement language. The Paris Agreement does not "require" that a balance of emissions and removals be reached. It sets a goal of Parties undertaking rapid reductions in emissions so as to achieve a balance of emissions and removals in the second half of the century. Full quote: "In order to achieve the long-term temperature goal set out in Article 2, Parties aim to reach global peaking of greenhouse gas emissions as soon as possible, recognizing that peaking will take longer for developing country Parties, and to undertake rapid reductions thereafter in accordance with best available science, so as to achieve a balance between anthropogenic emissions by sources and removals by sinks of greenhouse gases in the second half of this century on the basis of equity, and in the context of sustainable development and efforts to eradicate poverty." [, United States of America]	Accept, text modified
6605	93	32	93	35	Achieve a balance between anthropogenic emissions by sources and removals by sinks of greenhouse gases, which is why it is extremely important to emphasize which activities generate the most emissions. [, Mexico]	Acpet but not sure what change is being requested, 2.4 lays out which activities generate GHG emissions and here we give the potentail of different options
25363	93	32	93	36	It is wrong to claim or suggest that the balance objective of the Paris Agreement, referred to in Article 4.1, is designed to "offset irreducible emissions" and it is even more wrong to believe that emissions associated with air transport are emissions that are difficult to reduce. [, France]	Accept, text deleted
7611	93	32	93	39	Is direct air capture (DAC) not mentioned? If so, probably worth mentioning that the reason it's not mentioned is due to its light land footprint. [Kristin Campbell, United States of America]	Accept, added text
6293	93	33	93	33	"emission" -> "emissions" [Tristan Quaife, United Kingdom (of Great Britain and Northern Ireland)]	editorial, text deleted
2603	93	33	93	33	"emissions" [Wei Li, France]	editorial, text deleted
8539	93	34	93	34	This sentence let me uncomfortable. Why, air transport is chosen as an example of emission hard to eliminate while our efforts should first focus on this (to set a tax on kerosen)? I have the feeling that, by this sentence, we give a green light to governments and say: "OK let continue to emit CO2 by air transport, we will mitigate this with our mitigation options." [Marc Aubinet, Belgium]	Accept, text deleted
8541	93	37	93	37	"this" not "his" [Marc Aubinet, Belgium]	editorial, text deleted
3279	93	37	93	37	Spellnig error of this (his) [Viola Heinrich, United Kingdom (of Great Britain and Northern Ireland)]	editorial, text deleted
2605	93	37	93	37	"this" [Wei Li, France]	editorial, text deleted
18147	93	37	93	39	Please discuss whether there are other technical options for CDR that are not included in the discussion here (e.g. direct air capture with CCS), and how these might influence the conclusions. Please give a reason, why these other options are not included in the discussion. [Astrid Schulz, Germany]	Accept, added text to explain that this is the land report so only deals with mitigation options in the land sector

Comment No	From Page	From Line	To Page	To Line	Comment	Response
40535	93		93		Repetition / framing / Paris Agreement. Place this in one chapter section (Chapter 1?) and refer to it. [Valerie Masson-Delmotte, France]	Accept but there is some need to mention the Paris Agreement where it is in the context of what we are trying to do here . however removed text related to the balance and why we need NETs. Kept mention of Paris and NDCs as it explains why we have the last section.
22521	93	22	94	9	This introduction can be reduced in length [Anastasios Kentarchos, Belgium]	Accept, text shortened
7387	93	20	103	11	Exaclty the same comment as the above. This section risks irresponsible acceptance of analytical methods that may lack the dominant processes that shape their conclusions . The conslusions about available land for forestry and BECCS need to better reflect the agricultural and behavioral-econometric literatures of these topic, which are inadequately wieghted and inadequately reviewed. [Stephen Pacala, United States of America]	Accepted
14131	93	20	112	7	Page 93, line 33, "emissions" not "emission". Page 94, line 32, inset "?" after "otherwise" and a comma between """ and "for example". Page 94, line 41, insert comma between "changes" and "for example". Page 95, line 3, missing date for "Roe et al." reference, and note that elsewhere this reference is listed as "Roe et al. (2018)" and "Roe et al. (In press)". Page 96, line 1, replace full stop between "economic" and "Social" with a comma, and replace "Social" with "social". Page 96, lines 2, 4 and 6, why suddenly the need for quotation marks? Page 96, line 13, I think "negative emissions technologies" have previously been shortened to "NETs" in the report. Page 96, lines 20 to 35, there are seveal abbreviations (e.g. C, OM, SOC) in this paragraph that have not previously been defined. Also note that "C" and "carbon" are used in the same sentence (lines 20-21). Page 98, lines 44 to 46, here we have a different style of references yet again, there is no commma or space after "agreement" and the parentheses do not balance. Page 99, line 3, parentheses should both be around "2018b". Page 99, line 8, space missing between "agreement)" and "(Houghton". Page 100, line 3, should be "agreement", and there should be a space following "agreement". Page 100, line 4, delete ")" after "livestock". Page 100, line 7, "2" in "N2O" should be subscript, and should be a space between "N2O and "(Mutuo". Page 100, lines 12 to 17 - sentence does not make sense. Page 100, line 17, I do not see the logical link between the two sentences, and therfore do not see how "Therefore" can be used. Page 100, line 20, missing word "occur" between "may" and "in"? Page 100, lines 25-26, meaning of sentence is unclear. Page 100, line 44, "placeholder" statement needs addressing. Page 103, line 1-, I note that references from here on include a comma between the surname and the date, which is inconsistent compared with previous practice. Page 103, line 9, replace "Zilberman, 2017)" with "Zilberman 2017;". Page 103, lines 12-13, "placeholder" statement needs addressing. Page 103, line 30, replace "warmer conditions occurs" with "warmer conditions occur". Page 104, line 2, "Harper et al. (2018)" rather than "(Harper et al. 2018)". Page 107, line 4, presumably should read "see chapters 6 and 7" (wiithout the closing parentheses that follow). Page 107, line 19, "except" rather than "expect". Page 109, line 12, substitute "of GHG emissions" for "or GHG emission". Page 111, line 23, why define the abbreviated form "NDC" here when the abbreviation is used in the previous paragraph? Page 111, line 30, "Paris Agreement" rather than simply just "Paris". Page 112, lines 5-7 - this text looks like it should be part of the caption for Figure 2.38. [David Taylor, Singapore]	Accept
1515	93	20	112	7	Subchapter 2.7 is truly excellent, maybe with the exception of 2.7.3.2, which is still sketchy [Oliver Geden, Germany]	Accept, this section has been updated.
1217	94	24	92	33	Rewrite this paragraph. The take home message of this paragraph is not clear. Its starts with land cover and ends with substitution. Probably too many issues are being discussed in a single paragrpah. [Sebastiaan Luyssaert, Belgium]	Accept , text modified and counter factual text separated

Comment No	From Page	From Line	To Page	To Line	Comment	Response
38849	94	11	94	33	Section 2.7.1 needs more citations of findings. Searchinger et al. (Nature 2018) showed that LUC to bioenergy crop analyses don't account for opportunity cost. Their new index calculates which changes help or hurt the attempt to simultaneously mitigate climate change while meeting food needs, and they found that most biofuels double to triple emissions over more than 30 years. Ref: Searchinger, T.D., S. Wirseneus, T. Beringer, P. Dumas. 2018. Assessing the efficiency of changes in land use for mitigating climate change. Nature 564: 249-253. [, United States of America]	Accepted
38851	94	11	94	33	Conversion of non-food grass crops to native forests that were there ~100 years ago showed increased net ecosystem carbon balance, with co-benefits of significant reduction in irrigation and improved biodiversity of forest species. Deforestation over the past 100 years in the area has reduced native forests by 80%. This analysis compared simulations informed by observations of current soil and plant biomass and physiological parameters compared with simulations of regrowing native forests. REF: Law, B.E., T.W. Hudiburg, L.T. Berner, J.J. Kent, P.C. Buotte, and M. Harmon. 2018. Land use strategies to mitigate climate change in carbon dense temperate forests. Proc. Nat. Acad. Sci. 115(14):3663-3668. https://doi.org/10.1073/pnas.1720064115 [, United States of America]	Specific to forest section not here
1215	94	13	94	22	Add citations to the scientific literature on the topic. [Sebastiaan Luyssaert, Belgium]	Citation added
11579	94	16	94	16	is it subsidence farming or subsistence farming [Lawrence Aribo, Uganda]	editorial, text now deleted
22523	94	17	94	22	it is not only sensitive to agricultural intensification, but also to demand for agricultural produce [Anastasios Kentarchos, Belgium]	editorial, text now deleted
29841	94	18	94	22	Need references to support this assumption [Souparna Lahiri, India]	reference added
21039	94	19	94	21	The text rightly emphasized that "estimates of mitigation potential are very sensitive to assumptions about future agricultural intensification (high crop yields, intensified pasture management and livestock production systems may decrease the need for agricultural expansion and in consequence free up more land for mitigation)". However the discussion is not finished as various options that have been presented as relevant are not discussed, e.g. "shift in diets" beyond healthiness of the diets (various publication analyse the impact of various diets such as vegetarian/vegan or the consumption of "meat" produced in lab, insects,... . Other options such as vertical farming are also not mentionned while it would have been useful to review them (even if their potential to reduce the land consumption for food production might be very limited). While those subject are partially dealt with within chapter 5, clear cross-references should at least be included. Relevant sources include: Alexander, P., Brown, C., Arneth, A., Dias, C., Finnigan, J., Moran, D., & Rounsevell, M. D. (2017). Could consumption of insects, cultured meat or imitation meat reduce global agricultural land use?. Global Food Security, 15, 22-32. Specht, Kathrin, et al. "Urban agriculture of the future: an overview of sustainability aspects of food production in and on buildings." Agriculture and human values 31.1 (2014): 33-51. [, United Kingdom (of Great Britain and Northern Ireland)]	Accept with modification: diet change is dealt with, vertical farming is not. More detaisl are in chapter 5
6607	94	20	94	22	Describe in a clearer way since the idea is confusing [, Mexico]	Accept , text modified
15845	94	22	94	22	"...approaches to land protection or restoration, natural ecosystems health and productivity,..." [Caroline Vincke, Belgium]	Accept , text modified
1219	94	24	94	33	Add citations to the scientific literature on the topic. [Sebastiaan Luyssaert, Belgium]	Accepted with modification, made it clear this text related to differences between estimates included in fig 2.32

Comment No	From Page	From Line	To Page	To Line	Comment	Response
1277	94	25	94	35	Add citations to the scientific literature on the topic. [Sebastiaan Luyssaert, Belgium]	Accepted with modification, made it clear this text related to differences between estimates included in fig 2.32
38853	94	27	94	27	The spatial scale of activity and assessment is also an important consideration. [, United States of America]	Accept , text modified
755	94	32	94	32	Please revise. [Merja Tölle, Germany]	Accept , text modified
1221	94	35	94	38	Rewrite this paragraph. The take home message of this paragraph is not clear. I fail to see the flow of this section. [Sebastiaan Luyssaert, Belgium]	Accept with modification, text deleted
38855	94	40	94	44	Paragraph is out of place. It doesn't seem to relate to the preceding discussion. [, United States of America]	Revised
1223	94	40	94	44	Rewrite this paragraph. The take home message of this paragraph is not clear. I fail to see the flow of this section. [Sebastiaan Luyssaert, Belgium]	Revised
1225	94	40	94	44	Add citations to the scientific literature on the topic. [Sebastiaan Luyssaert, Belgium]	Citation added
337	94	43	94	44	This last line does not make a lot of sense. Needs to be clarified. [Brent Sohngen, United States of America]	accept last sentence deleted
38857	94	43	94	44	This last line does not make a lot of sense. Needs to be clarified. [, United States of America]	accept last sentence deleted
5363	94	11	96	17	This text is not as comprehensive, condensed and well-referenced as the text in an assessment report needs to be. It must be much more strongly underpinned by an assessment of the larger literature than it is now. [Helmut Haberl, Austria]	Accept, have tried to improve text
4093	94	11	96	17	Fig 2.32 is good on the mitigation potential. But how does this compare to the "REDUCTION demand" ? What if all actions are put in place at full capacity? Which are the priorities? Scenarios as discussed in 2.7.2 are interesting. Positive storyline should have some anticipation. And, is it tied with the later statement "Land-based response options could provide a third of the mitigation needed in the near term (2030 to 2050) 30 to close the gap between current policy trajectories and what is required to achieve the Paris targets 31 (medium evidence, high agreement)."?? [Turi Fileccia, Italy]	Accept with modification, Fig 2.32 does already have reduction in demand side measures, assumign that is what is meant by "reduction demand`", and there is text on this. Its not possible to put all in palce together, again there is already text that explains these are not additive, but new text makes this very clear. priorities are regionally dependent and dependent onother things that are cosnidered in e.g. chapters 6 and 7. By looking at the figure the reader can see which options can make the most difference. Will emphasise in new text about regionality and other considerations. I am not sure what is meant by "positive sotryline should have some anticipation". Section 2.7.2 seals with combined otpsions and priprities accroding to different storylines. Modified text itn eh introduction to this section to make this more clear.
4043	94	11	96	17	In this section you could reference the work of Harper et al. (2018), who has used the results of IAMs in order to evaluate the spatial tradeoffs of BECCS and afforestation, indicating the locations where each technology could offer the highest migitation potential. This is an important advance in the understanding of the tradeoffs and spatial characteristics of different CDR. Furthermore, it aims to solve the issue you mention on page 95 line 11 stating that different potentials may not be additive. References: Harper, A., Powell, T., Cox, P., House, J., Huntingford, C., Lenton, T., Sitch, S., Burke, E., Chadburn, S., Collins, W., Comyn, E., Daioglou, V., Doelman, J,. Hayman, G., Robertson, E., van Vuuren, D.P., Wiltshire, A., Webber, C.P., Bastos, A., Boysen, L., Ciais, P., Devaraju, N., Jain, A.K., Krause, A., Poulter, B. & Shu, S. Land-use emissions play a critical role in land-based mitigation for Paris climate targets. Nature communications 9, dio: 10.1038/s41467-018-05340-z (2018). [Vassilis Daioglou, Netherlands]	Accept with modification, we have referenced Harper later in this section

Comment No	From Page	From Line	To Page	To Line	Comment	Response
34063	94	11	104	21	Section 2.7.1: I am increasingly puzzled by the many places at which the mitigation potential of respeonse options is discussed (see also other remarks), it is in Chapter 1, 2, 5 and 6. With no clear distinction. [Elke Stehfest, Netherlands]	Accept with modification. Chapter 2 is the main place where mitigation ptientail is highlighted, chapters 3,4,5 have sectoral details and chapter 6 usees the poitentails highlighted here and talks about trade-offs and syenrgies. Have tried to make this clear in introduction. This was the stricture given to us in the scoping.
34065	94	11	104	21	The structure of 2.7.1 is extremely confusing and wrong. Within the section 2.7.1.2. "Cropland, grassland and livestock management options" further fith-level subsection deal with e.g. dietary change, forest management, all not part of the title. Why e.g. is the diet mitigation potential at all summarized in a confusing labelled sub-section structure, not even using the word "potential". [Elke Stehfest, Netherlands]	Accept, there is some mistake, these should not be sub sub sections, this was a problem that occurred in formatting the whole chapter
16195	94	12			At the end of title, 2.7.1 …… for climate mitigation, change to: 2.7.1 …….. for climate change mitigation and adaptation [Hamidreza Solaymani Osbooei, Iran]	Accept with modification title, shortened and does not mention mitigation
16849	94	12			At the end of title, 2.7.1 …… for climate mitigation, change to: 2.7.1 …….. for climate change mitigation and adaptation. Then, the revised subtitle has to add some drafted material related to climate change adaptation options at global scale. For example, UNCCD technical report No22 (https://www.unccd.int/sites/default/files/documents/2017-09/UNCCD_Report_SLM_web_v2.pdf) was explained the various adptation option based on Sustaianable Land Management (SLM). [Hamidreza Solaymani Osbooei, Iran]	Accept with modification. Shortened the title to remove adaptation. But also note, this section does not deal with climate adapation per se but impact of mitigationa and adaptation on cliamte where it has a direct impact, so if its just adpatation with no effect on claimte then its not included here. This is made clear in the introduction
23627	94	16			"subsidence" should be "subsistence" [Kerri Finlay, Canada]	editorial, text now deleted
8543	95	1	95	1	This figure refers to a paper that is (to my knowkedge) presently not published... This questions its relevance. [Marc Aubinet, Belgium]	accept with modifcation paper not published but figure updated and modified directly for this report and all the data included in it is published
8545	95	1	95	1	As a collateral damage, the references on which the numbers are based are not available. It is thus impossible to check their origin. [Marc Aubinet, Belgium]	Accept, they were included in the version submkited but got lost in formatting
8547	95	1	95	1	The figure gives mitigation potential but do specify neither how much time it is necessary for the measure to become efficient not for how much time they could remain efficient ? As an exemple for reforestation :"the effectiveness of using this land as a long-term carbon sink will be contingent on its ability to sustain a permanent carbon sink. In the long term, the ability of forests to sequester carbon declines with age." (Baldocchi and Penuelas 2018, Glob Chang Biol. 2018 Dec 27. doi: 10.1111/gcb.14559.) [Marc Aubinet, Belgium]	Agree, new version of figure gives time line
33385	95	1	95	4	BECCS is unproven at scale and only exists in pilot form, so saying its technically feasible, especially at the scale presented in the graphic, is incorrect. [Kelly Stone, United States of America]	Accept with modification - numbers are based on published peer review reference, included in 1.5 report, ranges are now better described. Discussions of CCS and caveats were included in the SR1.5, this report focuses on the land implications and caveats.
26983	95	1	95	9	Figure 2.3.2 is very useful. It however refers to the entire mitigation contribution of measures, without differentiating between reduced emissions and sequestration/CO2 removals. Since Section 2.7.1 does offer such differentiation in many cases, it would be helpful to also reflect on sequestration/removal potential in this figure. Also it is unclear why cleaner cook stoves do not fall under demand side measures. If we understand correctly, cleaner and more efficient cook stoves would reduce the demand for biomass. It would help if there was more clarity in the caption text as to how categories were assigned. Please see our comments on this same figure in the SPM. [, Germany]	Accept with modification, categories newly arranged

Comment No	From Page	From Line	To Page	To Line	Comment	Response
26985	95	1	95	9	The references given in the figure have not been given. If this figure has been taken from another publication, please provide the correct citation, else add the references. Please see also our comments on the same figure SPM.6. [, Germany]	Accept, references added in new version
30135	95	1	95	9	It should be indicated for what period the mitigation potentials apply since most options can apply only for a limited period of time. It is also not easy or even impossible to derive this from the main text. [, Netherlands]	Accept, clarification added in new version
15847	95	2	95	2	Very skeptikal about the use of this Figure 2-32. Needed to have a Warning note before indicating i) that the options can not be compared per se, because they rely on potential based on actual land use? ii) it focuses only on GtCO2 and not on the positive/negative feedbacks one option may have on ecosystem services, global circulation fluxes etc. Plus it does not say anything about the time to obtain the effect since the implementation, nor about the intensity of the implementation needed to have an effect. [Caroline Vincke, Belgium]	Accept - the text is celar that options cannot be compared and are nto additive, but now made it explcitly related to this figure, timelines clarified
38859	95	2	95	9	Not clear on what Roe et al. constitutes. Is it a metaanalsis of various studies? A modeling exercise in itself? Need more discussion on what is behind the values in this chart. [, United States of America]	Accept with modification, reference to Roe deleted
38861	95	3	95	3	Year of Roe et al. publication? Same on page 99. [, United States of America]	accpet, reference deleted
6295	95	3	95	3	Roe et al reference missing year. Presumably because it is in prep. Also elsehwere in document. [Tristan Quaife, United Kingdom (of Great Britain and Northern Ireland)]	accpet, reference deleted
1379	95		95		Mitigation potential cannot be simply averaged across independent studies. Round symbols indicate, probably, means, which have no any sense, since studies have different methods, locations, durations, study designs and so on. These methodological differences obviously determine the variation in results. This figure must be presented as values (dots) for each study or ranges, but no means. [Elena Valkama, Finland]	Accept with modifcation, this was not a simple average, but in ancy case the figure is redrawn sowiing individual estiamtes
21041	95	10	96	8	This paragraph describes the very different assumptions underpinning the literature which is presumably summarised in Figure 2.32. It would be more helpful if this body of literature were critically assessed and those papers making unrealistic assumptions were excluded. For instance, "some include biophysical or resource constraints" (rows 1-2) implying the others do not; what is the point of including these others? Addressing this point may also require changes to Figure 2.32 which is not referenced in the text. When this has been done the results should be compared with the statement on p.21 rows 8-9 of the SPM. [, United Kingdom (of Great Britain and Northern Ireland)]	Accept with modification, the figure now makes clear which estiamtes include which types of potentail, someof th emore unrealistc numbers are excusded for the ranges we settle on in the text below, the fig is referenced int eh text and numbers have been aligned with the SPM
23629	95	1			I disagree with the use of the term "healthy" in reference to diets. I think this is a loaded term. Shift to plant-based is more accurate. [Kerri Finlay, Canada]	Rejected, this is a widely used term
23631	95	1			the * is never defined in the figure legend [Kerri Finlay, Canada]	Accept, figure modified
23633	95	1			please specify whether the point on each line is the mean or the median of the estimates. [Kerri Finlay, Canada]	Accept, figure modified
977	95	1			the figure is not referred to in the text [Tobias Rütting, Sweden]	Accept,references added in new version

Comment No	From Page	From Line	To Page	To Line	Comment	Response
25365	95	2			We believe that this figure is relevant and justified, but we consider that it is currently subject to several defects: • We suggest producing a new figure based on the findings of the SRCCL rather than using an existing figure from an isolated scientific article. • We suggest to improve consistency between Figure SPM-6 page SPM-20 (also Figure 2.32 page 2-95) and Figure SPM-7 page SPM-23 (also Figure 5.14 page 5-69) and to clarify the information you wish to provide with these figures. Considered together, these figures are currently very confusing. • As a consequence of this copy and paste, neither in the report, nor in the SPM are given the details of what the references in the right column refer to. This situation should be corrected either by adding in the report the detail of the practices behind each proposed measure; or by deleting these numbers and providing a brief detail, with a clear reference to where in the report detail is find; or by explaining in the caption where the references numbers in the right column could be found. This is all the more important because the policy makers who would use this report, would need to have the IPCC findings without any confusion on the meaning behind "cropland management", "pasture management", "rice", enteric fermentation" and all other agricultural measures. • We suggest to use "mitigation options" instead of "mitigation response options" in order to avoid a confusion with the term "response measures" used in the climate negotiations. • We suggest checking the occurrence of the BECCS, currently quoted both in supply side measures and in land use change, leading to uncertainty in the accounting of potentials. • We suggest to explicitly write that the lines under land-use change, carbon sink enhancement and agricultural measures are a disaggregation of the lines under demand side and supply side demand, if it's really the case. • The list of options under the item "Land use change / Supply side measures" is not consistent: deforestation is a human action while wetlands and savannah are land types. We suggest to split and clarify this list as it is under the item "Land use change, carbon sink enhancement...". • We suggest to put "Cleaner cookstoves" under the item "Demand side measures". • See GENERAL COMMENT ON BIOCHAR. See also GENERAL COMMENT ON FIGURES. [, France]	accept, new figure created and aligned with figure SPM3
6995	95				Fig 2.32: Brilliant figure! The only problem is that A/R and BECCS are defined after they are first mentioned in the figure. [Debra Roberts, South Africa]	Accept, figure modified
21043	95				Figure 2.32 is not referenced in the text. Does it include all the categories of literature described in the next paragraph? What is the significance of the asterisks? [, United Kingdom (of Great Britain and Northern Ireland)]	Accept, figure modified
8549	96	1	96	1	incomplete sentence [Marc Aubinet, Belgium]	Accept text modified
757	96	1	96	1	Change full stop to comma after economic. [Merja Tölle, Germany]	editorial, done
3283	96	1	96	1	Roe et al. YEAR/InPress? [Viola Heinrich, United Kingdom (of Great Britain and Northern Ireland)]	Accepted, reference deleted
2607	96	1	96	1	which year? [Wei Li, France]	Accepted, reference deleted
1801	96	1	96	1	No year for Roe et al. Later, in L. 13, you write “in press”. Check elsewhere in text. [William Lahoz, Norway]	Accepted, reference deleted
15347	96	1	96	17	Suggest the discussion of mitigation at different carbon prices be included as a separate sub-section. Currently it does not have much prominance at the end of a large section. [, Australia]	Accept with modification, costs are discussed in chapter 6

Comment No	From Page	From Line	To Page	To Line	Comment	Response
38863	96	1	96	17	This discussion is muddled and hard to follow, and doesn't give an accurate description of some of the studies listed. For example Griscom et al. don't actually do any modeling, but gather information from a variety of other studies, comparing results from different modeling exercises without explaining how the results differ and which are stylized to avoid conflicts with food production and which are not, which is a problem. It would be better/stronger here to cite the actual work that Griscom et al. seek to reflect. And should include studies that generate cost esimates for LU mitigaiton responses like Sohngen and Mendelsohn (American Journal of Agricultural Economics, 2003); Kindermann et al. (PNAS; 2008); Golub et al. (PNAS, 2012); Favero et al. (Climatic Change, 2017); Baker et al. (Energy Policy online in 2018). [, United States of America]	Revised
29175	96	10	96	10	What is "they" refering to? [Jan Fuglestvedt, Norway]	Accept, text modified
1803	96	10	96	10	Who are “they”? [William Lahoz, Norway]	Accept, text modified
1227	96	10	96	11	Replace "They" by a clear reference to the work this sentences refers to. [Sebastiaan Luyssaert, Belgium]	Accept, text modified
1229	96	10	96	11	I suspect this sentence should be deleted as there is no discussion of the importance of these two prices. [Sebastiaan Luyssaert, Belgium]	reject: the relevance of the two prices is cleary stated in the text
28589	96	10	96	17	is this part of the preceding paragraph? If so, bring us back to the point [Alan Di Vittorio, United States of America]	Accept, text modified
339	96	10	96	17	As noted elsewhere, should include studies that have developed cost estimates for the various forestry land use options, including: Those studies include Sohngen and Mendelsohn (American Journal of Agricultural Economics, 2003); Kindermann et al. (PNAS; 2008); Golub et al. (PNAS, 2012); Favero et al. (Climatic Change, 2017); Baker et al. (Energy Policy online in 2018). [Brent Sohngen, United States of America]	accept with modification chapter 6 deals with costs, but have passed the references on
38865	96	10	96	17	Should include studies that have developed cost estimates for the various forestry land use options, including Sohngen and Mendelsohn (American Journal of Agricultural Economics, 2003); Kindermann et al. (PNAS; 2008); Golub et al. (PNAS, 2012); Favero et al. (Climatic Change, 2017); Baker et al. (Energy Policy online in 2018). [, United States of America]	accept with modification chapter 6 deals with costs, but have passed the references on
985	96	10	96	17	why is this part included if no conclusions/results from the reviewes are presented here? Just mention that they exist is unsatosfactory. Either remove, or add and discuss the ourcome of those reviews [Tobias Rütting, Sweden]	accept with modification, some of the results from these is presented in text below on single options
1231	96	22	96	22	Replace "...use(Six...) by "... use (Six ...)" [Sebastiaan Luyssaert, Belgium]	editorial, done
6297	96	22	96	22	Missing space before parenthesis [Tristan Quaife, United Kingdom (of Great Britain and Northern Ireland)]	editorial, done
3281	96	22	96	22	Add space "use(" --> "use (..." [Viola Heinrich, United Kingdom (of Great Britain and Northern Ireland)]	editorial, done
24201	96	31	96	31	Fungi are also microbiota. Do you mean "bacterial and fungal". Or just "microbial"? [Maria Luz Cayuela, Spain]	accept, deleted fungal
22525	96	32	96	33	The point is not so much that the sink is finite, but that it is greatly reversible and affected by climate [Anastasios Kentarchos, Belgium]	accept, added text on reversibilty
24203	96	32	96	35	This sentence is misleading. Since C sequestration potential of soils is uncertain and may decline, we should not consider it? It should be stated more clearly that soils as sinks are not the only solution, That a decrease of CO2 emissions from other sources is absolutely necessary and soils can not be taken as an excuse to keep on emitting CO2. [Maria Luz Cayuela, Spain]	Reject: we should consider it as important not only for mitigation but also adpatation and othe recosystem services. Not being taken as an excuse to keep emitting

