Comment No	From Page	From Line	To Page	To Line	Comment	Response
13189	0	0	0	0	This chapter includes much on restoration. More of it should be reflected in KM [David Cooper, Canada]	Accepted- included in new storyline
40607	0		0		Please see my general remarks on the report and those on the SPM. I appreciate the developments of chapter 4 from the FOD. However, I have some major concerns about the style, about the selection of references, and about how knowledge developments and key findings are communicated. [Valerie Masson-Delmotte, France]	Taken into account - the chapter has been substantially revised and to some extent restructures
40609	0		0		Please explain the selection of case studies, and why they are illustrative of land degradation issues in relationship to climate change. [Valerie Masson-Delmotte, France]	Accepted - the selection of cases has been explained
40611	0		0		The chapter is not fully balanced between mitigtation and adaptation. Have you considered carefully the synergies and trade offs between adaptation to climate change and responses to land degradation? How does the chapter expand on SR15 for instance with respect to land transitions, and climate resilient develpment pathways? What are the key messages from the chapter in relationship with future climate change as a function of e.g. the level of warming? There must be sharp differences in implications of today's warming, climate stabilisation at 1.5-2°C or larger levels. This is not explicit enough. [Valerie Masson-Delmotte, France]	Taken into account - the chapter has been substantially revised and to some extent restructures. Hhe plenary approved outline did not mention adaptation at all, and that is a reason we have less focus on adaptation. But we do discuss adaptation in various sections.
40613	0		0		Insights on reversible and irreversible aspects of land degradation may need to be more clearly assessed and expressed. [Valerie Masson-Delmotte, France]	Noted - irrereversible land degradation is tricky, except in some special cases (e.g. coastal erosion due to SLR). We have instead discussed this under "limits to adaptation" section 4.9.4.1
40655	0		0		Why does the chapter not cover non food crops (eg cotton production for fiber)? Is there literature on this. [Valerie Masson-Delmotte, France]	Noted - we focus on agricultural production systems rather than specific crops. However, a vast majority of the research is done on food crops.
21667	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]	Takein into account - Our table connecting with Ch 6 has been revised and the close connections are not there any longer
21671	0				Please do a word-search for "likely" in your chapter and ensure that any uses of the word that do not represent a formal, quantified uncertainty assessment are replaced with another appropriate expression. [Andy Reisinger, New Zealand]	Accepted and done
41563	0				Figures and Tables - Need the References or if it is conceived by authors [Cristobal Felix Diaz Morejon, Cuba]	Accepted
41569	0				In all text is almost inexistent the analysis for Small Islands Developing States that are very sensitive to land degradation [Cristobal Felix Diaz Morejon, Cuba]	Taken into account - where relevant we have tried to include references to SIDS, particularly in section 4.10.6
7317	0				Congratulations to the author team for producing a chapter which assesses a complex issue, but does so in a way that is easy to read and that is understandable for policy makers. The strong solutions focus is also commendable. But is there any reason that improved "climate services" are not specifically called out as a response option? [Debra Roberts, South Africa]	Noted - we have not discussed climate services, beyond the scope of this chapter. Probably more relevant for Ch 6
7319	0				The solutions focus of this chapter would be greatly enhanced if there was a greater focus the financial mechanisms and incentives available to address land degradation. [Debra Roberts, South Africa]	taken into account - in 4.10.1 and 4.10.2 we have some of this - to be mentioned in ES
14689	0				Chapter is inconsistent, with very detailed sections followed by highly conceptual sections. Very Asia focused while North America is rarely mentioned. [, Canada]	Noted - the structure has been improved. We disagree that it is Asia focused, and other reviers have a different opinion

Comment No	From Page	From Line	To Page	To Line	Comment	Response
3441	0				There are overlapping and duplication between this chapter and Chapter 3, which calls for an improved coordination in this connection. [, China]	Taken into account - the coordination with Ch 3 and other chapters has improved
27047	0				Chapter 4 in many sections does not seem to provide a scientific assessment of the current knowledge but rather a comprehensive literature review. It would be extremely helpful if the authors would further streamline the chapter and provide a meta-analysis of the cited literature in order to provide an IPCC assessment of the current knowledge that is relevant for the SRCCL, including confidence levels in your findings that are often missing in the current draft. [, Germany]	Taken into account - the revised text is much more like an assessment
33623	0				An illustrative figure can explain better than words. Please consider to include figures that illustrates 1) the carbon cycle-/carbon pools dynamics; the potential carbon pools could be different soil types, above ground biomass (AGB), below-ground biomass (BGB), dead wood, litter biomass, water bodies, etc. and 2) Carbon sink/emissions under different RCP assumptions. [, Norway]	Accepted - the Figure 4.1 tries to do this.
33625	0				Current finding indicates that soil contain 2-3 times more carbon than the atmosphere (Rumpel et al. 2018). Consider illustrating the proportion of soil carbon pool influenced by land degradation, both natural and anthropogenic induced, and negative emission technologies (NETs), restoration, re/afforestation, etc. [, Norway]	Rejected - we refer to Ch 2 for this.
11987	0				Vital information gets lost in the amount of text. To sharpen the messages that are to be conveyed, please: - be more specific, quantify information where possible, i.e., instead of saying "some regions / many people / large quantities" provide actual numbers / sizes / region names or examples of - use IPCC Uncertainty Language - synthesise the findings of various studies that provide results on similar approaches or consult review papers where available, and use your expert abilities to provide an assessment - focus on findings since AR5 [Hans Poertner and WGII TSU, Germany]	Noted - we are making an extra effort to do this. But often the research we assess is qualitative which is at odds with precise statements
11989	0				Define all acronyms at first use [Hans Poertner and WGII TSU, Germany]	Accepted
15351	1	1	1	1	Suggest this chapter include a more global synthesis. Currently it appears disjointed - like a patchwork of selected sections focusing on a few studies. The chapter does start out well in defining land, land management, sustainable land management, and land degradation itself, and some controversies around its definition and difficulties with assessment and monitoring. There is a lot of emphasis on above-ground biomass and plant-based negative emissions technologies. The SOC 4 per mille initiative is not given much focus although soil organic carbon is a much larger reservoir of carbon than vegetation (in this context there is too much emphasis on biochar, in section 4.11.7). [, Australia]	Taken into account - we have revised and restructured the chapter to achieve a better global synthesis
15353	1	1	1	1	Suggest the Chapter includes a discussion on enhanced weathering/Ca,Mg-silicate fertilization (Beerling et al. 2018) or mineral carbonation of serpentinite. Beerling et al 2018. Farming with crops and rocks to address global climate, food and soil security. Nature Plants, p.1. Tominaga et al 2017. Multi-scale magnetic mapping of serpentinite carbonation. Nature Communications, 8(1), 1870. [, Australia]	Accepted - we mention it in Section 4.0

Comment No	From Page	From Line	To Page	To Line	Comment	Response
15355	1	1	1	1	Suggest considering other evidence of changes in land use/land cover leading to changes in hydrology that will interact with climate change: García et al 2017. Patterns and controls of carbon dioxide and water vapor fluxes in a dry forest of central Argentina. Agricultural and Forest Meteorology, 247, 520-532. Houspanossian et al 2018. Long-lasting floods buffer the thermal regime of the Pampas. Theoretical and Applied Climatology, 131(1-2), pp.111-120. Marchesini et al (2015). Changes in evapotranspiration and phenology as consequences of shrub removal in dry forests of central Argentina. Ecohydrology, 8(7), 1304-1311. [, Australia]	Rejected - interesting suggestions, but it is about dryland which is outside the scope of this chapter. Relevant for Chapter 3. We have notified Ch3.
15357	1	1	1	1	Suggest incoprorating national scale syntheses on land degradation - such as Metcalfe and Bui (2016) for Australia as part of the 2016 State of the Environment report: https://soe.environment.gov.au/theme/land [, Australia]	Rejected - Available space (35-40 pages) does not permit us to discuss particular countries. And I suppose most of Australia would fit in Chapter 3 (drylands)
15359	1	1	1	1	Suggest discussing REDD+ earlier in the Chapter - currently the first mention is in 4.7.5. [, Australia]	Rejected - we have a section on reducing deforestation where REDD+ is discussed. We cannot see a reason for moving it.
30291	1	1	1	1	In conclusion on LD definition and baselines: As shown in various comments the term LD is value-loaded and thus an unsuitable entity for science. Ambiguity on the specification of a common baseline makes it worse. It is therefor unavoidable to abandon the use of the term LD in the scientific domain. Looking for a scientific sound alternative, change in concrete, individual LD components ARE unambiguously measurable and each component can be aggregated in space and time, applying a consistent baseline. Common components can be soil depth, SOC, texure, water holding capacity, fertility, NPP, food, water, and many others, depending on goal of the assessment. This individual component approach gives insight in the extent (area of change, quantity) and severity (quality) in past, present and future, compared to the baseline. Both elements, quantity (extent) and quality (condition), provide a total sum and the change over time per component, in absolute and relative terms. The weighing whether the change of different components as a whole is considered as 'land degradation' or 'progress' is a political one (apples and pears), and thus outside the domain of science and this assessment. Unless this fundamental shift in approaching 'LD' is not broadly acknowledged it will persist subjectivity (see page 9 line 15-28), a never ending debate and confusion, and lack in progress in the scientific and political field. This draft already makes a first attempt to address this point. Creating full clarity on the issue of LD and climate change is the assignment and purpose of this report. Elaborating on the above dilemma and doing a radical proposal by abandoning LD and shifting to 'change in components of land condition' and its impacts on CC would be a major achievement of this assessment. (similarly we speak of climate change in stead of climate 'degradation'; also in climate policies clear common baselines have been established) [, Netherlands]	Noted - Even if we agree on many of the claims in this comments, our task is assess the science.

Comment No	From Page	From Line	To Page	To Line	Comment	Response
13271	1	2	1	8	We question the value of a definition that discourages tracking declines in biodiversity and ecosystem services including of carbon storage and sequestration, especially when such declines are likely to be linked to increased risk of damage or loss (from pests, disease, drought, fire and climate change) and increased risk of GHG emissions. For instance the edge effects from roads are well studied and indicate significant increases in vulnerability to drying and fire up to 2kms into primary forest (Briant et al. 2010). Logging primary forests substantially reduces carbon stocks by 30-70% Keith et al. 2009, Bryan et al. 2010, Blanc et al. 2009 as well as loss of biodiversity, and ecosystem integrity (Zimmerman and Kormos 2012; Lindenmayer and Sato 2018) Further even well managed wood production forests can result in ongoing ecosystem degradation with increasing evidence that the interaction between logging, fire and climate change can result in ecosystem collapse (Lindenmayer & Sato 2018). • Blanc, L., Echard, M., Herault, B., Bonal, D., Marcon, E., Chave, J. and Baraloto, C. (2009) Dynamics of aboveground carbon stocks in a selectively logged tropical forest. Ecological Applications 19(6): 1397-1404. • Briant, G., Gond, V. and Laurance, S.G.W. (2010) Habitat fragmentation and the desiccation of forest canopies: A case study from eastern Amazonia. Biological Conservation 143(11): 2763-2769. • Bryan, J.E., Shearman, P.L., Ash, J., Kirkpatrick, J.B. (2010) The impact of a selective logging operation in Papua New Guinea on above ground biomass stocks. Ecological Applications 20: 2096-2103. • Keith H, Mackey B. and Lindenmayer D. (2009) Re-evaluation of forest biomass carbon stocks and lessons from the world's most carbon-dense forests. PNAS 106, 11635-11640. • Lindenmayer, D. & Sato, C. (2018) Hidden collapse is driven by fire and logging in a socioecological forest ecosystem. http://www.pnas.org/content/115/20/5181. • Zimmerman, B.L., and Kormos, C.F. (2012). Prospects for sustainable logging in tropical forests. BioScience 62(5) [Aila Keto, Australia]	Noted - the defintion includes issues of biodiversity (ecological integrity) and ecosystem services (value to humans)
12915	1	1	89	40	Overview: This document addresses many of the important factors in observing, monitoring, and mitigating effects of degradation. However, it is severelly unwieldy, with figures unexplained, and a general structure which frequently is not logical. A simpler story would be helpful. Of the many factors and processes listed, it's hard to tell what the priorities are. Note that the Knowledge Gaps section 4.12 has 7 entries. It would be better if this document followed those 7 entries, and they were listed in the executive summary. And the major headings of the text followed them, without quite so much detail, much of which is simply expressed in the form of references rather than mechanistic concept. At the end of reading this document, it is hard for the reader to know what to do next. [Robert Treuhaft, United States of America]	Taken into account - the section on approaches to monitoring has been shortened and revised. We have also revised the Knowledge Gaps