Comment No	From Page	From Line	To Page	To Line	Comment	Response
21045	96	32	96	44	The discussion surprisingly omits the significant role improved animal health can play: Mortality and morbidity contribute to excess emissions not just through compromised performance, but also a requirement for a larger unproductive follower herd to replace fallen stock. A detailed analysis can be found here: http://sciencesearch.defra.gov.uk/Default.aspx?Menu=Menu&Module=More&Location=None&Completed=0&ProjectID=17791 and https://www.climatexchange.org.uk/media/2031/livestock_health_and_ghg.pdf [, United Kingdom (of Great Britain and Northern Ireland)]	Noted, this section has been cut due to space limitations
26987	96	35	96	35	Please add the following sentence to the end of this paragraph: "Depending on soil temperature and (missing) intercropping practices, many European croplands have even turned into CO2 sources that gradually loose SOC (Kutsch et al. 2010, Buysse et al. 2017)." The corresponding references are: Kutsch WL, Aubinet M, Buchmann N, Smith P, Osborne B, et al. (2010) The net biome production of full crop rotations in Europe. Agriculture, Ecosystems and Environment 139, 336-345. And: Buysse P, Bodson B, Debacq A, De Ligne A, Heinesch B, Manise T, Moureaux C, Aubinet M (2017) Carbon budget measurement over 12 years at a crop production site in the silty-loam region in Belgium. Agriculture and Forest Meteorology 246, 241-255. [, Germany]	Reject: this is a global assessemnt and space limits preclude including regional trends
22527	96	37	96	38	The effect of tillage on SOC is greatly contested and depends on soil and vegetaiton systems [Anastasios Kentarchos, Belgium]	Noted: this is discussed in greater detail later on in the apragraphs
25367	96	37	96	39	We welcome the mention of organic material, cause this formulation is broader than just saying biochar. It is prefarable as it includes not only biochar but also other organic materials as composts, sludges, manure... See GENERAL COMMENT ON BIOCHAR. [, France]	noted
21047	96	37	96	52	A relatively balanced account of variable responses of soils to min/no-till agriculture, however It does not sufficiently draw out the findings of Powlson et al on the vertical distribution issue: That conclusion was supported by the largest ever meta-analysis of conservation tillage practices for temperate and boreal agriculture (Meurer et al. 2018, Earth-Science Reviews 177: 613–622) which is not referenced in the discussion. [, United Kingdom (of Great Britain and Northern Ireland)]	Accepted, ref added
6299	96	38	96	38	Missing space before parenthesis [Tristan Quaife, United Kingdom (of Great Britain and Northern Ireland)]	editorial, done
1805	96	42	96	42	"…has the potential to sequester…". Check for similar errors in text. [William Lahoz, Norway]	editorial, done, text moved
25369	96	43	96	47	It should be noted that conservation agriculture, reduced tillage may require more pesticides. [, France]	reject: more herbicides are required for zero tillage, not pesticides, this does not affect claimte mitigation potentail, trade offs ae considered in chapters 5 and in chapter 6
21049	96	43	96	52	The messaging here differs from that in Chapter 4, page 45, lines 5-8. In chapter 4 there is a reference not used in Chapter 2 - https://doi.org/10.1016/j.agee.2015.09.013 . It is interpreted as meaning that the benfits of no till are 'uncertain', but here there is medium evidence of a benefit. Need for consistency. When equivalent soil mass is considered it is clear that benefits are limited to the topsoil, e.g. https://doi.org/10.1016/j.earscirev.2017.12.015 . i would suggest that the 'medium evidence' might need to be down graded. [, United Kingdom (of Great Britain and Northern Ireland)]	accept, confidence statement deleted, we arleady cite many referenced that reflect the uncertianty
8551	96	47	96	50	No till practice may also lead to enhanced methane and N2O emissions due to more anaerobic conditions in the soil. This would be counter prodcutive. This is not enough studied at present. [Marc Aubinet, Belgium]	noted: there is text on this at the end of the section

Comment No	From Page	From Line	To Page	To Line	Comment	Response
26989	96	50	96	50	Please insert "On the other hand, deep ploughing can contribute to SOC sequestration by enlarging the storage space for carbon in the subsoil (Alcántara et al. 2016)." before "Meta-analyses…" The corresponding reference is: Alcántara V, Don A, Well R, Nieder R (2016) Deep ploughing increases agricultural soil organic matter stocks. Global Change Biology 22, 2939-2956. [, Germany]	accepted
1381	96	50	96	51	Meta-analysis by Haddaway et al (2017) clearly showed that C stock increase under no-tillage compared to tillage was in the upper soil (0–30 cm) around 4.6 Mg/ha (0.78–8.43 Mg/ha, 95% CI) over ≥ 10 years. The authors concluded "The transition of tilled croplands to NT and conservation tillage has been credited with substantial potential to mitigate climate change via C storage". [Elena Valkama, Finland]	accept with modification, ref already included among others from which was dais results are mised, but clarified to say results are both positive and negative
5461	96	52	96	52	A problem instead of an problem. [, Hungary]	Editorial
17135	96	19	97	21	As in sections 2.7.1.2.2 or 2.7.1.2.5, it is essential, to mention what are/could be the biogeophysical effects (and their consequences in terms of climate cooling or warming) of the changes in management that are listed in this section (in addition to the biogeochemical effects). For instance, agroforestery can contribute to increase C storage, but also surface roughness and evapotranspiration (synergies) while it may reduce surface albedo (trade off). Cover crops can contribute to store C, but it will also increase surface albedo, evapotranspiration and decrease N2O emissions and surface temperature (synergies). No till or reduced tillage could have limited or heterogeneous effects on soil C storage but it will increase surface albedo (possible synergies) ans well as surface temperature and reduce evapotranspiration (trade off)...Mentionning what are the biogeochemical and biogeophysical effects of those management options can help identifying which are the best options for climate mitigation and it would be more consistent to do so with other scetions of this Chapter (e.g. 2.7.1.2.2 p 100 lines 11-41). Those elements could be synthetised in a Table with columns indicating : C storage effect, effect on other GHG emissions, effect on albedo, effects on surface temperature/evapotranspiration, effect on surface roughness. [Eric Ceschia, France]	Accept with modification, added information where there is enough literature for an assessment, but many affects are context specific and dependent on previous management and location so it is not possible to put this in a table with a simple comumn for biopshysical effects . this is explained in miore detail in section 2.6. it would have been helpful if revviewer had suggested literature
979	96	1			I think the dot between economic and social should be a comma? [Tobias Rütting, Sweden]	editorial, text modified
981	96	7			"fiber and habitat" [Tobias Rütting, Sweden]	editorial, done
983	96	10			"They": to whom does this refer to? [Tobias Rütting, Sweden]	Accept, text modified
17131	96	23			decomposition rate is one thing but what also matters is the amount of C that will remain in the soil. If crop residues decompose 10 time faster than composted OM but that after a couple of years the same amount of C remains in the soil, it doesn't matter ! [Eric Ceschia, France]	Accept, text deleted
32231	96	23			decomposition rate is one thing but what also matters is the amount of C that will remain in the soil. If crop residues decompose 10 time faster than composted OM but that after a couple of years the same amount of C remains in the soil, it doesn't matter ! [, France]	Accept, text deleted
15281	97	2	97	3	for consistency use GtCO2yr-1 not GtCO2pa [Joalane Marunye, Lesotho]	editorial, done
29177	97	3	97	3	pa and yr-1 used in same sentecne. Please harmonize [Jan Fuglestvedt, Norway]	editorial, done
2609	97	3	97	3	"pa"?, "per year"? [Wei Li, France]	editorial, done
6301	97	11	97	11	"kow" -> "low" [Tristan Quaife, United Kingdom (of Great Britain and Northern Ireland)]	editorial, done
1807	97	11	97	11	kow -> low. [William Lahoz, Norway]	editorial, done

Comment No	From Page	From Line	To Page	To Line	Comment	Response
991	97	12	97	14	needs rephrasing and clatification [Tobias Rütting, Sweden]	accept with modification, text deleted
1233	97	15	97	15	Add at least one paragraph discussing the possible biophysical effects of soil management. Zero tillage, crop resdue management and fire management all have important biophysical effects (as discussed in previous sections). It is confusing that chapter 2 that starts with stressing the importance of the biophysical effects, ignores the same biophysical effects completely in what may be its most important section for policy-makers. References can be found in the review by Erb et al 2016 (doi/10.1111/gcb.13443). Although there might be large agreement concerning the biogeochemical effect of the listed land management, there remains low agreement and large uncertainty concerning their biophysical effect. Whenever the biogeochemical and biophysical effects have opposite signs, the net climatic effect may be uncertain. [Sebastiaan Luyssaert, Belgium]	add Erb et al reference. Soil management can affect albedo modification also need to be considered
26991	97	16	97	21	Information on soil carbon management would be highly relevant for policy makers, see for example the "4 per 1000" initiative and provide references to the chapters where this is further discussed. We strongly encourage the authors to include such information in the ES and SPM. [, Germany]	Noted. Policies discussed inc hapter 7
1383	97	17	97	18	Poeplau and Don (2015) have not studied N2O emissions. [Elena Valkama, Finland]	Reference deleted
6303	97	18	97	18	Missing space before parenthesis [Tristan Quaife, United Kingdom (of Great Britain and Northern Ireland)]	editorial, done
24205	97	18	97	21	This depends on the type of carbon added. Although fresh C inputs might increase N2O emissions, other forms of stable carbon might decrease or at least be neutral with N2O emissions. Several recent meta-analyses on the impact of biochar on N2O emissions (Verhoeven et al., 2017, Journal of Environmental Quality; ; Borchard et al., 2018, Science of the Total Environment) [Maria Luz Cayuela, Spain]	accept with modifcation, expanded paragraph to mention N2O reduction. Also added to biochar text,
29179	97	20	97	21	in terms of CO2eqivalents? [Jan Fuglestvedt, Norway]	Accepted, aded in co2 equivalence
25371	97	23	97	23	This title is currently inconsistent with all the contained subs-sections. In particular, "forest" should be added to this title to take into account subsection §2.7.1.2.2. "Forest-related options". [, France]	Accepted, should not be subsection
22529	97	31	97	31	The Special Report is fully packed with comprehensive reference to the very detrimental effect of N2O emissions from the production AND application of N synthetic fertilisers to agricultural soils, see e.g. SPM-8 line 9, SPM-20 line 1, 2-55 line 22-36, 2-58 line 26 to 2-59 line 29, 5-61 line 3-20, 5-66 line 43-46, etc. Therefore, concrete language on the need to further investigate and test (bio-based) alternatives to the amonia production via Haber-Bosch process is highly recommended. Further evidence on the need of action is that these represent no less than ½ of GHG emissions from the chemical industry (see e.g. the EU's GHG Inventory 2018 to UNFCCC), is responsible for up to 5% of global gas consumption and key factor of inland waters eutrophication through agricultural run-off, due to the low assimilation rates (see e.g. http://vaclavsmil.com/wp-content/uploads/docs/smil-article-worldagriculture.pdf) [Anastasios Kentarchos, Belgium]	Accept with modificatoin: emissions from N2O from fertiliser production is already included in section 2.4, the trade offs of response options are included in chapter 6, more details on uses of fertilsiers and alternatives are included in chapter 5, including moere efficent use of fertilisers, this section chapter only deals with climate impacts of response options. this text is now deleted
29181	97	32	97	32	Re "27% of all potent short-lived gases" is unclear. Should be better defined. [Jan Fuglestvedt, Norway]	accept with modification: "short lived gases has been defined in previous sections. Text now deleted
38867	97	32	97	34	Reverse sentence: "Measures addressing enteric fermentation … since agrice agriculture accounts for 56% of methane emissions ..." [, United States of America]	accept with modification, text deleted

Comment No	From Page	From Line	To Page	To Line	Comment	Response
33975	97	32	97	44	This section does not have anyting specific on reducing N2O emissions, yet a large body of work exists on mitigation options: e.g. reduce fertiliser use, manure managemen, nitrificating inhibitors, animal feed options etc. [Cecile de Klein, New Zealand]	The section is restructured
33977	97	35	97	35	publication year missing after Hayman et al. [Cecile de Klein, New Zealand]	editorial, text deleted
8553	97	39	97	39	Changing livestock diets to mitigate enteric methane emissions has been proven to be effective in reducing CH4 but raises other problems that are not evoked here. The diet change may be operated either by replacing a part of the forage (cellulose) by other concentrates (fat or starch) or by introducing food additives that favour alternative metabolic ways to consume carbon hydrates. Replacing a part of the forage by other concentrates lead to partly renounce to the advantage of ruminants that are the sole living organisms able to transform forage(cellulose) in proteins (milk, meat) consumable by humans. In addition, these concentrates have to be produced elsewhere, which has an ecological cost (while forage is directly available in grasslands). There are also challenges for the administration of the compounds, especially to ruminants that are under extensive grazing conditions (Patra, 2016 ; Patra et al., 2017 ; Llonch et al., 2017) The introduction of food additives raises problems of toxicity or of animal welfare: supplementing with antimethanogenic agents or with electron (H+) acceptors emissions, disrupt the natural rumen function and their misuse could lead to rumen disorders and potential health and other welfare problems (Llonch et al 2017). In any way, a cost-benefit assessment of the mitigation options and carbon footprint analysis of the livestock products using an integrated life cycle assessment needs to be done before any CH4 mitigation effort can be put into practice. (Patra et al 2016). Ref : P. Llonch, M. J. Haskell, R. J. Dewhurst and S. P. Turner Review: current available strategies to mitigate greenhouse gas emissions in livestock systems: an animal welfare perspective Animal (2017), 11:2, pp 274–284 A.K. Patra (2016) Recent Advances in Measurement and Dietary Mitigation of enteric Methane emissions in Ruminants Frontiers in Veterinary Science, 3, 39 Amlan Patra, Tansol Park, Minseok Kim and Zhongtang Yu. Rumen methanogens and mitigation of methane emission by anti-methanogenic compounds and substances Journal of Animal Science and Biotechnology (2017) 8:13 DOI 10.1186/s40104-017-0145-9 [Marc Aubinet, Belgium]	accepted. This discussion is added, more details are in chapter 5
8555	97	41	97	42	None of the reference given here refers to animal diet improvement. [Marc Aubinet, Belgium]	Reference replaced
4045	97	23	98	11	This section alludes to but does not explicitly state the possibility of sustainable intensification thorugh the integration of crop and livestock systems. In certain contexts this management method could vastly increase productivity, decrease emission intensity of food production, increase livelihoods, and act as a climate adaptation option (see Gil et al 2018). References: Gil, J.D.B., R. Garrett, A. Rotz, V. Daioglou et al. Tradeoffs in the quest for climate smart agricultural intensification in Mato Grosso, Brazil. Environmental Research Letters (13) 064025 (2018) [Vassilis Daioglou, Netherlands]	Accepted: this is included now.

Comment No	From Page	From Line	To Page	To Line	Comment	Response
987	97	3			use "yr-1" instead of "pa" (for concistency) [Tobias Rütting, Sweden]	editorial, done
989	97	11			"low agreement" [Tobias Rütting, Sweden]	editorial, done
17133	97	21			I would suggest to add the following sentence : "Cover crops on the other end has the potential to store C in the soil and reduce N2O emissions (Kaye and Quemada, 2017)". [Eric Ceschia, France]	accepted, added to end
32233	97	21			we would suggest to add the following sentence : "Cover crops on the other hand has the potential to store C in the soil and reduce N2O emissions (Kaye and Quemada, 2017). [, France]	accepted, added to end
17857	97	23			In this section, mitigation potentials are given for various options but without any description of what baseline they are measured against. This should be clarified so that readers understand the context of the potentials given. [Quentin Lejeune, Germany]	accept with modification, more details about options and numbers are in chapter 5
6305	98	3	98	3	Missing space at start of sentence [Tristan Quaife, United Kingdom (of Great Britain and Northern Ireland)]	editorial , done
17137	98	3	98	5	refer also to green manure (e.g. cover crops) asan option for reducing the use of synthetic fertilisers [Eric Ceschia, France]	Accept, text added
1235	98	12	98	12	Add at least one paragraph discussing the possible biophysical effects of cropland grassland and livestock management. Cropping, grazing, rice production and fertilizing all have important biophysical effects (as partly discussed in previous sections). It is confusing that chapter 2 that starts with stressing the importance of the biophysical effects, ignores the same biophysical effects completely in what may be its most important section for policy-makers. References can be found in the review by Erb et al 2016 (doi/10.1111/gcb.13443). Although there might be large agreement concerning the biogeochemical effect of the listed land management, there remains low agreement and large uncertainty concerning their biophysical effect. Whenever the biogeochemical and biophysical effects have opposite signs, the net climatic effect may be uncertain. [Sebastiaan Luyssaert, Belgium]	accept with modification: text has been added where there is sufficient information for an assessment
21051	98	13	98	13	Please add confidence statements to this section [, United Kingdom (of Great Britain and Northern Ireland)]	accept, confidence statements added to the mitigation potentail ranges
3811	98	13	98	13	Replace Title " Demand-side management in the food sector (diet change, waste reduction)" By " Demand-side management in the food sector " This recommendation is related to the following one. [Philippe Waldteufel, France]	accept with modification titles now alogned across the SRCCL
8557	98	13	98	34	Reducing food supply chains by consuming rather local products is probably one of the most efficient way of mitigation. Why isn't it evoked here ? [Marc Aubinet, Belgium]	accept, text added
11603	98	19	98	20	Due to increased urbanisation and popluation growth material, annual consumption in the world's cities is expected to increase from 40 billion tonnes to 90 billion tonnes by 2050 (Swilling et al. 2018). This represents a huge increase in demand for cement and the requirement for substituted wood. There is also the issue that wood would only be strong enough to construct low rise buildings extending the ecological and environmental footprint of mega cities required to house increasing populations. [Paul Dumble, United Kingdom (of Great Britain and Northern Ireland)]	reject: (noting this is relevant to the material substitution section so ine refs wrong here) the material substituion section does not suggest wood will replace all demand so the total demand is not relevant to the land report, estimates of mitigation potential are only for repacing some cement.
11605	98	19	98	20	Swilling, M., Hajer, M., Baynes, T., Bergesen, J., Labbé, F., Musango, J.K., Ramaswami, A., Robinson, B., Salat, S. and Suh, S. (2018). The Weight of Cities: Resource Requirements of Future Urbanization. Nairobi: UN Environment. http://www.resourcepanel.org/reports/weight-cities. [Paul Dumble, United Kingdom (of Great Britain and Northern Ireland)]	reject: (noting this is relevant to the material substitution section so ine refs wrong here) the material substituion section does not suggest wood will replace all demand so the total demand is not relevant to the land report, estimates of mitigation potential are only for repacing some cement.

Comment No	From Page	From Line	To Page	To Line	Comment	Response
15187	98	24	98	34	Actual impacts on human health and the economic benefits thereof could be included in this paragraph [Daniel Zarin, United States of America]	accept with modification: This is included in Chapter 5 and 6 .chapter 2 only deals with climate effects
3475	98	26	98	27	In fact, the overall and per capita beef consumption in China is relatively low, hence China does not belong to the countries with the highest overall and projected beef consumption. Please delete the word “China” in this statement. [Jianqi Sun, China]	accept with modification, text deleted
3437	98	26	98	28	“Countries with the highest overall and projected beef consumption include predominantly developed and emerging countries: USA, EU, China, Brazil, Argentina, Russia.” Is there the availability of the literature and data supporting the conclusion that China is a high beef consumer in modern times and in the future? [, China]	accept with modification, text deleted
14667	98	31	98	34	Suggest indicating that decreasing meat consumption would also have benefits to health in a number of countries. [, Canada]	reject, chapter 2 deals only with climate impacts, health co-nebefits are discussed in chapters 5 and 6
5463	98	31	98	34	It would be important to mention that consuming local food also attributes to less emission (less transportation, less wrapping, etc.) [, Hungary]	accept, this is now added
3813	98	34	98	34	Following the two existing paragraphs, insert an additional paragraph as follows: "Finally, a discussion of the demand-side management is bound to address the human population issue. The effect of anticipated worldwide population increase until 2050 would just about cancel entirely the results of mitigation efforts (diet change, waste reduction) described just above. Therefore, assessing population policies deserves to be added to the topics considered in this section (Bongaarts and O'Neill, 2017). [Philippe Waldteufel, France]	Accept with modification: this section is about bottom-up assessments of single response options., Section 2.7.2 uses integrated assessment models and deals with issue of population grwoth, econonic development etc. in asessing mitigation potentials
25373	98	36	98	36	As commented above, this subsection is not consistent with the titling of the subsection 2.7.1.2 [, France]	Accept, numbering modified
1237	98	37	98	40	Add citations to the scientific literature on the topic. I disagree with this statement. Very few models account for adaptation in the forestry sector because simulating adaptation woukd require models that can deal with tree species whereas most models use plant functional types. Likewise the net climate effects of afforestation and deforestation have been well study but very few models can actually simulate the net climate effects of forest management because that requires that the model simulates canopy structure (which excludes all big-leaf canopy approaches and thus most ESMs and IAMs). [Sebastiaan Luyssaert, Belgium]	Accept with modification: deleted sentence
38871	98	37	98	52	There is no discussion of the costs associated with different mitigation options. It is important to include that element here. Also, Griscom et al. don't actually do any modeling, but gather information from a variety of other studies, comparing results from different modeling exercises without explaining how the results differ and which are stylized to avoid conflicts with food production and which are not, which is a problem. It would be better/stronger to cite the actual work/studies that Griscom et al. seek to reflect, which would also address the first point here (having studies that generate cost esimates for LU mitigation responses: Sohngen and Mendelsohn (American Journal of Agricultural Economics, 2003); Kindermann et al. (PNAS; 2008); Golub et al. (PNAS, 2012); Favero et al. (Climatic Change, 2017); Baker et al. (Energy Policy online in 2018). [, United States of America]	Accept with modification. Chapter 6 deals with costs, references shared with chapter 6
17859	98	42	98	44	What is the counterfactual / baseline? Continued deforestation / degradation at present rates? And what is the timescale? The text suggests that estimates use different timescales, but it would be helpful to know whether this is medium or longer term, or is it simply an estimate of how much current emissions could be reduced? [Quentin Lejeune, Germany]	Accept : text states that upper end of range is current deforestation\degradation rates. We now make it clear that timeline in figure 2 is 2030 to 2050. Added text to clarify that upper end is estiamte of how much current emissions could be reduced.

Comment No	From Page	From Line	To Page	To Line	Comment	Response
341	98	42	98	46	As noted elsewhere, should include studies that have developed cost estimates for the various forestry land use options, including: Those studies include Sohngen and Mendelsohn (American Journal of Agricultural Economics, 2003); Kindermann et al. (PNAS; 2008); Golub et al. (PNAS, 2012); Favero et al. (Climatic Change, 2017); Baker et al. (Energy Policy online in 2018). [Brent Sohngen, United States of America]	Accept with modification. Chapter 6 deals with costs, references shared with chapter 6
5051	98	42	98	46	Please consider including additional information on scenario assumptions to provide the ranges of mitigation potential by reduced deforestation. [, Japan]	Accept : text states that upper end of range is current deforestation\degradation rates. We now make it clear that timeline in figure 2 is 2030 to 2050. Added text to clarify that upper end is estiamte of how much current emissiosn could be reduced.
5053	98	42	98	46	We would suggest describing here the recent important findings by Busch and Engelmann, 2017, on cost-effectiveness of reduced deforestation in order to corroborate the current text. [, Japan]	Accept with modification. Chapter 6 deals with costs, references shared with chapter 6
38873	98	42	98	46	Should include studies that have developed cost estimates for the various forestry land use options, including Sohngen and Mendelsohn (American Journal of Agricultural Economics, 2003); Kindermann et al. (PNAS; 2008); Golub et al. (PNAS, 2012); Favero et al. (Climatic Change, 2017); Baker et al. (Energy Policy online in 2018). [, United States of America]	Accept with modification. Chapter 6 deals with costs, references shared with chapter 6
5465	98	44	98	44	Is the sentence finished? If yes than a parenthesis is missing after high agreement. [, Hungary]	editorial - done
15849	98	48	98	48	"…and changing management practise in order to favour forest resilience". [Caroline Vincke, Belgium]	Reject: management is not always for resillience, sometimes for carbon or timber
1239	98	48	98	48	Replace the word "biophysical". Seems that the word "biophysical" is used here with its typical meaning for socio-economic studies. This meaning is very different from the meaning of this word in the rest of this chapter. Its usage here has no link with albedo, transpiration, roughness, ... and only refers to what is called "biogeochemical" in the rest of the chapter. [Sebastiaan Luyssaert, Belgium]	Accept with modification, deleted text.
29183	98	52	98	52	"IPCC carbon pools" need explanation [Jan Fuglestvedt, Norway]	Accept with modification, deleted text.
40537	98		98		check coherency with chapter 5 for 2.7.1.2.1 [Valerie Masson-Delmotte, France]	Accept: consistency checked
38869	98	36	100	44	This whole section on forest-related response options needs vast improvement in terms of interpretation and use of recent literature. [, United States of America]	accept, text updated
23635	98	24		34	The reference to meat being emissions-intensive is missing one key point - that meat production in prairie/ semi-arid climates actually makes a lot of ecological sense. Prairie grassland is ideal for ruminant farming, but is difficult to farm for human-quality plant material. In order to grow wheat, legumes, etc, prairie grasslands need to be irrigated and intensively managed. I agree that meat production in many regions of the world is detrimental to ecosystem health, but the northern Great Plains of the US and Canada may be one area where there is more nuance worth recognizing. I am not arguing that livestock production doesn't contribute GHG, but more that abandoning livestock altogether will have negative ecological impacts in some areas. Soussana et al 2009 Animal.4: 334-350. Conant et al 2001 Ecological Applications. 11:343-355. Conant et al 2017.Ecological Applications. 27:662-668. Alemu et al 2017. Agricultural Systems. 158:1-13. [Kerri Finlay, Canada]	accept with modification: this discussion is included in Chapter 5

Comment No	From Page	From Line	To Page	To Line	Comment	Response
26993	99	3	99	5	The reference used here assumes a complete stop of timber harvest, which is neither possible given the goods and services needed from forests nor climate-friendly, as (at least most of) these goods and services would be achieved from other, most likely more fossil-fuel intensive sources. Please consider to delete this sentence or at least to clarify that this is a hypothetical maximum sequestration potential by writing "estimated a hypothetical maximum sequestration potential of...". [, Germany]	Accept, text deleted
17861	99	3	99	5	What is the counterfactual / baseline for the estimate by Houghton and Nassikas 2018? Is the potential measured against continued emissions at current levels? or a BAU scenario? [Quentin Lejeune, Germany]	Accpet with modification: the counterfactual is having non forest land, so this os for non-forest converted to forest, it is not measasure against other options. Have added text to clarify what afforestation/reforestation means and that it considers non-forest land converted to forest.
28591	99	4	99	4	the units are wrong if this is the cumulative value [Alan Di Vittorio, United States of America]	Accept, text deleted
6307	99	4	99	4	Units should not be expressed as per year for a cumulative figure. [Tristan Quaife, United Kingdom (of Great Britain and Northern Ireland)]	Accept, text deleted
665	99	7	99	9	Reference related to carbon sequestration by afforestation in China has not been cited. We suggest that one may additionally cite the reference "Yao et al., 2018". Ref: Yao, Y., S. Piao, and T. Wang, 2018: Future biomass carbon sequestration capacity of Chinese forests. Sci. Bull., 63, 1108-1117, doi:10.1016/j.scib.2018.07.015. [Shilong Piao, China]	Reject, estimates are all global. Unfortunately we did not have space to write about regional potentials
343	99	7	99	10	As noted elsewhere, should include studies that have developed cost estimates for the various forestry land use options, including: Those studies include Sohngen and Mendelsohn (American Journal of Agricultural Economics, 2003); Kindermann et al. (PNAS; 2008); Golub et al. (PNAS, 2012); Favero et al. (Climatic Change, 2017); Baker et al. (Energy Policy online in 2018). [Brent Sohngen, United States of America]	Accept with modification: chapter 6 deals with costs, references shared with chapter 6
38875	99	7	99	10	Should include studies that have developed cost estimates for the various forestry land use options, including Sohngen and Mendelsohn (American Journal of Agricultural Economics, 2003); Kindermann et al. (PNAS; 2008); Golub et al. (PNAS, 2012); Favero et al. (Climatic Change, 2017); Baker et al. (Energy Policy online in 2018). [, United States of America]	Accept with modification: chapter 6 deals with costs, references shared with chapter 6
32455	99	7	99	21	It is important to take permanence into account in afforestation and reforestation schemes, which is linked to the purpose of afforestation or reforestation actions. [Simone Lovera-Bilderbeek, Paraguay]	Accept, there is some text and a refence added to the paragraph below on permanence
29995	99	8	99	9	Two more references could be added here: (1) CALVIN, K., WISE, M., KYLE, P., PATEL, P., CLARKE, L. & EDMONDS, J. 2014. Trade-offs of different land and bioenergy policies on the path to achieving climate targets. Climatic change, 123, 691-704. (2) Doelman, J.C., Stehfest, E., van Vuuren, D.P., Tabeau, A., Hof, A.F., Braakhekke, M.C., Gernaat, D.E.H.J., van den Berg, M., van Zeist, W., Daioglou, V., van Meijl, H., Lucas, P. Estimating afforestation potentials and possible risks to food security. Global Change Biology, in review (to be accepted before the deadline of 7 april 2019). [, Netherlands]	accept with modification: IAM studies are dleat with in section 2.7.2, Calvin is referenced there, the second reference is not in google scholar so not sure it is accepted at time of writing
38877	99	11	99	12	Suggest revising this to be more objective and accurate. Revise to delete 'realistic' and 'most recent' from this sentence. There are many who would strongly disagree with this statement as written, especially other authors cited in the Griscom et al. paper. Also, it is often NOT appropriate to average across modeling studies, especially if they are very different modeling types using different and unharmonized scenarios, which was done in Griscom et al. [, United States of America]	Accepted, text deleted
2611	99	12	99	12	how many models? [Wei Li, France]	accept with modification, text deleted