Comment No	From Page	From Line	To Page	To Line	Comment	Response
4095	1		89		The reading of this chapter is depressing. 27 years following Rio provide us - in particular on land degradation - a picture of unknowns, uncertainties, obsolete information, ignorance. There is enough evidence of the failure of UN conventions, in particular UNCCD. The revealing statement is given in Ex Summary, page 4, lines 21-22: "There are no reliable global estimates of the extent and severity of land degradation due to both conceptual and methodological reasons" ; and again, page 5 line 25: "The current global extent and severity of land degradation is not well known". This is not acceptable and be admitted as such, wherever the responsibilities stand. The discussion on ways to address land degradation and on SLM is somewhat generic, old and provides no to little information on what has really worked in terms of land management practices as Conservation Agriculture and in particular no till. [Turi Fileccia, Italy]	Noted - about the state of the knowledge, we agree that it is disappointing, and we try to explain why. About conservation ag, we review (in the revised version) the most recent science and have expanded the discussion about addressing land degradation - it is now the longest section of the chapter.
14779	1		157		This generally applies to the entire Chapter. When sustainability transition and socio-technical regime shifts are discusses, we can not stop talking about socio-ecological adaptation and migitation. How does the concept of socio-ecological regime shifts apply to sustainability transition and multi-level perspective? [Laxmi Pant, Canada]	unclear comment
1301	1		157		I feel the chapter is nicely written however Fig. 4.16 on page 80 looks very blurred in current version of the report, therefore it needs to be replaced. [Pushp Raj Tiwari, United Kingdom (of Great Britain and Northern Ireland)]	Taken into account - the figure has been revised
25413	1	1			We suggest to check the correctness in Chapter 4 of the use of the word Negative emissions technologies (NET), in comparison to Carbon Dioxide Removals (CDR) and Greenhouse Gases Removals (GGR). See GENERAL COMMENT ON TERMINOLOGY. [, France]	Accepted -
2479	1	1			Please consider to at least briefly include the topic of remediation of contaminated sites. [Sigrid Kusch-Brandt, Germany]	Noted - remediation of contaminated sites is not particularly relevant for climate change, but we mention it as a co-benefit of biochar in 4.10.5
28319	1				There is substantial repetition through the chapter; removing this will reduce the length and make it easier for the reader to find the key information. In some cases the superfluous text is well-expressed, compared with the relevant core section, so it would be preferable to combine the relevant text. [Barron Joseph Orr, Germany]	Noted and repetition removed where appropriate
24865	2	35	2	35	Section 4.9.1. should be revised to "climate-related land degradation impacts on poverty...." [Justice Issah Musah Surugu, Germany]	Rejected - the title is now: Relationships between LD, CC, and poverty
7459	2	2			It has been recognized in this chapter that agriculture is a key driver of land degradation, however, there is no specific chapter dedicated to the 'impacts of intensifying agricultural activity on land degradation'. The 'bioenergy' is addressed in a specific chapter (nº 7). Agriculture, as a cause of degradation, is analyzed in a dispersed manner throughout the chapter. This makes the importance of agriculture as a degradation factor was diffuse in the text. I think it would be appropriate to dedicate a specific chapter to analyze all considerations about this factor. [Rafael Blanco-Sepulveda, Spain]	Rejected - but there is a crosschapter box on intensification
24867	3	10	3	10	Section 4.11.1 should be revised because the content should explain the subheading and do not force to allow the subheading to allow the entire content (the subheading is too long). [Justice Issah Musah Surugu, Germany]	Accepted
24869	3	13	3	13	Section 4.11.3 subheader is too long, revise (it tries to tell the full story of the subsection...make it shorter) [Justice Issah Musah Surugu, Germany]	Accepted
24871	3	19	3	19	Section 4.11.8 subheader is too long, revise (it tries to tell the full story of the subsection...make it shorter) [Justice Issah Musah Surugu, Germany]	Accepted
30503	4	1	4	9	need to be clear land degradation imapct on cultural heritage. [Hannah Fluck, United Kingdom (of Great Britain and Northern Ireland)]	Noted - cultural heritage is included in "value to humans"

Comment No	From Page	From Line	To Page	To Line	Comment	Response
31751	4	2	4	3	this isnt an evidence statement = it's very broad and obvious and doesn't need confidence level [Mike Morecroft, United Kingdom (of Great Britain and Northern Ireland)]	Taken into account - the ES has been revised substantially
33629	4	2	4	8	Key phrases such as "productive capacity" and "Ecological integrity" may need explanation/definition. Brown et al (2016) has reviewed different definitions of ecological integrity (referee Table 1. Statements about ecological integrity assessment; DOI 10.1007/s10531-016-1111-0) How is productive capacity explained? What is the relationship between productivity capacity and carbon stock? [, Norway]	Noted - Ecological integrity is a comon term and should not need to be defined. Yes, it is to some extent vague/broad, that is why we have selected this term in order to be inclusive. Productive capacity is also a common term. The relationship between C stock and productive capacity is discussed in 4.2..5
1535	4	2	4	8	Why is the measure of land value in this section, solely pegged on its importance to humans, at a complete disregard of values to nature/ non humans? Worth noting is that chapter 4, page 42 outlines impacts of climate related land degradation on nature. Report should be keen to consider ecological communities in their entirerity, both human and non human interactions with land. [Lucy Atieno, Kenya]	Noted - the defintion has been revised. The definition includes ecological integrity.
1549	4	2	4	8	Why is the measure of land value in this section, solely pegged on its importance to humans, at a complete disregard of values to nature/ non humans? Worth noting is that chapter 4, page 42 outlines impacts of climate related land degradation on nature. [Lucy Atieno, Kenya]	Noted - the chapter has clarified the definition so that it refers to both humans and nature
30251	4	2	4	9	This definition differs from the definition of land degradation in the LDRA report of IPBES. Is that on purpose and if so, please motivate. Further, in the LDRA, distinction has been made between land degradation as process and degraded land as a state. In this definition it seems that LD is solely defined as a currently ongoing process leading to future degradation. Land that has been degraded in the past and stabilized at a bad condition is not part of the definition. This would limit the assessment to future loss of land condition only, omitting the impact of LD in the past and potential gains of restoring historical LD (which is far bigger than the expecting LD up to 2050). A serious omission. Further, not making this explicit distinction leads to misunderstandings for many are not aware of the different interpretations. The global ambiguity in defining LD is typical for the last decades, and an important cause of the persistent deadlock in scientific and political progress in this field (see Caspari et al 2014 Review of global assessments of land and ecosystem degradation and their relevance in achieving the land-based Aichi Biodiversity targets. ISRIC, UWA, PBL, WRI.) [, Netherlands]	Noted - the definition is deliberately different from the IPBES report. This is further explained in the text
30253	4	2	4	9	Giving the proposed definition in this doc, loss of SOC is no loss of land condition as such, only if it impacts productivity. But loss of SOC contributes also to the climate problem and to loss of water holding capacity and so the water cycle. These are all high values for man and relevant components of ecological integrity. Consequently, loss in soil components such as SOC are part of land degradation as well. This inconsistence contributes to the confusion around the definition and doing a sound scientific assessment. [, Netherlands]	Accepted - the text is revised

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30255	4	2	4	9	Land degradation' as a term is a negative value statement. Loss of ecological integrity is the result of human transformation of the land, promoting a few desired functions such as food and timber, at the cost of other functions. A trade off which became significant since Neolithic times. Whether this trade off between functions is valued positive or negative differs from person to person and cannot be scientifically determined without global consensus on criteria (what will never happen). Even the herders at the Loess Plateau in China did not consider their land as degraded, living there for centuries. Therefore, the use of the term (change in) 'land condition' is more neutral and scientifically appropriate than using the term LD. It is up to the policy makers to decide whether such a change is good or bad (=LD), desired or not desired, subjectively weighing the various changes in the conditions (factors & functions) of the land. See also: text box on page 19 in the LDRA SPM (2018) and See: Van der Esch et al (2017) Exploring future changes in land use and land condition and the impacts on food, water, climate change and biodiversity; Scenarios for the UNCCD Global Land Outlook, page 26 and 27. [, Netherlands]	Noted - comment is unclear
30257	4	2	4	9	Be explicit on the baseline to which decline is measured. Any ambiguity on this leads to confusion about the results of an assessent. From your definition it might be conluded that the baseline is the pristine state given the explicit relation with human-induced processes, so before human interventions (we suggest to use this baseline). But other parts of the definition seem to limit LD only to currently ongoing decline, which suggest the present as baseline. Pros and cons of the alternative baselines can be found in: UNEP 2003 Report of the expert meeting on indicators of biological diversity including indicators for rapid assessment of inland water systems. CBD SBSTTA document UNEP/CBD/SBSTTA/9/INF/7 (Annex on baselines) In: Kotiaho et al (2016) A global baseline for ecosystem recovery. Nature, 523 (7597): 37 And in: Chapter 2 of the IPBES's LDRA main report. [, Netherlands]	Noted - we have included a discussion about baselines (theoretically important but practically difficult) in section 4.2.4
39231	4	2	4	9	Land degradation is narrowly defined and may benefit from further or clearer definition in the Executive Summary. The example of carbon stocks declining but if no loss in productivity is used as an example of no land degradation. However, loss of soil carbon will negatively impact ecosystem integrity -- for example, decrease water holding capacity, infiltration, increase runoff, decrease nutrient supplying power and microbial activity/diversity. [, United States of America]	Noted - the defintion has been revised.
11993	4	2	4	9	This bullet includes too many different thoughts. It could be split into two statements: One which defines land and forest degradation, and another that separates degradation and carbon stock [Hans Poertner and WGII TSU, Germany]	Accepted - we have rewritten the paragraph and separated the points
40163	4	2	4	9	Ths iclusion of a definition in the Execuive Summry is not a practice. I believe that th point this bullet wants to convey can be so without providing the definition in the paragraph. [Thelma Krug, Brazil]	Noted - Considering that others define LD differently, we feel it is useful to convey the definition, that underpins the whole chapter, right up front.

Comment No	From Page	From Line	To Page	To Line	Comment	Response
5375	4	2	4	11	I find this figure and its caption useful. However, this formulation "In forest land, reduction in biomass carbon stocks alone is not necessarily an indication of a reduction in carbon sinks. Sustainably managed forest landscapes can have a lower biomass carbon density but the younger forests have a higher growth rate, and therefore contribute stronger carbon sinks, than natural forests" is in my view potentially problematic. I agree that young forests may absorb a lot of C (even old-growth forests can absorb much C, see Luyssaert, S., et al., 2008. Old-growth forests as global carbon sinks. Nature 455, 213–215. https://doi.org/10.1038/nature07276). In many cases, however, the existence of a young forest is contingent on the removal of the old-growth forest that had existed on the same land area before, and this removal is associated with C losses ("slow in, fast out", Körner, C., 2003. Slow in, Rapid out-Carbon Flux Studies and Kyoto Targets. Science 300, 1242–1243. https://doi.org/10.1126/science.1084460). Even if parts of the C are incorporated in long-lived socioeconomic C stocks (Lauk, C., et al. 2012. Global socioeconomic carbon stocks and carbon sequestration in long-lived products 1900-2008. Environmental Research Letters, 7, 034023 doi: 10.1088/1748-9326/7/034023), this C loss to the atmosphere is substantial and must not be neglected. Only a fraction of the biomass of a harvested forest is incoroporated in high-value timber, usually far more than 50% are lost (left on site, twigs, bark, undergrowth, etc.) or lost due to soil warming after canopy removal, etc., or used for short-lived products from which the C is quickly released to the atmosphere as well. We cannot cherisch C sinks of young forests without also accounting these "fast out" losses. Hence this formulation needs to be strongly revised in a manner that does not lend itself to misinterpretation. Strict use of a consistent language in terms of stocks and flows of C as well as consideration of the entire cycle of events are key here. The "fast out" component must not be conceiled'! [Helmut Haberl, Austria]	unclear, it probably refers to Figure 4.1, which has been revised
7085	4	3	4	3	Consider adding a footnote explaining the IPCC's assessment terms. [Debra Roberts, South Africa]	Noted - This should be provided in some other part of the report
21101	4	3	4	6	The definition of land degradation refers to 'long-term reduction or loss of the biological productivity of land, its ecological integrity or its value to humans'. Is there a timescale over which degradation is considered long-term? Please consider adding clarification here. [, United Kingdom (of Great Britain and Northern Ireland)]	Rejected - we want the definition to be generic, however, the issue of baselines (relevant for your comment) has been added below the definition.
17453	4	4	4	6	The IPBES definition of land degradation should be taken into account here: "Land degradation refers to the many processes that drive the decline or loss in biodiversity, ecosystem functions or their benefits to people and includes the degradation of all terrestrial ecosystems." (https://www.ipbes.net/system/tdf/ipbes_6_inf_1_rev.1_2.pdf?file=1&type=node&id=16514)(INCLUDE PROPOER REFERENCE). This definition might be valuable to reference or define "ecological integrity" in more detail. Further, "or its value for humans" is a very un-concrete definition as this can be used to justify multiple interests - simplifying it down to economic terms. It could therefore be changed to "and its value to humans through decreasing ecosystem services" as this makes a clearer reference to the multiple co-benefits humans can have through ensuring healthy ecosystems [Taehyun Park, Republic of Korea]	Rejected - we developed a definition for land degradation with a focus on climate change, based on the UNCCD definition of desertification, in which land degradation is defined.

Comment No	From Page	From Line	To Page	To Line	Comment	Response
33175	4	6	4	7	This suggests conversion is degradation. Ecosystem services of some types are lost, but its new land use (pasture, cropping) is a desirable land use that provides important, but different ecosystem services. As such, the converted land can be in a good state or suffer from degradation. This point should be addressed explicitly to dispel the notion that all pasture and cropland is degraded because it is not the original land cover. [Stephen Prince, United States of America]	Taken into account - the text has been revised
15361	4	6	4	8	Suggest restructuring this sentence to "Therefore, in this context, a decrease in carbon stock does not necessarily indicate land degradation if it is not accompanied by a decline in productive capacity." [, Australia]	Taken into account - the text has been revised
8637	4	6	4	8	Suggest to build the sentence like this: 'Therefore, in this context, unless it is accompanied by a decline in productive productive capacity, a decrease in carbon stock does not necessarily indicate land degradation' [Louise Andresen, Sweden]	Taken into account - the text has been revised
5801	4	6	4	8	"a decrease in carbon stock does not necessarily" affects productive capacity, right! So why the authors separate it! [Sanaz Moghim, Iran]	Taken into account - the text has been revised
17455	4	6	4	8	Land degradation should be understood in the context of diminished global vegetation carbon stock - and the resulting restoration potential. (Erb et al. https://www.nature.com/articles/nature25138). And it is the restoration potential of this vegetation carbon that can help to remove a large part of the excess of carbon dioxide in the atmosphere - depending on what IPCC pathway human development will follow. Therefore, this report should define the decrease of vegetation carbon stock as one key aspect of land degradation. Justifying the vegetation carbon stock decrease as non-degrading practice, if, for example a continuous productive capacity for e.g. biomass is ensured, might send the wrong message to policy makers and puts the substitution effects of bioenergy or product use before nature based CDR measures that serve multiple benefits through ecological land restoration. These can play a crucial role to mitigate climate change - including biodiversity protection and environmental integrity. [Taehyun Park, Republic of Korea]	Taken into account - the text has been revised
2423	4	7	4	7	a decrease in carbon stock does not necessarily indicate land degradation. it is necessary to establish a minimum value for organic carbon content depending on the main type of soil (10 orders ?) [Amparo Cortés, Spain]	Taken into account - the text has been revised
8635	4	7	4	7	Carbon stock must be introduced first [Louise Andresen, Sweden]	Taken into account - the text has been revised
18343	4	7	4	8	Probably, it is better to talk about "fluctuation (positive or negative) in carbon stock does not necessarily indicate land degradation". Progressive declination in carbon stock necessarily indicate land degradation. [Gerardo Ojeda, Colombia]	Taken into account - the text has been revised