Comment No	From Page	From Line	To Page	To Line	Comment	Response
1241	99	22	99	22	Add at least one paragraph discussing the possible biophysical effects of afforestation/reforestation. Both have important biophysical effects (as discussed in previous sections). It is confusing that chapter 2 that starts with stressing the importance of the biophysical effects, ignores the same biophysical effects completely in what may be its most important section for policy-makers. References can be found in previous section of Chapter 2 and the review by Erb et al 2016 (doi/10.1111/gcb.13443). Although there might be large agreement concerning the biogeochemical effect of afforestation/reforestation, there remains low agreement and large uncertainty concerning their biophysical effects. Whenever the biogeochemical and biophysical effects have opposite signs, the net climatic effect may be uncertain. [Sebastiaan Luyssaert, Belgium]	noted: there is a whole pargraph at the end of the forest section doing just his
17863	99	23	99	24	As above - what is the baseline? [Quentin Lejeune, Germany]	accept with modification: this is stated now in modified text in the intro, . Estimates of mitigation potential for land management options are sensitive to assumptions of “available” land on which to implement the option, the prior land cover, assumed baseline and counterfactuals (eg. what the land could have been used for otherwise, with most studies comparing to current activity), t
25383	99	23	99	37	We suggest that additional elements be added on sustainable forest management and improved forest management. See GENERAL COMMENT ON THE TYPOLOGY OF FOREST ACTIVITIES and GENERAL COMMENT ON IMPROVED FOREST MANAGEMENT (IFM). [, France]	Accepted, text expanded and now refers to much more detailed text in chapter 4, not sure where comments are on typoloogy and IFM as not on this chapter
32663	99	23	99	37	This paragraph should better distinguish 1) the emissions occurring immediately when bioenergy is burned as a substitute for fossil fuel and 2) the very slow absorption of CO2 in a growing forest. The paragraph assumes too easily that fuel substitution involving bioenergy immediately reduces emissions in the energy sector. This has been strongly criticized, e.g., by Searchinger et al., 2018, Nature Communications, DOI: 10.1038/s41467-018-06175-4). [Jean-Pascal van Ypersele, Belgium]	accept with modification: the caveats to bioenergy including carbon pay back times are discussed in detail in the bionergy section and in the bioenergy box.
32665	99	23	99	37	It would be useful to consider revisiting the wisdom of considering that wood is "carbon-neutral". Indeed, as explained in Searchinger et al. (2018), if a country’s laws give its power plants strong financial incentives to switch from coal to wood on the theory that wood is carbon-neutral, those power plants have incentives to burn wood regardless of the real carbon consequences. See Searchinger et al., 2018, Nature Communications, DOI: 10.1038/s41467-018-06175-4 and the open letter signed by more than 800 scientists: https://empowerplants.files.wordpress.com/2018/01/scientist-letter-on-eu-forest-biomass-796-signatories-as-of-january-16-2018.pdf [Jean-Pascal van Ypersele, Belgium]	accept with modification: the caveats to bioenergy including carbon pay back times are discussed in detail in the bionergy section and in the bioenergy box.
667	99	31	99	31	The sentence "Carbon removal from the atmosphere occurs at faster rates in young to medium aged forests" is lack of reference. We suggest that one may cite the reference Yao et al. (2018). Ref: Yao, Y., S. Piao, and T. Wang, 2018: Future biomass carbon sequestration capacity of Chinese forests. Sci. Bull., 63, 1108-1117, doi:10.1016/j.scib.2018.07.015. [Shilong Piao, China]	accept but also check for other refs
7535	99	31	99	37	BUT allowing for regrowth must consider the carbon debt left by the years required to regrow forests. See Sterman et al. (2018) Does replacing coal with wood lower CO2 emissions? Dynamic lifecycle analysis of wood bioenergy, ENVTL. RESEARCH LETTERS. [Durwood Zaelke, United States of America]	accept with modification carbon debt is discussed in the bioenergy section

Comment No	From Page	From Line	To Page	To Line	Comment	Response
7613	99	31	99	37	BUT allowing for regrowth must consider the carbon debt left by the years required to regrow forests. See Sterman et al. (2018) Does replacing coal with wood lower CO2 emissions? Dynamic lifecycle analysis of wood bioenergy, ENVTL. RESEARCH LETTERS. [Kristin Campbell, United States of America]	accept with modification carbon debt is discussed in the bioenergy section
38879	99	34	99	37	Recommend adding 'with varying degrees of net CO2 emissions effects" at the end of the text in parantheses. [, United States of America]	reject: accept they are all different but that is shown in the figure, and the different pieces of text that are referred to in this sentence.
29843	99	34	99	37	Need more and robust evidence. [Souparna Lahiri, India]	Accept with modification: the relavant literature is assessed in the sections highlighted
38881	99	35	99	37	Timber harvest for bioenergy does not reduce emissions. It has additional impacts on forests that are regrowing after harvest for bioenergy. Analyses must include observations, models and life cycle assessments. Accounting for wood product use and associated emissions reduces the land sink potential. Refs: Law, B.E., T.W. Hudiburg, L.T. Berner, J.J. Kent, P.C. Buotte, and M. Harmon. 2018. Land use strategies to mitigate climate change in carbon dense temperate forests. Proc. Nat. Acad. Sci. 115(14):3663-3668. https://doi.org/10.1073/pnas.1720064115; 40. Hudiburg, T.W., S. Luyssaert, P.E. Thornton, B.E. Law. 2013. Interactive effects of environmental change and management strategies on regional forest carbon emissions. Environmental Science & Technology 47(22):13132-40. Doi: 10.1021/es402903u; Hudiburg, T. W., Law, B. E., Wirth, C. & Luyssaert, S. Regional carbon dioxide implications of forest bioenergy production. Nat. Clim. Change 1, 419-423 (2011); Birdsey, R., P. Duffy, C. Smyth, W. Kurz, A. Dugan and R. Houghton. Climate, Economic, and Environmental Impacts of Producing Wood for Bioenergy, Env. Res. Letters (2018); Schulze, E. D., C. Körner, B. E. Law, H. Haberl and S. Luyssaert. Large-scale bioenergy from additional harvest of forest biomass is neither sustainable nor greenhouse gas neutral. GCB Bioenergy: 4(6): 611-616 (2012); Searchinger et al., Europe's renewable energy directive poised to harm global forests, Nature Communications 9:3741 (2018). [, United States of America]	accept with modification carbon debt is discussed in the bioenergy section and bioenergy box
1279	99	37	99	37	"enabling areas of land to be used continuously for mitigation providing harvest is followed by regrowth". This statement is contradicted by several recent reports/papers on "carbon neutrality of biomass use" and several regional studies see Hudiburg et al 2012 (doi/10.1038/NCLIMATE1264) and Valade et al 2018 (doi/10.1186/s13021-018-0113-5) and references therein. The statement completly ignores the issue of "parity time" shown by Fargioni et al 2008 (doi/10.1126/science.1152747) and confirmed by tens studies with a focus on forest management. The parity issue is essential in the IPCC context because timing of the negative emissions are an important determinant in the global temperature. [Sebastiaan Luyssaert, Belgium]	accept, added text on parity issue and caveats
21865	99	39	99	52	The description of the substitution impacts of wood products gives a bit shallow view on the uncertainties related to the quantitative estimate and the interpretation of the estimated value range. 1) Generally, it is worth highlighting that the value presented as the mitigation potential in itself does not provide enough information to guide decision-making: It should be assessed together with the changes in tree and soil carbon stock, the carbon stock in harvested wood products, the issues with saturation of the forest sink and permanence of the forest stock, and the potential carbon leakage resulting from international trade. These issues have been brought up in different parts of the report (incl. the previous paragraph), but not in depth in the context of the presented quantitative range. [, Finland]	Accept, added text above on caveats and managing sinks stocks and subsitution

Comment No	From Page	From Line	To Page	To Line	Comment	Response
21867	99	39	99	52	2) It would be illustrative to differentiate between the current level of wood products consumption which represents the amount of emissions currently avoided, and the marginal increase in the use of wood (change in the market share of wood based products). The former effectively quantifies the amount of emissions that would be caused if wood products were not produced, while the latter can be attributed to additional climate change mitigation. Due to issues with data availability and the wide range of possible assumptions, particularly the latter remains extremely difficult to quantify. 3) The given average displacement factor appears low considering that only construction-related end uses of wood are included. Instead of a single value, a range of displacement factors could be considered such as the one found in Sathre & O'Connor (2010), or preferably a more justified/realistic range (see e.g. Braun et al. 2016, Gustavsson et al. 2017, Soimakallio et al. 2016). [, Finland]	accept with modification: the range was given from sathre and O'conner but text has now been deleted
21869	99	39	99	52	4) The given displacement factor quantifies the avoided emissions per amount of wood contained in the final product. This is a valid approach as long as all material streams of the value chain are quantified and aggregated, but in case they are not, the total use of wood needed to produce the final product remains unquantified. This influences the estimate and its interpretation. 5) In such upscaling exercise of substitution impacts, one should ideally not use an average value found from literature for the displacement factor, but one for each pair of wood products and their substitutes (making sure that the functional units match each other) based on the end use distribution of intermediate wood-based products. Whether the presented figure is an outcome of such an exercise remains unclear, as the cited source is not (yet?) available online. Although carrying out such an exercise may not in practice be possible due to lack of data, the related uncertainty behind the estimate should at least be acknowledged. [, Finland]	Noted and underlying literature checked
21871	99	39	99	52	6) In addition to construction, a range of end uses across several value chains substituting more emission-intensive materials and energy exist and could be considered. Although no peer-reviewed articles may be published before the literature cutoff date on this matter, it seems that the allocation of sidestreams to textiles, chemicals, composites, etc. may have more potential for climate change mitigation than increasing wood construction, due to restrictions posed by market structures. [, Finland]	Noted and underlying literature checked
21873	99	39	99	52	7) Technology and related environmental footprint will not remain unchanged in time. Accordingly, substitution impacts ought to be calculated using assumptions for a possible future market structure and product portfolio (say, in 2050) (Soimakallio et al. 2016, Penaloza et al. 2018). On one hand, the displacement factor can be assumed to be reduced in the future due to the decarbonization of the energy sector and the consequently decreasing emissions of some of the alternative manufacturing industries. On the other hand, there will be completely new types of products, also wood-based products (e.g. micro fiber based construction products) that may have an entirely different environmental profile than the engineered wood products of today. Although it is not possible to reliably account for these dynamics for the purpose of iterating the quantitative range, it would be important to acknowledge the uncertainties to show the reader that the reported value range is unlikely to comprise the full plausible range. [, Finland]	Accept, added on caveats and managing sinks stocks and subsitution

Comment No	From Page	From Line	To Page	To Line	Comment	Response
21875	99	39	99	52	Braun, M., Fritz, D., Weiss, P., Braschel, N., Büchsenmeister, R., Freudenschuß, A., Gschwantner, T., Jandl, R., Ledermann, T., Neumann, M., Pölz., W., Schadauer, K., Schmid, C., Schwarzbauer, P. and Stern, T. 2016. A holistic assessment of greenhouse gas dynamics from forests to the effects of wood products use in Austria. Carbon Management 7(5–6): 271–283. Gustavsson, L., Haus, S., Lundblad, M., Lundström, A., Ortiz, C.A., Sathre, R., Le Truong, N. and Wikberg, P-E. 2017. Climate change effects of forestry and substitution of carbon-intensive materials and fossil fuels. Renewable & Sustainable Energy Reviews 67: 612–624. Peñaloza, D., Erlandsson, M., Berlin, J., Wålinder, M. and Falk, A. 2018. Future scenarios for climate mitigation of new construction in Sweden: Effects of different technological pathways. J. Clean. Prod. 187: 1025–1035. Soimakallio, S., Saikku, L., Valsta, L. and Pingoud, K. 2016. Climate Change Mitigation Challenge for Wood Utilization The Case of Finland. Environ. Sci. Technol. 50: 5127–5134. [, Finland]	Accept, added refs
415	99	39	99	52	Definition of displacement factor DF as the emission reduction per amount of C in FINAL wood product (as done by Sathre and O'Connor 2010) is very misleading, because it does not take into account the amount of wood used to produce the final product. (This definition of DF deviates from original definition by Schlamadinger and Marland emphasizing the amount of wood demanded for producing the product, not only that is left in final product.) For instance, using this definition energy-intensive wood products demanding for a lot of wood biomass in processing stage do not differentiate in DF from wood products with very low energy demand. This is a fundamental issue as biomass is always a limited resource! Essential in climate change mitigation would be to find wood products using roundwood in economical way. I suggest to make a note, where this issue is recognized. [Kim Pingoud, Finland]	accept deleted text on DF
11607	99	39	99	52	Alternative renewable energy sources such as refuse derived fuel (sometimes decribed as alternative fuels) for the production of cement (e.g. Chatziaras et al. 2016, López-Sabirón et al 2015) or other energy intensive products such as aluminium have not been explored as mitigation for increasing urban land demand of land for substituted biomass/wood. This should bebriefly mentioned as a gap requiring further review. [Paul Dumble, United Kingdom (of Great Britain and Northern Ireland)]	reject: the suggestions here are about greenhouse gas flux in the energy and industrial sector, they would not change greenhouse gas flux in the land sector (such as bioenergy crops do) unless substituting for wood burnt for these, burning refuse could be used to substitute for energy in a variety of places. I think this is a bit specific with limited literature for a global assessment. I am also not sure it is one of the major gaps. We discuss energy from residues under the bioenergy section, but do not get specific about that the energy is sued for. again this seems more relvant to the industrial sector and not the land report.
11609	99	39	99	52	Chatziaras Nickolaos , Constantinos S. Psomopoulos Nickolas J. Themelis , (2016),"Use of waste derived fuels in cement industry: a review", Management of Environmental Quality: An International Journal, Vol. 27 Iss 2 pp. 178 – 193, DOI: 10.1108/MEQ-01-2015-0012; López-Sabirón Ana M, Kristina Fleiger, Stefan Schäfer, Javier Antoñanzas3, Ane Irazustabarrena3, Alfonso Aranda-Usón4, Germán A Ferreira (2015). Refuse derived fuel (RDF) plasma torch gasification as a feasible route to produce low environmental impact syngas for the cement industry Waste Management & Research, Volume: 33 issue: 8, page(s): 715-722. Article first published online: June 16, 2015; Issue published: August 1, 2015. https://doi.org/10.1177/0734242X15586476 [Paul Dumble, United Kingdom (of Great Britain and Northern Ireland)]	reject: the suggestions here are about greenhouse gas flux in the energy and industrial sector, they would not change greenhouse gas flux in the land sector (such as bioenergy crops do) unless substituting for wood burnt for these, burning refuse could be used to substitute for energy in a variety of places. I think this is a bit specific with limited literature for a global assessment. I am also not sure it is one of the major gaps. We discuss energy from residues under the bioenergy section, but do not get specific about that the energy is sued for. again this seems more relvant to the industrial sector and not the land report.

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32457	99	39	99	52	As pointed out above, the positive impacts of harvested wood products on climate change are disputed (Keith et al., 2015 and Law et al., 2018.) also because most studies on the climate impacts of harvested wood products fail to take into account all counterfactual scenarios and the potential negative economic impact of wood availability on incentives to ensure resource efficiency in the construction and retail sectors through other means. [Simone Lovera-Bilderbeek, Paraguay]	Accepted with modification, added text and refs on caveats
38883	99	42	99	42	Reference should be "Kauppi" not "Pekka Kaupi". [, United States of America]	accepted
6903	99	47	99	50	recent papers (2018) on the same topic of the same authors: (1) Nabuurs, G.-J., E. J. M. M. Arets, and M.-J. Schelhaas, 2018: Understanding the implications of the EU-LULUCF regulation for the wood supply from EU forests to the EU. Carbon Balance Manag., 13, 18, doi:10.1186/s13021-018-0107-3. https://cbmjournal.biomedcentral.com/articles/10.1186/s13021-018-0107-3 (Accessed January 11, 2019); (2) Iordan, C.-M., X. Hu, A. Arvesen, P. Kauppi, and F. Cherubini, 2018: Contribution of forest wood products to negative emissions: historical comparative analysis from 1960 to 2015 in Norway, Sweden and Finland. Carbon Balance Manag., 13, 12, doi:10.1186/s13021-018-0101-9. https://cbmjournal.biomedcentral.com/articles/10.1186/s13021-018-0101-9 (Accessed January 11, 2019), and that which is seemingly very relevant: (3) Grassi, G., R. Pilli, J. House, S. Federici, and W. A. Kurz, 2018: Science-based approach for credible accounting of mitigation in managed forests. Carbon Balance Manag., 13, 8, doi:10.1186/s13021-018-0096-2. https://cbmjournal.biomedcentral.com/articles/10.1186/s13021-018-0096-2 (Accessed January 11, 2019). [Georgii Alexandrov, Russian Federation]	accept with modification, added text and refs on caveats
1243	100	1	100	1	Add at least one paragraph discussing the possible biophysical effects of forest management. Wood harvest has important biophysical effects (as partly discussed in previous sections). It is confusing that chapter 2 that starts with stressing the importance of the biophysical effects, ignores the same biophysical effects completely in what may be its most important section for policy-makers. References can be found in previous section of Chapter 2 and the review by Erb et al 2016 (doi/10.1111/gcb.13443). Although there might be large agreement concerning the biogeochemical effect of afforestation/reforestation, there remains low agreement and large uncertainty concerning their biophysical effects. Whenever the biogeochemical and biophysical effects have opposite signs, the net climatic effect may be uncertain. The physical and ecological limitations in optimizing forest management for its net climate effects is shown in the study by Luyssaert et al 2018 (doi/10.1038/s41586-018-0577-1). In my opinion, Section 2.7.1.2.5 of Chapter 2 is a good example of a nicely balanced section. [Sebastiaan Luyssaert, Belgium]	accept with modification, the text was always here, in fact less will be said here and more reference back to the biophysical section
25375	100	2	100	9	Agroforestry is not a forestry-related option, as it concerns croplands and grasslands and not forestlands (in this case, it's a degradation activity). [, France]	accept: text moved to agriculture
5467	100	3	100	3	Agreement instead of agreemen. [, Hungary]	accpet, text replaced
26995	100	11	100	26	This text can be deleted. There is no need to triplicate content on forests which has already been given several times in this chapter. [, Germany]	accept with modification. Text reduced and refers back to earlier section

Comment No	From Page	From Line	To Page	To Line	Comment	Response
1245	100	11	100	26	This paragraph only deals with the biophysical effects of afforestation/deforestation. This section deals with afforestation/reforestation, forest management and agroforestry. Each of these very different land management strategies deserves its own paragraph concerning its biophysiacl effect. The current paragraph is misleading in the sense that the reader may be given the impression that only afforestation and deforestation have biophysical effects. In my opinion, Section 2.7.1.2.5 is a good example of a nicely balanced section. [Sebastiaan Luyssaert, Belgium]	Accept, text added
8559	100	17	100	17	Avoided deforestation is not a mitigation way. It just avoid worsening climate change ! [Marc Aubinet, Belgium]	reject: avoiding the emissions from deforestation is a mitigation measure as are avoiding emissions from fossil fuels
40325	100	17	100	17	sugget to change avoided deforestation to reduced deforestation - consistent with secton 6.3.1.15 [Thelma Krug, Brazil]	accept, done
18365	100	19	100	20	sentence currently reads "...increases in rainfall may in neighbouring regions". This appears to be incomplete - may what? [Will Rolls, United Kingdom (of Great Britain and Northern Ireland)]	accpet, text reduced and refers mostly to previous section
15635	100	20	100	24	None of these studies include BVOC and SOA effects. [Tuomo Kalliokoski, Finland]	aceppt, added text
6309	100	22	100	22	Check punctuation at end of sentence [Tristan Quaife, United Kingdom (of Great Britain and Northern Ireland)]	accept, done
21053	100	24	100	25	This statement that "global effects are small" is unreferenced and may give the misleading impression that we do not need to think very carefully about where afforestation and reforestation occur. For example, see Muri (2018) http://iopscience.iop.org/article/10.1088/1748-9326/aab324/meta which clearly demonstrates that significant trade-offs that can occur (" The geographical location of the bioenergy feedstock is shown to be key to the success of such measures in the context of temperature targets"). Please rewrite this statement to reflect this. [, United Kingdom (of Great Britain and Northern Ireland)]	accpet, text modified
21055	100	41	100	41	Apologies if I have misunderstood, but…… the previous paragraph (line 24-25) appears to dismiss the potential trade-offs of afforestation/reforestation at high latitudes, despite the albedo effect ("small compared to….). However, here, at mid-latitudes (where there is less snow), you seem to be arguing that the effect could be significant ("does not support climate mitigation where there is snow on the ground"). This seems to be inconsistent. Could you please clarify the trade-offs between mitigation and albedo effects in these two paragraphs. [, United Kingdom (of Great Britain and Northern Ireland)]	accpet, text modified
2613	100	41	100	44	unfinished [Wei Li, France]	Accepted
38885	100	47	100	48	"Protection and restoration of wetlands, peatlands and coastal habitats (such as mangrove forests, salt marshes and seagrass meadows) reduces net carbon loss ..." Seagrasses aren't discussed in the remainder of the subsection. Suggest either deleting, or adding information on seagrass mitigation potential below. [, United States of America]	accept , text delted
3285	100	48	100	48	Spelling: provides continueD or … [Viola Heinrich, United Kingdom (of Great Britain and Northern Ireland)]	acepted - done
2615	100	48	100	48	continued [Wei Li, France]	acepted - done
1809	100	48	100	48	continue -> continued. [William Lahoz, Norway]	accepted - done
40539	100		100		check coherency with x chapter box in chapter 1 [Valerie Masson-Delmotte, France]	accepted - to do final check
1247	100	47	101	7	Consider mentioning the trade-off between CO2 and CH4 following rewetting. [Sebastiaan Luyssaert, Belgium]	Accept, text added

Comment No	From Page	From Line	To Page	To Line	Comment	Response
7305	100	14			Meaning of "while globally a cooling is generally simulated when oceans are interacting" is not clear. [Debra Roberts, South Africa]	accpet, text deleted
33387	101	49	49	51	This is heavily contested within the literature and the exception that they do not covert ecosystems high in carbon is a huge. Corn ethanol and woody biomass have both been found to be worse than their fossil fuel equivalents, even though corn ethanol largely displaces grasslands and woody biomass was tested under multiple situations where it displaced less than ideal sinks. See Sterman et al 2018 Environ Res. Lett. 13 015007 [Kelly Stone, United States of America]	accept with modification: This is a key finding supported by the two most recent IPCC reports on the topic, where there are bar charts (based on published studies) that explicitly show this. Indirect effects are more uncertain and are discussed later on in the chapter.
26143	101	4	101	6	Question: Is it possible that the well documented CO2 emissions from drained peatlands are in fact offset by reduced CH4 emissions, given their different forcing factors? [Reid Detchon, United States of America]	Noted, but no sufficient reference
6905	101	5	101	6	Warren, M., K. Hergoualc'h, J. B. Kauffman, D. Murdiyarso, and R. Kolka, 2017: An appraisal of Indonesia's immense peat carbon stock using national peatland maps: uncertainties and potential losses from conversion. Carbon Balance Manag., 12, 12, doi:10.1186/s13021-017-0080-2. http://cbmjournal.springeropen.com/articles/10.1186/s13021-017-0080-2 (Accessed December 14, 2017); Webster, K. L., J. S. Bhatti, D. K. Thompson, S. A. Nelson, C. H. Shaw, K. A. Bona, S. L. Hayne, and W. A. Kurz, 2018: Spatially-integrated estimates of net ecosystem exchange and methane fluxes from Canadian peatlands. Carbon Balance Manag., 13, 16, doi:10.1186/s13021-018-0105-5. https://cbmjournal.biomedcentral.com/articles/10.1186/s13021-018-0105-5 (Accessed January 11, 2019). [Georgii Alexandrov, Russian Federation]	checked and added while appropriate
6907	101	6	101	7	Alexandrov, G. A., V. A. Brovkin, and T. Kleinen, 2016: The influence of climate on peatland extent in Western Siberia since the Last Glacial Maximum. Sci. Rep., 6, doi:10.1038/srep24784. [Georgii Alexandrov, Russian Federation]	reference added
14669	101	6	101	7	These two references are for UK blanket bog systems only. There is a large body of paleoclimate and contemporary process-based evidence to show how peatlands are quite resistant to climate change through a variety of strong internal feedbacks. See a systematic review here: Waddington, et al (2015). Hydrological feedbacks in northern peatlands. Ecohydrology, 8(1), 113-127. [, Canada]	Checked and added
3245	101	10	101	10	It is good to see that it is stated that Blue Carbon issues will be dealt with in the Ocean report, but I would like it to be clarified earlier (ie. Chapter 1) that coastal wetlands are to be considered as part of the Ocean report. Overall, coastal wetlands are not given much detail, and this is dissapointing given the recent decision at COP24 to encourage parties to incorporate inventories of coastal wetland carbon into the NIRs (IPCC GPG Supplement 2013) [John Devaney, Ireland]	Checked and reflected in revision
1249	101	27	101	27	Add at least one paragraph discussing the possible biophysical effects of rewetting. Rewetting has important biophysical effects (at least because the vegetation will change dramatically). It is confusing that chapter 2 that starts with stressing the importance of the biophysical effects, ignores the same biophysical effects completely in what may be its most important section for policy-makers. References can be found in the review by Erb et al 2016 - section on peatland drainage (doi/10.1111/gcb.13443). Although there might be large agreement concerning the biogeochemical effect of rewetting, there remains low agreement and large uncertainty concerning its biophysical effects. Whenever the biogeochemical and biophysical effects have opposite signs, the net climatic effect may be uncertain. [Sebastiaan Luyssaert, Belgium]	Discussion extended

Comment No	From Page	From Line	To Page	To Line	Comment	Response
22531	101	28	101	39	it could be mentioned here that biochar also (according to metanalyses) have the potential to reduce N2O emissions from soils [Anastasios Kentarchos, Belgium]	accept, this has been added
1251	101	36	101	36	Replace "…((Woolf et al …" by "…(Woolf et al … " [Sebastiaan Luyssaert, Belgium]	editorial
1253	101	36	101	37	Check citation format (brackets should be around the years, not around the author name) [Sebastiaan Luyssaert, Belgium]	editorial
28593	101	37	101	37	thees units should be per year [Alan Di Vittorio, United States of America]	editorial
1255	101	38	101	38	Check citation format (brackets should be around the years, not around the author name) [Sebastiaan Luyssaert, Belgium]	editorial
1257	101	39	101	39	Add at least one paragraph discussing the possible biophysical effects of biochar. Biochar may have important biophysical effects on soil albedo. It is confusing that chapter 2 that starts with stressing the importance of the biophysical effects, ignores the same biophysical effects completely in what may be its most important section for policy-makers. Although there might be large agreement concerning the biogeochemical effect of rewetting, there remains low agreement and large uncertainty concerning its biophysical effects. Whenever the biogeochemical and biophysical effects have opposite signs, the net climatic effect may be uncertain. [Sebastiaan Luyssaert, Belgium]	Accepted, text added
38889	101	40	101	47	The "robust evidence, medium agreement" confidence finding in the ability of BECCS to contribute meaningful emissions reductions seems at odds with other parts of this report. In other places, significant doubts are expressed about whether BECCS is even a feasible technology. For example, in D 3.1 on pg. 30 of the SPM, lines 9-11, it is acknowledged that "there are knowledge gaps ... in terms of both their efficacy and their broader impacts" for several mitigation technologies, and BECCS is given as an example. This statement is rated as "robust evidence, high agreement". Further, on pg. 23 of Chapter 1, line 4, the report states that "Confidence in the net BECCS carbon uptake potential is low." Finally, the report states in multiple places that there is no empirical evidence that BECCS will ever be viable at scale in reality. On pg. 7 of Chapter 5, line 19, it is observed that "Compared with aspirations, very little BECCS implementation has been done to date." On pg. 33 of Chapter 6, lines 18-19, the report states "Note that while five BECCS demonstration projects exist (Torvanger 2018), it has yet to be deployed at scale (Kemper 2015)." These are only two of several examples where the report correctly calls the viability of BECCS into question. How can this report express confidence that the scientific community does not know if BECCS will work and has little confidence in the net carbon uptake potential of BECCS, but also express confidence that it will achieve somewhere between 0.5-12 Gt in annual emissions reductions? Recommend reducing the confidence rating of the finding that BECCS will contribute meaningful reductions to, at best, "medium evidence, low agreement". Also, the low end of the mitigation potential for BECCS would seem to be zero based on the characterization in other parts of the document. Recommend making this change as well. [, United States of America]	accept with modification, confidence statements have been harmonised across chapters 2 and 6 and the SPM
30219	101	41	101	41	The statement on the BECCS potential is not in line with the statement in the SPM of SR1.5 (in section C3.2) that the BECCS potential is upto 5 GtCO2/yr. Please correct or explain. [, Netherlands]	Cross checked to ensure consistency
38893	101	41	101	41	These are pure modeling studies that have not been benchmarked, thus 'robust evidence' seems too high of a criteria for how these studies match what the potential for BECCS is in reality. [, United States of America]	Noted

Comment No	From Page	From Line	To Page	To Line	Comment	Response
26997	101	41	101	42	We are surprised that the figure for the mitigation potential of BECCS is given with "robust evidence and medium agreement" while other chapters including the SPM D.31 highlight knowledge gaps for BECCS. [, Germany]	Cross checked with other chapters
38895	101	41	101	43	In what/by year are the estimates for? 2100? Presumably it is pretty far into the future to account for technology development and deployment. [, United States of America]	Sentence removed
29659	101	41	101	47	How does this mitigation potential fit in with the ranges provided in SR1.5, and the bottom up potential (up to 5 GtCO2) given in SR1.5 C3.1 [, Saint Lucia]	Cross checked with SR15
21059	101	42	101	42	This range is inconsistent with that presented in SR1.5, which is 0.5-5Gt (based on Fuss et al). Both ranges are presented as medium agreement with a high level of evidence. This inconsistency on an important issue is confusing for policmakers. Please clarify why the ranges differ or harmonise them. [, United Kingdom (of Great Britain and Northern Ireland)]	Checked and verified
4049	101	42	101	47	A recently published scenario analysis of biomass supply and demand perfectly supports this sentence (Daioglou et al. 2019). This study compares different socioeconomic and technological futures to assess different biomass supply and conversion routes, comparing the overall mitigation. Crucially, the study shows that technological development and land management are the critical aspects to ensure that biomass plays a positive role in climate change mitigation efforts. The key question is not "can land-based CDR help or not?", but rather "under what conditions are these technologies helpful, and under what conditions are they a burden?". These arguments are also supported by already cited literature Popp et al. (2017), Doelman et al. (2018). References: Daioglou, V., Doelman, J. C., Wicke, B., Faaij A. & van Vuuren, D. P. Integrated assessment of biomass supply and demand in climate change mitigation scenarios. Global Environmental Change 54, 88-101, doi: 10.1016/j.gloenvcha.2018.11.012 (2019). [Vassilis Daioglou, Netherlands]	accepted, Reference added
8563	101	49	101	51	I don't understand what is meant exactly by "life-cycle emission". Does it refer to the production/distribution chain ? In the case of use of renewable energy (wood) this has been shown to be incorrect (Searchinger et al., Nature Communicationsvolume 9, Article number: 3741 (2018)) [Marc Aubinet, Belgium]	Accepted with modification: This is a key finding supported by the two most recent IPCC reports on the topic, where there are bar charts (based on published studies) that explicitly show this. Indirect effects are more uncertain and are discussed later on in the chapter.
40541	101		101		check coherency with SROCC on substance and outcome of assessment. [Valerie Masson-Delmotte, France]	Accept this is for wetland section but have checked for consistency, SROCC LA is a CA on this chapter
29845	101	28	102	13	Statements made in the context of Biochar, Bioenergy and BECCS and life-cycle emissions are vague and misleading devoid of any concrete evidence, models and studies dealing with variables under different conditions (there are too many ifs and buts for any scientific conclusion). Ideally, more references to studies and models done under various conditions, with variables and assumptions related to land, food security, land degradation, deforestation of natural and old growth forests, impact of plantations and monocultures, loss of habitat, biodiversity and livelihood is still needed to arrive at more scientific and robust conclusions. There is a clear absence of that in this report. [Souparna Lahiri, India]	Rejected: This Chapter focuses on mitigation options only, and vast literature on the topic was consulted. Interlinkages with land degradation, biodiversity, etc., are assessed in Chapter 6
33391	101	49	102	13	The value of bioenergy from a carbon perspective is more disputed in the literature than this section reflects. Consider Sterman et. al Environmental Res. Lett. 12 015007; Booth 2018 Environ. Res. Lett. 13 035001, and Searchinger (2018) in Nature (volume 564, December 2018). [Kelly Stone, United States of America]	accept with modification. These arguments are not related to lifecycle emissions, but to carbon dynamics, which are discussed in the following paragraph (see the literature cited for the carbon payback times).