Comment No	From Page	From Line	To Page	To Line	Comment	Response
32731	4	7	4	8	I was rather surprised to see such a bold statement - loss of C does not necessarily imply land degradation. This is not a common definition, and it would be important for the authors to either rethink this or justify this statement. If degradation is defined as value to humans, then it is hard to believe that the massive loss of soil C upon land conversion to agriculture does not count as degradation. Call it something, acknowledge that soil C storage is essential for climate change mitigation, acknowledge that loss of soil C reduces site productivity, and just call it something! In addition, on page 5, line 22, the authors talk about the loss of soil C upon agricultural conversion as a form of degradation, directly conflicting with this statement. The introduction to teh chapter does a wonderful job of explaining the debate between social scientists and natural scientists on teh definiion of land degradation, but this summary statement seems very one-sided. [Kate Lajtha, United States of America]	Taken into account - the text has been revised
5091	4	8	4	8	The phrase, "Forest degradation is land degradation which occurs in forest land". seems too common to be placed in Executive Summary. We would suggest replacement with the definition of SLM (P4-10, Line 2) or SFM (P4-12, Line 36 – 39), or alternately adding the following sentence: "although there are some ideas to define forest degradation, it is still under development because of difficulties in measuring and operationally implementing" (P4-10, Line 15 – 26). [, Japan]	Rejected - we feel it is important to clarify forest degradation up front.
8639	4	8	4	8	specify like this: 'Forest degradation defines land degradation which occurs….' [Louise Andresen, Sweden]	Rejected - we think the expression is clear
15023	4	8	4	8	The sentence 'Forest degradation is land degradation which occurs in forestland' is deceptive as forest degradation may occur due to processes which have nothing to do with land, e.g. heavy pest or disease attack or tree cutting by humans, etc. Please consider using the phrase 'Forestland degradation (instead of forest degradation) in the above sentence. [Muhammad Mohsin Iqbal, Pakistan]	Rejected - the definition does not exclude degradation processes that are not based on the land conditions,
25019	4	10	4	12	the sustiable land management (a very broad and easy to use term) is not the only way to avoid, reduce or reverse the land degradation processes; The suggestion is not practical [Binaya Shivakoti, Japan]	Taken into consideration - the ES has been revised
27051	4	10	4	15	The emphasis on management being the main determining factor in land degradation in this paragraph and the headline statement in line 36 "most forms of degradation can be prevented and reversed…" could create the impression that the adverse effects of climate change could be fully contained through management and therefore do not constitute a major hazard but "just" a gradual adaptation challenge. Please ensure a balanced formulation here to avoid such a misperception. [, Germany]	Taken into account - the revised ES discusses residual damages
30259	4	10	4	15	The statement that land management does determine whether land will degrade or not does not comply with the definition above. Due to climate change biological productivity can decline from heat stress, drought and salination due to sea level rise. [, Netherlands]	Taken into account - the ES has been revised substantially
17693	4	11	4	11	It could be clarified here what the "even more urgently" refers to - even more urgently than what? [, Sweden]	Taken into account - the ES has been revised substantially
7077	4	12	4	12	Do you mean 'land degradation process'? It is not explicit what process is being referred to here. [Debra Roberts, South Africa]	Taken into account - the ES has been revised substantially
8641	4	12	4	13	Specify like this: 'Climate change exacerbates degrading processes through increased heat stress and drought…' [Louise Andresen, Sweden]	Taken into account - the ES has been revised substantially

Comment No	From Page	From Line	To Page	To Line	Comment	Response
33631	4	12	4	15	We suggest to consider illustrating the trends of current and future land degradation with time series and how much of the global cropland and pasture area have increased and significant proportion of ecosystems no longer functioning. For example, between 1985 and 2013, the global cropland and pasture area have increased by 16.7% (Borrelli et al. 2017, https://www.nature.com/articles/s41467-017-02142-7 [, Norway]	Rejected - change in crop land does not automatically mean a degradation
18345	4	13	4	13	"There are serious indications that the global increase in temperature is promoting a greater emission of CO2 from the soils, due to soil organic matter (SOM) decomposition in temperate and tropical soils" Bond-Lamberty, B., Thomson, A. (2010) Temperature-associated increases in the global soil respiration record. The heat stress promoting microbial activity and consequently SOM decomposition. [Gerardo Ojeda, Colombia]	Noted
17457	4	13	4	13	The term "sustainable management" should be more clearly defined. E.g. by adding sustainable management "that is increasing ecosystem and landscape resilience to climate change induced degradation." [Taehyun Park, Republic of Korea]	Noted - the ES has been revised
17695	4	13	4	14	The underlying report does not really provide a background on increased wind (action). The relevant chapter section mentions one paper that refers to observed increases in near-coastal waters, rather than land, and two other papers with more regional character that do not see increased. Could cross-refer with AR5/WGI here. [, Sweden]	Noted - the evidence that CC significantly impacts wind strength except in terms of cyclones, is lacking. Therefore we cannot see that e.g. wind erosion will be affected by climate change (Velocity of Erosive Wind)
21943	4	13	4	17	The role of wild-fires could be added here to the increasing effects of heat stress (https://storage.googleapis.com/planet4-international-stateless/2018/12/22863407-greenpeace-report_lost-in-smoke_december-2018.pdf) [Taehyun Park, Republic of Korea]	Noted - the ES has been revised. There is now a special cross-chapter box on fire.
17697	4	14	4	14	Perhaps "but it is land management that is decisive for wheter..." rather than "yet land management", to add clarity. [, Sweden]	Noted - the ES has been revised.
6373	4	14	4	20	Examples given on climate impacts on food (agricultural) production focus on large economies (Australia, China, Europe) and fail to mention the evidence (in addition to the local knowledge) of impacts in vulnerable regions, such as those prone to drought, i.e. West Africa {5.2.2.2, p 20, line 41-45} [, Gambia]	Noted - we do not mention particular regions in the ES
25415	4	15	4	16	Could the relative importance of these drivers be indicated in comparison to other drivers of land degradation such as industrial contamination, mining, ... ? [, France]	Noted - no, there is no literature to support this
30261	4	15	4	18	Given your LD definition, agriculture always degrades land for it causes loss of ecological integrity and loss of many values such as cabon storage, wood production, water holding capacity and climate regulation. As indicate in another comment, climate change DOES change components of land condition as well as does land management. Whether these changes are assessed as land degradation is not part of the scientific domain but up to the political domain, weighing the trade offs between the various components (factors and functions of land) [, Netherlands]	Noted - the definition has been revised. But agriculture, by definition, is not a degradation
21723	4	15	4	18	I fully agree with the sentiment of this statement, However it is in possible contradiction of the definition as given. See my notes on the definition. [Graham von Maltitz, South Africa]	Noted - the ES has been revised.
2433	4	17	4	17	this does not necessarily mean that agriculture and forestry always cause significant land degradation [Amparo Cortés, Spain]	Noted
2463	4	17	4	18	this does not necessarily mean that agriculture and forestry always cause significant land degradation [Amparo Cortés, Spain]	Noted

Comment No	From Page	From Line	To Page	To Line	Comment	Response
7079	4	19	4	19	This seems to contradict the point on line 16 that agriculture is not equal to land degradation. The mere conversion of forests to agricultural land also does not seem to qualify as land degradation according to the definition in the first headline statement. [Debra Roberts, South Africa]	Taken into account - the ES has been revised substantially
8643	4	19	4	19	Specify like this: 'Land degradation occurs as a result of conversion of natural tropical forests to agriculture…' [Louise Andresen, Sweden]	Taken into account - the ES has been revised substantially
40165	4	19	4	19	The statement that "Land degradation occurs as a result of conversion of tropical forests to agriculture (very high 20 confidence) and in agriculture worldwide wherever land management is unsustainable" may seem to suggest that these are the only degradation drivers. Would suggest the following : Land degradation may result, among others, as a ... [Thelma Krug, Brazil]	Taken into account - the ES has been revised substantially
13181	4	19	4	20	This descritption seems tio be biased in its treatment of tropics versu other areas, and seems to be inconistent with defintiion on page 9 of this chapter (that Land trasnformation that reduces ecoslogical intengrity and enhances sustainable food production need not be calssified as degrdation), unless it is assumed/concluded that food production in tropical forests is inhernelty unsustainable. While such arguments may be made, I doubt that they are "very high coinfidence". Also depends on defintiaiton of "forests". I suggest that this forumation be avoided. [David Cooper, Canada]	Taken into account - the ES has been revised substantially
33633	4	19	4	20	Land degradation occurs not only as a result of conversion of tropical forests to agriculture but also other land uses such as changes to settlement, infrastructure (road, hydroelectric dams, industry, mining, etc). Regional consequence of urbanization are in may cases a loss of productive agricultural soils (Lorenz K., Lal R. 2018. Agricultural Land Use and the Global Carbon Cycle. In: Carbon Sequestration in Agricultural Ecosystems. Springer, Cham). Please consider to include this literature in your assessment. [, Norway]	Taken into account - the ES has been revised substantially
33481	4	19	4	20	Land degradation occurs also when primary forests are transformed into production forests. This certainly affects the ecological integrity of the forest, as the ability of an ecosystem to support and maintain ecological processes and a diverse community of organisms, through loss of biological diversity and changes in ecosystem processes. Biological productivity of land may also decrease in the long term if fertilisation is not applied (Pukkala 2017), and potentially even with fertilisation, at least if biological productivity includes all plant, animal and fungal biomass instead of tree growth only. The impacts of repeated clear-cut logging cycles (with removal of trees from the ecosystems, soil preparation, and in many cases removal of logging residue and stumps for bioenergy) on biological productivity of forest land, through changes in soil quality and soil communities (saprotrophs and mycorrhizal fungi) are not known but are likely to be negative (e.g. long-term reduction of carbon, nitrogen and phosphorus). In the Nordic countries, about half of the species in the national Red Lists are forest species (Framstad et al. 2013). In the other European countries, the situation is probably similar or worse because many forest species have already gone extinct. Forest transformation from primary to production forest affects also its value to humans in several ways, including many negative ways. Forest degradation is not mentioned in the executive summary. I think it is very relevant and should be mentioned. Reference: Pukkala 2017: Optimal nitrogen fertilization of boreal conifer forest. Forest Ecosystems 4:3. Framstad et al. 2013: Biodiversity, carbon storage and dynamics of old northern forests. TemaNord 2013:507. [Jenni Nordén, Norway]	Taken into account - the ES has been revised substantially

Comment No	From Page	From Line	To Page	To Line	Comment	Response
25417	4	19	4	21	This sentence seems too restrictive in view of the complexity and diversity of land degradation. The specificity of tropical forests is not justified here. Finally, there seems to be a contradiction between this sentence and paragraph lines 13-17 on page 4-11. [, France]	Taken into account - the ES has been revised substantially
39233	4	19	4	21	Land degradation occurs as a result of forest to agriculture conversion. Any type of forest land conversion (to agriculture, housing, other) generally results in land degradation. This particular point in the Executive Summary is poorly worded. Do the authors mean that land degradation can result worldwide whenever land management is unsustainable? But this is true for more than agriculture. Also avoid using undefined acronyms in the Executive Summary in general. [, United States of America]	Taken into account - the ES has been revised substantially
7359	4	20	4	20	To support the estimation of "Not all human impacts on land result in degradation according to the definition of land degradation used in this report" I suggest the reference "Kapur, S., Akça, E., Zucca, C., Berberoğlu, S., & Miavaghi, S. R. (2019). Anthroscapes: A Robust Basis for Mapping Land Quality and Sustainable Land Use Patterns. In Eastern Mediterranean Port Cities (pp. 63-77). Springer, Cham." [Erhan Akca, Turkey]	rejected - anthroposcapes is not a widely used term
17459	4	20	4	20	The heading of this paragraph indicates that land degradation only occurs through land use change and agriculture. Besides agriculture, land degradation also occurs also through most forestry practices on forested lands and in other wild ecosystems. [Taehyun Park, Republic of Korea]	Taken into account - the ES has been revised substantially
5093	4	21	4	24	Sources of the values, "20 – 25%" and "15 – 20%", are unclear and these values seem to be inconsistent with those in section 4.5.2l; and therefore, we would suggest using the same values in the Executive Summary and each cited Chapter. Also, please clarify why the confidence level is low confidence. [, Japan]	Taken into account - the ES has been revised substantially
30263	4	21	4	26	This is incorrect. First estimations on the change of various components of land degradation in the past, present and future (SSPs) have been made though for UNCCD's Global Land Outlook. [, Netherlands]	Rejected - the scientific basis for such estimations is discussed in section 4.3.4.
33635	4	22	4	24	Does the size "about 15-20%" also include areas covered by dominace of ecological or economic less useful species like e.g. invasive species as an indicator of land degradation? Please consider including information from https://doi.org/10.1034/j.1600-0706.2001.930104.x in your assessment. Since invasive species by definition have flexible behaviour, they can increase their abundance along environmental gradient. "Flexibility in behaviour, and mutualistic interactions, can aid in the success of invaders in their new environment" https://doi.org/10.1073/pnas.091093398. [, Norway]	Rejected - the suggested papers are not relevant for estimating the global extent and severity of land degradation
25021	4	24	4	26	Not relevant and could be safely deleted without losing the vital information [Binaya Shivakoti, Japan]	Noted - the ES is revised
25419	4	24	4	26	This sentence remains true for all kind of forests, not only tropical forests. [, France]	Noted - the ES is revised
21105	4	27	4	28	Suggestion to change the word 'consequences' to 'impacts' to maintain consistency with report SPM. [, United Kingdom (of Great Britain and Northern Ireland)]	Noted - the ES is revised
39235	4	27	4	28	The statement is correct, but it is curious the authors only point out precipitation, as changes in temperature (e.g., warming) also increase the risk of land degradation. It is strange that this point would not emerge from the chapter. [, United States of America]	Taken into account - the text has been revised
41547	4	27	4	35	Please, I propose incorporate the drought to the risk of land degradation, in the following two manners: [Cristobal Felix Diaz Morejon, Cuba]	Rejected - but Chapter 3 is more relecant for this