Comment No	From Page	From Line	To Page	To Line	Comment	Response
32631	101	4	103	36	Explanation of comments:These comments address the bioenergy parts of the report. Discussion of bioenergy occurs in almost every chapter and in the technical summary. Rather than offer redundant comments, the comments provided here are focused on the discussion in chapter 2. However, I ask that these comments be provided to the authors of other chapters because much of the same discussion applies to these chapters as well. I apologize, due to limited available time, for likely typographical errors and poor phrasing Explanation of comments:These comments address the bioenergy parts of the report. Discussion of bioenergy occurs in almost every chapter and in the technical summary. Rather than offer redundant comments, the comments provided here are focused on the discussion in chapter 2. However, I ask that these comments be provided to the authors of other chapters because much of the same discussion applies to these chapters as well. [Timothy Searchinger, United States of America]	Noted/ accept with modification: Thanks for the extensive comments provided to the whole report. These inputs were shared to all the chapter discussing bioenergy, afforestation, IAMs and land competition in general. They were also discussed in a ad hoc cross-chapter meeting for better coordination. We found that some of these aspects were already covered in several parts of the report, and others have been better explained using some of the proposed refs. The concept of competition for land for multiple uses is addressed in Chapter 1, 5 and 6, and mentioned in the context of climate change mitigation in Chapter 2 (where ILUC and carbon payback times are explicitly discussed). The vast ranges of potentials for BECCS and IAMs are addressed in a dedicated box.
32637	101	4	103	36	Short summary of bioenergy discussion: The basic calculations and assumptions underlying the key statements regarding bioenergy in these pages are presented only in the papers cited, and those papers themselves (particularly those that involve modeling) often leave out their own key assumptions. However, based on familiarity with a large number of the references and my own writings, I identify the following problems, which can be summarized as follows: 1.Most if not all of the discussion is based on a mistaken assumption that the burning of biomass, at least initially, should be treated as carbon neutral. This assumption is incorporated into lifecycle analyses and most models used to estimate bioenergy potential. 2.Phrased differently, using land to grow energy crops (the primary estimated source of bioenergy feedstock) inherently comes at the cost of not using that land for other purposes. The analysis of discussion does not properly count or directly confront this opportunity cost in evaluating the potential of bioenergy. 3.In the discussions of both bioenergy and reforestation, the chapter confuses the source of the human activity that causes the mitigation, which is a combination of growth in agricultural yields or reductions in demand and protection of native forests and other natural lands. Bioenergy and reforestation are mostly just ways of realizing this the resulting availability of land that is “liberated” from food production. (These achievements are in various ways built into the assumptions of the models or simpler analyses projecting mitigation potential for either bioenergy or reforestation.) The core mitigation activity is therefore the adjustments to yields and demand, which has critical implications for policy. 4.Bioenergy and reforestation greatly differ as mitigation because land will typically regenerate forest on its own – or through human efforts that occur regardless of climate change – even if agricultural land becomes surplus. The benefits of bioenergy, if any, are therefore only the net gains using land for bioenergy compared with that reforestation. Even under assumptions of increasing “land liberation,” that means bioenergy usually increases emissions when factoring in the opportunity cost. Even with extremely favorable assumptions, bioenergy will nearly always generate small percentage savings compared to fossil fuels and even if land is assumed to be available. 5.Without explanation, but through its endorsement of other papers, the discussion here implicitly treats the timing of emissions as irrelevant or at least irrelevant so long as they occur by 2100. That typically means uses of bioenergy that actually increase carbon in the atmosphere for decades are still treated as reducing emissions if continued use will reduce	Noted/ accept with modification: Thanks for the extensive comments provided to the whole report. These inputs were shared to all the chapter discussing bioenergy, afforestation, IAMs and land competition in general. They were also discussed in a ad hoc cross-chapter meeting for better coordination. We found that some of these aspects were already covered in several parts of the report, and others have been better explained using some of the proposed refs. The concept of competition for land for multiple uses is addressed in Chapter 1, 5 and 6, and mentioned in the context of climate change mitigation in Chapter 2 (where ILUC and carbon payback times are explicitly discussed). The vast ranges of potentials for BECCS and IAMs are addressed in a dedicated box.

Comment No	From Page	From Line	To Page	To Line	Comment	Response
32639	101	4	103	36	Basic Assumption of carbon neutrality: Burning biomass will always emit at least some more carbon than burning fossil fuels per unit of energy because of molecular bonds, and often substantially more due to water content and other inefficiencies. (Timothy D. Searchinger, Tim Beringer, Daniel M. Kammen, Eric F. Lambin, Wolfgang Lucht, Peter Raven, Jean-Pascal van Ypersele 2018) (T. D. Searchinger, Beringer, and Strong 2017). Bioenergy can therefore only reduce emissions relative to fossil fuels if these bioenergy emissions are offset in some way. That can occur through additional carbon absorption through additional plant growth, or through reduced sources, such as reduced decomposition of biomass by microbes, fire or human consumption. Yet, to be a true offset, this plant growth or reduced consumption must additionally result from the bioenergy. Thus, the mere fact that biomass results from plant growth does not make it carbon free. This point has now been broadly accepted in theory, (Haberl et al. 2012). As the IPCC stated in AR V, carbon neutrality assumes "the CO2 (carbon dioxide) emitted from biomass combustion is climate neutral because the carbon that was previously sequestered from the atmosphere (before combustion) will be re-sequestered if the growing stock is managed sustainably." It underscores that, "[t]he shortcomings of this assumption have been extensively discussed in environmental impact studies and emission accounting mechanisms" and "the neutrality perception is linked to a misunderstanding of the guidelines for GHG (greenhouse gas) inventories." Fifth Assessment Report, IPCC, Agriculture, Forestry and Other Land Use (AFOLU) http://www.ipcc.ch/pdf/assessment-report/ar5/wg3/ipcc_wg3_ar5_chapter11.pdf p 879, footnote 14. Although this board is generally accepted, the lesson is commonly ignored, and carbon neutrality is a core assumption of numerous papers relied upon in the draft. Incorporation of carbon neutrality assumption into analyses of direct bioenergy GHG benefits: On page 2-101, lines 49-52, the draft writes: "Direct life-cycle emissions of most modern bioenergy alternatives constitute net 50 savings in comparison to fossil fuels, providing they do not result on conversion of ecosystems high in carbon." (citations omitted). This analysis claims, in effect, that using agricultural land for bioenergy provides direct greenhouse gas savings of over 50%, as would using abandoned agricultural land that would otherwise reforest. These analyses are based literally on the assumption that biomass is carbon neutral through the simple act of not counting the carbon dioxide emissions from burning biomass or the carbon dioxide released by fermenting starches into ethanol. (This can be seen by elaboration of the major categories of emissions in the primary table in (T.D. Searchinger, Edwards, et al.	Noted/ accept with modification: Thanks for the extensive comments provided to the whole report. These inputs were shared to all the chapter discussing bioenergy, afforestation, IAMs and land competition in general. They were also discussed in a ad hoc cross-chapter meeting for better coordination. We found that some of these aspects were already covered in several parts of the report, and others have been better explained using some of the proposed refs. The concept of competition for land for multiple uses is addressed in Chapter 1, 5 and 6, and mentioned in the context of climate change mitigation in Chapter 2 (where ILUC and carbon payback times are explicitly discussed). The vast ranges of potentials for BECCS and IAMs are addressed in a dedicated box.

Comment No	From Page	From Line	To Page	To Line	Comment	Response
32641	101	4	103	36	Source of greenhouse gas mitigation in estimates primarily result and are contingent on reduced agricultural land use: Papers that claim large potential for mitigation by forest growth or bioenergy, including BECCS, rely on decreasing agricultural land. For example, the vast majority of the reforestation potential estimated in (Griscom, 2017) is based on reforesting all the world's grazing land that was originally forest, which is generally the world's most productive grazing land. ((Timothy D. Searchinger et al. 2018) estimated grazing land that was originally forested or had more than 60% canopy cover as 40% of the world's grazing land.) The estimates of BECCS potential in the IMAGE, MAGPIE and GCAM models are also predicated on either large agricultural yield gains or reductions in consumption (Popp et al. 2014). (See discussion of those model results in (T. D. Searchinger, Beringer, and Strong 2017)), which make agricultural land available for bioenergy. These models require a variety of conditions, and assumptions, which mean they should not be interpreted as predictors of what would actually happen if the world enacted policies to encourage bioenergy. For example, the IMAGE and MAGPIE models both impose as model conditions absolute protection of the world's forests. Both models also assume both large exogenous yield gains and further, large endogenous increases in yield as a result of higher food prices spurred by increased demand. With these conditions, increased demand for bioenergy must result in reductions in agricultural land. The GCAM model works similarly but also finds room for BECCS through large reductions in livestock consumption. The GCAM model imposes a perfect terrestrial carbon price, which means, for example, that anyone in the world cutting down a tree must pay the carbon cost of the tree and anyone planting trees (or producing bioenergy crops that reduce fossil carbon) is compensated for that carbon gain. In effect, this model therefore too guarantees all but perfect forest protection. One further result is that farmers with grazing land remove land from beef production and plant that land in bioenergy crops until the price of beef rises to a new equilibrium. The result frees up hundreds of millions of hectares of land. What the model is essentially analyzing is a large global tax on beef consumption. Three essons should be taken from this description. First, these models are attempts to analyze what the world's land might generate assuming perfect or nearly perfect land use design and in the case of GCAM, some ideal carbon-efficient food consumption. That should at most be	Noted/ accept with modification: Thanks for the extensive comments provided to the whole report. These inputs were shared to all the chapter discussing bioenergy, afforestation, IAMs and land competition in general. They were also discussed in a ad hoc cross-chapter meeting for better coordination. We found that some of these aspects were already covered in several parts of the report, and others have been better explained using some of the proposed refs. The concept of competition for land for multiple uses is addressed in Chapter 1, 5 and 6, and mentioned in the context of climate change mitigation in Chapter 2 (where ILUC and carbon payback times are explicitly discussed). The vast ranges of potentials for BECCS and IAMs are addressed in a dedicated box.

Comment No	From Page	From Line	To Page	To Line	Comment	Response
32643	101	4	103	36	The discussion of ILUC is inappropriate and factoring in modeled estimates of indirect land use change do not properly count the carbon opportunity costs of land. The discussion of indirect land use change is treated in the draft as though bioenergy delivers direct greenhouse gas savings and ILUC indicates some kind of cost. In fact, as discussed above, when bioenergy merely diverts existing plant production to bioenergy use, there are no direct savings. Analyses of market-mediated effects, "indirect" effects," are in fact an effort to find offsets for the carbon released by bioenergy production. Please see the graphics in (T.D. Searchinger 2010) to understand how this work. To emphasize, this is not a conceptual point, but a description of physically what is going on in ILUC analyses. These offsets of can result from three sources: (1) reductions emissions of carbon dioxide by people and livestock because of reduced food consumption; (2) increased carbon uptake through increased agricultural yield gains on existing agricultural land, and (3) new crops or grass production on expanded agricultural land, but the cost should include. However, the gains from new crop production from clearing forest, for example, must factor in the loss of any existing carbon storage. Understanding that ILUC is a search for all these forms of market-mediated offsets has many implications. First, it means that any claims to offsets, and therefore GHG benefits, from diverting agricultural land to bioenergy production are at best highly uncertain. The text properly describes the high uncertainties in these models (and probably even understates them). But then key point is that this analysis is not a search for costs, it is a search for benefits. If ILUC is uncertain, so are any estimates of GHG benefits from bioenergy. Second, the ILUC analysis is not an estimate of the cost of estimates of GHG benefits from bioenergy while meeting otherwise existing levels of food demand because price-induced reductions in food demand are sources, and common major sources, of GHG benefits. This benefit could be calculated as reduced land conversion because of the need to replace less food, but the actual, physical effect is the result of fewer emissions of carbon dioxide directly by people and livestock through reduced respiration (and a little through reduced waste).(T.D. Searchinger, Edwards, et al. 2015) showed that the ILUC models used by governments in the	Noted/ accept with modification: Thanks for the extensive comments provided to the whole report. These inputs were shared to all the chapter discussing bioenergy, afforestation, IAMs and land competition in general. They were also discussed in a ad hoc cross-chapter meeting for better coordination. We found that some of these aspects were already covered in several parts of the report, and others have been better explained using some of the proposed refs. The concept of competition for land for multiple uses is addressed in Chapter 1, 5 and 6, and mentioned in the context of climate change mitigation in Chapter 2 (where ILUC and carbon payback times are explicitly discussed). The vast ranges of potentials for BECCS and IAMs are addressed in a dedicated box.

Comment No	From Page	From Line	To Page	To Line	Comment	Response
32645	101	4	103	36	Any benefit of bioenergy can at most be a net gain compared to reforestation: As the above example conveys, to properly calculate the GHG consequences of bioenergy – even under the assumption that agricultural land becomes surplus – any estimate of the GHG reductions from bioenergy (including BECCS) should deduct a reasonable estimate of the reforestation sequestration benefit. For example, if reforestation were to sequester 3tC/ha/y, and bioenergy generate only 2 tC/ha/y (far more than would be generated by cellulosic ethanol today), then the net consequences is -1tC/ha/y. But even if bioenergy were to generate 4tC/ha/y, and reforestation 3tC/ha/y, then the net gain would only be 1tC/ha/y. That needs to be translated into percentage reductions compared to the use of fossil fuels. Assuming no production emissions from the bioenergy production, the reduction relative to fossil fuels would only be 25% (1-3tC/4tC). That is unlikely to be a useful climate reduction strategy because all climate strategies require virtual 100% reductions in emissions from the energy sector. The reason reforestation should be considered the counterfactual baseline is first that even without any mitigation effort, surplus agricultural land typically regenerates native vegetation and assuming it were naturally forested, typically grows back as forest. For example, (Poorter et al. 2012) provided an analysis of average above-ground carbon sequestration rates from a range of abandoned croplands in the tropics (drier and wetter), which generates an estimate of 4.1tC/ha/y when adjusted to factor in below-ground vegetative carbon and soil carbon sequestration rates (Timothy D. Searchinger et al. 2018) (methods). Combining this tropical estimate with other papers that analyzed forest regrowth in the estimate globally for abandoned cropland was 3.6 tC/ha/y (Timothy D. Searchinger et al. 2018). Many of these lands naturally regenerated, while others were planted, but those plantings did not reflect climate mitigation decisions; they reflected instead common private and governmental efforts to reforest surplus agricultural land where it occurs. If reasonably good agricultural land is available to become surplus, reforestation is therefore a likely counter-factual. Moreover, even if additional mitigation expenditures were necessary, a proper opportunity cost analysis should account for the carbon that could be sequestered at the same expense, and in general, reforestation should be cheaper than bioenergy. It is possible that there are might be some surplus agricultural lands that for disturbance reasons might not regenerate natural vegetation without additional effort and might be more	Noted/ accept with modification: Thanks for the extensive comments provided to the whole report. These inputs were shared to all the chapter discussing bioenergy, afforestation, IAMs and land competition in general. They were also discussed in a ad hoc cross-chapter meeting for better coordination. We found that some of these aspects were already covered in several parts of the report, and others have been better explained using some of the proposed refs. The concept of competition for land for multiple uses is addressed in Chapter 1, 5 and 6, and mentioned in the context of climate change mitigation in Chapter 2 (where ILUC and carbon payback times are explicitly discussed). The vast ranges of potentials for BECCS and IAMs are addressed in a dedicated box.

Comment No	From Page	From Line	To Page	To Line	Comment	Response
32647	101	4	103	36	GHG reductions from use of savannas for bioenergy appears to be based on long payback periods and would have enormous biodiversity costs: The other main source of additional lands for bioenergy often identified are in a land use category commonly called “other” (Popp et al. 2014). “Other” in reality means the world’s tropical savannas. Many of the BECCS potential analyses assume loss of half or more of the entire biome (Popp et al. 2014). From a GHG standpoint alone, this analysis appears overstated as well. In (Gibbs et al. 2008) (Fargione et al. 2008) and (T.D. Searchinger, Estes, et al. 2015), the various authors all found substantial carbon pay-back times for conversion of tropical savannas to food and energy crops. It is unclear what other analyses are doing to determine that these conversions generate GHG reductions, but I believe that the savings found in the GCAM, IMAGE and MAGPIE models described (Popp et al. 2014) do so because they do not apply time-amortization or time-discounting and instead focus on what are often long-term results in 2100 (discussed more below). From a biodiversity standpoint, the conversion of these savannas, particularly at the scales of hundreds of millions of hectares proposed, would be catastrophic. The world’s tropical savannas are enormous centers of biodiversity regardless of whether they are in protected areas. (T.D. Searchinger, Estes, et al. 2015). Vast numbers of biodiversity hotspots are savannas. (Myers et al. 2000) Most of the Cerrado has already been lost, and African mammalian species, among others, are in spectacular decline. Although the draft contains general language warning of potential trade-offs between carbon and biodiversity, that language does not do justice to the ecological destruction that is implicit in many of these BECCS potential analyses. [Timothy Searchinger, United States of America]	Noted/ accept with modification: Thanks for the extensive comments provided to the whole report. These inputs were shared to all the chapter discussing bioenergy, afforestation, IAMs and land competition in general. They were also discussed in a ad hoc cross-chapter meeting for better coordination. We found that some of these aspects were already covered in several parts of the report, and others have been better explained using some of the proposed refs. The concept of competition for land for multiple uses is addressed in Chapter 1, 5 and 6, and mentioned in the context of climate change mitigation in Chapter 2 (where ILUC and carbon payback times are explicitly discussed). The vast ranges of potentials for BECCS and IAMs are addressed in a dedicated box.

Comment No	From Page	From Line	To Page	To Line	Comment	Response
32649	101	4	103	36	The timing discussion is inaccurate and appears to have a major effect on estimates of bioenergy potential. Page 2-12 lines 43-44 states that "forcing from bioenergy systems is temporary and less relevant to long-term temperature stabilization, provided the biomass is regrown." The issue of the timing of emissions is a big and complex one, but this statement is fundamentally flawed. First, although bioenergy emissions are potentially offset in the long-term by continued use or forest regrowth, they do not merely postpone mitigation but result in actual increases in emissions and therefore warming for many years. During this period, a variety of damages immediately occur, plus there are consequences in the form of melting glaciers, acidifying oceans, thawing permafrost etc. that are not eliminated just because emissions are ultimately removed. There are also serious risks of crossing a variety of tipping points. Any consideration of the value of the timing of mitigation should also account for basic economic factors, such as the time value of money. There is also the very real risk that promised long-term mitigation will not occur. Based on these considerations, governments to date have chosen 20 or 30 years to account for the effect of bioenergy emissions (Timothy D. Searchinger, Tim Beringer, Daniel M. Kammen, Eric F. Lambin, Wolfgang Lucht, Peter Raven, Jean-Pascal van Ypersele 2018). Measures that increase emissions in the next few decades, rather than reduce them, would also seem inconsistent with the Paris accords. This timing also appears to play a significant if unspoken role in estimates of bioenergy potential. For example, based on my understanding, the estimates of bioenergy and BECCS potential published by the users of the GCAM, IMAGE and MAGPIE models all base results on effects on either emissions or radiative forcing in the year 2100. As such, uses of bioenergy even with long payback periods that occur, e.g., in 2050 or before, will appear beneficial. The report should not discuss these estimates (even implicitly through references to other papers that cite these and similar studies) without explaining this point. In other words, the report should explain that they are based on approaches, contrary to those now taken in the U.S. and Europe, that evaluate bioenergy only based on results on radiative forcing decades later even if they result in increases in atmospheric warming for decades. [Timothy Searchinger, United States of America]	Noted/ accept with modification: Thanks for the extensive comments provided to the whole report. These inputs were shared to all the chapter discussing bioenergy, afforestation, IAMs and land competition in general. They were also discussed in a ad hoc cross-chapter meeting for better coordination. We found that some of these aspects were already covered in several parts of the report, and others have been better explained using some of the proposed refs. The concept of competition for land for multiple uses is addressed in Chapter 1, 5 and 6, and mentioned in the context of climate change mitigation in Chapter 2 (where ILUC and carbon payback times are explicitly discussed). The vast ranges of potentials for BECCS and IAMs are addressed in a dedicated box.

Comment No	From Page	From Line	To Page	To Line	Comment	Response
32651	101	4	103	36	Bioenergy from forest-harvest: On page 2-102, lines 35-45, the report briefly discussed bioenergy from managed forests. In addition to the discussion of timing, which I mention above, I have several suggestions. First, the report should mention that there is a broad consensus from a large number of studies that harvesting wood deliberately for energy use, using the alternative of leaving the wood in the forest, will increase carbon dioxide in the atmosphere for decades to centuries. This is the finding of roughly a dozen separate modeling studies of different forests with different management regimes used for different energy purposes. See papers cited in (Timothy D. Searchinger, Tim Beringer, Daniel M. Kammen, Eric F. Lambin, Wolfgang Lucht, Peter Raven, Jean-Pascal van Ypersele 2018); (Sterman, Siegel, and Rooney-Varga 2018). The intuitive reasons this must be the case are explained in the above paper. Second, the report should mention that while some studies employ economic analysis to claim that these additional emissions may be offset by changed management, these studies are based on highly fixed assumptions. (Cintas et al. 2017) is a good example. In that study, assumptions built into the model in effect preclude the possibility that additional wood would be harvested from the world's forests in response to bioenergy demand that would not otherwise be harvested. The paper does so through three assumptions: (1) all land within the modeled forest area will be cut whether for bioenergy or not; (2) bioenergy demand continues indefinitely into the future; (3) no bioenergy demand could be met by harvesting wood either in this forest or elsewhere that would not otherwise be cut. Because this same forest area must supply all wood demand, the only way to do so is to change management. This is not a real- world situation. [Timothy Searchinger, United States of America]	Noted/ accept with modification: Thanks for the extensive comments provided to the whole report. These inputs were shared to all the chapter discussing bioenergy, afforestation, IAMs and land competition in general. They were also discussed in a ad hoc cross-chapter meeting for better coordination. We found that some of these aspects were already covered in several parts of the report, and others have been better explained using some of the proposed refs. The concept of competition for land for multiple uses is addressed in Chapter 1, 5 and 6, and mentioned in the context of climate change mitigation in Chapter 2 (where ILUC and carbon payback times are explicitly discussed). The vast ranges of potentials for BECCS and IAMs are addressed in a dedicated box.

Comment No	From Page	From Line	To Page	To Line	Comment	Response
32653	101	4	103	36	Alternative discussion of bioenergy: I would suggest alternative discussion of bioenergy including the following points: •Most large estimates of bioenergy potential rely primarily on the growth of energy crops. •Most studies estimate that agricultural land is likely to expand to meet rising demand •Large estimates of the potential for bioenergy to provide GHG reductions, without jeopardizing food supplies, are therefore based on larger than typically estimated increases in agricultural yields or reductions in expected growth in demand, such as diet shifts. •If productive agricultural land becomes available, it will typically reforest or otherwise regrow native vegetation, whether naturally or through plantings regardless of climate mitigation. •Any benefits of bioenergy on such land therefore are only those that exceed the carbon sequestration from regrowing natural vegetation, including the amount that could occur if necessary for the same economic cost. •Such gains are likely to be rare and limited. Bioenergy potential studies have not focused on such net gains but have improperly counted all gains. •Many studies that estimate large bioenergy potential from existing crops are based on a number of conditions that are designed to test possible technical potential under ideal assumptions rather than to predict real-world conditions. For example, models typically assume perfect or near-perfect forest protection, so that bioenergy cannot cause conversion of forests or other high-carbon lands. Some assume policies that will lead to large reductions in consumption of beef and a freeing up of large areas of pasture. Nearly all assume that governments and individuals will make large, and sometimes ideal, investments to push yield gains. •Many large bioenergy potential studies do not discount the availability of bioenergy even its use would increase carbon in the atmosphere for 20 or 30 years, as is now the focus of government biofuel policies, so long as reductions in radiative forcing would occur in 2100 either through continued use of bioenergy or forest regrowth. Such use of bioenergy would increase warming for decades. •Large numbers of studies have estimated that the additional harvest of wood for bioenergy will lead to increased carbon in the atmosphere for decades to centuries if the alternative is leaving that same amount of wood in the forest. [Timothy Searchinger, United States of America]	Noted/ accept with modification: Thanks for the extensive comments provided to the whole report. These inputs were shared to all the chapter discussing bioenergy, afforestation, IAMs and land competition in general. They were also discussed in a ad hoc cross-chapter meeting for better coordination. We found that some of these aspects were already covered in several parts of the report, and others have been better explained using some of the proposed refs. The concept of competition for land for multiple uses is addressed in Chapter 1, 5 and 6, and mentioned in the context of climate change mitigation in Chapter 2 (where ILUC and carbon payback times are explicitly discussed). The vast ranges of potentials for BECCS and IAMs are addressed in a dedicated box.
32459	101	40	103	13	As pointed out above it would be important to take into account realistic counterfactual scenarios as well that take into account, for example, the natural restoration capacity of degraded ecosystems like forests in a set aside scenario. This dimension seems lacking from the current analysis. [Simone Lovera-Bilderbeek, Paraguay]	Reject: Scenarios are considered in the following sections, where alternative land use scenarios are explored by different IAMs
18367	101	40	103	13	A large number of different feedstocks, conversion pathways and end uses are summarised quite briefly in these sections and it is not particularly clear which fuel type is being discussed at each point. In view of the very broad range of potential payback periods for different bioenergy supply chains, there is perhaps an argument for expanding this section to define and discuss them more explicitly. Alternatively, you could discuss each of them in turn with a heading, so we know what we're reading about? [Will Rolls, United Kingdom (of Great Britain and Northern Ireland)]	accept wtih modification: The major focus of this report is on land management, rather than on possible biofuel pathways. The latter were largely discussed in previous IPCC reports (SREN and appendix to WGIII Ch. 11 in AR5). A short reference to these documents and other papers is given here, different pathways are breifly mentioned inteh bioenergy box

Comment No	From Page	From Line	To Page	To Line	Comment	Response
21057	101	40	103	36	This section on bioenergy and BECCS is very well written and extremely informative. However there is a prominent area of debate that could be covered more clearly. The use of forest biomass is an area of considerable scientific and public debate but not really touched upon here (though payback times are mentioned). Critics such as the work of Searchinger have made this an area of great interest to policymakers and it feels like this wider debate isn't really reflected in the discussion here. Please consider adding a discussion on this issue. [, United Kingdom (of Great Britain and Northern Ireland)]	accept with modification: Thanks for the appreciation. The use of forest biomass for energy application is expected to play a minor role, and mostly from residues. The major bioenergy potential lies in non forested land, via possible establishment of bioenergy plantations. The views of Searchinger on the matter, mostly related to ILUC, are discussed in the dedicated ILUC section, and on the carbon payback times.
38891	101	40	103	36	Suggest better disaggregating the use of bioenergy (well described including full lifecycle emissions, land use impacts, and substitution effects); CCUS (not described, can be applied to emissions generated from a variety of fuels); and BECCS, which combines the two. The potential to "add" CCUS on to bioenergy is not fully decribed, although BECCS is mentioned at the beginning of the section. Alternately, reframe this section as bioenergy only. [, United States of America]	accept with modification: The major focus of this report is on land management, rather than on possible biomass utilization pathways. The latter were largely discussed in previous IPCC reports (SREN and appendix to WGIII Ch. 11 in AR5). A short reference to these documents and other papers is done.
30221	101	41	103	36	In this section bioenergy use seems to be equated to the use of BECCS. That is incorrect. Section C3.2 of the SPM of SR 1.5 says:" The use of bioenergy can be as high or even higher when BECCS is excluded compared to when it it is included, due its (bioenergy) potential for replacing fossil fuels across sectors." Therefore it is necessary to discuss bioenergy also separtely rom BECCS. [, Netherlands]	Accepted: Mitigation potential of bioenergy only added.
38897	101	41	103	36	Given the title on page 101, line 40, and given the very heavy reliance on BECCS in most of the IAM modeling for deep decarbonization scenarios, one would think that there would be more than a couple sentences on the potential role (including costs and deployment issues, in addition to mitigation estimates) given to the topic, but that is it in this section. [, United States of America]	accepted: There is an entire box on mitigation potentials from BECCS in IAMs, which is now referred to in the text.
8561	101	51	103	35	All references relative to this section are missing. Difficult to validate in these conditions. [Marc Aubinet, Belgium]	accept, refs added
38887	101	24	109	15	This section focuses almost entirely on IAMs and how they handle land-use change with no discussion about land-use models (that typically have a better representation of forestry than IAMs) and land management, particularly in forestry. Studies like Sohngen and Mendelsohn (American Journal of Agricultural Economics, 2003), Bosetti et al. (Energy Policy, 2007), Favero et al. (Climatic Change, 2017), and Tian et al. (Land Economics, 2018) show that forest management is an important component of fluxes. This section needs to acknowledge that most IAMs have not yet accounted for forest management. [, United States of America]	Modified and extended
993	101	37			"GtCO2-eq yr-1"? [Tobias Rütting, Sweden]	editorial
32553	101	40		47	If you are going for high evidence, high agreement, you should probably have more than 3 references. I suggest adding Muri (2018), ERL, doi: 10.1088/1748-9326/aab324. [Helene Muri, Norway]	accepted, ref added
2617	102	6	102	6	I agree that "can be more energy and GHG intensive" but also get higher yields. [Wei Li, France]	Accpted, text added
2619	102	7	102	10	This may be true for switchgrass but not for sure for miscanthus. See Cadoux, S., Riche, A. B., Yates, N. E. & Machet, J.-M. Nutrient requirements of Miscanthus x giganteus: conclusions from a review of published studies. Biomass and Bioenergy 38, 14–22 (2012). AND Miguez, F. E., Villamil, M. B., Long, S. P. & Bollero, G. A. Meta-analysis of the effects of management factors on Miscanthus ×giganteus growth and biomass production. Agric. For. Meteorol 148, 1280–1292 (2008) [Wei Li, France]	reject: Also these references report that N fertilizers are needed for misanthus, but at lower rates than other crops. This is the result we also report in the report.

Comment No	From Page	From Line	To Page	To Line	Comment	Response
15189	102	15	102	25	This paragraph misses the constraint on BECCS associated with accessibility of a geological storage reservoir (P.A. Turner et al. 2018. Climatic Change. Https://doi.org/10.1007/s10584-018-2189-z [Daniel Zarin, United States of America]	reject: Outside the scope of this report,
4051	102	15	102	25	I agree with the statement that large scale deployment of bioenergy will require increasing ammounts of land, unless supplied by residues. However this paragraph does not give any insight on the potential supply of biomass/bioenergy at low emission factors/payback times. This has recently been quantified by a study which goes beyong the cited Elshout et al. (2015) and detemrines spatially explicit bioenergy potentials and emission factors, presenting results in a so-called "emission-supply" curve and assessing the main sensitivities (crop yields, technological development, amortisation period, food demand) (Daioglou et al. 2017). Such studies help further quantify the technical poential of "low emission" biomass and its spatial characteristics. References: Daioglou, V., Doelman, J., Stehfest. E., Müller, C., Wicke, B., Faaij, A., & van Vuuren D.P., Greenhouse gas emission curves for advanced biofuel supply chains. Nature Climate Change 7, 920-924, 10.1038/s41558-017-006-8 (2017). [Vassilis Daioglou, Netherlands]	accept, refs added
5365	102	15	102	45	This text is not yet balanced and does not do justice to the large recent literature on these issues. For example, the following references are relevant. There is a lot more to be included. This still needs substantial attention before it is up to IPCC standards of a fair and unbiased assessment. It misses, among others, several relevant recent papers by Holtsmark (e.g. Holtsmark, B., 2015. A comparison of the global warming effects of wood fuels and fossil fuels taking albedo into account. GCB Bioenergy 7, 984–997. https://doi.org/10.1111/gcbb.12200), by Searchinger (e.g. Searchinger, T.D., et al. 2018. Europe's renewable energy directive poised to harm global forests. Nature Communications 9, 3741. https://doi.org/10.1038/s41467-018-06175-4), Pingoud (e.g., Pingoud, K., 2018. Trade-offs between forest carbon stocks and harvests in a steady state – A multi-criteria analysis. Journal of Environmental Management 210, 96–103. https://doi.org/10.1016/j.jenvman.2017.12.076), Schulze (e.g., Schulze, E., et al., 2012. Large-scale bioenergy from additional harvest of forest biomass is neither sustainable nor greenhouse gas neutral. GCB Bioenergy 4, 611–616. https://doi.org/10.1111/j.1757-1707.2012.01169.x), Kurz (e.g. Kurz, W.A., et al. 2016. Climate change mitigation through forest sector activities: principles, potential and priorities 1. Unasylva 67, 61.). See also Haberl, H., 2013. Net land-atmosphere flows of biogenic carbon related to bioenergy: towards an understanding of systemic feedbacks. GCB Bioenergy 5, 351–357. https://doi.org/10.1111/gcbb.12071 [Helmut Haberl, Austria]	accept with modification. We consulted the references and they essentially refer to the topic of carbon payback times, mainly about forest-based bioenergy. It seems these refs do not add to the aspects already included and expanded on. Forest bioenergy plays a minor role, because the major potential supply lies on dedicated crops. It is not clear to what regards this text is imbalanced in specific terms. This is only one sub section of this chapter and we do not have room to include everythings but have tried to be balanced. It was appreciated as very well balanced by other reviewers.
18363	102	17	102	18	suggest adding "Carbon debt and carbon sequestration parity in forest bioenergy production" Mitchell et al 2012 (https://doi.org/10.1111/j.1757-1707.2012.01173.x) to references. This paper illustrates the differences in carbon payback at different management intensities on different site types. [Will Rolls, United Kingdom (of Great Britain and Northern Ireland)]	accept, refs added

Comment No	From Page	From Line	To Page	To Line	Comment	Response
15263	102	18	102	21	Current use of industrial biomass is rarely from dedicated land, it is a by-product of forest management for other purposes (primarily solid wood products). Biomass feedstocks are often residues from harvesting or processing of wood products, thinning for saw-timber production, or clearing of small damaged or diseased trees. It is rarely from dedicated biomass where 100% of the land management is for this purpose. There is significant potential to expand the use of sustainable industrial biomass by utilising more of these by-products and continuing to improve forest management, without the need for large scale new planting of energy crops. This needs to be examined and explained in more detailed and put into context against models and other traditional uses. [Andrew Dugan, United Kingdom (of Great Britain and Northern Ireland)]	accept: This perspective has been more clearly explained in the text.
30969	102	18	102	21	On the point that biomass puts pressure on land and risks the loss of carbon-rich land cover which is replaced by bioenergy crops that in themselves will not provide immediate returns in terms of C02 savings when compared to the work that is already being done by naturally-occurring ecosystems. It would be useful to see a definition of 'residues'. [Kelsey Perlman, France]	noted: Comment unclear
33393	102	21	102	23	A lot about the feasibility of biofuels rests on limiting it to marginal lands (which is a fairly small amount of land), but what ensures this will happen in the real world? Why would bioenergy companies produce on marginal lands when they have the resources to acquire better land that would produce biomass more easily (but likely displace food production, biodiversity and/or have a huge carbon costs in loss of high carbon sequestering ecosystems)? [Kelly Stone, United States of America]	noted: This is out context for this chapter. The policy dimension of the mitigation options are the core of Chapter 7, and the interlinkages with the other challenges are discussed in Chapter 6. Further the objective of the IPCC reports is to be policy relevant, but not policy prescriptive
30971	102	21	102	24	What does 'available' mean? The quotation marks and discussion here imply that this is a contested term. We appreciate that this is acknowledged. It would indeed be poorly advised to accept any findings of what land is 'available' for bioenergy use, if those findings have not taken current land use (and both its long- and short-term climate impacts), presence of biodiversity and protected species, and the need to protect traditional and local livelihoods and land rights, into account. [Kelsey Perlman, France]	accept: This has been better clarified.
1259	102	23	102	24	Check whether these references are in the reference list. I could not find any of them. [Sebastiaan Luyssaert, Belgium]	Checked and linked
18369	102	24	102	25	is "low agreement" formal uncertainty language, or simple English usage? Should it be in italics? [Will Rolls, United Kingdom (of Great Britain and Northern Ireland)]	accept: Sentence revised
17865	102	27	102	32	Another reference could be Daioglou et al. 2017: Greenhouse gas emission curves for advanced biofuel supply chains [Quentin Lejeune, Germany]	accept: Reference added
38899	102	27	102	33	In first sentence of this paragraph, suggest replacing statement that emissions of carbon "may take up to a century to be re-paid" with the statement "may take more than a century to be repaid". The second sentence in this paragraph suggests that establishing bioenergy crops on tropical forest or peatlands could take over 100 years, a finding that best describes the degree of uncertainty present in the current literature on biofuel GHG impacts. The first sentence should be revised to be consistent with this. [, United States of America]	accept: Sentence changed
26145	102	27	102	33	Question: Have these estimates accounted for offsetting reductions in CH4 emissions? [Reid Detchon, United States of America]	noted: Yes, it is.
33389	102	27	102	41	See Sterman et al 2018 Environ Res. Lett. 13 015007, where the conclusion on the payback times within a 100 years comes to a different conclusion. [Kelly Stone, United States of America]	accept: reference added

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30011	102	32	102	32	a similar analysis with similar conclusions has been done for the whole world (i.e. not restricted by specific scenario locations as in Harper et al 2018) by Daioglou et al 2018, please add: DAIOGLOU, V., DOELMAN, J. C., STEHFEST, E., MÜLLER, C., WICKE, B., FAAIJ, A. & VAN VUUREN, D. P. 2017. Greenhouse gas emission curves for advanced biofuel supply chains. Nature Climate Change, 7, 920. [, Netherlands]	accept: reference added
6909	102	37	102	39	Valade, A., S. Luyssaert, P. Vallet, S. Njakou Djomo, I. Jesus Van Der Kellen, and V. Bellassen, 2018: Carbon costs and benefits of France's biomass energy production targets. Carbon Balance Manag., 13, 26, doi:10.1186/s13021-018-0113-5. https://cbmjournal.biomedcentral.com/articles/10.1186/s13021-018-0113-5 (Accessed January 11, 2019). [Georgii Alexandrov, Russian Federation]	accept: reference added
2621	102	39	102	39	I don't understand what the "opposing conclusions" specifically mean. [Wei Li, France]	accept, Now better explained
38901	102	41	102	41	Suggest adding recent literature on this topic: Baker et al. (2019). Potential complementarity between forest carbon sequestration incentives and biomass energy expansion. Energy Policy. 126. 391-401. 10.1016/j.enpol.2018.10.009. https://www.sciencedirect.com/science/article/pii/S030142151830661X [, United States of America]	accept: reference added
21061	102	41	102	45	This is true, but it does not take into account the possibility of threshold behaviour in the climate system during the payback time. Could you consider adding this additional nuance. [, United Kingdom (of Great Britain and Northern Ireland)]	reject Literature is missing to this regard (to the best of our knowledge)
38903	102	41	102	45	This statement is not universally true/agreed upon for biomass "... the forcing from bioenergy systems is temporary and less relevant to long-term temperature stabilisation ..." though having the caveat that the 'biomass is regrown' helps. This is a controversial topic. Strongly suggest making the caveats clearer. For example: "... the forcing from NET EMISSIONS OUTCOMES OF bioenergy systems IN SOME INSTANCES CAN BE temporary and less relevant to long-term temperature stabilisation provided the biomass is regrown." [, United States of America]	reject, Redundant, it is already taken care by the caveat "provided the biomass is regrown"
38905	102	47	102	48	Agree with the low evidence and agreement here. ILUC is an important part of bioenergy systems GHG accounting, thus the related caveats should again be made clearer. For example, "Attribution of emissions from iLUC to bioenergy (mostly crop-based biofuels) risk undermining THE POTENTIAL net climate change mitigation benefits FOR THE USE OF SOME TYPES OF BIOMASS." [, United States of America]	accepted, Sentence changed
40321	102	51	102	51	suggest the following construction : While this MIGHT be the case for MOST mitigation options requiring land (e.g, afforestation, reduced deforestation), it is a …. bioenergy (please see also material in the appendix for Bioenergy in Chapter 11 of AR5 WG III) on this subject). There are plenty literature that do not support iLUC for land activities displaced for the production of bionenergy, for instance. [Thelma Krug, Brazil]	accept, Sentence revised, and studies that do not support ILUC referred to in the text.

Comment No	From Page	From Line	To Page	To Line	Comment	Response
38907	102	47	103	12	It is unclear why the first sentence is assigned "low evidence". The statement is saying that there is a risk that iLUC may undermine the benefits of bioenergy, not that it will do so for certain. The paragraph goes on to cite several studies that have looked at this question and have produced findings to support the statement that a significant risk exists. This is certainly a controversial topic and deserves the "low agreement" label and there is a need for more research in this area. And it is uncertain whether this risk will ultimately be realized. But there is a body of scientific research that shows that a risk exists. Suggest assigning this statement "medium evidence" instead. [, United States of America]	reject, The evidence level reflect the degree of controveries, as many studies argue against ILUC because it cannot be measured, but it is only speculative
38909	102	47	103	13	In this section about indirect land-use change (iLUC), it is important to note that some impacts from iLUC may be reductions in emissions, not increases. For example, a series of articles on effects of markets for bioenergy in North America showed potential for increased rather than decreased carbon stocks resulting from shifting lands from pasture, marginal agriculture, or idle lands into forest production, and/or forest management improvements leading to higher productivity. See, for example: Abt, R.C., C.S. Galik, AND J.D. Henderson. 2010. The near-term market and greenhouse gas implications of forest biomass utilization in the southeastern United States. Nicholas School of the Environment, Working Pap. CCPP 10- 01, Duke University, Durham, NC. 34 p.; Baker, J.S., C.M. Wade, B.L. Sohngen, S. Ohrel, A.A. Fawcett. 2019. Potential complementarity between forest carbon sequestration incentives and biomass energy expansion. Energy Policy 126:391-401.; Dale, V.H., E. Parish, K.L. Kline, and E. Tobin. 2017. How is wood-based pellet production affecting forest conditions in the southeastern United States? Forest Ecology and Management 396: 143-149.; Duden, A.S., P.A. Verweij, H.M. Junginger, R.C. Abt, J.D. Henderson, V.H. Dale, K.L. Kline, D. Karssenberg, J.A. Verstegen, A.P.C. Faaij, and F. van der Hilst. 2017. Modeling the impacts of wood pellet demand on forest dynamics in southeastern United States. Biofuel, Bioprod., Bioref. 11:1007-1029.; Cintas, O., G. Berndes, A.L. Cowie, G. Egnell, H. Holstrom, G. Marland, and G.I. Ögren. 2017. Carbon balances of bioenergy systems using biomass from forests managed with long rotations: bridging the gap between stand and landscape assessments. GCB Bioenergy 9:1238-1251. [, United States of America]	accept, This is an additional perspective. Now included in the text (with refs)
38911	102	47	103	14	This section is extremely biased and does not represent the literature in a balanced manner, which is inappropriate for this report. Strongly recommend revising this section to use less subjective language to better reflect the science to date. Currently it seems to carry specific intent to discredit iLUC emissions accounting for biomass. [, United States of America]	reject, The evidence level reflect the degree of controveries, as many studies argue against ILUC because it cannot be measured, but it is only speculative. This section reports about a controversial issue, and language and refs have been used to represent the diversity of views. Other reviewers appreciated the balance
187	102	47	103	36	Please, in Bordonal et al., Renewable and Sustainable Energy Reviews, Vol 52, 547-556 (2015), it is considered the LUC from several agricultural areas to sugarcane in Brazil (ethanol) showing an increase of C reservoirs (biomass and soil) through conversion of arable and pastoral lands into sugarcane, and a decrease of C reservoirs when citrus, plantation forest and natural forest are converted to sugarcane. Here we support that the impact of dLUC on biomass and soil C pools must be considered while expanding sugarcane plantation as an important mechanism for GHG abatement beyond the avoided emissions through use of sugarcane ethanol. Payback estimatives are also provided in this considering LUC in Brazil, related to sugarcane ethanol production [Newton La Scala Jr., Brazil]	accept: Additional sentence on the argument added, with the suggested reference

Comment No	From Page	From Line	To Page	To Line	Comment	Response
189	102	47	103	36	In Bordonal et al., Ren. Sustainabla Enegy Reviews, vol 52, 547-556 (2015): Expansion of sugarcane plantation contributed to attenuate GHG emissions from agriculturalproduction phase, ofwhich 57% were offset by the C storage into biomass through dLUC. Soils had almost neutral effect on C budget by the year 2030, since the increases in soil C stocks through conversion of arable lands into sugarcanewere offset by the depletion of soil C stocks from pastoral conversion. Furthermore,such GHG abatement tends to increase for the next years as the non-burning harvest is expected to be phased out in the most dense cultivated sugarcane region in Brazil. [Newton La Scala Jr., Brazil]	accept: Additional sentence on the argument added, with the suggested reference
317	102	47	103	36	Still in Bordonal et al. Ren. Sust. Energy Rev.: With Coffsetof9.8MgCO2eq ha 1 yr 1 through substitution of fossil fuels [8] and taking into account the cumulative GHG balance of 217.1TgCO2eq for a total cultivated area of 192.4Mha during the 2006–2030 period, an emission avoidance of 1885Tg CO2eq would occur by substituting fossil fuels,which is approximately 8.7 times the GHG balance reported herein. Therefore, a cumulative GHG balance of 217.1TgCO2eq regarding dLUC and sugarcane cultivation could be completely offset by the C savings from sugarcane-based ethanol use in substitution of fossil fuels in Brazil. [Newton La Scala Jr., Brazil]	accept: Additional sentence on the argument added, with the suggested reference
38913	102	49	103	1	Delete these sentences. This representation is misleading and inaccurate. Bioenergy for energy crops are not the only feedstock that has iLUC attributed to it in LCAs. Also, MANY studies on AR incorporate iLUC/leakage (look at any global modeling exercise on this topic for evidence of this!). [, United States of America]	accept with modification: The sentence is revised as per the comment of an other reviewer. We here refer to a vast literature that is largely focusing on ILUC effects from biofuels
38915	103	1	103	3	This sentence needs clarification and citations. Suggest deleting current text and using something like this: "Indirect land use change (iLUC) is an important form of leakage to consider when assessing net emissions associated with bioenergy. There are different definitions of GHG leakage in the literature, but according to the IPCC (2000) Special Report on Land Use, Land-Use Change, and Forestry leakage is 'the indirect impact that a targeted LULUCF activity in a certain place at a certain time has on carbon storage at another place or time.' Essentially, at global levels all land-use emissions are captured (as further geographic displacement or leakage cannot occur) and therefore direct." [, United States of America]	accept, Sentence revised
5367	103	6	103	13	This text raises the impression that early estimates of iLUC were exaggerated but that meanwhile there was a consensus that iLUC effects are low. In my view, this impression is not correct, and in any case, if that message is intended, it would need to be based on a much broader, stonger, and unbiased assessment of the recent literature. This assessment would need to consider that iLUC effects are very likely dependent on the volume of fuel to be produced, as well as on many other factors in the global land system. Writing the text so that the above-quoted impression is created based on one very old reference (Searcher et al 2008) compared to another also quite old reference (Ahlgren and Di Lucia 2014) is no suitable basis, and moreover, if the authors want to send this message, this needs to be explicit, and it needs to be based on a full assessment of literature, including statements on robustness of evidence and agreement in the community. [Helmut Haberl, Austria]	accept, We added the volume of biofuel deployment to the text and we revised the text to mitigate this concern, also adding additional references.

Comment No	From Page	From Line	To Page	To Line	Comment	Response
38917	103	9	103	12	As currently written, this sentence is an inaccurate summary of the available literature. It overstates the degree of convergence of recent studies around the iLUC values for corn bioethanol. There has been much less convergence than this sentence implies, and many recent findings are significantly higher than 20g CO2/MJ. This sentence implies that, if anything, recent estimates may be lower than the 20g CO2/MJ estimate. There is some evidence in recent studies that this could be true, but there is also some evidence that the opposite may be true. Based on the recent literature there are a wide range of estimates, and many are fairly different and significantly higher than 20 gCO2/MJ. There does not seem to be convergence around the estimate of 20 gCO2/MJ, as the sentence implies. The range of recent estimates needs to be widened, and several additional studies need to be cited. A summary of highly relevant studies published through 2017 can be found on page 50 of "Biofuels and the Environment: The Second Triennial Report to Congress" from the U.S. Environmental Protection Agency, available here: https://cfpub.epa.gov/si/si_public_record_report.cfm?Lab=IO&dirEntryId=341491. Suggest citations of every study conducted since 2014 in that summary, since that is the year of the study currently cited in this draft. This would include Bento and Klotz 2014, CARB 2014, Plevin et al. 2015, Valin et al. 2015, and Taheripour et al. 2017. Suggest also rephrasing this sentence to say "... more recent estimates are lower than the original estimate, but still show a wide range of uncertainty, varying from -75 gCO2 MJ-1 to +55gCO2 MJ-1 (Ahlgren and Di Lucia 2014, Bento and Klotz 2014, CARB 2014, Plevin et al. 2015, Valin et al. 2015, Taheripour et al. 2017)." [, United States of America]	accept, The text is revised and the ranges and references added
38919	103	10	103	12	Searchinger (2008) was NOT the first publication of corn ethanol estimates so the word 'originally' here is inaccurate. Delete it. Could instead use 'at one point' or something like that. This statement is also a little misleading, as the studies cited had very different assumptions, etc., so to present as 'if all else is equal and here are the estimates' is not appropriate. Suggest including something about WHY the estimates differ, instead of inferring that that the first one was overestimated. Make this entire section less biased. [, United States of America]	accept, The text is revised and a range of estimates provided.
5369	103	16	103	36	This paragraph is supported by 6 different references, two of which are not present in the reference list (Harding et al., Hallgren). Another reference (Georgescu et al. 2013) apparently discusses climate effects of expansion of megapolitan areas, and the abstract (I did not have access to the full article) does not mention bioenergy. Hence I suggest that this paragraph either needs to be corroborated by additional literature, or must be strongly revised or even deleted. The biophysical mechanisms alluded to (l18) should be made explicit to facilitate judging the plausibility of the arguments without going back to the original literature. How much bioenergy can be produced under the conditions mentioned, e.g. in l26, is unclear and needs to be stated. It is unclear whether it was assessed to what extent the cooling found according to the studies of Georgescu and Harding could potentially be counteracted by possible warming resulting from C effects from the relocation of the annual crops replaced (iLUC). Unless a lot better and more plausible evidence can be found, I find this paragraph highly problematic because it might invite drawing strong conclusions with potentially high policy relevance without proper assessment of potentially counteracting factors (replacement of annual crops) or potentially constraining conditions. [Helmut Haberl, Austria]	accept with modification, These effects are clearly important, but the availability of studies is limited but well documented. We revised the confidence level to "medium". Other considerations regarding indirect effects are discussed in the chapter above, and included in the cited study Hallgren et al.
2623	103	16	103	36	most references are not in the reference list [Wei Li, France]	reference added

Comment No	From Page	From Line	To Page	To Line	Comment	Response
4053	104	1	104	1	This figure and its caption slightly misleading since they imply that the IMAGE 1.5 and 2 degree scenarios lead to large amounts of bioenergy production which contribute to GHG emissions, rather than mitigating them. This however masks the fact that (i) in the IMAGE projections the LPJmL DGVM is used (as opposed to the Harper et al. (2018) JULES model), which leads to different results, (ii) The payback times depend heavily on the bioenergy technology being adopted and the mitigation level in the energy system, and (iii) The IMAGE SSP2-1.9 and SSP2-2.6 scenario have different techno-economic assumptions on technologies and yield improvements which lead to improved bioenergy payback times than Harper et al. (2018), with Harper et al. (2018) adopting rather pessimistic assumptions. In order to make it clear that these maps do not reflect IMAGE results concerning BECCS potentials, I suggest the second sentence of the caption to be rephrased to "The scenarios were produced using land-use projections of the IMAGE Integrated Assessment Model (Stehfest et al. 2014) using a central mitigation pathway (Shared Socioeconomic Pathway 2, SSP2-RCP1.9 or IM1.9 and SSP2-RCP-2.6, or IM 2.6)." Please also add a final sentence highlighting the importance of assumptions concerning the results in the maps: "The Harper et al. (2018) payback times differ from the original IMAGE climate change mitigation projections due to varying assumptions on crop yields and carbon capture rates". [Vassilis Daioglou, Netherlands]	Accept with modification, figure deleted, text modified to reflect this
5371	104	1	104	4	It is not really clear why this figure is included here, and also in what sense it is the result of a thorough assessment of the literature. As far as I can judge, this is one among many model results on the possible future spatial distribution of bioenergy crops and their C payback times. I assume that there are many other maps that could also have been shown. If that figure should remain, it must be explained in what sense it was found to be the most informative and/or most robust assessment. This would have to include a much stronger justification based on an assessment of the large body of literature on possible future spatial distributions of energy crops. [Helmut Haberl, Austria]	Accept with modification, figure deleted, text modified to reflect this
3195	104	2	104	11	2.6 scenario is widely considered as unrealistic. Therefore, 1.9 scenario is extremely unrealistic. Suggestion: to omit Figure 2.33 [, Russian Federation]	Accept with modification, figure deleted, text modified to reflect this
30157	104	3	104	5	The caption to figure 2.33 is misleading since it suggests the IMAGE 1.5 and 2 degree scenarios lead to large amounts of bioenergy production which contribute to GHG emissions, rather than mitigating them. This however is not true and masks the fact that (i) in the IMAGE projections the LPJmL DGVM is used (as opposed to the Harper et al. (2018) JULES model), which leads to different results, (ii) The payback times depend heavily on the bioenergy technology being adopted and the mitigation level in the energy system, and (iii) The IMAGE SSP2-1.9 and SSP2-2.6 scenario have very different assumptions on technologies and yield improvements which lead to much lower improved bioenergy payback times than in Harper et al. (2018). Therefore, we suggest to rephrase the second sentence of the caption into "The scenarios were produced using landuse projections of the IMAGE Integrated Assessment Model (Stehfest et al. 2014) using a central mitigation pathway (Shared Socioeconomic Pathway 2, SSP2-RCP1.9 or IM1.9 and SSP2-RCP-2.6, or IM2.6)." And to add a final sentence highlighting the importance of assumptions concerning the results in the maps: "The Harper et al. (2018) payback times are much higher than the original IMAGE climate change mitigation projections due to different assumptions on crop yields and carbon capture rates". [, Netherlands]	Accept with modification, figure deleted, text modified to reflect this

Comment No	From Page	From Line	To Page	To Line	Comment	Response
29847	104	14	104	21	It is unethical to raise the issue of enhamced weathering when there is not enough literature even to debate around and discuss. Or,the conclusion has to be a clear No. [Souparna Lahiri, India]	Reject, this is an option laready included in SFR1.5 and as such we need to assess it inrelation to land for this report
6221	104	15	104	18	In this sentence in Chapter 2, the range for carbon removal through enhanced weathering is 0.72-95GtCO2/yr (low evidence, low agreement). However, this range is inconsistent with the number used in Chapter 6, page 43, Table 6.4 and Chapter 6, page 45, lines 33-35, where 0.5-4GtCO2/yr (low evidence, medium agreement) is used. [Weimu Xu, Ireland]	cross checked and revised
32825	104	23	104	23	The description here should clearly explain inputs and outputs of models. Many of the mitigation options are only embedded into the assumptions of SSPs, while outputs are BECCS and afforestation numbers. [Doreen Stabinsky, United States of America]	Noted. Not really clear what is meant by the reviewer.
40545	104		104		I cannot see any representation of dispersion / uncertainty in this figure, why? Only using one vegetation model, why this one? [Valerie Masson-Delmotte, France]	Revised and clarified
29849	104	23	108	15	After the IPCC 1.5 degrees report and the four illustrative model pathways were put forward in the report, it was expected that the present land report will build further upon the response model base on afforestation integrating reforestation, foresy restoration, ecosystem integrity, ladn governance, land tenure and rights of indigenous and local communities, using published and peer reviewed references to move towards a concrete conclusion on land based response option. Instead, the present report has not bothered to use references on reforestation, forest restoration, ecosystem integrity and ladn rights and tenure if IPs and local communities incouding governance, and tried to bring in aspects of bioenergy, BECCS again as part of of land based mitigation potential where untested, unproven pathways are tried to be integrated in tot he land based response with known impacts on land and livelihood, food security, promoting outdated and dubious land management and forest management systems, with too many ifs and buts. This dangerous game of playing with bioenergy and BECCS needs to be stopped and proper scientific rigour should be undertaken to build conclusive models and scenarios. Such an important report cannot suffer from exclusion of vital references and issues that have been raised over and over again. [Souparna Lahiri, India]	Noted. Chater 2 is focusing on the land and GHG consequences of land based mitigation. Consequences of these scenarios for sustainable deveopment are discussed in detail in chapter 6.
1495	104	23	108	32	The entirety of section 2.7.2 confuses SSPs and RCPs throughout. RCP were the scenarios developed for CMIP5 and were concentration pathways (hence the name). SSPs are the scenarios developed for CMIP6 and are driven by socio-economics (hence the name). The SSPs should never be referred to as RCPs. Each SSP will have a different pathway to achive the same 2100 radiative forcing, in particular they will have different amounts of land use change, land based emissions, land based removals. So to explore climate mitigation, scenarios need to be compared within the same SSP e.g. comparing BECCS for SSP1-1.9, SSP1-2.6, SSP1-4.5. Alternatively the scenarios could be compared across the socio-economic dimension e.g. BECCS for SSP1-2.6, SSP2-2.6, SSP4-2.6, SSP5-2.6. To mix socio-economics and climate policy confuses the issue entirely. [William Collins, United Kingdom (of Great Britain and Northern Ireland)]	Rejected. This is a misinterpretation of the SSPs. Indeed SSPs are characterized by different socio-economic developments but can be combined with RCP targets for climate change mitigation. Details are dscribed in the x-box on scenarios in chapter 1.