Comment No	From Page	From Line	To Page	To Line	Comment	Response
33637	4	27	4	35	The relationship between rainfall and risk of land degradation might be either positive (moisture limiting environment), negative or neutral. Rather, it depends on stability of an ecosystem, resistance and resilience of an ecosystem. A current study by Xu et al (2018) has indicated that an increasing trend of tree cover was reported with rainy day frequency and wet season length. https://doi.org/10.1111/geb.12707 Moreover, in water limited ecosystem increasing of precipitation an important factor in explain the microbial interactions (Wang et al 2018, Higher precipitation strengthens the microbial interactions in semi-arid grassland soils https://doi.org/10.1111/geb.12718 [, Norway]	Taken into account in the chapter
21107	4	27	4	35	This statement includes a number of different findings but they are not all clearly linked to the main statement on increasing intensity of rainfall events leading to increased risk of land degradation. Please expand on how (a) climate induced vegetation change leads to increased risk of degradation and in which regions if possible, and (b) how SLR and more intense hurricanes increase the risk of land degradation. [, United Kingdom (of Great Britain and Northern Ireland)]	Noted - the ES is revised
13485	4	27	4	35	The first statement should reflect the fact that the last three sentences in the paragraph do not pertain to rainfall events [Lourdes Tibig, Philippines]	Noted - the ES is revised
33135	4	28	4	29	Please I respectfully suggest a change of "or" on line 28 to "and/or". While "of" on line 29 to "for" to provide more clarity to the alternative statements. [Elohor Freeman Oluowo, Nigeria]	Noted - the ES is revised
8645	4	29	4	29	remove the ' / ' and chose one of the words [Louise Andresen, Sweden]	Noted - the ES is revised
2439	4	30	4	30	climate change will impact floodplains and delta areas, glacis, slopes,... [Amparo Cortés, Spain]	Noted - the ES is revised
2441	4	31	4	31	Climate induced vegetation distribution changes [Amparo Cortés, Spain]	Noted - the ES is revised
17699	4	31	4	31	"climate change induced" may be clearer than "climate induced". [, Sweden]	Noted - the ES is revised
30265	4	31	4	35	Given the LD-definition in chapter 4 all changes in vegetation are land degradation; they do not 'increase the risk at LD'. Sea level rise will decline the biological productivity and -given the definition- causes land degradation. [, Netherlands]	Noted - but that is an incorrect interpretation of the definition
3359	4	34	4	34	Add typhoon after huriricane such as hurricane (typhoon), hurricanes (typhoon), and add coastal before pepole. [Rongshuo Cai, China]	Taken into account - we are using cyclone
25023	4	36	4	36	Most forms (does this means >50%), vague. Better to be more specific, if possible [Binaya Shivakoti, Japan]	Noted - the ES is revised
33639	4	36	4	36	Please consider replacing the phrase "adequate actions" by "sustainable land management"? Or, include "that includes sustainable land management" at the very end of the sentence [, Norway]	Taken into account - the ES has been revised substantially
32733	4	36	4	36	I take exception to the idea that most forms of degradation can be reversed. This is ignoring a huge literature on degradation of desert grassland to shrubland or scrub with massive erosion and C loss issues - and attempts to restore desert grasslad have mostly failed. [Kate Lajtha, United States of America]	taken into account - we suggest this is covered in Chapter 3.

Comment No	From Page	From Line	To Page	To Line	Comment	Response
33179	4	36	4	36	If degradation is reversible, the definition on line 4 could be seen as a contradiction. This point raises the whole issue of the multiple types of degradation. Here it is land in a resilient state which can recover naturally or by moderate human intervention. The "long term reduction" line 4 refers to the permanently degraded phase from which recovery does not occur naturally and only at enormous cost by human intervention. The report by Yengoh, G. T., Dent, D. L., Olsson, L., Tengberg, A., & Tucker, C. (2016). https://www.researchgate.net/publication/275768719 makes this point. IPBES LDRA Ch 4.1.2. gives a more comprehensive account. These distinctions are very important since much confusion in discussions of land degradation can be traced to failure to identify the type and therefore fails to indicate its properties as specified by type. [Stephen Prince, United States of America]	Taken into account - the ES has been revised substantially
33137	4	40	4	41	There is need to replace "have additional" on line 40 to "would have" to convey a more probabilty for the climatic occurrence. The sentence should please read "however would have additional physical effects on the global climate like those arising from .....". And I respectfully suggest a revision on line 41 after significant to " ... which can be significant and have been observed to oppose related carbon balances." [Elohor Freeman Oluowo, Nigeria]	Taken into account - the ES has been revised substantially
33181	4	41	4	42	Maybe better to say "...some proven methods..." [Stephen Prince, United States of America]	Taken into account - the ES has been revised substantially
13487	4	41	4	43	A statement defining SLM should be helpful, this being the first time it is mentioned in this Executive Summary [Lourdes Tibig, Philippines]	Taken into account - the ES has been revised substantially
17461	4	42	4	42	The definition of the term "Sustainable Land Management" should be better included in the text as "Sustainable Forest Management" is terminology that is controversial and often seen as being misused. [Taehyun Park, Republic of Korea]	Rejected - SLM is defined in the text, but not in the ES
21751	4	42	4	43	A further consideration in the definition. Does degradation “result in” reduction in biodiversity, ecological integrity etc. Or is degradation a “result of” “consequence of” reduction in biological production etc. Note the UNCCD IPCC definitions have tended to use “resulting from”, not “resulting in” . Though degradation “results from” human activities, the sentence however seems to imply that it “results from” a decline in land condition – this seems to be the wrong way around from a cause-effect perspective. [Graham von Maltitz, South Africa]	Taken into account - the definition is revised (the word result is replaced by cause)
8981	4	42	4	43	A consideration in the definition of land degradation. Does degradation “result in” reduction in biodiversity, ecological integrity etc. Or is degradation a “result of” “consequence of” reduction in biological production etc. Note the UNCCD IPCC definitions have tended to use “resulting from”, not “resulting in” . Though degradation “results from” human activities, the sentence however seems to imply that it “results from” a decline in land condition – this seems to be the wrong way around from a cause-effect perspective. [Jean-Luc Chotte, France]	Taken into account - the definition is revised (the word result is replaced by cause)
11995	4	45	4	45	"Novel degradation pathways" might appear very abstract to non-specialist readers. Rephrase [Hans Poertner and WGII TSU, Germany]	Taken into account - the ES has been revised substantially
2425	4		4		Forest degradation is land degradation which occurs in forested land Only forest degradation needs to be mentioned? Vegetative cover instead of forest can be the right formula. [Amparo Cortés, Spain]	Taken into account - the ES has been revised substantially
2427	4		4		Climate change exacerbates many land degradation ... Induced climate change exacerbates [Amparo Cortés, Spain]	Taken into account - the ES has been revised substantially

Comment No	From Page	From Line	To Page	To Line	Comment	Response
2429	4		4		Climate change exacerbates processes 13 through increasing heat stress and drought, crust formation on soil surfaces [Amparo Cortés, Spain]	Noted
2431	4		4		Soil sealing, agriculture and clearing of land for food and timber production are key [Amparo Cortés, Spain]	Rejected - this is discussed in the text but not in the ES
2435	4		4		political, and social, including lack of knowledge social, including cultural heritage [Amparo Cortés, Spain]	Noted - the ES has been revised
2437	4		4		Land degradation occurs as a result of laund use changes as conversion of tropical forests to agriculture [Amparo Cortés, Spain]	Noted - the ES has been revised
21103	4	19	5	34	Lines 19-26 on page 4 and lines 25-34 cover similar information on current understanding of the extent and severity of land degradation worldwide. Please consider combining these two statements. [, United Kingdom (of Great Britain and Northern Ireland)]	Taken into account - the ES has been revised substantially
6359	4	44	5	6	Thank you to the authors for their work on this useful chapter. Could some regional information be provided here, to describe which areas are most severely impacted by climate change driven land degradation? Land degradation driven by glacial retreat should also be included either here or elsewhere. [, Gambia]	Noted - LD caused by glacial retreat is treated in the SROCC
39237	4	44	5	6	Suggest to merge this paragraph with second paragraph (lines 10-18 of page 4). The summary of this paragraph could be part of "Climate change exacerbates many land degradation processes in terms of rates and magnitudes of degradation, therefore sustainable land management is even more urgently required to avoid, reduce and reverse degradation." [, United States of America]	Taken into account - the ES has been revised substantially
33183	4	46	5	2	Novel degradation pathways can be a result of changes in the water... [Stephen Prince, United States of America]	Taken into account - the ES has been revised substantially
23805	4	1	6	26	The Executive summary of Chapter 4 suffers from the same problem as Chapter 3 in being too general without any quantified statements being presented. [This is in contrast to Chapter 2 in which almost all paragraphs of the Exec Summary are well quantified] [, India]	Taken into account - an extra attempt has been made to quantify
33627	4	1	6	26	Please consider to include in the executive summary information about how impacts of climate change and land degradation affect pollinators. In our view, how pollinator population are affected by climate change are policyrelevant information. Both througt increase and decrease of temperature, other climate change related impacts and by land dynamics in general, but pollinators might also have direct and indirect effects on plant productivity, ecosystem biodiversity and ultimately for food security as described in chapter 5.2.4.5. [, Norway]	Noted - pollination has been included in the body of the text (4.6.2)
21721	4	1	6	26	A number of the Exec summary points are poorly worded and this entire section would benefit from carful editing. Many sentences or too complex and as such the meaning become ambiguous. [Graham von Maltitz, South Africa]	Accepted - the ES has been thorougly revised and restructured
12861	4	1	6	44	The Exec Summ is good, but it would be more effective with fewer bullets. Is it possible to remove one or two wihout compromising integrity? For example, "Most forms of land degradation can be prevented …adequate action" is siimilar to "Land degradation can be addressed successfully in most cases by implementation of Sustainable Land Management" [Robert Treuhaft, United States of America]	Accepted - the number of bullets have been reduced

Comment No	From Page	From Line	To Page	To Line	Comment	Response
12863	4	1	6	44	It would be much more effective if the Exec Summary tracked the bullets in the Table of Contents 1-to-1, both in sequence and in subject. That is, the headings of the exec summary should be, with maybe slight redcutions in numbers of words, found in the Table of Contents. Also, for example, there is no reference to 4.12 in the Exec Summary. A 1-to-1 correspondence would make the organization of the chapter a lot more accessible. With subsection references in ascending order (as in the TOC). [Robert Treuhaft, United States of America]	Rejected - constrained by number of bullets
2421	4	7	6	26	a decrease in carbon stock does not necessarily indicate land degradation. it is necessary to establish a minimum value for organic carbon content depending on the main type of soil (10 orders ?) [Amparo Cortés, Spain]	Taken into account - the text has been revised
6371	4		6		In the Ch. 5 summary, livelihoods is only mentioned as in terms of "co-benefits" for mitigation {p 5, line 28-30}, but not in terms of impacts to livelihoods. [, Gambia]	Noted
30279	4		6		Impacts of a possible cascade of land-related tipping points as elaborated by Steffen et al 2018 (Hoth House Earth; PNAS) would be a valuable additional information on how climate change and land degradation may relate, with possible devastating consequences. This would add value to the more common linear approaches. [, Netherlands]	Taken into account - section 4.9.5
4251	4		6		The Executive Summary's flow is straight forward, smooth from causes to impacts to the solutions to land degradation. It is simple to understand and get the message transition to the readers efficiently. [Lee-Sim Lim, Malaysia]	Noted
29671	4	33	10	35	It would be more inclusive to use the term "tropical cyclones" rather than "hurricanes". This paragraph could also mention that SIDS are at particularly high risk of land degradation due to sea level rise and tropical cyclones (small island developing states) [, Saint Lucia]	Accepted
33173	4	1	89	10	Surely this chapter should precede Ch 3 Desertification? Especially as chapter 3 treats desertification as a subset of land degradation (land degradation in drylands). [Stephen Prince, United States of America]	rejected - even if we agree with the comment, the plenary approved outline is clear about the order of chapters
33255	4	1	89	10	A general comment: much of the text deals with degradation related to drivers other than climate. Obviously (as is stated) these may interact with climate, but they are often presented here without clear linkages and, in some cases there are none. Inventories of causes are available elsewhere (e.g. IPBES LDRA Ch.4). [Stephen Prince, United States of America]	Taken into account - the revised ES has made the links to CC clearer
33261	4	1	89	10	The structure and clarity of this chapter could be improved. The section titles are, in some cases, rather obscure, and section contents drift away from clear connections with the title and, in some cases, any obvious connection with climate. For example, p 24, line 12-15 give a rather confusing description of the contents, of 4.4.3.1. and 2.) then the section titles (and some contents) do not follow the stated topics. I suggest the chapter is reviewed, (1) to increase clarity of the sections titles and (2) remove all marginally significant content and, where appropriate, move it to an existing or new, relevant section or delete it. The structure of Table 4.1 is very clear and would be a possible way to organize the entire chapter. [Stephen Prince, United States of America]	Accepted - the chapter has been substantially revised and restructured for clarity and flow of argument
33277	4	1	89	10	Much of the contents address trends in degradation, yet there is no explicit discussion of the logical need for baselines for comparison (see comment on p29 line 3). There is a detailed account of this issue in IPBES LDRA (section 4.1.4). See comment on p29 line 3. [Stephen Prince, United States of America]	Accepted - the issue of baseline for assessing land degradation is discussed in 4.2.4