Comment No	From Page	From Line	To Page	To Line	Comment	Response
345	104	23	109	15	This section focuses almost entirely on the IAMs and how they handle land use change. It does not address land management, particularly in forestry, where there are important interactions between forest management and the atmosphere. Sohngen and Mendelsohn (American Journal of Agricultural Economics, 2003) showed this by integerating a global forest management model with DICE. Bosetti et al. (Energy Policy, 2007) then conducted anlaysis integrating a global forestry model with WITCH. Both show that land use is important but that forest management is 30-40% of total mitigation effort by the forest sector. More recently Favero et al. (Climatic Change, 2017) integrated a forest managemetn model with WITCH and illustrated that forests when used for sequestration and BECCS could prloduce up to 10 Gt CO2 per year over the century, with a large share of this due to management. Tian et al. (:Land Economics, 2018) show that forest managemet is an important component of fluxes. THis section needs to acknowledge that IAMs have not yet accounted for forest management. [Brent Sohngen, United States of America]	Accepted. As suggested the chapter highlights that most IAMs do not account for forest management.
33615	104	23	109	15	Ch. 2-5 brings up a number of factors and feedbacks that are involved in climate forcings, including albedo, water retention, carbon retention and methane decomposers in upland soils. For instance, some of these are summarized in section 2.6.2.1. Thus, we also know that these cycles can be managed for mitigation. However, in the integrated assessment of various response options in 2.7.2, the perspectives on mitigation mostly falls down to GHG emissions while importance of methane sinks, albedo, hydrological cycles etc. should also be incorporated. [, Norway]	Accepted. The text now highlights the lack of biophysical effects of land use in at least most scenarios.
38921	104	23	109	15	This section focuses almost entirely on IAMs and how they handle land-use change. It does not address land management, particularly in forestry, where there are important interactions between forest management and the atmosphere. Sohngen and Mendelsohn (American Journal of Agricultural Economics, 2003) showed this by integerating a global forest management model with DICE. Bosetti et al. (Energy Policy, 2007) then conducted analysis integrating a global forestry model with WITCH. Both show that land use is important but that forest management is 30-40% of total mitigation effort by the forest sector. More recently Favero et al. (Climatic Change, 2017) integrated a forest management model with WITCH and illustrated that forests when used for sequestration and BECCS could produce up to 10 Gt CO2 per year over the century, with a large share of this due to management. Tian et al. (Land Economics, 2018) show that forest management is an important component of fluxes. This section needs to acknowledge that IAMs have not yet accounted for forest management. [, United States of America]	Accepted. As suggested the chapter highlights that most IAMs do not account for forest management.
8565	104	23	109	15	This section is very hard to understand. It is not autonomous as it refers to scenarios that are not explicited. [Marc Aubinet, Belgium]	Noted.
8567	104	23	109	15	Apparently the scenarios described in this section are based on measures that are not discussed/evaluated (may in other chapters ?) and whose feasbility is not established. This makes the whole section not convincing at all. [Marc Aubinet, Belgium]	Noted.

Comment No	From Page	From Line	To Page	To Line	Comment	Response
14049	104	23			Whilst calling this “integrated pathways” is OK, you should be very clear to spell out that the IAMs neglect the biophysical effects of land-use/BECCS. Hence, any measure they use to quantify the demand for land to meet a target will likely underestimate the requirement (as the biophysics offsets the carbon benefit). Thus the choice of BECCS or other land-based mitigation of emissions, may not be so cost-optimal afterall… I feel this caveat should make its way right into your exec summary and through to the SPM. [Chris Jones, United Kingdom (of Great Britain and Northern Ireland)]	Accepted. The text now highlights the lack of biophysical effects of land use in at leastm ost scenarios.
16197	104	23			At the end of title, 2.7.2 …… for climate mitigation, change to: 2.7.1 …….. For climate change mitigation and adaptation [Hamidreza Solaymani Osbooei, Iran]	Noted. This comment is unclear.
16851	104	23			At the end of title, 2.7.2 …… for climate mitigation, change to: 2.7.1 …….. For climate change mitigation and adaptation. For example, the study of Azari et al (2017) achieved that the impact of climate change in the increase of watershed sediment yield is more than the stream flow and varies from 35.9–47.7% for the period 2040–2069. Implementing conservation practices under climate change can reduce the sediment yield of watershed up to 7.2% and for the sub-basin scale up to 46.4%. Range management practices were found to be the most effective practice in the decrease of sediment at the sub-basin scale and porous gully plugs and terrace construction, the most effective at the watershed scale. [Hamidreza Solaymani Osbooei, Iran]	Rejected. This level of detail is not adequate for this section.
4055	105	6	105	13	In the list of land base dmitigation options "1st generation biofuels" are mentioned explicitly, but "2nd generation" or "advanced" (i.e. those based on lignocellulosic crops) are not. They might be included under "bioenergy", however the current phrasing is misleading as it suggests that only 1st generation biofuels are included. [Vassilis Daioglou, Netherlands]	Accepted. Wording has been changed so that 2nd generation bioenergy is now also included
28595	105	7	105	15	statement of limited options in IAM does not agree with evidence. The included list is fairly comprehensive, while the not-included list has only two things that have releatively small effects. [Alan Di Vittorio, United States of America]	Accepted. We prolonged the list of options not included.
40327	105	12	105	12	sugget to change avoided deforestation to reduced deforestation - - consistent with secton 6.3.1.15 [Thelma Krug, Brazil]	Accepted. Changed as suggested.
21063	105	17	105	27	An important recent paper is Frank et al 2018 (https://www.nature.com/articles/s41558-018-0358-8), which demonstrates the important role that agriculture plays in meeting Paris goals. Please include this paper - this paragraph may be an appropriate location, but it would fit well in many places in this discussion of land-mitigation links. [, United Kingdom (of Great Britain and Northern Ireland)]	Accepted. Included as suggested.
32827	105	22	105	27	This wording is a bit odd. Land is certainly important for mitigation, but beyond just these elements that can be easily incorporated into IAMs. Extreme care should be taken throughout this chapter, and certainly in discussion of IAMs and their outputs, to make sure that the discussion does not give undue attention to those land-based options that easily fit into models. Keep figure 2.32 always in mind as you are writing this section. [Doreen Stabinsky, United States of America]	Accepted. We added addtional mitigation options as well biophysical effects not included in most scenarios derived by IAMs.
32461	105	22	105	27	As the assumptions upon which these pathways are based are actually contradicted by some of the findings in Chapter 2 itself (esp. 2.6.2.1) it would be more appropriate to state "These pathways are based on the assumptions that large-scale afforestation and reforestation removes substantial amounts of CO2 from the atmosphere....." [Simone Lovera-Bilderbeek, Paraguay]	Accepted. We changed the sentence accordingly.
29189	105	22	105	35	Use km2 instead of Mha ? (As in SR1.5 SPM) [Jan Fuglestvedt, Norway]	Accepted - changed accordingly

Comment No	From Page	From Line	To Page	To Line	Comment	Response
2625	105	40	105	40	explain why decreasing [Wei Li, France]	Accepted. The text now explains that CO2 emissions in baseline scenarios decrease due to to agricultural intensification and decreases in demand for agricultural commodities.
29185	105	40	105	41	Would be good if you explain why there is a decrease [Jan Fuglestvedt, Norway]	Accepted. The text now explains that CO2 emissions in baseline scenarios decrease due to to agricultural intensification and decreases in demand for agricultural commodities.
28597	105	40	105	43	It is misleading to say that CO2 emissions go negative in the baseline case. This trend is seen only in the average across 5 scenarios and 5 IAMS. Each scenario and IAM has a distinct pathway and only in some cases does the baseline go negative. Using the average of the distinct pathways misprepresents the purpose of scenario-based modeling, which is to provide alternatives, not averages. [Alan Di Vittorio, United States of America]	Accepted. We added 'most' to make clear that not necessarily all scenario go negative by the end of the century.
21065	105	40	105	45	It's an interesting observation and perhaps surprising observation that in all of the baseline cases, across all SSPs, that land use becomes a sink not a source by the end of the century. This warrants further explanation - what is driving this change? That it apparently occurs in the less sustainably orientated SSPs might seem odd and is deserving of discussion. [, United Kingdom (of Great Britain and Northern Ireland)]	Accepted. The text now explains that CO2 emissions in baseline scenarios decrease due to to agricultural intensification and decreases in demand for agricultural commodities.
1261	105	40	105	45	Add at least one paragraph discussing the biophysical effects that are expected to come with these emission reductions. It is confusing that chapter 2 that starts with stressing the importance of the biophysical effects, ignores the same biophysical effects completely in what may be its most important section for policy-makers. It is not clear which biophysical effects are and which biophysical effects are not included in the RCP scenarios. Which raises the question what will be the net TOA forcing of the RCP scenarios after the biophysical effects are accounted for. [Sebastiaan Luyssaert, Belgium]	Accepted. We added that biophysical effects not included in most scenarios derived by IAMs.
29187	105	47	105	47	It would also be useful to explain a bit more about how the baseline scenarios should be interpreted (i.e. about "unconstrained" vs "constrained by mitigation") [Jan Fuglestvedt, Norway]	Noted. The manuscript states that baseline case are without climate change mitigation.
40329	105	48	105	48	sugget to change avoided deforestation to reduced deforestation- consistent with secton 6.3.1.15 [Thelma Krug, Brazil]	Accepted. Changed as suggested.
29993	105	50	105	50	this might be an additional relevant reference, also/or later on in this section: Doelman, Jonathan C., et al. "Exploring SSP land-use dynamics using the IMAGE model: Regional and gridded scenarios of land-use change and land-based climate change mitigation." Global Environmental Change 48 (2018): 119-135. [, Netherlands]	Rejected. The Doelman et al paper has not been included as the other references refer to the dedicated SSP papers and Doelman et all gives an overview on all IMAGE SSPs.
18149	105	51	106	2	Please discuss whether the focus on these CDR technologies is an assumption of the modeling (insofar as these are the only CDR options in the technology portfolio assessed) ot whether other technical CDR options have been part of the technology portfolio. [Astrid Schulz, Germany]	Accepted. We highlight in more detail which mitigation options are not covered.
995	105	23			cosider order of figures. Fig. 2.36 refered to in text before Figs. 2.34 and 2.35 [Tobias Rütting, Sweden]	Accepted. The early referece to 2.36 has been excluded.
26999	105	40			The baseline should please be the current mitigation policies and not a hypothetical scenario without any mitigation. [, Germany]	Noted. In principal this makes sense. But the implementation of detailed current policies as well as NDCs in the IAMs has only occured after the major assessments of the SSPs with IAMs
997	105	47			what exactly is "strong"? Better to use quantitative terms [Tobias Rütting, Sweden]	Noted. The quantitative numbers for mitigation are given in the following sentences.
5055	106	12	107	14	Suggest using RCP4.5, RCP2.6 and RCP1.9 instead of 45, 26 and 19 respectively in the horizontal axis in Figure 2.34 and Figure 2.35 in order to improve clarity. [, Japan]	Accepted. Changed accordingly.

Comment No	From Page	From Line	To Page	To Line	Comment	Response
25385	106	13			We believe this figure is relevant and justified, but we suggest to improve it by different ways: • Differences among SSP should be better illustrated. In particular, we suggest replacing the box plots with sets of SSP-specific points, with a colour code corresponding to each SSP. • The meaning of the abbreviations indicated in the right-hand side of the figure should be given. In particular, it should be explicitly noted that these are energy crops, if this is the case. • In the caption, Mha should be corrected by Mkm2. • The readability of the figure would be greatly improved by using the entire page. [, France]	Partially accepted. Meaning of the abbreviations indicated in the right-hand side of the figure are now given in more detail & Mha has been corrected by Mkm2. Differences among SSPs could not be shown explicitly due to space limitations.
999	106	13			lower panel: what does "CCS" stands for? In fact, that panel is not discussed in the text, suggest deleting or add discussion on it [Tobias Rütting, Sweden]	Accepted. We modified the lower panel. This panel is also discussed in the text referred to as BECCS.
27001	107	5	107	14	Figure 2.35: Please see our comments on Figure SPM.5. In addition we have the following suggestions for the figure in chapter 5: - We suggest providing the area at the y-axis as percentage of the 2010 value. - It would be helpful to provide an indication of the end-of-century forcing for the baseline scenario. - Considering that the audience here is broader than those familiar with the forcing and probable warming of different RCPs, the associated global temperature increase or stabilised CO2 concentration of each RCP should be shown. - Please make it more clear that the cause of the land use changes are the response measures and not the climate impacts. [, Germany]	Rejected. End-of-century forcing could not be listed for the baselines as they differ very strongly especially across SSPs (see Riahi et al 2017). The manuscript maes clear that mitigation options that require land conversion (BECCS 24 and afforestation) can shape the land system dramatically
28599	107	6	107	6	As in the previous figure/comment, averaging across different pathways obscures actual temporal trends and comparisons across climate generated by a particular pathway [Alan Di Vittorio, United States of America]	Rejected. In principal it would make sense to also decompse across the SSPs (as it has been done eg in Popp et al 2017, GEC). But this is not possible due to space limitations.
21067	107	16	107	20	The SSPs are described in more detail later in the report (chapter 6). Surely, given their prominence in the discussion here, they should be described at an earlier stage. For example, the reader might not be clear why you have chosen SSP2 here and what it represents [, United Kingdom (of Great Britain and Northern Ireland)]	Accepted. The description of the SSPs has been shifted to the scenario x-box in chapter 1.
21069	107	16	107	20	I appreciate that you are just using archetypes to demonstrate key points, however the significance of the SSPs is that they show how the different future socio-economic world we create significantly impacts mitigation. Some of the most profound implications of this are for land use. Therefore it would be helpful to not just have a comparison within SSP2, but across the different SSPs. [, United Kingdom (of Great Britain and Northern Ireland)]	Rejected. In principal it would make sense to also decompose across the SSPs (as it has been done eg in Popp et al 2017, GEC). But this is not possible due to space limitations.
11581	107	18	107	19	remove the bracket in RCP) 1.9 in line 18 and replace expect by except in line 19 [Lawrence Aribo, Uganda]	Accepted. Changed accordingly.
40323	107	23	107	23	suggest to change … measures on avoided deforestation to measures to reduce deforestation -- consistent with secton 6.3.1.15 [Thelma Krug, Brazil]	Accepted. Changed accordingly
29191	107	16	108	32	It would help the reader if you could provide some more explanantion of how the scenarios should be seen and "used" by readers; i.e. if they are meant as illustrative etc (And not predictions, recommendations etc) [Jan Fuglestvedt, Norway]	Accepted. Such explainations are embedded in the scenario x-box in chapter 1.
29193	107	16	108	32	sorry if I missed it but could you relate the scenarios more clearly to temperature outcome? [Jan Fuglestvedt, Norway]	Rejected. As stated in the text all scenarios except of 1 are based on RCP1.9.
33395	107	22	108	34	The number of negative emissions called for in each scenario should be included in the textual descriptions. The texts and graphs need to be better intigrated here to tell the story, or people could easily get an incomplete picture. [Kelly Stone, United States of America]	Accepted - Changed as suggested by the reviewer. Negative emissions for each CDR option have been included for each Pathway.

Comment No	From Page	From Line	To Page	To Line	Comment	Response
29195	107	22	109	8	Could you also relate the scenarios more to fossile fuel CO2 emissions? [Jan Fuglestvedt, Norway]	Rejected. Beyond the scope of the SRCCL. This is treated in detail in SR1.5.
38923	108	16	108	17	Better if actually cite some of the studies and mitigation options used in studies cited by Griscom et al. [, United States of America]	Accepted. Individual options have been listed.
17451	108	24	108	28	Please elaborate on the Pathway6 RCP1.9 in more depth here, as this is the pathway that illustrates what's needed if we are to avoid reliance on large-scale BECCS and instead want to maximise co-benefits with the SDGs. Understanding the trade-offs related to our near-term (in)action is crucial for policymakers as they are consider revisions to the NDCs. Given that this pathway (Pathway6 RCP1.9) is featured also in the SR15 (as the illustrative model pathway P1), it would be good to acknowledge this, for improved big picture understanding. [Taehyun Park, Republic of Korea]	Accepted. Additional information on pathway 6 has been added as well the acknoledgement that this is the same as LE pathway in SR1.5.
29197	108	30	108	30	I support the use of archetypes, but I think you need to explain more to the reader about how to "use" these. [Jan Fuglestvedt, Norway]	Accepted. More details on the use of these scenarios has been added.
17867	108	32	108	34	This figure is useful as a way of showing different ways for the land sector to contribute to a 1.5 pathway, however it should be made clear in the figure that archetype 1 is an RCP2.6 pathway, and it would be helpful to understand what the other pathways mean for overshoot of 1.5°C. It would be helpful if the key could incldue the solid and dashed lines. It would also be helpful to have some further explanation of what is included in AFOLU / AFOLU with biomass/CCS. Is the burning and regrowth of biomass included in AFOLU? This is explained at the top of page 108, but an explanation in the figure caption would be helpful. [Quentin Lejeune, Germany]	Accepted. It has now been made clear that archetype 1 is based on RCP2.6. We also included explainations for soild and dashed lines in the legend. It is now explained what is included in the AFOLU and AFOLU /BECCS.
11583	108	16			introduce ' be ' (after also) [Lawrence Aribo, Uganda]	Accepted. Changed accordingly
21071	109	10	109	10	Change to "temperature goal" (singular). [, United Kingdom (of Great Britain and Northern Ireland)]	Accepted. This paragraph has been excluded.
21073	109	10	109	15	This paragraph doesn't really add a great deal to the discussion and simply says that land is important. Moreover, the brief points it makes and there discussed in further detail lower down (and to some extent contradict the point being made here - i.e 2.7.3.1 reveals that the treatment of land in NDCs is actually quite patchy). It should therefore be removed. Also, the first sentence is repeated at the start of section 2.7.3. [, United Kingdom (of Great Britain and Northern Ireland)]	Accepted. This paragraph has been excluded.
29199	109	10	109	15	As far as I can see, this text is not needed here; espcially since section 2.7.3 starts with something very similar. [Jan Fuglestvedt, Norway]	Accepted. This paragraph has been excluded.
1491	109	10	109	15	Presumably this paragraph was left here by mistake [William Collins, United Kingdom (of Great Britain and Northern Ireland)]	Accepted. This paragraph has been excluded.
26147	109	10	109	20	Delete lines 10-15 or combine with lines 18-20 to avoid repetition. [Reid Detchon, United States of America]	Accepted. This paragraph has been excluded.
1517	109	12	109	12	I'm not sure why there is a "Wigley 2018" reference following a quote from the Paris Agreement [Oliver Geden, Germany]	Accept, editorial mistake, now removed
1811	109	15	109	15	Perhaps the authors could comment on the attitude of the USA and, now Brazil, to the Paris agreement, and potential consequences and/or ways forward. [William Lahoz, Norway]	disagree: it is not the job of IPCC to criticise country policy, in any case this chapter deals with claimte consequences to response optiopns, chapter 7 deals with governance
21077	109	18	109	18	Change to "temperature goal" (singular). [, United Kingdom (of Great Britain and Northern Ireland)]	agree
38925	109	18	109	20	The word "central" in this sentence is an editorial inference with respect to the Paris Agreement. The Paris Agreement does not state that land sector mitigation is central to achieving its singular long term temperature goal. Suggest rephrasing the beginning of the sentence to read "Land sector mitigation [DELETE: is central to] HAS THE POTENTIAL TO CONTRIBUTE TO ACHIEVE the Paris Agreement temperature goal[DELETE:s] and to meeting..." [, United States of America]	Accept, text deleted

Comment No	From Page	From Line	To Page	To Line	Comment	Response
1001	109	18	109	20	repetition from line 10-12. The lines 10-15 sems misplaced, should be after the new section heading (2.7.3)? [Tobias Rütting, Sweden]	Accept, editorial mistake, now removed
29661	109	18	109	28	This paragraph goes too far in its interpretation of the Paris Agreement by implying that, for example, article 4.1 is not clear about whether both emissions and removals are anthropogenic. The balance is between anthropogenic emissions and anthropogenic removals, and translations of the Paris Agreement make this very clear. It is also incorrect to say that the balance goal itself can be interpreted using different GWPs. When the Paris Agreement was written it was based on AR5, using GWP100. While a balance between emissions and removals could in general be calculated using different GWPs, if we are talking in the context of the Paris Agreement then it is only correct to use GWP100, and any implication in the SRCCL that article 4.1 could be redefined would be policy prescriptive. Further problems with this paragraph include that it implies that balance in the context of article 4.1 could be regional or global, when the goal in article 4.1 is a global goal, and the implication that the timescale is unclear, when the Paris Agreement explicitly states that the balance (as calculated globally using GWP100) should be in the second half of the 21st century. [, Saint Lucia]	Accept, text mostly deleted
1493	109	18	109	28	There are too many questions in this paragraph as this is supposed to be an assessment. The point is that the Paris Agreement means we need to increase sinks. The sentence on lines 30-32 covers much of what needs to be said. [William Collins, United Kingdom (of Great Britain and Northern Ireland)]	Accept, text modified
16861	109	18	109	32	The text should mention that if the GHG balance between emissions and sinks includes natural sinks, global mean temperature would not stabilize in relevant time-scales. That would thus not be consistent with the Paris Agreement which aims to stabilize temperature below 2 degree increase. [Antti-Ilari Partanen, Finland]	Reject, text mostly deleted but the balance is clarified now as being anthropogenic sinks since the COP in Katowice
21075	109	18	109	32	This paragraph focuses on a contribution to a single part of the the Paris Agreement while the title of the section is more general. Suggest that this section begins with a more general statement on the ways land mitigation options contribution achieving the PA temperature goal before focusing in on the balance text. [, United Kingdom (of Great Britain and Northern Ireland)]	Accept, text mostly deleted
29851	109	18	109	32	The assumption that the anthropogenic mentioned in the Paris Agreement applies to both emissions and removals, and natural sinks are excluded could be a pure conjecture bordering on incorrect interpretation of the lines in the Paris Agreement. This interpretation is vital and important in building up future land based response options. The Ministerial Declaration on Forests in COP 24 referred to this line and the implication clearly pointed to the fact that forest as carbon sinks is being seen as an offset to balance the anthropogenic emissions by sources. That also points out how forests is today seen within the framework of climate change negotiations, essentially as a pawn to be used where necessary and to be sacrificed otherwise. So, a wrong assumption in this land report could prove to be costly in the end. [Souparna Lahiri, India]	Accept, text mostly deleted
33617	109	20	109	28	Several of these questions where sorted out in the Paris Agreement rulebook adopted in COP24 in Katowice and e.g. which metric to use and in our view it is clear from the Paris Agreement that anthropogenic applies to both sources and sinks. You may therefore reconsider the language especially in line 26-28 in light of output from Katowice. [, Norway]	Accept, text mostly deleted
29203	109	25	109	26	I suggest adding a ref to SR1.5; ch1. [Jan Fuglestvedt, Norway]	noted. text deleted

Comment No	From Page	From Line	To Page	To Line	Comment	Response
29201	109	26	109	26	I suggest adding "and the clime response" after ""of the balance" [Jan Fuglestvedt, Norway]	noted. text deleted
21079	109	26	109	28	This sentence borders on prescriptive language. Suggest it is changed to: " [, United Kingdom (of Great Britain and Northern Ireland)]	noted. text deleted
25377	109	30	109	32	Please correct "assuming" by "since" as the fact that anthropogenic applies to both emissions and removals is absolutely not an assumption. Several provisions under the UNFCCC, including the French version of Paris Agreement, prove it. See also the following scientific article: - Fuglestvedt J, Rogelj J, Millar RJ, Allen M, Boucher O, Cain M, Forster PM, Kriegler E, Shindell D. 2018 Implications of possible interpretations of 'greenhouse gas balance' in the Paris Agreement. Phil. Trans. R. Soc. A 376: 20160445. http://dx.doi.org/10.1098/rsta.2016.0445 [, France]	noted. text deleted
27003	109	30	109	32	Please mention that this statement is based on current technologies. [, Germany]	Accept, added current and text moved to end of section
29205	109	30	109	32	Important but a bit uncelar. The magnitude of remaing emisisons and hwo these are "balanced" by negative CO2 emisisons will affect the magnitude of negative emissions needed , the side effects and also the climate outcome. [Jan Fuglestvedt, Norway]	accept, text modified and moved to end of section
8569	109	31	109	31	See my comment on P93L34 [Marc Aubinet, Belgium]	accept text deleted
38927	109	34	109	45	Does the analysis in this section include "economy-wide" NDCs, which inherently include AFOLU even if not specified? [, United States of America]	Accept. Yes they do, added some text
33619	109	35	109	42	What you here call "intended" NDC where turned into formal NDCs throught the Paris Agreement. Hence, you do not need to use intended NDCs anymore (The intended NDCs are now the first NDCs under the Paris Agreement). In line 40 when you describe NDCs submitted to date, it would be better to call it the first NDCs since it will be new NDCs in 2020, and this report will be used for some years where this distinction will be important. [, Norway]	Reject, the anslsyes quoted were based on the intended NDCs, some NDCs were updates as they were formally submitted, again as this report will be sued for some time, better to use the date of submission than first etc. but also as said some of these were the INDCs not the first NDCs
14133	109	37	109	39	The claim that no NDCs mention bioenergy (lines 38-39) is simply not true. The NDCs for Cambodia, Indonesia and Malaysia, for example, all mention bioenergy and set specific targets for increasing biofuel in the biofuel:fossil fuel fuel mix for use in transport in these countries. As mentioned in my earlier comments there are also good reasons why few countries - not none - mention bioenergy. This has to do with the within country focus of activities covered by NDCs and uncertainty regarding future C markets and a replacement for REDD+. [David Taylor, Singapore]	Accepted, text modified
32661	109	38	109	40	This sentence assumes that fuel substitution involving bioenergy automatically reduces emissions in the energy sector. This has been strongly criticized, e.g., by Searchinger et al., 2018, Nature Communications, DOI: 10.1038/s41467-018-06175-4). It should be mentioned for balance. [Jean-Pascal van Ypersele, Belgium]	reject: the countries in this context are using it as a mitigation measure, this issues is dealt with at length in the bioenergy subsection and cross chapter bopx, while bioenergy is dealt with as carbon neutral in the neergy section, land related emissions are captured in the Agruculture and LULUCF sector.
28831	109	42	109	45	Suggested literature: Dube L.C. (2019) Conserving Carbon and Biodiversity Through REDD+ Implementation in Tropical Countries. In: Behnassi M., Pollmann O., Gupta H. (eds) Climate Change, Food Security and Natural Resource Management. Springer, Cham (https://doi.org/10.1007/978-3-319-97091-2_15) [Lokesh Chandra Dube, India]	Reject: this section is about what is included in the NDCs, not about mitigation and biodiversity potentail from REDD+.
29207	109	34	110	12	How is equivalent CO2 emissions calculated in section 2.7.3.1? The NDCs use differen metrics for calculation of CO2-eq emissions. Some info on what is done here would be useful. [Jan Fuglestvedt, Norway]	Accept. Actually this is just CO2 from LULUCF so deleted e or eq
15283	109	51	110	2	The figure for the estimated net LULUCF flux in 2030 has a large uncertainty value and also the net calculated LULUCF in 2030 has too large an uncertainty value [Joalane Marunye, Lesotho]	noted: not sure what the reviewer is asking for here, the uncertainty comes from the paper that is being quoted, the incertainties and how they were derived are fully explained therein