Comment No	From Page	From Line	To Page	To Line	Comment	Response
33295	4	1	89	10	Much of the contents of sections 4.2 and 4.3 are on topics that are not relevant to their titles. See comments on page 8, line 6 and page 13, line 43. [Stephen Prince, United States of America]	Accepted - the chapter has been restructured
33305	4	1	89	10	The term "climate" is frequently misused throughout this chapter. Climate is a 30 year average, not the rainfall, temperature or whatever in a single year. Whenever the actual, as opposed to statistical average, values are used, they should be called "weather", not "climate".The distinction should probably made multiple times in the Report to correct this common error and its consequent confusions. [Stephen Prince, United States of America]	Noted
8979	4	1	157	37	The UNCCD SPI would encourage further evaluation of the definition of land degradation, and would encourage that definition be adopted consistently in all other chapters. Although much improved from the FOD, further efforts between Chapter 3 and 4 need to be made to ensure both deliver something unique and yet synergistic, as much as possible. [Jean-Luc Chotte, France]	Accepted - the definition has been shared with other chapters and is now given already in Ch 1
11991	4	1			Executive summary: Many bullets overlap, and many bullets cover more than just one issue but it would be clearer if each bullet only covered a single idea. There is not much logical flow in the ES - please decide whether you start with the drivers & processes of degradation followed by consequences, or the other way around. Statements should follow each other in logical sequence - they currently appear very mixed [Hans Poertner and WGII TSU, Germany]	Taken into account - ES has been revised to increase the structure and flow. But we have not used a strict driver, impacts, response logic.
27049	4	3			"many" seems not necessary, please delete. [, Germany]	Taken into account - text is revised
12447	4	12		18	Can something be said about the set of minimum required environmental conditions which identify transition to land degradation, or a non-sustainable situation? Such borderline conditions which may well be region specific, would be useful to identify (quantify). [Hans Poertner and WGII TSU, Germany]	Noted - the ES has been revised. But the answer is NO, such conditions are not possible because they are value laden. Degradation is not a binary phenomenon.
164	4	15		16	include a confidence level or substantiate with literature [Chukwuma Anoruo, Nigeria]	Noted - the ES has been revised
12451	4	19			Can the degree and rate of such conversion of tropical forest into agriculture be quantified? [Hans Poertner and WGII TSU, Germany]	Taken into account - the ES has been revised substantially
8151	4	19			It is stated that "Land degradation occurs as a result of conversion of tropical forests to agriculture…". Why is it only tropical forest? If conversion occurs in non-tropical forest than it is not considered as land degradation? By definition (Page 4, line 2) land degradation is defined as a negative trend in land condition resulting in long term reduction of e.g. loss its value to humans. Conversion is for example farming land that applies good techniques and has good value for humans, provide food supply, is this included in land degradation? [Haruni Krisnawati, Indonesia]	Taken into account - the ES has been revised substantially
12449	4	22		24	Giving a % fraction of human-used land may illustrate better how human activities are affecting sustainability or cause land degradation. [Hans Poertner and WGII TSU, Germany]	Noted - we discuss this in Section 4.4.1. It is important not to confuse human influence on ecosystem with degradation. Sustainably managed land is not degradation
12453	4	36		43	Worsened environmental conditions will challenge the success of sustainable land management. Such information on limits to adaptation efforts does not come through in the present writing. The next bullet points a bit more in this direction. [Hans Poertner and WGII TSU, Germany]	Taken into account - the ES has been revised substantially

Comment No	From Page	From Line	To Page	To Line	Comment	Response
27053	4	36			The headline statement suggests a very strong influence of land management compared to biophysical factors, which appears inconsistent with the additional hazard through climate change described in the next paragraph (4-44 ff). It could also create the impression that the adverse effects of future climate change could be fully contained through management and therefore do not constitute a major hazard but "just" a gradual adaptation challenge. Please ensure a balanced formulation here to avoid such a misperception. [, Germany]	Taken into account - the revised ES now discusses residual damages and limits to adaptation
8647	5	2	4	2	substantiate like this: 'stimulation of novel but unfortunate land uses aimed…' [Louise Andresen, Sweden]	Noted - the ES has been revised
15025	5	7	4	7	The full word for 'NETs' may be used as it is appearing for the first time. [Muhammad Mohsin Iqbal, Pakistan]	Noted - the ES has been revised
15027	5	13	4	13	The half bracket after 'co-benefits' may be removed. [Muhammad Mohsin Iqbal, Pakistan]	Noted - the ES has been revised
15029	5	25	4	31	There is repetition about the extent and methods of assessing land degradation in Para 3, page 4 (line 19-26) and Para 3, page 5 (line 19-31). May please be reconciled. [Muhammad Mohsin Iqbal, Pakistan]	Taken into account - the ES has been revised substantially
2443	5	1	5	1	intensified and more frequent wildland fires [Amparo Cortés, Spain]	Noted - the ES has been revised
39239	5	1	5	6	What about the role of invasive species (vegetation and insects)? [, United States of America]	Noted - mentioned but not in the ES
25421	5	2	5	3	The latter statement should be the subject of a separate sentence since it is not a degradation induced by climate change, but a degradation directly associated with human activity, as part of climate change mitigation. [, France]	Noted - the ES has been revised
2465	5	3	5	3	Climate change can also contribute to improved temporarily land productivity [Amparo Cortés, Spain]	Noted
41549	5	3	5	4	Please explain more in short the affirmation - "Climate change can also contribute to improved land productivity,notably in [Cristobal Felix Diaz Morejon, Cuba]	Noted - the ES has been revised
33641	5	3	5	6	Please elaborate how climate change can improve "land productivity in high latitudes and specify how land productivity is used in this context. Is this related to increase warmer periods, tree-line shifts and increase in carbon stock per unit area? What is the net gain/loss because of climate change? [, Norway]	Noted - discussed in the text but not in ES
21109	5	4	5	6	is 'however' missing before 'the majority of? Also, how are they affected? Positively or negatively? Please clarify. [, United Kingdom (of Great Britain and Northern Ireland)]	Noted - the ES has been revised
13489	5	4	5	6	There should be a better phrase than "not well known". [Lourdes Tibig, Philippines]	Noted - the ES has been revised
2445	5	5	5	5	the majority of world affected population [Amparo Cortés, Spain]	Noted - the ES has been revised
7081	5	5	5	5	The statement 'the majority of affected population is located in the global South' seems out of place in this bullet. It is an important point that should be in a separate bullet if you have assessed it and have sufficient supporting information in the chapter. [Debra Roberts, South Africa]	Noted - the ES has been revised
39241	5	5	5	5	What is the Global South? [, United States of America]	Noted - the ES has been revised
7083	5	7	5	7	Clarify what 'NETs' means. [Debra Roberts, South Africa]	Noted - the ES has been revised
30267	5	7	5	7	Please explain 'NET' [, Netherlands]	Noted - the ES has been revised
21111	5	7	5	7	Please define Negative Emissions Technologies in Executive Summary. [, United Kingdom (of Great Britain and Northern Ireland)]	Noted - the ES has been revised
39243	5	7	5	7	First time, spell out NET. [, United States of America]	Noted - the ES has been revised

Comment No	From Page	From Line	To Page	To Line	Comment	Response
39245	5	7	5	7	Not clear what NETs stands for in the Executive Summary. [, United States of America]	Noted - the ES has been revised
39247	5	7	5	7	Define NETs. [, United States of America]	Noted - the ES has been revised
21725	5	7	5	7	NET needs to be written in full. [Graham von Maltitz, South Africa]	Noted - the ES has been revised
8173	5	7	5	7	The abreviation «NET» could not be found in the Glossary in connection to «Negative emission technologies» [Harold Leffertstra, Norway]	Noted - the ES has been revised
8987	5	7	5	7	NET needs to be written in full. [Jean-Luc Chotte, France]	Noted - the ES has been revised
32735	5	7	5	7	First: define NET. All acronyms should be defined at point of use. This is only defined much later - in the chapter introduction. This is one I was not familiar with, and this suggests many readers less familiar with the subject willb e confused as well. Secondly, this statement ignores a large body of research, most currently the work of Whendee Silver and colelagues, showing that compost and fertilizer additions can actually do exactly he opposite of what is stated here. [Kate Lajtha, United States of America]	Noted - the ES has been revised
8649	5	7	5	7	NET must be written out the first time to explain what the abbreviation means [Louise Andresen, Sweden]	Noted - the ES has been revised
26151	5	7	5	7	Spell out NETs on first reference [Reid Detchon, United States of America]	Noted - the ES has been revised
12859	5	7	5	7	Define NET [Robert Treuhaft, United States of America]	Noted - the ES has been revised
40167	5	7	5	7	Please wirte NET in full - acronym did not occur before [Thelma Krug, Brazil]	Noted - the ES has been revised
1837	5	7	5	7	You have not introduced NET in the text (you have done so in the index, and do later in p. 4-6). [William Lahoz, Norway]	Noted - the ES has been revised
25423	5	7	5	9	Would it be possible to give the results associated with afforestation/reforestation and BECCS, which are the main NETs highlighted by this report in the other chapters? [, France]	Noted - the ES has been revised
5095	5	7	5	9	Suggest adding "some" so that the sentence would read: "...with large-scale deployment of several land-based NETs, ..." because some NETs have the potential to reduce the risk of land degradation. [, Japan]	Noted - the ES has been revised
13491	5	7	5	9	NETS should be spelled out first. [Lourdes Tibig, Philippines]	Noted - the ES has been revised
40169	5	7	5	9	Would suggest to complement the sentence "Intensification of land management associated with large-scale deployment of land-based NETs,including fertilizer additions, irrigation, and the use of fast growing (monoculture) species increases the risk of land degradation IF NOT PROPERLY MANAGED [Thelma Krug, Brazil]	Noted - the ES has been revised
33185	5	7	5	10	Give the full ver of NET before using abbreviation. [Stephen Prince, United States of America]	Noted - the ES has been revised
13183	5	7	5	14	improtance point. But suggest to avoid use of NETs since this is not used in other chapters. [David Cooper, Canada]	Noted - the ES has been revised
33643	5	7	5	14	The effect of intensification should reflect in detail here. The main challenges associated with intensification are maximizing input such as applications insecticides, herbicides, fertilizers, modified crop cultivates, etc. As a result, water and/ soil ecosystems are most likely to pollut. This has an implication on ecosystem functioning, such as biodiversity, pollination, etc. [, Norway]	Noted - the ES has been revised
39249	5	7	5	14	This summary paragraph does not reflect content described in the chapter. Specifically, "the use of fast growing (monoculture) species increases the risk of land degradation" is not mentioned in the chapter. The only references in the chapter to monoculture are in relation to risk of pest outbreak and biodiversity, not land degradation. Similarly, "fast growing" is mentioned only once, as a response to bioenergy demand. Recommend striking this paragraph. [, United States of America]	Taken into account - the text has been revised

Comment No	From Page	From Line	To Page	To Line	Comment	Response
2447	5	11	5	11	e.g. salinization from irrigation, chemiscal pollution from inorganic fertilizers [Amparo Cortés, Spain]	Noted - the ES has been revised
17465	5	12	5	12	In most cases of afforestation through industrial monoculture plantations, the effects on the ecological integrity of the landscape are questionable and the impact on local communities is often negative. [Taehyun Park, Republic of Korea]	Noted - the ES has been revised
25425	5	12	5	13	This sentence is important and should be kept. Consistency should be ensured in other parts of the SRCCL dealing with the trade-offs and cobenefits associated to afforestation and reforestation. See GENERAL COMMENT ON CDR AND SUSTAINABILITY. [, France]	Taken into account - this is kept but rephrased. It is also discussed in Ch 6 and Ch 7
2449	5	13	5	13	opportunities exist to restore lands with potential significant co-benefits criteria to define restoration will be useful [Amparo Cortés, Spain]	Noted - the ES has been revised
8651	5	13	5	13	one ') ' too much [Louise Andresen, Sweden]	Noted - the ES has been revised
7087	5	15	5	24	Are you able to quantify the amount of past emission due to soil degradation? What is the projected land degradation related emission? [Debra Roberts, South Africa]	Noted - Very hard to disentangle the effects of soil degradation and land conversion. But Chapter 2 has numbers on the loss of terrestrial carbon, including what comes from siol degradation
6363	5	15	5	24	Degredation of peatlands and the impact on GHG fluxes should be included here as an important example. [, Gambia]	Accepted
30269	5	15	5	24	It would be informative to provide first estimates of land based carbon from change in land condition. Historical loss of SOC is estimated globally at 147 Gt C and is expected to another ~35 Gt C from natural land conversion + SOC loss from bad cropland management + burning and dehydration of peatlands (Van der Esch et al 2107). Vegetation loss in the period 2010 - 2050 will emit another ~45 Gt C. The restoration of historical SOC loss, in particular in existing croplands (max ~100 Gt C), and prevention of future loss (~35 + 45 Gt C) would significantly contribute to the increase of the remaining carbon budget of ~150 Gt C to achieve the 1.5 degree Celcius climate target. [, Netherlands]	Noted - we acknowledge the importance of this, but it is probably more relevant for Chapter 2 for two reasons: the geographical scope is divided between Ch3 (Drylands) and Ch4 (rest of the world), and it is hard to disentangle the effects of land degradation and land conversion. Chapter 2 will have this discussion. The comment has been transferred to Ch 2
30719	5	15	5	24	Degredation of peatlands and the impact on GHG fluxes should be included here as an important example. [, United Republic of Tanzania]	Accepted
21991	5	15	5	24	The whole paragraph is not clear and needs to be improved in terms of sentence structure [Vanda Acácio, Portugal]	Noted - the ES has been revised
25427	5	16	5	18	Other sections of the report are not consistent with this sentence. See in particular Cross-Chapter Box 1 in Chapter 1. [, France]	Noted - the ES has been revised
5097	5	17	5	18	Current statement in Executive Summary that "globally the forest area has increased appears to be in contradiction with the statement "the total forest area from 1990 to 2015 declined by 3%". Request revision to maintain consistency. [, Japan]	Taken into account - the ES has been revised substantially
2451	5	18	5	18	carbon density in areas lost ???? [Amparo Cortés, Spain]	Noted - the ES has been revised
21113	5	18	5	18	Please could you look at the discussion of global 'forest area' across different chapters? The SPM figure shows a decrease, Ch1 p11 line 34 talks about a 'net loss of forest area and net gain of tree cover, and Ch4 p5 18 says global forest area increased. [, United Kingdom (of Great Britain and Northern Ireland)]	Taken into account - the ES has been revised substantially

Comment No	From Page	From Line	To Page	To Line	Comment	Response
33483	5	18	5	18	"… globally the forest area has increased…" It is important to mention that despite the increase in total forest area, the area of primary forests has decreased (FAO 2016). This relates to losses of ecological integrity, as the ability of an ecosystem to support and maintain ecological processes and a diverse community of organisms, and losses of value to humans, and losses of biological productivity in terms of plant, animal and fungal biomass. The carbon stock of primary forests and their soils is greater than those of production forests. E.g. dead wood, absent or present in low volumes in production forests, accounts for ca. 20% of the carbon stock of a primary forest (Russell et al. 2015). See Pfeifer et al. (2015) for a SE Asian study. References: Russell et al. 2015. Quantifying carbon stores and decomposition in dead wood: A review. Forest Ecology and Management 350: 107-128. FAO 2016: Global Forest Resources Assessment 2015. How are the World's forests changing? Second Edition. Pfeifer et al. 2015: Deadwood biomass: an underestimated carbon stock in degraded tropical forests? Environmental Research Letters, Volume 10, Number 4 [Jenni Nordén, Norway]	Noted - the text has been revised. We have also in different parts of the chapter highlighted the role of below-ground processes, even if a more in-depth treatment is beyond what is possible in the ES.
14259	5	20	5	20	are due both to [Lukas Van Zwieten, Australia]	Noted - the ES has been revised
40171	5	20	5	20	include TO in … are due TO both biophysical differences [Thelma Krug, Brazil]	Noted - the ES has been revised
5099	5	22	5	22	Source of the value, "60-75%", is unclear; and therefore request clarification of source of citation. [, Japan]	Taken into account - the text and ES is revised.
17023	5	22	5	22	One may strongly argue this figure. Rather, agricultural soils have retained only 60-75% of their soil organic carbon under natural conditions. Also the IPCC relative stock change factors (FLU, FMG, and FI) (over 20 years) for management activities on cropland (Table 5.5 of 2006 IPCC Guidelines) support a different range. A loss of C in the range given could occur when the native cover is forest and the C stored in vegetation is included. but this is not the case here. A loss of SOC in the order mentioned here has been found in samples for teh conversion of grassland to cropland, but is an extreme case, not a general development. [Roland Hiederer, Italy]	Taken into account - the text and ES is revised.
685	5	22	5	23	The statement that agricultural soils have lost 60-75% of the original carbon is not supported by the liteature. See commenton p 31 to 32 below [Daniel Pennock, Canada]	Taken into account - the text and ES is revised.
40173	5	23	5	23	replace CONTINUES to CONTINUE [Thelma Krug, Brazil]	Noted - the ES has been revised
25025	5	25	5	25	...not well known, does this mean it is therefore quite difficult to link land degradation with CC. Better to expand the sentence to clarify its implication to/by CC. [Binaya Shivakoti, Japan]	Taken into account - the ES has been revised substantially
28321	5	25	5	26	LD is certainly complex and difficult to measure, and some aspects re subjective; is this the point being made by calling it a "normative process"? Please clarify. [Barron Joseph Orr, Germany]	Taken into account - the ES has been revised substantially
17701	5	25	5	27	This would seem to repeat page 4, lines 19-22. The two sections could perhaps be combined or redrafted to avoid duplication. [, Sweden]	Taken into account - the ES has been revised substantially
6815	5	25	5	34	Although there are some assessments of land degradation in the nondryland globally , there is a lack of assessment of land degradation at the region scale; in addition to desertification, land degradation, and non-desertification land degradation in the region, please revise it . [Changke Wang, China]	Taken into account - the ES has been revised substantially
6817	5	25	5	34	This section is repeated on page 4, lines 21-25, and it may over emphasize that there are no reliable global estimates of the extent and severity of land degradation due to both conceptual and methodological reasons.it is not objective. [Changke Wang, China]	Taken into account - the ES has been revised substantially

Comment No	From Page	From Line	To Page	To Line	Comment	Response
6361	5	25	5	34	This paragraph should include those regions for which is data scarcity is the most problematic (e.g. least developed countires), and where would benefit from improved land degradation monitoring systems. [, Gambia]	Noted - the ES has been revised. But uncertainties remain about the spatial extent of LD
30717	5	25	5	34	This paragraph should include those regions for which is data scarcity is the most problematic (e.g. least developed countires), and where would benefit from improved land degradation monitoring systems. [, United Republic of Tanzania]	Noted - we have included a discussion about knowledge and data gaps (4.11) and and also mentiond this in the revised ES
30271	5	25	5	35	Estimates of change in components of land degradation have been made over longer periods; See: Stoorvogel et al reconstructing the natural state at a resolution of 30 arc sec (SOC, soil depth, texture, land cover) in: Stoorvogel JJ, Bakkenes M, Temme AJ, Batjes NH and Ten Brink BJE. (2017a). S-World: A Global Soil Map for Environmental Modelling. Land Degradation & Development. 28: 22–33. AND Stoorvogel JJ, Bakkenes M, Ten Brink BJ and Temme AJ. (2017b). To What Extent Did We Change Our Soils? A Global Comparison of Natural and Current Conditions. Land Degradation & Development. AND: Van der Esch et al. 2017. [, Netherlands]	Rejected - the mentioned papers describe the methodology for combining data sources (soils, geomorphology, terrain, etc etc), which is very useful. But they do not present any results which are useful in our assessment.
33187	5	26	5	26	Is "normative" correct? [Stephen Prince, United States of America]	Yes - but the wording has been changed
11999	5	27	5	29	This sentence could be part of the bold headline statement [Hans Poertner and WGII TSU, Germany]	Noted - the ES has been substantially revised
5101	5	29	5	29	Please add further information on "other kinds of data" as described in section 4.4.4 (P4-29, Line 34). [, Japan]	Taken into account - this is discussed in 4.11, but not in the revised ES
1839	5	29	5	29	Perhaps the authors could provide examples of these other data. [William Lahoz, Norway]	Taken into account - this is discussed in 4.11, but not in the revised ES
29673	5	29	5	34	Can anything be added about challenges / barriers to monitoring in some regions (e.g. islands face challenges with monitoring systems and modelling) [, Saint Lucia]	Rejected - outside the scope of the report
21727	5	30	5	30	At present remote sensing data does not go sufficiently far into the past to fully understand many degradation processes as the degradation events precede the remote sensing data, [Graham von Maltitz, South Africa]	Noted - but we have to use the available data the best we can
8989	5	30	5	30	Although I agree that remote sensing is important because it has timeframes of several decades, at present its timeframe may be to short to fully understand many degradation processes as the degradation events precede the remote sensing data, [Jean-Luc Chotte, France]	Noted
28323	5	30	5	31	incomplete: time scales relevant for monitoring and managing land degradation [Barron Joseph Orr, Germany]	Taken into account - the ES has been revised substantially
1841	5	31	5	31	Perhaps the authors could indicate if there is a range of complexity in the simulation models. [William Lahoz, Norway]	Noted - there is some discussion in 4.3.4 and 4.4.1
8653	5	35	5	35	language: 'Land degradation processes such as deforestation, increasign wild fires and permafrost thawing, which affect natural and semi-natural ecosystems have their highest warming potential through the release of greenhouse gasses and the reduction in land carbon sinks……' [Louise Andresen, Sweden]	Taken into account - the ES has been substantially revised
17467	5	35	5	35	The difference between "natural" and "wild" ecosystems should be clarified in relation to the paragraph above. [Taehyun Park, Republic of Korea]	Taken into account - the ES has been substantially revised
25429	5	35	5	37	This sentence is unclear. In addition, would it be possible to check the consistency in the common climate terminology used between degradation and deforestation? In general, forest degradation (forest remaining forest) is well distinguished from deforestation (conversion of one forest into land category). [, France]	Taken into account - the ES has been substantially revised
30273	5	35	5	37	the last part of the sentence: '….. where forests are lost' makes the sentence hard to understand. [, Netherlands]	Taken into account - the ES has been substantially revised
21729	5	35	5	37	need rewording [Graham von Maltitz, South Africa]	Taken into account - the ES has been substantially revised

Comment No	From Page	From Line	To Page	To Line	Comment	Response
12001	5	35	5	43	This statement should follow the one starting on page 4, line 44 for improved logical flow [Hans Poertner and WGII TSU, Germany]	Taken into account - the ES has been substantially revised
21115	5	36	5	36	highest warming potential' could be better phrased. Maybe 'greatest impact on warming'? 35-37 is also an important message that should be brought out in the SPM. [, United Kingdom (of Great Britain and Northern Ireland)]	Acceptet - the ES has been substantially revised
40175	5	36	5	36	Suggest to replace "… highest warming potential through" by CONTRIBUTES MOST [Thelma Krug, Brazil]	Acceptet - the ES has been substantially revised
39251	5	38	5	3	"Agricultural land is a dominant source of non-CO2 greenhouse gases" is true for N2O but not methane and is still number 1 for CO2. [, United States of America]	Accepted - text is revised
2453	5	38	5	38	and these emissions are exacerbated by climate change or ecologically based management impositions, like keeping agricultural areas flooded for more time that agriculturally agreed. [Amparo Cortés, Spain]	Noted - beyond the scope of the ES
17703	5	38	5	39	The "Agricultural land… exacerbated by climate change" would seem to be out of context if in this paragraph. Could consider moving it. [, Sweden]	Taken into account - the ES has been substantially revised
25027	5	44	5	44	Climate change and land degradation…. (not CLIMATE and land degradation…) [Binaya Shivakoti, Japan]	Taken into account - the ES has been substantially revised
27055	5	44	5	44	Please add "Change" after "Climate" (climate degradation does not exist). [, Germany]	Taken into account - the ES has been substantially revised
8655	5	44	5	44	do you mean human or ecosystem vulnerability, perhaps elaborate in an extended sentence. [Louise Andresen, Sweden]	Taken into account - the ES has been substantially revised
33189	5	44	5	44	I think "threat multiplier" will not be understood by non-experts. Maybe use a different term. [Stephen Prince, United States of America]	Taken into acccount - threat multiplier is explained
24851	5	44	5	45	Authors must check the executive summary to make sure there is consistency in the (as yet insufficient) evidence about the variables and relationships and results of climate-land change and poverty, livelihoods, etc. Section 4.9.1 is not yet congruent with executive lines 44-45 (states high confidence) on page 5. There are so many debates in this issue and so much riding on a clear exposition of the evidence, the authors will do a great service for the readers by thoroughly examining and reflecting clearly on the evidence. [Justice Issah Musah Surugu, Germany]	Taken into account - the ES has been substantially revised
30275	5	45	5	45	Why 'opposed'? Please be specific. [, Netherlands]	unclear comment
11709	5	47	5	47	vulnerable is more suitable than sensitive [Serah Kahuri, Kenya]	Rejected - the vulnerability is the combination of sensitivity and coping capactity, in this case it should be sensitivity
41551	5	7	6	6	The abbreviation NET would be explained when is written for first time. [Cristobal Felix Diaz Morejon, Cuba]	Noted - the ES has been revised
12459	5	44	6	15	Understanding the magnitudes of these challenges, even if in a semi-quantitative way, e.g. number of people affected, observed and projected increase in poverty, would strengthen the message largely. [Hans Poertner and WGII TSU, Germany]	Noted - (semi) quantification of the risk is done in Chapter 7
41553	5	45	6	1	I suggest add: " Climate change, including increasing climate variability, is increasing human and ecological communities' [Cristobal Felix Diaz Morejon, Cuba]	Taken into account - the ES has been substantially revised

Comment No	From Page	From Line	To Page	To Line	Comment	Response
17025	5	23	25	24	The statement that "soils under conventional agriculture continues to be a source of greenhouse gases" is too generic. At least in Europe this staement cannot be supported by soil inventories, such as LUCAS. [Roland Hiederer, Italy]	Rejected - the LUCIS system is an inventory of Europan top soils (upper 20 cm, which is insufficient for understanding soil carbon stocks) without any time dimension, hence sources/sinks cannot be assesed using LUCAS. The only reliable method for assessing the flow of carbon between the atmoshpere and terrestrial systems (in the absense of long observatins series, which are very scattered) is to use eddy-covariance measurements. This gives the annual balance of, but must be coplemented with longer term studies of changes in soil carbon stocks (see e.g. 4.10.2). The propensity of evidence from eddy-correlation measurements is that conventional cropping is a source.
2297	5	5			I would expect this to say "affected land area" instead of "affected population" as most of this paragraph has spoken of natural impacts not population impacts? [Nina Hunter, South Africa]	Noted - the ES has been revised
12455	5	7		14	Such text does not make reference to NET through restauration of natural ecosystems and the associated avoidance of land degradation. [Hans Poertner and WGII TSU, Germany]	Noted - the ES has been revised
11997	5	7			"NETs" (negative emissions technologies): define all acronyms at first use. [Hans Poertner and WGII TSU, Germany]	Noted - the ES has been revised
25085	5	7			NETs --> negative emission technologies (NETs) [Junguo Liu, China]	Noted - the ES has been revised
32855	5	12			Whenever afforestation and reforestation appear, there should also be treatment of forest and ecosystem restoration. These practices go beyond the possibilities of afforestation and reforestation for restoring degraded lands and increasing carbon stocks. See Dooley et al. (2018) for example, with a thorough literature review. [Doreen Stabinsky, United States of America]	Taken into account - this is discussed in the text, but beyond the scope of the Executive Summary
12457	5	16		22	Quantification of such trends in forest areas would send a stronger message. [Hans Poertner and WGII TSU, Germany]	Noted - unclear what is meant by "such trends"
13493	5	25			Same comment re the use of "not well known" Do you mean not accurately quantified? [Lourdes Tibig, Philippines]	Taken into account - the ES has been revised substantially
6921	5	27			Suggest rewording "However, many approaches exist which can…" [Debra Roberts, South Africa]	Taken into account - the ES has been revised substantially
6923	5	29			"other kinds of data" - please be specific. Ground-truthed? [Debra Roberts, South Africa]	Taken into account - this is discussed in 4.11, but not in the revised ES
12003	5	44			Do you perhaps mean risk multiplier? [Hans Poertner and WGII TSU, Germany]	Taken into acccount - threat multiplier is explained
33139	6	1	6	4	I would suggest an inclusion of the word "global" before food insecurity challenges, to read "" To adequately respond to global insecurity challenges". And a comma after climate change on line 3 followed by such as to highlight the impacts and should please read "The impacts of climate change such as drought, heat stress, more intensive rainfall are expected to have "worse" negative affect on agricultural productivity [Elohor Freeman Oluowo, Nigeria]	Rejected - local/regional food security is a much more urgent issue than global food insecurity.
1843	6	2	6	2	need -> needs. [William Lahoz, Norway]	Taken into account - the ES has been substantially revised
2455	6	3	6	3	The impacts of climate change (quality of life, drought ... [Amparo Cortés, Spain]	Taken into account - the ES has been substantially revised
7089	6	3	6	4	What is the magnitude of the effect? [Debra Roberts, South Africa]	Taken into account - the ES has been substantially revised
29675	6	3	6	5	SLR and tropical storms and cyclones also affect agricultural productivity in SIDS [, Saint Lucia]	Noted - discussed elsewhere in the chapter