Comment No	From Page	From Line	To Page	To Line	Comment	Response
11585	109	22			introduce 'be ' after forcers [Lawrence Aribo, Uganda]	noted. text deleted
12853	110	1	110	22	Figure 2.37 is very difficult to follow. In line 6 it is stated that calculating the LULUCF can result in discrepancies of a factor of 3. Then a list of calculations are given, but very little physical insight as to what is going on. There is a yellow bar in the key, but no yellow bar on the graph (is the key supposed to refer to the yellow shaded area?). Simple mechanistic differences between the lines on the right should be attempted, instead of, or in addition to, a long list of references. The story is made to sound so complicated as to be ineffective. [Robert Treuhaft, United States of America]	accpted, text modified, the figure is reporduced from another paper, in my version the yellow shows. Not surew aht is meant by "Simple mechanistic differences between the lines on the right should be attempted, instead of, or in addition to, a long list of references." Altered the text to try to make things more clear
17869	110	6	110	12	This is an important section, but it is not very easy to understand. Some more explanation of the different approaches and what the different between then means for tracking progress in land mitigation would be helpful. [Quentin Lejeune, Germany]	Accetped. Text modified to be more clear.
2627	110	7	110	7	why not "0.7-3.8"? The min figure below is 0.7 [Wei Li, France]	accept: deleted numbers
33621	110	4	111	8	Figure 2.37 and its caption: What you here call "intended" NDC where turned into formal NDCs throught the Paris Agreement. Hence, you do not need to use intended NDCs anymore. The NDCs referred to here are the first NDCs under the Paris Agreement. It will be new NDC in 2020, based on this the figure and figure caption could be simplified. E.g. replace Pre-(I)NDC with first NDCs or NDC (current policies). [, Norway]	Reject: at the time the two analyses were done (grassi and forstell) these were still INDCs, some countries did change their NDCs from their INDCs, so this reflects what was inlcuded at the time of anlaysis in the papers quoted
29211	110	10	112	7	section 2.7.3.2.: This unfinished section is promising. [Jan Fuglestvedt, Norway]	noted: but following another comment text delted
5373	111	10	111	14	In my view it would be problematic to include additional analyses post review-round 2 that would then obviously not be subject to peer-review in the final draft, as IPCC products routinely are. If yet-to-be-done analyses should be included, they must undergo rigorous peer-review, in order not to compromise the quality and credibility of the assessment. [Helmut Haberl, Austria]	Accept, text deleted
21983	111	15	111	15	Would it be possible to underline that the Paris Rule book and its implementation will be essential for the concretesing of future NDCs, and the issue of including quantified economy wide reduction targets? In addition, I think it should be mentioned that the Conference of Parties serving as Meeting of the Parties to the Paris Agreement will play a decisive role in determining the functioning of the Global Stocktake, as with many other provision, it will be of utmost importance how these will be implemented. There is an article in the Max Planck Yearbook of United Nations Law on this. P Minnerop, 'Taking the Paris Agreement forward. Continuous Strategic Decision-making on Climate action by the Meeting of the Parties, (Ed. by R Wolfrum and F Lachenmann) Volume 21 (2017), 124-166. [Petra Minnerop, United Kingdom (of Great Britain and Northern Ireland)]	accept: added text. Issues around estimating mitigation will also be key to transparency and credibility and is part of the ongoing development of the Paris Rulebook. Did not add the ref as not a peer reviewed paper
38929	111	15	111	16	The enhanced transparency framework also includes reporting on national GHG inventories, which seems equally relevant to this section. [, United States of America]	acccept, reference to this discussion in section 2.4 combined now with text on ETF
15349	111	15	111	17	Suggest deletion: it is a repeat of previous section p.37. [, Australia]	Accepted, text deleted
38931	111	17	111	20	"The Global Stocktake is potentially the real 'engine' of the Paris Agreement, because any identified 'gap' between 'collective progress' and the 'well-below 2°C trajectory' is expected to motivate increased mitigation ambition by countries in successive rounds of NDCs." This subjective statement is out of place in the report. Reframe objectively, noting that the GST provides a snapshot of the current status of global climate change efforts. Parties may use this to inform subsequent NDCs. [, United States of America]	Accept, text deleted

Comment No	From Page	From Line	To Page	To Line	Comment	Response
1519	111	18	111	21	"Expected to motivate" is way too strong. Politically, expectations are more modest, although countries will always pretend they adhere to the Paris Agreement but somebody else might be responsible for the gap between talk, decisions and actions (see Geden 2018, in Nat. Geosci. 11, 380-383). There migt be "softer" methods to lure governments into delivering on their promises regarding the targets of the Paris Agreement (see Karlsson-Vinkhuyzen et al. 2018, in Clim. Policy 18, 593-599; Rajamani/Werksman 2018, in Phil. Trans. R. Soc. A 376: 20160458) [Oliver Geden, Germany]	Accept, text deleted
38933	111	23	111	24	The tense and tone of this sentence should reflect its basis in modelled projections. Suggest the following changes: "The submitted Nationally Determined Contributions (NDCs) across all sectors, currently fall short of what [DELETE: is] WOULD BE required [DELETE: to meet] FOR 2 degree or 1.5 degree CONSISTENT pathways [, United States of America]	Accepted, text modified
27005	111	23	111	28	Please cite the SR1.5 in the paragraph. [, Germany]	Accepted, text modified
21081	111	25	111	25	The range of 2.5 presented here is a little misleading. There are a range of estimates and methodologies that are used to address this research question, which helps to result in a degree of confusion. The lower end may potentially be as low as 2.4 (http://iopscience.iop.org/article/10.1088/1748-9326/aab53e/meta) but the upper end could be higher than 3. The latest Gap Report has a range of 2.9 to 3.4 for unconditional NDCs, with conditional lowering by 0.2C. It may be best to point to a single authoritative source like the Gap Report, while also noting that there is uncertainty in this area. You should also point to the statement in SR1.5 of around 3C from NDCs. [, United Kingdom (of Great Britain and Northern Ireland)]	Accepted, text modified
29663	111	25	111	26	SR1.5 should be cited here [, Saint Lucia]	Accepted, text modified
29209	111	25	111	26	You mad add ref to Sr1.5 [Jan Fuglestvedt, Norway]	Accepted, text modified
21083	111	29	111	30	The near term is not 2030-2050. That is the medium term. The near term is more reasonably thought of as up to 2030. If you characterise post-2030 as near term, this is contradicting the key message of SR1.5 that actions prior to 2030 are likely to determine whether we meet Paris Goals. Please amend. [, United Kingdom (of Great Britain and Northern Ireland)]	Accepted, text modified, deleted 2050
1263	111	35	111	38	This kind of conclusions assumes that land-based mitigation option come with no biophysical effects (in other words the biophysical changes due to land-based mitigation are climate neutral). Half of this section lists evidence that this is NOT the case. I'm very surprised to see this kind of unnuanced statements in the concluding paragraphs of this chapter. Add at least a paragraph that mention this key uncertainty. I agree that there is high agreement and high confidence that the land sector can mitigate emissions. I disagree that there is high agreement and high confidence that these action will result in reducing the global temperature (see tens of references above). [Sebastiaan Luyssaert, Belgium]	accept with modification. Took out the confidence statement as this is now from one report only. Added some text to discuss that biophysics are nto included in the reporting. But the ucnertainty still seems to high to include in any kind of reporting/accounting with any confidence as the range across the models is very large
5057	111	36	111	40	It is not clear whether "land-based response options" and "Land sector response options "in the chapter 2 page 111 are meaning the same. Adding clearer definition of them would be appreciated. In addition to above, we see similar languages, for example, Land-based options (Chapter2-page7), Land-based mitigation (Chapter2, page112) and Land-based CDR options (Chapter2-page107). We would also suggest clarifying these definitions and giving more detail explanation. [, Japan]	Accept, text deleted but terms made cosnistent across the report

Comment No	From Page	From Line	To Page	To Line	Comment	Response
27009	111	40	111	42	Please explain why land sector options are classified as "near term solutions while other options are being developed and deployed". Please replace "near term solutions" with "near at hand" as "near term" could give the impression that these measures will no longer be applied in the future. [, Germany]	accept with modification, text deleted
40547	111		111		refer to SR15 in core text of section 2.7.3.2 and possibly update if new literature is avaialble since approval of SR15. [Valerie Masson-Delmotte, France]	accept, text added
29665	111	29	112	3	Is there evidence that a third of mitigation needed for 1.5°C in 2050 could come from land-based responses? The Roe et al. 2018 paper cited only seems to consider a 2°C pathways. Has further analysis using the range of 1.5°C scenarios shown the proportion of what is needed for 1.5°C? The figure 2.38 should be labelled to show that it refers to 2°C pathways, if this is indeed the case. [, Saint Lucia]	Accept with midification, Roe et al results deleted
27007	111	37			Does "The paper" refer to the SRCCL? [, Germany]	accept with modification, text deleted
13179	112	1	112	7	Figure 2.38. reducing food waste and diet shitfs are not really "land-based". Theyare part of the broader food system. Suggest to separate out and ensure conissetency across chapters. [David Cooper, Canada]	accept with midification: we have been asked to use "response options relying on the use of land" across the SRCLL also to refer to those involving demand reductions that also affects the use of land eg. Means using less land"
38935	112	5	112	5	The word 'double' is missing. [, United States of America]	accept with modification, text deleted
1003	112	5	112	7	Should this part of the figure caption? [Tobias Rütting, Sweden]	accept with modification, text deleted
5059	112	11	112	15	Policymakers may be interested in the point how much the global scale estimate reflected local scale information because the estimates from the Bookkeeping model and GHG inventories are compared in the chapter. We suggest it would be worth including more detailed information on Bookkeeping model for the points 1) what is the data source of biomass density map and how it is prepared; and 2) how and from what data sources the ground-based inventory data is collected. [, Japan]	Rejected. The comment is well taken. However, word limits within the Box preclude such detail.
3197	112	12	112	12	Perhaps, not 'soils', but ' soil carbon' or 'organic matter in soils'. [, Russian Federation]	Rejected. The comment is well taken, but not essential.
2629	112	12	112	12	not only biomass but also soil [Wei Li, France]	Noted.
2631	112	14	112	14	"vegetation" instead of trees [Wei Li, France]	Rejected. The comment is well taken, but the original text was not changed.
2633	112	17	112	17	No really. Need to be careful to draw the conclusion on "overestimate". See Arneth 2016 Nat Geo. Also Bookkeeping model by Houghton doesn't have gross LUC, may underestimate past fluxes. [Wei Li, France]	Accepted, but the original text was not changed.
2635	112	22	112	24	better to note DGVMs also vary with respect to vegetation types defined and included [Wei Li, France]	Rejected for reasons of word limit.
3199	112	25	112	25	Suggestion: add 'change' after ' land cover'. [, Russian Federation]	Editorial.
18243	112	25	112	25	not only forest management, but also other land management such as grazing, as well as more recently also irrigation, tillage, fertilisation (Le Quere, 2018) [Julia Nabel, Germany]	Accepted, but the original text was not changed.
2637	112	26	112	26	not clear what the "land sink" here refer to [Wei Li, France]	Accepted. The revised text should clarify the meaning.

Comment No	From Page	From Line	To Page	To Line	Comment	Response
27905	112	9	113	52	The special report on land should address the discrepancy in the treatment of LULUCF/Forest based mitigation in global model estimates and GHG country reporting of anthropogenic forest CO2 sinks. In summary, estimates of the anthropogenic forest sink in countries' GHGIs and global models (reflected in AR5) are not conceptually comparable. The magnitude of the differences may jeopardize the intent of the Global stocktake to assess collective progress towards the targets of the Paris Agreement. To minimize this risk, the forthcoming AR6 will need to assess available literature that provides results with a greater level of disaggregation. [Itchell Guiney, South Africa]	Accepted. The revised section 2.3 discusses the discrepancy at length.
29213	112	8	114	18	Box 2.1: this is a very useful box. [Jan Fuglestvedt, Norway]	Thank you
22533	112	8	114	19	This box concerns flux estimation, not mitigation specifically. It should therefore be placed in Ch2.4. In fact, this kind of at-a-glance reference would greatly help Section 2.4's readability. There would also be scope for streamlining betwen the material in this box and the material already in 2.4. Also, 2.7 and 2.4 should be placed next to each other (or even merged) given the close relationship between them. [Anastasios Kentarchos, Belgium]	should be with 2.4
27013	112	9	114	18	Box 2.1 is a very helpful description, but would be more useful at the beginning of the chapter (where the results of the various models are discussed). [, Germany]	Rejected. The editors chose to list Boxes at the end of the chapter.
38937	112	9	114	18	Box 2.1 omits the role of land-use models that are not IAMs. These models and the elements they capture are unique from but complement the work by other model types and should be included here as well. [, United States of America]	Rejected. The first two types of models described in the Box are land-use models that are not IAMs.
3287	112		114		Can box 2.1 be moved to where is its mainly referenced to in Section 2.4? This was done in Chapter 6 (page 15) and worked very well. [Viola Heinrich, United Kingdom (of Great Britain and Northern Ireland)]	The editors chose where to include the Boxes.
27011	112	1			Figure 2.38 is an interesting figure which could be further developed and be shown to communicate the role of the land sector and the individual options for GHG mitigation. In the left panel, the diagonal lines with the star "Land Sector" on top need to be better explained and uncertainty ranges need to be added to the right panels please. [, Germany]	accept with modification, text deleted
13389	113	12	113	23	This paragraph is missing a key point that we can estimate GPP from satellites (and not just biomass and greenness). Although first attempts needed associated weather data to do so (Running et al 2004, https://doi.org/10.1641/0006-3568(2004)054[0547:ACSMOG]2.0.CO;2), there is more promise based on sun-induced fluorescence (Frankenberg et al 2011,GRL, https://doi.org/10.1029/2011GL048738), from which GPP estimations can also be enhanced by downscaling using ancillary satellite data (e.g . Duveiller & Cescatti, 2016, RSE, https://doi.org/10.1016/j.rse.2016.04.027) [Gregory Duveiller, Italy]	Rejected. The word limit for Boxes necessarily results in some omissions.

Comment No	From Page	From Line	To Page	To Line	Comment	Response
12855	113	12	113	23	One of the most important means of 3-D structure and biomass estimation is interferometric radar. The failure to mention it, or even mention radar, will make this part of the document anachronistic. It should be mentioned along with lidar. Interferometric radar has far greater spatial and temporal coverage (all-weather) than any optical sensor. Some of the best aboveground biomass dynamics results have come from TanDEM-X (see Askne et al 2018 and Treuhaft et al. 2017). Also note that TanDEM-L, a proposed mission from DLR, will do L-band InSAR for vegetation structure. For general references on InSAR for vegetation, see Cloude and Papathassiou 1998 and Treuhaft and Siqueira 2000. Baccini 2017 is missing from the reference list. Saatchi 2015 is also missing. [Robert Treuhaft, United States of America]	Rejected. The word limit for Boxes necessarily results in some omissions.
6231	113	12	113	23	An important omission here are soil moisture data from satellites. Understanding the water conditions of soil is vital for understanding methane fluxes and also natural CO2 fluxes. The SMAP mission now includes estimate of net ecosystem CO2 exchange, for example. I appreciate the box is about estimating anthropogenic land carbon fluxes but there are numerous examples where soil moisture is an important variable such as degraded peatland. It may also be worth drawing attention to newer observations that are now being adopted such as Solar Induced Fluorescence, which provides a much more direct measure of productivity than traditional vegetation indices. [Tristan Quaife, United Kingdom (of Great Britain and Northern Ireland)]	Rejected. The point is important but judged unnecessary in the limited context of this Box.
6719	113	12	113	32	Inversion using satellite-observed CO2 concentration is an emerging technology to monitor continental-scale land CO2 fluxes. For example, GOSAT of Japan (maksyutov et al. 2013), OCO-2 of USA (Eldering et al. 2017), and TanSat of China are operating. Maksyutov, S., Takagi, H., Valsala, V.K., Saito, M., Oda, T., Saeki, T., Belikov, D.A., Saito, R., Ito, A., Yoshida, Y., Morino, I., Uchino, O., Andres, R.J., Yokota, T., 2013. Regional CO2 flux estimates for 2009–2010 based on GOSAT and ground-based CO2 observations. Atm. Chem. Phys. 13, 9351–9373. Eldering, A., Wennberg, P.O., Crisp, D., Schimel, D.S., Gunson, M.R., Chatterjee, A., Liu, J., Schwandner, F.M., Sun, Y., O'Dell, C.W., Frankenberg, C., Taylor, T., Fisher, B., Osterman, G.B., Wunch, D., Hakkarainen, J., Tamminen, J., Weir, B., 2017. The Orbiting Carbon Observatory-2 early science investigations of regional carbon dioxide fluxes. Science 358, 188. [Akihiko Ito, Japan]	Rejected. The word limit for Boxes necessarily results in some omissions.
6233	113	20	113	20	To say “data are only available for recent decades” is very general. I think it is important here to be more precise. Some data (vegetation indices, albedo, arguably also land cover) are available since the early 80’s on spatially and temporally synoptic scales. Others (such as lidar and radar for biomass) are only relatively recent and typically are neither spatially or temporally synoptic. There is also the issue of how appropriate the resolution of the data sets are for particular applications. For example the typical 1km resolution of many global imagers can only provide net changes in an LULUCF context when being applied to complex heterogeneous landscapes. [Tristan Quaife, United Kingdom (of Great Britain and Northern Ireland)]	Rejected. The word limit for Boxes necessarily results in some omissions.
1813	113	23	113	23	Perhaps the authors could mention the use of reanalyses to estimate land surface quantities over a period of years, including the calculation of trends. [William Lahoz, Norway]	Rejected. The word limit for Boxes necessarily results in some omissions.

Comment No	From Page	From Line	To Page	To Line	Comment	Response
6721	113	34	113	38	Add several representative references of flux networks: Baldocchi, D., Falge, E., Gu, L., Olson, R., Hollinger, D., Running, S., Anthoni, P., Bernhofer, C., Davis, K., Evans, R., Fuentes, J., Goldstein, A., Katul, G., Law, B., Lee, X., Malhi, Y., Meyers, T., Munger, W., Oechel, W., Pau U, K.T., Pilegaard, K., Schmid, H.P., Valentini, R., Verma, S., Vesala, T., Wilson, K., Wofsy, S., 2001. FLUXNET: a new tool to study the temporal and spatial variability of ecosystem-scale carbon dioxide, water vapor, and energy flux densities. Bulletin of the American Meteorological Society 82, 2415-2434. [Akihiko Ito, Japan]	Rejected. The word limit for Boxes necessarily results in some omissions.
27015	113	35	113	35	Please insert "net" before "CO2 flux". [, Germany]	Accepted, but the original text was not changed.
8571	113	43	113	43	Tubiello not in reference list [Marc Aubinet, Belgium]	Accepted. Reference added.
11567	113	44	113	44	use super script to write correct chemical formula of carbon dioxide in Non-CO2 [Lawrence Aribo, Uganda]	Editorial
11571	113	48	113	48	consider replacing of at the end with on [Lawrence Aribo, Uganda]	Rejected.
11569	113	52	113	52	correct prmary to primary [Lawrence Aribo, Uganda]	Accepted.
1815	113	52	113	52	primary. Check for similar typos in text, e.g., P. 2-114, L. 10, L. 11. [William Lahoz, Norway]	Noted.
1005	113	52			"primary" [Tobias Rütting, Sweden]	Accepted.
29669	114	1	114	18	The agreed Enhanced Transparency Framework rules from COP 24 should be consulted to ensure this section is up to date (i.e. flexibility provided to those developing countries that need it, rather than differentiation between developed and developing countries) [, Saint Lucia]	Rejected for reasons of word limit.
21985	114	1	114	18	How is the reporting for developing country Parties different? Is that derived from the Paris Agreement, or the Decision of the COP, perhaps this should be clarified? [Petra Minnerop, United Kingdom (of Great Britain and Northern Ireland)]	Rejected for reasons of word limit.
17871	114	1	114	18	It would be helpful to elaborate on the differences between modelled and reported land-based emissions and removals (as covered by Grassi et al. 2018). Additionally, further explanation on accounting would be very relevant and useful here. E.g. see Krug 2018: Accounting of GHG emissions and removals from forest management: a long road from Kyoto to Paris, and Mackey et al. 2013 (NCC): Untangling the confusion around land carbon science and climate change mitigation policy. These papers elaborate on how accounting rules under the KP enabled credits from land-based activities to offset a portion of emissions from other sectors, and highlight the challenge of using such offsets (namely that the prevention of emisions from land-based activities cannot adequately counteract the effects of continuing fossil fuel emissions). [Quentin Lejeune, Germany]	Accepted. The revised text (not the Box) elaborates these differences.
3289	114	2	114	17	Could link back to/refer to Figure 2.9 (section 2.4; Page 43); same goes for DGVM and Bookkeeping models as it is a very clear Figureand easy to intepret. [Viola Heinrich, United Kingdom (of Great Britain and Northern Ireland)]	Accepted. Revised text clarifies these relationships.
27017	114	3	114	4	Please amend the statement on the differentiating between developing and developed countries which does not hold for reporting under the Paris Agreement's transparency framework, please see https://unfccc.int/sites/default/files/resource/l23_0.pdf?download. [, Germany]	Rejected for reasons of word limit.
22195	114	10	114	10	Should not it be 'modelled' rather than 'modellef'? [Edson Leite, Brazil]	Accepted.
2639	114	10	114	10	"modelled" [Wei Li, France]	Accepted.

Comment No	From Page	From Line	To Page	To Line	Comment	Response
29667	114	14	114	18	Please add further context about accounting rules and how they were used under the Kyoto Protocol to allow the transfer of credits from land-based emissions reductions as a means to offset fossil fuel emissions. This is very relevant for tracking progress under the Paris Agreement, including for the Global Stocktake, and is also relevant to the ongoing development of rules for market-based mechanisms under the Paris Agreement. [, Saint Lucia]	Rejected for reasons of word limit.
1007	114	10			"modelled" [Tobias Rütting, Sweden]	Accepted.
25379	115	1	115	1	Information on the latest major forest fires (summer 2017 and summer 2018, in particular) would be welcome, although it is only to say that the state of scientific knowledge is currently insufficient to take these recent events into account. [, France]	Accepted. Information available for British Columbia for 2017 and 2018 has been added. Global data are not yet available
14671	115	4	115	4	Box 3 does not show any substantial change in the fire regime of boreal North America whatsoever, despite text to the contrary in the Cross-Chapter box above (see page 2-115, line 30). [, Canada]	Not necessarily. The big surges in fires in British Columbia during 2017 and 2018 are illustrative
3221	115	7	115	7	add: "its control of fire weather, as well as" in-between “through” and “its interaction” [Maria Ulrika Johansson, Sweden]	Accepted
3223	115	13	115	13	add citation (Archibald et al. 2013) Archibald, S., C. E. R. Lehmann, J. L. Gómez-Dans, and R. A. Bradstock. 2013. Defining pyromes and global syndromes of fire regimes. Proceedings of the National Academy of Sciences 110:6442-6447. [Maria Ulrika Johansson, Sweden]	Accepted
23523	115	16	115	33	Recent Analysis revealed a significant interaction between religion and week day, i.e. regions with different religious affiliation (Christian, Muslim) display distinct weekly cycles of burning.The religion vs. week day interaction only is significant for croplands, i.e. fire activity in African croplands is signifi- cantly lower on Sunday in Christian regions and on Friday in Muslim regions. Pereira JMC, Oom D, Pereira P, Turkman AA, Turkman KF (2015) Religious Affiliation Modulates Weekly Cycles of Cropland Burning in Sub-Saharan Africa. PLoS ONE 10(9): e0139189. doi:10.1371/journal.pone.013918 [Renata Libonati, Brazil]	Rejected. Not relevant to the broader theme of the box
17759	115	19	115	19	Please consider adding along the lines of: Anthropogenic fires are typically more frequent, early-season, low-intensity and smaller than wildfires (Archibald et al. 2013). When traditional land management ceases a fire regime shift often occurs, towards longer fire intervals, more late-season, high-intensity, larger fires (Bowman et al. 2011). Cf: Bowman et al. (2011): The human dimension of fire regimes on Earth. Journal of Biogeography 38:2223-2236; Archibald, S., et al. (2013): Defining pyromes and global syndromes of fire regimes. Proceedings of the National Academy of Sciences 110:6442-6447. [, Sweden]	Not accepted. While this is relevant there is insufficient space in the box. The references suggested have already been included in other contexts in the box
3225	115	19	115	19	change words in … precipitation main influence on fire regimes before the Holocene, human activities have in all flammable biomes been the dominant drivers since humans arrived to the continents (Bond et al. 2005, Bowman et al. 2011). [Maria Ulrika Johansson, Sweden]	Not accepted. In the interest of keeping to the prescribed length of the box, a number of senetences on the historical context have already been removed in earlier revisions
3227	115	19	115	19	add: A fire regime is defined as the frequency, season, intensity, and sizes of fires (Gill 1975). Fires can be crown fires, often killing mature trees, surface fires, where mature fire-adapted trees often survive, or ground fires, burning organic soils (Archibald et al. 2013). Anthropogenic fires are typically more frequent, early-season, low-intensity and smaller than wildfires (Archibald et al. 2013). When traditional land management ceases a fire regime shift often occurs, towards longer fire intervals, more late-season, high-intensity, larger fires (Bowman et al. 2011). [Maria Ulrika Johansson, Sweden]	Partly accepted. Definition of "fire regime" given in glossary. The rest of the material is too long and text-book like for the box.