Comment No	From Page	From Line	To Page	To Line	Comment	Response
33141	6	5	6	5	I respectfully suggest you change the uncertainty language be change to high agrreement, for is very true and widely documented. [Elohor Freeman Oluowo, Nigeria]	Noted and agree, the ES has been revised
33383	6	5	6	5	I respectfully suggest you change the uncertainty language to "high agrreement", for is very true and widely documented. [Elohor Freeman Oluowo, Nigeria]	Noted and agree, the ES has been revised
17705	6	6	6	7	"with few studies … and climate settings" provides rather little actual information. Suggest capturing the spareseness of studies with a confidence statement instead, or under knowledge gaps. [, Sweden]	Accepted - text revised and this is brought up under knowledge gaps
2457	6	8	6	8	Land degradation exacerbated by climate change can have profound implications for human population distributions, quality of life, societal stability and cultural practices [Amparo Cortés, Spain]	Noted
6365	6	8	6	15	Can anything be added more specifically on regional challenges? Where is land degradation and human migration and conflict particularly challenging? What does this mean for our ability to achieve the SDGs? And can anything be added here about adaptation options and addressing loss and damage due to e.g. forced migration, loss of livelihoods and cultural practices etc. [, Gambia]	Noted - in cases where reliable regional data exist, they are used to exemplify a process in the text (not in the ES). But in general it is beyond the scope of this report to make regional assessments.
21117	6	8	6	15	Based on the underlying text for this statement (4.9.3, 4.9.4), please amend this section to clarify that land degradation resulting from climate change is one of the contributing factors that can lead to migration, conflict and cooperation. [, United Kingdom (of Great Britain and Northern Ireland)]	Accepted - uncertainty statements have been revised
30721	6	8	6	15	Can anything be added more specifically on regional challenges? Where is land degradation and human migration and conflict particularly challenging? What does this mean for our ability to achieve the SDGs? And can anything be added here about adaptation options and addressing loss and damage due to e.g. forced migration, loss of livelihoods and cultural practices etc. [, United Republic of Tanzania]	Noted - in cases where reliable regional data exist, they are used to exemplify a process in the text (not in the ES). But in general it is beyond the scope of this report to make regional assessments.
30505	6	8	6	15	cultural heritage as wel as cultural practices. [Hannah Fluck, United Kingdom (of Great Britain and Northern Ireland)]	Accepted - text inserted
5103	6	12	6	15	Suggest adding "involving local people and incorporating local knowledge and culture"(P4-51, L45) after "the participatory design of responses" for easier understanding by readers. [, Japan]	Taken into account - indigenous/local knowledge mentioned in the revised ES
5105	6	14	6	14	Suggest replacing "climate related land degradation" with "climate-related land degradation" to keep the wording consistent among the Executive Summary and main text. [, Japan]	Taken into account - the ES has been revised substantially
2459	6	16	6	16	Land degradation can be addressed successfully in most cases by implementation of Sustainable Land Management and for recovery of contaminated areas [Amparo Cortés, Spain]	Noted - contaminated areas is outside the scope of this report
32739	6	16	6	16	Again, this statement seems to try to be overly politically correct and implies that if we just try hard enough, and educate people, land degradation can be reversed. This ignores evidence that population growth pressure on land inherently is going to degrade land. As long as humns graze ruminants, harvest trees, and convert grasslands to agriculture, land degradation will occur no matter how much we educate anyone. [Kate Lajtha, United States of America]	Taken into account - the revised ES discusses residual damages

Comment No	From Page	From Line	To Page	To Line	Comment	Response
13273	6	16	6	17	This statement is untrue as soon as you consider ecological processes and services provided by primary forests and other primary ecosystems. Full recovery of primary forest and other carbon rich ecosystem carbon stocks can take several hundred years and depending on the scale of past damage and loss may never be recoverable. In light of the scale of both the climate and biodiversity crises there is an urgent need to elevate protection of remaining primary forests and other primary ecosystems to minimise the risk of further loss and escalating GHG emissions (CBD/COP/DEC 14 30) [Aila Keto, Australia]	Noted - the ES has been revised. But we do not claim that land degradation always can be successfully adressed. In the revised ES we have a special pragraph on residual effects
25029	6	16	6	17	Sustainable land management' is a very vague/abstract suggestion and next to impossible recipe for the implement. But definitively an easy exit for the authors. [Binaya Shivakoti, Japan]	Accepted - text is revised and more explanation is included
24175	6	16	6	17	SLM is about managing to avoid degredation. SLM is not the correct term to for rehabilitating highly degraded land. This is the domain of restoration ecology . [Derek Berliner, South Africa]	Accepted - text is revised
21731	6	16	6	17	Can SLM compensate for climate chang induced degradation? [Graham von Maltitz, South Africa]	Noted - in principle yes, but it depends on the magnitude of climate change
8991	6	16	6	17	Just a thought, can this assumption be applied when the degradation is climate change driven, I.e. can SLM compensate for a concurrent decline in rainfall and increase in temperature within a dryland environment. [Jean-Luc Chotte, France]	Noted - in principle yes, but it depends on the magnitude of climate change
33191	6	16	6	17	See comment on p 4, line 41. Optimism is good, but I think some qualification is appropriate. [Stephen Prince, United States of America]	Taken into account - the revised ES discusses residual damages
13495	6	16	6	20	Calibrated language is not in the usual format-assessment of evidence preced that of the agreement. [Lourdes Tibig, Philippines]	Takein into account - the ES is revised
26153	6	16	6	20	This important summary statement - with very high confidence - should be elevated to the SPM [Reid Detchon, United States of America]	Noted
13185	6	16	6	26	This para should also refernce ecosysetem restoration and land rehabilitation within landscapes [David Cooper, Canada]	Takein into account, these issues are adressed in another key message in the revised ES
7091	6	16	6	26	Please check and address overlaps between this bullet and the bullet on p4 lines 36-43. [Debra Roberts, South Africa]	Taken into account - the ES has been revised substantially
13497	6	17	6	20	This statement should follow lines 41-43 , page 4 [Lourdes Tibig, Philippines]	Taken into account - the ES has been revised substantially
11711	6	19	6	19	to entire river basins : change to entire landscapes [Serah Kahuri, Kenya]	Rejected - landscapes is a very vague term, river basin is a fucntional and well defined region. There are studies of river basis.
25431	6	20	6	20	To avoid the breaking of keywords, we suggest to use "sustainable land management [including][and] sustainable forest management". [, France]	Taken into account - the ES has been revised substantially
41555	6	20	6	23	Please Include the lack of adequate technologies , not only of finances. [Cristobal Felix Diaz Morejon, Cuba]	Rejected - technologies are usually known but not implemented
39253	6	20	6	26	Seems the political context should be a barrier as well. [, United States of America]	Taken into account - the ES has been revised substantially
30277	6	23	6	26	A few key factors in reducing future land conversion are lacking, in particular a change towards meat-poor diets and slowing down demographic growth. See for a complete list: Table SPM 2 in the SPM of the IPBES Land Degradation and Restoration Assessment (LDRA). [, Netherlands]	Rejected - we refer to Ch 5 and Ch6
17469	6	24	6	26	This list of measures should include aspects of ecosystem protection, subsidies for ecological agriculture and natural forest management and a stronger assurance of Indigenous and local community land rights. [Taehyun Park, Republic of Korea]	Noted - the ES has been revised. There is limited space in the ES to mention such details.
29773	6	24	6	26	Indigenous culture can also be included as a measure that facilitates implementation of practices that reduce, or reverse land degradation by way of stewardship obligations, Indigenous laws, and ways of being and conducting business. [Tanya Smith, Canada]	Noted - indigenous/local knowlege has been mentioned in the revised ES

Comment No	From Page	From Line	To Page	To Line	Comment	Response
21945	6	25	6	26	"farmer networks and extension officers" are unprecise and outdated concepts and should be called "group extension approaches and rural advisory services". Examples of group extension approaches involve working with different farmer networks and Farmer Field Schools (FFS). Agricultural extension is nowadays mostly called rural advisory services and can be both public and private. [Anna Tengberg, Sweden]	Accepted - the text has been changed
27057	6	25	6	26	Please add "professional training". [, Germany]	Noted - the ES has been revised
2461	6	26	6	26	networks and extension officers , or forcing decontamination when economically viable. [Amparo Cortés, Spain]	Noted
5107	6	26	6	26	Suggest modification of reference: {4.10.1, 4.10.2, 4.10.3, 4.10.4} to {4.10.1, 4.10.4}. [, Japan]	Editorial
15031	6	26	6	26	Please consider using the term 'extension services' rather than 'extension officers'. [Muhammad Mohsin Iqbal, Pakistan]	Noted - the term is changed to rural advisory services
32737	6	27	6	27	Maybe it was for political reasons, but the authors do not address the role of humans, and grazing, in land degradation, focusing almost entirely on climate change. REALLY? There is a huge literature on the debate of the role of livestock grazing on land degradation that is ignored almost entirely here. There is a large literature on grazing and alternate grazing methods on land degradation. Why is none of this mentioned here? [Kate Lajtha, United States of America]	Rejected - the focus on the report is climate change. Furthermore, grazing is primarily covered in Ch 3
41557	6	30	6	31	Please , I am not very convinced and disagree that this affirmation: ¨This chapter examines the scientific understanding [Cristobal Felix Diaz Morejon, Cuba]	Noted
39255	6	31	6	31	Define the difference between dry lands and non-dry lands here. [, United States of America]	Rejected - we refer to Ch 3 where drylands are defined and discussed at length
33193	6	31	6	31	But would be more logical and better following this chapter. [Stephen Prince, United States of America]	Rejected - we agree, but the plenary approved outline is firm on the order of chapters
33143	6	32	6	34	Please write "proceed on line 32 to past tense as "proceeded". I would also suggest a revision from "how they are related to climate and possibly to climate change on line 34 to read "how they relate to climate and climate change" [Elohor Freeman Oluowo, Nigeria]	Rejected
40177	6	33	6	34	Suggest to change "...they are related to climate and possibly to climate change" to they are related to climate and to climate change, where possible. [Thelma Krug, Brazil]	Accepted
7093	6	34	6	34	Should this be a 'systematic review' or an 'assessment'? Systematic review seems to give the sense that you are conducting a primary study whereas, the task of this report is to assess the body of knowledge that is already out there. [Debra Roberts, South Africa]	Accepted
7095	6	36	6	36	Consider replacing 'examine' with 'assess' . [Debra Roberts, South Africa]	Accepted
7097	6	38	6	38	Consider replacing 'examined' with 'assessed' . [Debra Roberts, South Africa]	Accepted
7099	6	39	6	39	Consider replacing 'examined' with 'assessed' . [Debra Roberts, South Africa]	Accepted
7101	6	40	6	41	Consider replacing 'The remainder of the chapter discusses how land degradation can be addressed, based on the concept of sustainable land management: avoid, reduce and reverse land degradation (Section 4.10)' with 'The remainder of the chapter assesses land degradation mitigation options based on the concept of sustainable land management: avoid, reduce and reverse land degradation'... [Debra Roberts, South Africa]	Accepted
7103	6	43	6	43	Consider dropping 'important' since any form of knowledge gap is important. [Debra Roberts, South Africa]	Accepted - but changed to critical
40615	6		6		There is a challenge with the logical order of information in the ES. For instance, SLM is defined at the end here, while the concept is already used in some of the first bullet points. [Valerie Masson-Delmotte, France]	Taken into account - the ES has be revised and restructured

Comment No	From Page	From Line	To Page	To Line	Comment	Response
13499	6	28	8	40	The Introduction part is too long. It iis being suggested that the information in these pages be more condensed and concise. [Lourdes Tibig, Philippines]	Rejected - since land degradation is an ambigious phenomenon we need to discuss different views and interpretations
40617	6		13		I find the overall introduction (4.2 and 4.3) quite long, and several aspects read as quite normative ; is this what emerges from an assessment of the literature, or the views of the author team here? What belongs to this chapter, what would be better placed in chapter 1, overarching between chapters 3 and 4? The Anthropocene framing may be better placed in chapter 1. There are elements about a scientific debate page 7 which do not help a reader not specialist of the field to fully understand why it is reported here and what it implies. I understand that it is also connected to choices for definitions and approaches. It would be nice for this chapter to better identify recent knowledge developments and approaches and how the key findings differ from those in AR5, more explicitely. [Valerie Masson-Delmotte, France]	Noted - since land degradation is such an ambigious phenomenon we need to discuss different views and interpretations.
12461	6	16		26	The term "most cases" calls for specification, and for quantification possibly by giving a % number for successful cases or calling out limiting conditions, capacities and residual risks etc. [Hans Poertner and WGII TSU, Germany]	Taken into account - the ES has been revised substantially
7105	7	2	7	2	The phrase 'accompanied humanity' gives the impression that there is an anthropogenic dimension to all forms of land degradation. Is that necessarily correct? You need to consider the implication of this phrase for the point that you are making here. [Debra Roberts, South Africa]	Noted - it is consistent with the definition in 4.3.1
39257	7	2	7	2	Consider re-wording "time immemorial". [, United States of America]	Accepted
33645	7	2	7	4	Please consider evaluating land degradation with respect to urbanization since it has increased by a factor of 13 over the past century according to Crutzen P.J. (2006) The “Anthropocene”. In: Ehlers E., Krafft T. (eds) Earth System Science in the Anthropocene. Springer, Berlin, Heidelberg. [, Norway]	Taken into consideration - there is now a cross-chapter box on urbanisation
33647	7	2	7	4	Please consider the following additional arguments for a new epoch, the Anthropocene. In the last 150 years humankind has exhausted 40% of the known oil reserves that took several hundred million years to generate. Nearly 50% of the land surface has been transformed by direct human action, with significant consequences for biodiversity, nutrient cycling, soil structure, soil biology, and climate. More nitrogen is now fixed synthetically for fertilisers and through fossil fuel combustion than is fixed naturally in all terrestrial ecosystems. More than half of all accessible freshwater is appropriated for human purposes, and underground water resources are being depleted rapidly in many areas. http://www.igbp.net/globalchange/anthropocene.4.1b8ae20512db692f2a680009238.html [, Norway]	Rejected - even if we agree with the comment, we need to shorten the chapter
4275	7	2	7	8	It should be careful in saying the GHG increment since 8000 years ago is due to anthropogenic activities base on the documents cited. Based on Fuller et al (2011) and Kaplan et al (2011) paddy farming and livestock activities that contribute to the increase of GHG was estimated to be as early as 3000 years ago. Vavrus et al (2018) estimated CO2 level started to increase 8000 years ago, but did say the increment level of CO2 during industrilisation is significant, so should be not earlier than 18th century. So please double check or rewrite the statement. [Lee-Sim Lim, Malaysia]	Taken into account - the text has been revised