Comment No	From Page	From Line	To Page	To Line	Comment	Response
23519	115	26	115	29	Global fire emissions of carbon increase by about 10% between 1700 and 1900, reaching a maximum of 3.4 Pg C yr−1 in the 1910s, followed by a decrease to about 5% below year 1700 levels by 2010 (Ward et al 2018). I suggest to use this reference: Ward, D.S., Shevliakova, E., Malyshev, S., Rabin, S., 2018. Trends and Variability of Global Fire Emissions Due To Historical Anthropogenic Activities. Global Biogeochem. Cycles 32, 122–142. https://doi.org/10.1002/2017GB005787 [Renata Libonati, Brazil]	Not accepted. While this paper and data are relevant, there is insufficient space in the box to include it. Also the emissions are only reported until 2010, or prior to AR5. We are giivng priority to new information since AR5.
14673	115	31	115	31	Ansman 2018 is an inappropriate reference for the increasing burned area in Canada. See this recent reference for a more thorough examination: https://doi.org/10.1139/cjfr-2018-0293 [, Canada]	Accepted. Hanes et al. has been added.
17761	115	32	115	32	The "worst"… might be replaced by "largest" (what is meant by worst is a bit ambiguous from a physical point of view). [, Sweden]	Accepted
3229	115	32	115	32	remove the word “worst” In the 2017 fire season in British Columbia, the total area burnt was the largest ever recorded since the 1950’s with at least 0.9 Mha… [Maria Ulrika Johansson, Sweden]	Accepted
14675	115	33	115	33	1.2 Mha was burned in British Columbia, Canada in 2017. The final fire report is located here: https://www2.gov.bc.ca/assets/gov/public-safety-and-emergency-services/emergency-preparedness-response-recovery/embc/bc-flood-and-wildfire-review-addressing-the-new-normal-21st-century-disaster-management-in-bc-web.pdf [, Canada]	Accepted. But I have used a published reference (Hanes et al. 2019)
2641	115	48	115	48	"GFED4s"? [Wei Li, France]	Accepted
3201	116	1	116	2	a) May be Gt in more appropriate; b) Are these estimates of CO2 fluxes or CH4 as well? In the latter case CO2-eq is applicable; is it about gross-emissions or net-emissions? [, Russian Federation]	Accepted. Changed to Gt C. The figures refer to all molecules with C (including CO2, CO, CH4, etc. These are gross emissions.
23725	116	6	116	7	Fire can affect the carbon exchange between atmosphere and land through the ozone and aerosols emission, in which ozone decreases GPP and aerosols increases GPP. A newly published paper: Yue, X. and Unger, N. (2018) Fire air pollution reduces global terrestrial productivity, Nature Communications, doi: 10.1038/s41467-018-07921-4. [Xiyan Xu, China]	Accepted
3231	116	20	116	20	change the beginning of the sentence to: Flammable ecosystems are adapted to their specific fire regime (Bond et al. 2005). A fire regime shift alters vegetation and soil…. [Maria Ulrika Johansson, Sweden]	Accepted
31679	116	20	116	27	Iinclude Flores et al. 2017 (https://doi.org/10.1073/pnas.1617988114). They analysed the resilience of the Amazonian forest to wildfires. The study provides evidence that inundated lowland forests areas are more vulnerable to fire than highlands, which may also contribute to the release of large amounts of carbon. Their findings corroborate with, and aggregate value to, the evidences provided in the reffered paragraph. [, Brazil]	Not accepted. The level of detail is too much to include in the fire box (which has restrictions of about 1500 words). Other chapters and sections can pick up such detail as appropriate
3233	116	27	116	27	add: Fire suppression in systems adapted to frequent fires may lead to loss of biodiversity and food security (Parr et al. 2014) and a fuel build-up increasing the risk of more severe wildfires, killing mature trees and hence reducing long-term carbon storage of the system (Russell-Smith et al. 2015, Pawlok et al. 2018). [Maria Ulrika Johansson, Sweden]	Partly accepted. The points are relevant, especially the latter part about excessive fire suppression and fuel build up. However, there is little space in the box to elaborate this point. However, the last paragraph has now mentioned the need to avoid excess fuel build up as part of fire management.
3235	116	36	116	36	add “length” in: The fire weather season length has already increased….. [Maria Ulrika Johansson, Sweden]	Accepted
3237	116	39	116	39	add “regimes” in: influencing fire regimes [Maria Ulrika Johansson, Sweden]	Accepted

Comment No	From Page	From Line	To Page	To Line	Comment	Response
3239	116	39	116	39	Archibald, S., C. E. R. Lehmann, J. L. Gómez-Dans, and R. A. Bradstock. 2013. Defining pyromes and global syndromes of fire regimes. Proceedings of the National Academy of Sciences 110:6442-6447. Barlow, J., L. Parry, T. A. Gardner, J. Ferreira, L. E. O. C. Aragão, R. Carmenta, E. Berenguer, I. C. G. Vieira, C. Souza, and M. A. Cochrane. 2012. The critical importance of considering fire in REDD+ programs. Biological Conservation 154:1-8. Bond, W. J., F. I. Woodward, and G. F. Midgley. 2005. The global distribution of ecosystems in a world without fire. New Phytologist 165:525-538. Bowman, D. M. J. S., J. Balch, P. Artaxo, W. J. Bond, M. A. Cochrane, C. M. D'Antonio, R. DeFries, F. H. Johnston, J. E. Keeley, M. A. Krawchuk, C. A. Kull, M. Mack, M. A. Moritz, S. Pyne, C. I. Roos, A. C. Scott, N. S. Sodhi, and T. W. Swetnam. 2011. The human dimension of fire regimes on Earth. Journal of Biogeography 38:2223-2236. Gill, A. M. 1975. Fire and The Australian Flora: A Review. Australian Forestry 38:4-25. Parr, C. L., C. E. R. Lehmann, W. J. Bond, W. A. Hoffmann, and A. N. Andersen. 2014. Tropical grassy biomes: misunderstood, neglected, and under threat. Trends in Ecology & Evolution 29:205-213. Pawlok, D., Z. H. Benjamin, W. Yingping, and W. David. 2018. Grasslands may be more reliable carbon sinks than forests in California. Environmental Research Letters 13:074027. Russell-Smith, J., C. P. Yates, A. C. Edwards, P. J. Whitehead, B. P. Murphy, and M. J. Lawes. 2015. Deriving Multiple Benefits from Carbon Market-Based Savanna Fire Management: An Australian Example. PLOS ONE 10:e0143426. Smith, P., H. Haberl, A. Popp, K.-h. Erb, C. Lauk, R. Harper, F. N. Tubiello, A. de Siqueira Pinto, M. Jafari, S. Sohi, O. Masera, H. Böttcher, G. Berndes, M. Bustamante, H. Ahammad, H. Clark, H. Dong, E. A. Elsiddig, C. Mbow, N. H. Ravindranath, C. W. Rice, C. Robledo Abad, A. Romanovskaya, F. Sperling, M. Herrero, J. I. House, and S. Rose. 2013. How much land-based greenhouse gas mitigation can be achieved without compromising food security and environmental goals? Global Change Biology 19:2285-2302. [Maria Ulrika Johansson, Sweden]	Partly accepted. The references relevant to the text of the box on fire have been cited.
11563	116	39	116	40	use long fire weather season instead of long weather fire season [Lawrence Aribo, Uganda]	Accepted
29853	116	52	117	3	Here the fire management strategies should also include tree species such as in the case of planted forests and plantations where incidence of fire can be reduced with species that are not inflammable such as eucalyptus or chir pine etc. [Souparna Lahiri, India]	Accepted. Have added "natural and planted forests"
3203	117	7	117	12	Cross-Chapter Box 3, Figure 1: May be it is expedient to give more explanation for SS3 and SS5 assumptions, because it is widely known that forest fires in Russia in southern Siberia are becoming more frequent and their magnitude is getting higher. [, Russian Federation]	Accepted. The acronyms have been expanded and a new reference provided to make the concept of SSPs clearer.
40553	117		117		What can this box provide in terms of risk / level of future warming / land use scenario? More insights need to be captured and linked to chapter 7 for the risk assessment traceability. Missing a clear conclusion using confidence language and repeated in the chapter ES. [Valerie Masson-Delmotte, France]	Accepted. We have added a clear conclusion with uncertainty language to the box and we have clarified the messages about how climate change is likely to affect fire risk in the future
23637	117	7		13	I am having trouble interpreting this figure. What are the /8 values in the legend? This is not self explanatory. Also, the caption indicates "light gray" and "dark gray" shading - I don't see any gray in the map. [Kerri Finlay, Canada]	Accepted. We are contacting the authors of the paper to obtain high resolution versions of the figure.

Comment No	From Page	From Line	To Page	To Line	Comment	Response
3205	118	4	118	4	Suggestion: replace 'chemistry through increased greenhouse gasses' with 'composition through increasing concentrations of greenhouse gases ' [, Russian Federation]	Accept. Editorial.
11783	118	5	118	9	FAQ 2.1: The "greeing" effect is described in detail while effects of warming are referred to only briefly as "other impacts". Does this reflect the actual balance of positive and negative effects? Suggest to mention (some of) the "other impacts" because they might not be clear to the audience of the FAQs. This would also help to avoid confusion when "browning" is discussed in contrast to "greening" as of line 17. [Hans Poertner and WGII TSU, Germany]	Noted. In a substantial altering of the text the mention of 'greening" and "browning has been removed
2817	118	6	118	6	"…increased concentrations of GHGs in the atmosphere have resulted…". I.e. "have" instead of "has" [Bettina Weber, Germany]	Accept. Editorial.
11785	118	6	118	6	FAQ 2.1: Would it be useful to point out regional differences of the "greeing" effect? The way this sentence is phrased now, readers might conclude that additional CO2 increases plant growth everywhere around the world. [Hans Poertner and WGII TSU, Germany]	Noted. In a substantial altering of the text the mention of 'greening" and "browning has been removed
2819	118	8	118	8	please write "Earth's" with capital letter [Bettina Weber, Germany]	Noted. In a substantial altering of the text has removed mention of the "Earth"
2821	118	11	118	11	Fullstop after bracket. [Bettina Weber, Germany]	Accept. Editorial
3291	118	11	118	11	Full stop required: envelopes). A warming… [Viola Heinrich, United Kingdom (of Great Britain and Northern Ireland)]	Accept. Editorial
18245	118	15	118	15	what does the "these" refer to, only to the hot climates or generally to the change in the climate? If the latter maybe add "often" to "negatively" - since there might be regions where climatic changes are beneficial for land use [Julia Nabel, Germany]	Accept. We refer to the hot climates and this is now explicitly written in the text
11787	118	15	118	17	FAQ 2.1: Only the last third of the text addresses effects on land cover and land use explicitly. Can the first sentences be shortended and the actual effects be described more clearly? [Hans Poertner and WGII TSU, Germany]	Accept. The text has been substantially altered to address this comment
11789	118	28	118	32	FAQ 2.2 For non-expert audiences, it might be useful to explain how the land-induced changes addressed here relate to climate (changes) and why the example of surface warming due to deforestation and its consequences in Brazil illustrates how land use contributes to climate change. What is being said about vegetation and soils after this example might appeal more logical to people without prior knowledge. [Hans Poertner and WGII TSU, Germany]	Accepted. We have modified the statement and tried to put forward the contribution of land and land use changes to climate change
11565	118	36	118	37	How cloud and dust affect albedo (+ or -ve) is not coming out clear. Please add some explanation [Lawrence Aribo, Uganda]	Accepted. We have highlighted the positive and negative effects. Those are more thoroughly described in chapter 2 and chapter 3 but we have tried to improve this double-sided effect in the statement
17061	118	42	119	5	Basacially the same issue as highlighted above: Add a comment on the anthropogenic influence also since the processes will occur simultaneously. [Morten Andreas Dahl Larsen, Denmark]	Noted. This presumably refers to the comment #17071 and is asking how both climate change and human practices impact the hydrological cycle simultaneously. A sentence has been inserted to this effect.
23639	118		119		Overall, I think this box of FAQs needs more substance. It seems to just be a series of examples, with little direction or reason for the chocie of examples given. The questions themselves are very very broad - are these actual FAQ? From where? Given that this is ulfimately the point of the whole chapter, I think this box is overly simplistic and not very helpful. [Kerri Finlay, Canada]	Noted. The FAQs in the SRCCL are purposefully broad and short, with the intention of including explanations of key terms and concepts. Chosen examples are only specific illustration, sampled from the chapters where readers can find more substance
30905	118		119		the FAQs add no value and could be removed [Mike Morecroft, United Kingdom (of Great Britain and Northern Ireland)]	Rejected. The FAQs in the SRCCL are purposefully broad and short, with the intention of including explanations of key terms and concepts.
40557	118		119		Links with changes in ocean and cryosphere could be made explicitely in FAQ 2.3. FAQ2.2 could be more explicit about air quality. [Valerie Masson-Delmotte, France]	Accepted. Air quality has been added in FAQ 2.2 - CHRIS NEEDS TO ADD FOR LAND/OCEAN

Comment No	From Page	From Line	To Page	To Line	Comment	Response
27019	118	12			Changes in the surface albedo due to LUC are mentioned in chapter 2 as a relevant driver of climate change. Please consider mentioning albedo effects in this FAQ. [, Germany]	Noted. This FAQ is about the the effect of climate on land. The albedo feedback effect mentioned here is beyond the scope of the FAQ, however, it falls into the scope of FAQ #2.
7393	118	42		51	This is a very important question asks by the researchers frequently. The discussion in fact left out one particular area where climate change affects water resources. That is sealevel rise. The personal experince in coastal islands of Bangladesh founf out that, although, there is plenty of water available for the islanders, almost no freshwater is available for drinking and other household purposes due to sea level rise (SLR). The rise of sea level induced by global warming, not only contaminated the surface water for daily living, underground water being used for drinking affected too. Water fetched from tube-wells or shallow wells for drinking tastes abnormally salty in recent time however, at present, found to be impossible to drink any more. People are trying hard to harvest drinking water from sources of rainwater which is not enough for year round. [Md Hossain, Australia]	Noted. There is little scientific literature to support this view point. Salt water intrusion (SWI) into coastal freshwater aquifers has been shown in many studies to predominantly be a function of over-exploitation of the ground water resource which leads to the SWI. The impcat of SLR has been shown to be negligible. We do not doubt the example the review provides but we cannot find evidence that attribute this to SLR. We therefore do not include this point in the FAQ.
8573	122	54	122	55	The title of the reference is wrong . Should be : Ballantyne, A. P., Alden, C. B., Miller, J. B., Tans, P. P., and White, J. W. C.: Increase in observed net carbon dioxide uptake by land and oceans during the last 50 years, Nature, 488, 70–72, 2012. [Marc Aubinet, Belgium]	Corrected
6705	124	12	124	12	Correct record is: Bonan, G., 2008: Forests and climate change: Forcings, feedbacks, and the climate benefits of forests. Science, 320, 1444-1449. DOI:10.1126/science.1155121 [Akihiko Ito, Japan]	Corrected
24905	124	12	124	15	Please check the correct references of these two items [Borbala Galos, Hungary]	Corrected
3815	124	36	124	36	insert a reference: Bongaarts, J. and B. C. O'Neill, 2017: Global warming policy: is population left out in the cold? Science 361 (6403), 650-652, DOI: 10.1126/science.aat8680 [Philippe Waldteufel, France]	Rejected
24207	127	37	127	37	The citation: Cayuela et al 2017 (cited in page 59 is missing: 14. Cayuela, M.L., Aguilera E., Sanz-Cobena, A., Adams D.C., Abalos, D., Ryals, R., Silver, W.L., Barton, L., Alfaro M., Pappa, V., Smith, P., Garnier, J., Billen, G., Bouwman, L., Bondeau, A., Lassaletta, L. 2017 Direct nitrous oxide emissions in Mediterranean climate cropping systems: emission factors based on summary of available measurement data Agriculture Ecosystems & Environment 238: 25-35. [Maria Luz Cayuela, Spain]	Added
8575	142	26	142	27	redundant reference [Marc Aubinet, Belgium]	Removed
635	152	47	152	47	Due to Comment from Page 9, Line 49, we suggest that one may add the reference: Li, Y., Z. Zeng, L. Huang, X. Lian, and S. Piao, 2018a: Comment on "Satellites reveal contrasting responses of regional climate to the widespread greening of Earth". Science, 360, eaap7950, doi:10.1126/science.aap7950. [Shilong Piao, China]	Rejected
639	152	47	152	47	Due to Comment from Page 10, Line 17, we suggest that one may add the reference: Li, Y., T. Wang, Z. Zeng, S. Peng, X. Lian, and S. Piao 2016b: Evaluating biases in simulated land surface albedo from CMIP5 global climate models. J. Geophys. Res. Atmos., 121, 6178-6190, doi:10.1002/2016JD024774. [Shilong Piao, China]	Rejected
661	152	47	152	47	Due to Comments from Page 82, Line 3, we suggest that one may additionally cite the reference: Li, Y., and Coauthors, 2018b: Divergent hydrological response to large-scale afforestation and vegetation greening in China. Sci. Adv., 4, eaar4182, doi:10.1126/sciadv.aar4182. [Shilong Piao, China]	Rejected

Comment No	From Page	From Line	To Page	To Line	Comment	Response
641	152	51	152	51	Due to Comment from Page 10, Line 17, we suggest that one may add the reference: Lian, X., and Coauthors, 2018: Partitioning global land evapotranspiration using CMIP5 models constrained by observations. Nat. Clim. Chang., 7, 640-646, doi:10.1038/s41558-018-0207-9. [Shilong Piao, China]	Rejected
23521	155	26	115	29	Earl and Simmonds find that there is a strong statistically significant decline in 2001–2016 active fires globally linked to an increase in net primary productivity observed in northern Africa, along with global agriculturalexpansion and intensification, which generally reduces fire activity. Earl, N., Simmonds, I., 2018. Spatial and Temporal Variability and Trends in 2001–2016 Global Fire Activity. J. Geophys. Res. Atmos. 123, 2524–2536. https://doi.org/10.1002/2017JD027749 [Renata Libonati, Brazil]	Rejected
645	164	11	164	11	Due to Comment from Page 41, Line 5, we suggest that one may add the reference: Piao, S., and Coauthors, 2018b: Lower land-use emissions responsible for increased net land carbon sink during the slow warming period. Nat. Geosci., 11, 739-743, doi:10.1038/s41561-018-0204-7. [Shilong Piao, China]	Added
18247	175	9	175	9	Sonntag, S., González, M. F., Ilyina, T., Kracher, D., Nabel, J. E., Niemeier, U., ... & Schmidt, H. (2018). Quantifying and Comparing Effects of Climate Engineering Methods on the Earth System. Earth's Future, 6(2), 149-168. [Julia Nabel, Germany]	Corrected
6729	178	24	178	26	Correct record should be: Tian, H., Lu, C., Yang, J., Banger, K., Huntzinger, D.N., Schwalm, C.R., Schwalm, C.R., Michalak, A.M., Cook, R., Ciais, P., Hayes, D., Huang, M., Ito, A., Jain, A., Lei, H., Mao, J., Pan, S., Post, W.M., Peng, S., Poulter, B., Ren, W., Ricciuto, D., Schaefer, K., Shi, X., Tao, B., Wang, W., Wei, Y., Yang, Q., Zhang, B., Zeng, N., 2015. Global patterns and controls of soil organic carbon dynamics as simulated by multiple terrestrial biosphere models: current status and future directions. Global Biogeochem. Cycles 29. DOI:10.1002/2014GB005021. [Akihiko Ito, Japan]	Corrected
2643	178	34	178	34	wrong doi [Wei Li, France]	Revised
28557	180	53	180	54	this reference belongs under D [Alan Di Vittorio, United States of America]	Moved
6731	181	33	181	35	Use captal only for the head of author names and title. Also, correct the reference information. [Akihiko Ito, Japan]	Accept. Citation added, thank you.
33561	183	29	183	31	There is a problem with the "Wim et al." reference. The last name of the author is "Thiery" and not "Wim". Also the names of the other authors are only included as initials in the reference. [Sonia Seneviratne, Switzerland]	Corrected
13773	184	8	184	8	doi and page numbers in reference are missing [Moira Doyle, Argentina]	Added
6237	186	53	186	53	Bad formating in reference [Tristan Quaife, United Kingdom (of Great Britain and Northern Ireland)]	Formatted
7473			9		The authors should consider adding a diagram on complex interaction path of climate system, positive (amplified) and negative feedback (mute) caused by external factors (for example, see Carpenter, 1990) [Onema Adojoh, United States of America]	Figure 2.13 represents complex interactions between climate system and land use/land cover changes. We were unable to locate a reference from an incomplete citation, i.e. Carpenter 1990.
7475			19		The positions of the Intertropical Convergence Zone (ITCZ) and Monsoon System (MS) during the boreal winter and summer, is required. . Their illustrations show the forcing or driving factor influencing the regional land, sea, atmospheric, vegetation, and climate variability. I would suggesting a simple sketch on this (e.g., Adojoh et al., 2017) [Onema Adojoh, United States of America]	Reject. These are generally known phenomena and their relative seasonal positions and influence are well known and the subject of many text books. We do therefore not agree that a figure of these phenomena is necessary.
112					good over all. [Brian Huberty, United States of America]	Thanks.

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14009					I didn't review the FOD, so this is my first reading of the land report. In general I thought this was a great job – there is an immense amount of good information in this chapter – the authors are to be congratulated on this. I do, though, find it very long and I think there are some confusing aspects of the structure with some areas being treated multiple times. I think there is scope for rationalizing the text (well over 100 pages seems too long) and removing duplication. That would help sharpen the message. I would recommend that the CLAs do 2 things: take an overview of all the sections – it seems maybe different Las have written similar things in different places, which the CLAs can hopefully spot and remove the duplication – I appreciate it can feel hard to remove good text, but being strict with length will really help the final readability. Second – CLAs should go over the text and make sure that most of it contributes to statements in the Exec Summary – again, in the interest of brevity, if there is any text which does not pull through directly to an Exec Summary statement then it can be shortened. Again, I appreciate that for readability, some degree of background is required, but this rule of thumb will help identify content which is more "review" than "assessment" (esp. assessment since AR5 which is your stated reference) [Chris Jones, United Kingdom (of Great Britain and Northern Ireland)]	Yes, agree on most of your points. We have reorganized assessment materials at chapter and section levels to reduce duplication and to make storyline more clearly presented.
14011					Example of duplication. Land biophysical effects on climate. This is brought out nicely in the intro (2.1). It is then covered briefly in 2.2.1… Then, some 50 pages later, there begins an entire section on this. 2.6 begins with a nicely written overview of the background – but at this stage such background is not required. The concept that land affects climate is already established in this chapter, and there is no new insight in the background. While this might feel brutal I'd suggest cutting it. Section 2.6 can go straight into assessing new science since AR5. [Chris Jones, United Kingdom (of Great Britain and Northern Ireland)]	Agree. We have coordinated section 2.1, 2.2, and 2.6 to reduce duplications and inconsistency.
14013					Example of duplication. BVOCs. Section 2.5.1.3, p.64 (2 full pages) – this is good, but too detailed – it reads like a review. I suggest this needs to be halved and the key points brought out more clearly. Then there is section 2.5.1.4 – I'm not sure why needs a new section as this is still BVOCs and just extends 2.5.1.3. Then there is 2.5.2 – covering similar topics but in models. Then shortly after, section 2.5.3.3, p.70 – another page and a half which covers many similar aspects. Overall BVOCs feel rather overdone for their importance. (see my previous comment re prioritizing text due to how it pulls through to the exec summary or not) [Chris Jones, United Kingdom (of Great Britain and Northern Ireland)]	It was quite hard to integrate the BVOC component in the flow of text of this section. The contributing author who wrote this component at the beginning of the process wrote 3 times more text and far too much details. We cut the text in halfon the SOD, and further cuts were done at teh final stage. Additionally, the final text was reformulated, divided in the components in the new section structure: Emissions, impacts and future impacts. This was also done for organic aerosols and BC, in additions to BVOCs. We feel that there were some repetitions still left out in the final version. We made sure that the text included is fully correct, with the most recent references.
14015					Example of duplication. Figures. Fig 2.27 is very similar to 2.21. I'm not clear what they show differently and hence why both needed. [Chris Jones, United Kingdom (of Great Britain and Northern Ireland)]	This comment is not clear as these Figure numbers do not exist.
14017					Please be careful re units of carbon. You switch between GtC and GtCO2. Either is fine, and I realise different communities favour different choices. But please choose one for your chapter. Key figures maybe could have multiple axes showing both. But numbers in the text should be clear. [Chris Jones, United Kingdom (of Great Britain and Northern Ireland)]	Accepted. Text revised.
14019					note "evidences" is not plural. There is evidence that…, or there are multiple lines of evidence that… [Chris Jones, United Kingdom (of Great Britain and Northern Ireland)]	Noted, we have checked and revised throughout chapter.

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32823					Dooley, K et al. (2018) Missing pathways to 1.5C: the role of the land sector in ambitious climate action. Climate Land Ambition and Rights Alliance. Available from: climatelandambitionrightsalliance.org/report [Doreen Stabinsky, United States of America]	Thank you for the reference
24381					This chapter is very difficult to read. Some sections are repetitive. There is a lack of integration, resulting in sections that partly repeat each other but provide a somewhat different message on the same topic. Some more coherence is needed. [, Belgium]	Thanks. We have reorganized materails cross sections to ensure clear storyline.
38939					The references chosen were consistently bewildering. Land-atmosphere interactions sections were not written from the perspective of someone who studies these things. [, United States of America]	noted-references are updated
38941					The chapter is quite comprehensive in the number of topics and their interactions being addressed, but generally difficult to follow especially in the first 30 pages. The overview/highlights could be better organized thematically to guide the reader. [, United States of America]	We have further improved the chapter to make it more readable.
38943					Ensure that any references to the enhanced transparency framework or global stock take are updated to ensure COP-24 outcomes. [, United States of America]	Accepted
38945					"We can conclude that in the agricultural sector, emissions are higher in non-Annex 1 countries than in Annex 1 countries (high confidence)." Use terms consistently. This chapter sometimes refers to "developed" and"developing" countries, sometimes "Annex 1" and "non-annex 1" countries. Each of these terms has specific meanings in the UNFCCC and Paris Agreement. Terms should be used consistently, and defined at first use. [, United States of America]	Terms checked and harmonised
38947					Strongly suggest using 'projections' instead of 'predictions' when discussing modeling results in this chapter. The term 'predictions' connotes more certainty than models/modelers really can offer. [, United States of America]	Agree, we have replaced "predictions" with "projections" wherever applicable.
38949					This chapter focuses almost entirely on IAMs and how they represent land-use interactions. It omits land management, especially in forestry, where there are important interactions between forest management and the atmosphere. Various tools and studies have evaluated this aspect of land use and should be integrated into this chapter, including but not limited to: Sohngen and Mendelsohn (American Journal of Agricultural Economics, 2003); Bosetti et al. (Energy Policy, 2007); Favero et al. (Climatic Change, 2017); Tian et al. (Land Economics, 2018). IAMs do not have the level of forestry represented in these models/studies. [, United States of America]	Accepted. We agree that this chapter is also discussing IAM scenarios as well as that those scenarios do not cover forest management in a sufficient way. This aspect has been highlighted. But also outcome from other models are discussed, such as DGVMs or bottom up models, also including forest management assessments.
38951					This chapter ignores competely the role that non-IAMs/vegetation land-use models have in the literature as well as the market and land-use management elements that such models bring into the literature. [, United States of America]	Noted. Besides IAMs this chapter also discusses DGVM as well as bottom up model (including those containing land use management) outcomes.
18021					The land-atmosphere interactions chapter is comprehensive and well written. One comment/suggestion is regarding section 2.5.4 Changes in hydrological cycle. The change of evapotranspiration is of significance for hydrological cycle. The authors can think about adding a few sentences on the change of evapotranspiration. [Jian Peng, United Kingdom (of Great Britain and Northern Ireland)]	We have move this sub-section to section 2.3. Evapotranspiration is assessed in section 2.6.

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23667					As a whole, this chapter is lacking a discussion of inland waters. Wetlands are mentioned occasionally, and lakes are included in one table (2.2), but there is considerable work that has been done emphasizing the importance of inland waters (lakes, reservoirs, and streams) on the global carbon budget. I understand that this is incorporated into the WGII AR, but does appear to be lacking in this Special Report. Some broad papers that could be included: Cole et al 2007 Ecosystems. 10:171-184. Tranvik et al 2009. Limnology and Oceanography. 54:2298-2314. Prairie 2008. Can J Fish Aquat Sci. 65:543-548, [Kerri Finlay, Canada]	We have further assessed carbon budget over inland water and wetland in section 2.4. However, the papers listed here are published before 213.
30875					can you ensure consistency in use of Pg vs. Gt (Peta gramme vs. Gigatonne) througout [Mike Morecroft, United Kingdom (of Great Britain and Northern Ireland)]	Editorial
30885					It would be good to include material on the GHG emission associated with the manufacture of nitrogen fertilisers (in addition to N2O emissions in field). This is a major source of emissions which could be reduced by lower and more targeted fertiliser use. This is not covered at all at present in the executive summary. There is currently just a short reference on pages 97-98 (this could also be expanded) [Mike Morecroft, United Kingdom (of Great Britain and Northern Ireland)]	I think the CO2 emissions from fertilizer production are counted in the industrial sector.
4007					The attribution of both land degraddation and desertification werrants more assessment using unertainty calibrated language and level of confidence. [Noureddine Yassaa, Algeria]	Noted. We refer the reviewer to Chapter 3 (3.3.2) and Chapter 4 (4.4).
4103					Cross chapter box between chapter 2&3 for dusts is desirable [Noureddine Yassaa, Algeria]	We didn't create a cross chapter box, but worked with Ch.3 team to make assessments on dust related issues more consistent between two chapters.
17439					Throughout the entire report there is no inclusion of impact of salinity intrusion by rising sea level, which is caused by climate change. Some references to which include Wong, P.P., I.J. Losada, J.-P. Gattuso, J. Hinkel, A. Khattabi, K.L. McInnes, Y. Saito, and A. Sallenger, 2014: Coastal systems and low-lying areas. In: Climate Change 2014: Impacts,Adaptation, and Vulnerability. Part A: Global and Sectoral Aspects. Contribution of Working Group II to the Fifth Assessment Report of theIntergovernmental Panel on Climate Change [Field, C.B., V.R. Barros, D.J. Dokken, K.J. Mach, M.D. Mastrandrea, T.E. Bilir, M. Chatterjee, K.L. Ebi, Y.O. Estrada, R.C. Genova, B. Girma, E.S. Kissel, A.N. Levy, S. MacCracken, P.R. Mastrandrea, and L.L.White (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA, pp. 361-409.; and Nurse, L.A., R.F. McLean, J. Agard, L.P. Briguglio, V. Duvat-Magnan, N. Pelesikoti, E. Tompkins, and A.Webb, 2014: Small islands. In: Climate Change 2014: Impacts, Adaptation, and Vulnerability. Part B: Regional Aspects. Contribution of Working Group II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change [Barros, V.R., C.B. Field, D.J. Dokken, M.D. Mastrandrea, K.J. Mach, T.E. Bilir, M. Chatterjee, K.L. Ebi, Y.O. Estrada, R.C. Genova, B. Girma, E.S. Kissel, A.N. Levy, S. MacCracken, P.R. Mastrandrea, and L.L.White (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA, pp. 1613-1654. [Taehyun Park, Republic of Korea]	Yes, this is an important aspect of sea level rise impacts. It is more relevant to Ch.4 - land degradation. We have forwarded your comment to Ch.4 team to consider.

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15593					In this chapter BVOCs and their effect on the aerosol and cloud formation is discussed separately (2.5.2) but not really accounted for in the other parts of the chapter when discussing the net climate impacts of different actions. It should be more clearly aknowledged that the studies modeling the mitigation through land-use are still missing this effect, although the BVOC-aerosol-CCN phenomena has been described well enough as a process (as can be seen from the references in 2.5.2). There are some results connecting this process to forest management in the boreal region and illuminating the cooling effect which may even be larger than the warming due to albedo change (please see Nikinmaa et al. 2017 Biogeoscience Discussion https://doi.org/10.5194/bg-2017-141, Kulmala et al. 2014 http://hdl.handle.net/10138/228728). Increased cloud albedo due to BVOC-SOA-CCN likely reduces the adverse surface albedo effect of forests in high latitudes. [Tuomo Kalliokoski, Finland]	Yes, The link BVOC-Aerosols-CCN is critically important in boreal forests. We discussed it briefly, because we received many comments that the BVOC section was already too large, and needs to be reduced. But the BVOC-Aerosol-CCN is discussed as you mentioned in 2.5.2 and I had included a final section on the effects on precipitation that was removed at a last stage because of size limitation, and some reviewers mentioning that it was too much detail...
40511					Coordination with SROCC is important for the assessment of emissions linked with permafrost thawing. [Valerie Masson-Delmotte, France]	Agree, we have reviewed SROCC to ensure consistency
40559					Chapter 2 is difficult to read. One reason is the writing style (see my other comments). Another reason is a sort of "catalogue" approach. Finally, the selection of the visual elements is not always easy to understand (why this figure, what is the message, why is it important for this report). There could be an improved flow of information to guide the reader. [Valerie Masson-Delmotte, France]	We have reorganized materials cross section to avoid duplication and make entire chapter more integrated.