Comment No	From Page	From Line	To Page	To Line	Comment	Response
33195	7	4	7	4	The Anthropocene is usually considered to start in 1950. - Waters, C. N., Zalasiewicz, J., Summerhayes, C., Barnosky, A. D., Poirier, C., Gałuszka, A., Cearreta, A., Edgeworth, M., Ellis, E. . C., Ellis, M., Jeandel, C., Leinfelder, R., McNeill, J. . R., Richter, D. deB., Steffen, W. L., Syvitski, J., Vidas, D., Wagreich, M., Williams, M., Zhisheng, A., Grinevald, J., Odada, E., Oreskes, N., & Wolfe, A. . P. (2016). The Anthropocene is functionally and stratigraphically distinct from the Holocene. Science, 351(6269). https://doi.org/10.1126/science.aad2622 -Ludwig, C., & Steffen, W. (2017). The 1950s as the Beginning of the Anthropocene. In Reference Module in Earth Systems and Environmental Sciences. Elsevier. https://doi.org/10.1016/B978-0-12-409548-9.09940-1 [Stephen Prince, United States of America]	Taken into account - the text has been revised and we do not discuss Anthropocene
33649	7	4	7	19	Degradation are most likely to assocate with demography. It's suggestable to associate archaeological and time sequences with demographic growth (relevant reference "When the World's Population Took Off: The Springboard of the Neolithic Demographic Transition by Bocquet-Appel 2011; DOI: 10.1126/science.1208880 [, Norway]	Accepted - reference added
39259	7	5	7	5	Some may read this to mean that only CO2 and methane are greenhouse gases. [, United States of America]	Accepted - text is clarified
5803	7	5	7	7	just make sure about this statement! Locally, globally! [Sanaz Moghim, Iran]	Noted
33651	7	5	7	19	Please consider including he role of modern agriculture to non- CO2 emissions. Parallel to the expansion of agriculture and domestication of livestock, NOx might be increased in the Anthropocene. This was confirmed by Crutzen P.J (2006) that is the beginning of a growth in the atmospheric concentrations of several "greenhouse gases", in particular CO2, CH4 and N2O. E.g. application of animal manure and Nitrogen fertilizers and (de)nitrification processes are potential sources of NO2. [, Norway]	Noted - in the interest of space we have not been able to expand the section. We have inserted references to Ch 2 where this is discussed comprehensively
6175	7	7	7	7	use livestock only , the word domstication usally used for wlidlife [Sawsan Mustafa, Sudan]	Accepted
7107	7	12	7	12	Consider replacing 'say' with 'about' [Debra Roberts, South Africa]	Accepted
39261	7	12	7	14	"Say" is too imprecise and informal. Additionally, this sentence may understate how far you have to go back to find non-human affected landscapes. Arguably humans have affected the global landscape as long as they (and their ancestor species) have been alive. [, United States of America]	Taken into account - text is revised
33653	7	12	7	15	Please consider to illustrate status of land degradation with (1) amount of soil losses per unit areas of land uses (arable land, grazing lands and forest) or total tonnes of soil per year worldwide. (2) corresponding equivalent estimated economic loss, US$ per year. [, Norway]	Rejected - later in the chapter we refer to different estimates of soil loss. The corresponding estimate of economic loss (in US$) is highly contested and contextual. We give some rough estimate of loss in relation to Global Gross Product.
6177	7	12	7	15	very old Literature canyou updat?/Very short statements and too much references [Sawsan Mustafa, Sudan]	Acknowledged - these are seminal articles
17027	7	14	7	14	How can one make such a statement "if detailed evidence are scattered"? This sentence needs some revising. [Roland Hiederer, Italy]	Taken into account - the text has been revised
7109	7	15	7	15	Consider replacing 'say' with 'about' [Debra Roberts, South Africa]	Accepted
6179	7	16	7	19	It good if you refer to IPCC GHG inventory results [Sawsan Mustafa, Sudan]	Accepted
41559	7	20	7	22	You can´t express only: ¨Not all human impacts on land result in degradation according to the definition of land [Cristobal Felix Diaz Morejon, Cuba]	Noted - an example is given

Comment No	From Page	From Line	To Page	To Line	Comment	Response
16521	7	20	7	25	[Add the value of land of ELD, UNCCD.] 10–20% of the Earth's drylands are degraded. Estimated economic loss about USD 6.3–10.6 trillion/yr. Changes to land cover in the past twenty years have reduced the value of the annual flow of ecosystem services by USD 4-20 trillion/yr. The global cost of lost ecosystem service values estimated to be USD 6.3–10.6 trillion/yr(ELD(THE ECONOMICS OF LAND DEGRADATION) 2015). [, Republic of Korea]	Acknowledged - dryland issues are treated in Ch 3
33655	7	21	7	21	Please consider to support the statement by adding some concrete examples of human impacts that has positive impacts on land. Or link the statement to other parts of the report that deals with such impacts. [, Norway]	Accepted - text is revised with examples
33201	7	21	7	21	Giving GLASOD this prominence is unwise since it has been soundly rejected. Although it is cited here for its historical significance, it should be made clear that it and others like it (see Prince 2016) are now soundly rejected to emphasize it should not be used (and misused) by the unwary. The Sonnoveldt 2009 citation might be augmented with Prince 2016 where GLASOD and additional maps of the same type are assessed. [Stephen Prince, United States of America]	Accepted - but GLASOD is only referred to as a historical fact
40179	7	21	7	21	include full stop after Glossary). [Thelma Krug, Brazil]	Accepted
33197	7	22	7	23	See comment on p4 line 6. [Stephen Prince, United States of America]	Noted
33145	7	24	7	24	Please I suggest you add "away" after which moves land to now read "which moves land away from a ……." [Elohor Freeman Oluowo, Nigeria]	Rejected
40181	7	24	7	24	The paragraph "Land use is a socio-economic process which moves land from a natural to a used state…" is not a naturally true. Land use is a political decision about how land in the territory might be used. So, natural forests might fall under forest use, and remain as such thereafter. So need to be careful not to generalize that land use entails a change from a state to another. This would be land use change. [Thelma Krug, Brazil]	Taken into account - the sentence is removed
24177	7	26	7	27	Mention needs to be made of twoconflicting paradigms of rangeland degredation , one that views rangelands and carrying capcity as an equilibrium that needs to be attained, the other seesarid and semi arid ecosystesm as non equilibrial that makes the defining of degredation very difficult as these systems are alos more resilient. See for example Behnke , 2000. Equilibrium and non-equilibrium models of livestock population dynamics in pastoral Africa: their relevance to Arctic grazing systems. The Tenth Arctic Ungulate Conference, 9-13 August 1999, Tromsø, Norway. R. H . Behnke [Derek Berliner, South Africa]	Rejected - 1/ this is an important debate but primarily relevant for drylands (Ch 3) and 2/ the space does not really allow us to elaborate on this interesting debate.
6181	7	26	7	37	Very short statements and too much references [Sawsan Mustafa, Sudan]	Noted - references are essential
33199	7	27	7	27	The word "perceived" suggest they were always right! I suggest "proposed". [Stephen Prince, United States of America]	Accepted
33147	7	32	7	42	Please line 32 after conflicting views to line 33 would need revision and have suggested as "This conflicting views is not confined to science only, but also to have caused tension between the scienific understanding of land degradation and policy (ref). And on line 39 after measurement is best as "measurements which is becoming more realistic. Then 2 online 39 also "the assessments are becoming more ……" and on line 42, there is need for emphasis on measures and I have suggested as "implementing any paliative and/or adaptive measures [Elohor Freeman Oluowo, Nigeria]	Taken into account - the text has been removed

Comment No	From Page	From Line	To Page	To Line	Comment	Response
33657	7	34	7	35	The authors should consider including the role of both land owner and users. Land users are not necessary land owners or visa versa. Thus, not only direct or indirect land users (e.g. investor) but also (indigenous) land owner that might have leased land to other users. In many cases strengthening the use of indigenous knowledge might be a basis for local decision making, to reverse land degradation and attaining sustainable land management. [, Norway]	Taken into account - the text has been removed
33203	7	37	7	42	Suggested addition - "One solution has been proposed (Prince 2016), that is to adopt the target condition of the land user as the baseline for comparison." [Stephen Prince, United States of America]	Taken into account - the text has been removed
8657	7	38	7	38	it is not easy to understand the 1/ what do you mean ? [Louise Andresen, Sweden]	Taken into account - the text has been removed
23861	7	38	7	41	Remove / after the numbers 1,2,3,4 [, India]	Taken into account - the text has been removed
39263	7	39	7	39	How do "measurements become more realistic"? Suggest replacing "measurements" with "observations" or "assessments". [, United States of America]	Taken into account - the text has been removed
33205	7	46	7	48	Also cite Chapter 4 of the IPBES LDRA where there is a much more in-depth treatment (Sect 4.1.2). [Stephen Prince, United States of America]	Accepted
12865	7	1	8	4	This is an interseting discussion of historical perspectives, but it is not at all represented in the Exec Summary [Robert Treuhaft, United States of America]	Noted
27059	7	1	13	41	Section 4.2 (apart from 4.2.1 that opens the chapter) introduces basic concepts and definitions related to land degradation. We would expect such information in chapter 1, which is devoted to such issues. We suggest shortening this section and moving most of its content to chapter 1. [, Germany]	Taken into account - definition is presented in Ch 1 but explained in Ch 4
13501	7	1	14	26	Far too long. Can it possibly be condensed and still convey the information? [Lourdes Tibig, Philippines]	Taken into account - the text has been condensed somewhat
12005	7	12			write, e.g., "millenia" [Hans Poertner and WGII TSU, Germany]	Accepted
12007	7	13			Could you provide an example [Hans Poertner and WGII TSU, Germany]	Acknowledged - in the interest of space we focus on contemporary issues
25087	7	15			Xinying is a given name. Hence, the reference (Xiuying et al., 2012) is incorrect. [Junguo Liu, China]	Noted - text is revised
2301	7	21			I think instead of pointing to the glossary the definition should be outlined now at the start of the chapter on this very issue. I see it is defined on page 8 so rather refer to page 8. [Nina Hunter, South Africa]	Accepted
25433	8	1	8	2	Could the relative importance of these drivers be indicated in comparison to other drivers of land degradation such as industrial contamination, mining, ... ? [, France]	Noted - it is very hard to rank them because they are highly contextual.
33207	8	1	8	2	The wording here suggests that land conversion is always degradation, and that since "management is possible....", conversion must be undesirable. There are a few cases where "rewilding" is being undertaken, but management aimed at restoring all to natural vegetation will never be widespread so long as humans need the services provided by converted land. If natural vegetation is the standard then, yes, conversion is degradation, but humans introduce a phase change to land cover that is desired for other services. See comment on page 4, line 6. [Stephen Prince, United States of America]	Noted
33149	8	2	8	2	Please I respectfully suggest you replace "since" to "From". And after he full stop high confidence. Begin a little with a contrasting like "However". To read, However, this does not mean that agriculture and foestry..... [Elohor Freeman Oluowo, Nigeria]	Accepted

Comment No	From Page	From Line	To Page	To Line	Comment	Response
12009	8	2	8	4	These statements appear lost here, suggest removing this paragraph or cross-linking to the relevant sections where these arguments are assessed in more detail [Hans Poertner and WGII TSU, Germany]	Rejected - this is a summary statement
21993	8	2	8	4	Unclear sentences [Vanda Acácio, Portugal]	Accepted - text is revised
18347	8	3	8	3	This sentence require a reference. It is a very important point in the discussion about Land Degradation: Exists a sustainable land management?, is this management focused to carbon persistence in soils? Is high carbon storage in soils correlated with high water availability for plant uptake? Is it possible to develop a crop production without increase CO2 emissions from soils? [Gerardo Ojeda, Colombia]	Noted it is further discussed in section 4.3.1
7111	8	3	8	4	In the ES, one gets the impression that the chapter will further unpack how the interactions between economic, political and social contributes to land degradation. Here, it has been mentioned again with no assessment of how these three factors interact in the context of land degradation. [Debra Roberts, South Africa]	Acknowledged - this is covered in subsequent sections, mainly 4.9 and 4.10
12867	8	6	8	40	Previous IPCC reports are not included in the Exec Summary [Robert Treuhaft, United States of America]	Noted
33151	8	16	8	37	Please on line 16, I suggest you remove "be" and replace "contributing" to "contribute". Line 19, replace "and" with "or" "this in" with "those" on the same line 19. So also, a replacement of "has" on line 20 with "have". Delete "is" on line 24 and replace "is" on line 25 with "was". on line 26, replace "is not" with "was also not" I suggest more strength to the assertion on line 31 by replacing "has" to "adequately" and after "addressed" add "the" and it will now read "it adequately addressed the different aspects related to some....." And after "relevant to" before "extreme impacts" add "assess their respective extreme impacts" There need to delete "on" "after socio-economic systems and.." And lastly on line 36 after degradation begin as "Nevertheless, the report substantially presented the concept of sustainable land management as an effective risk reduction tool". [Elohor Freeman Oluowo, Nigeria]	Taken into account
39265	8	17	8	17	"Neither drivers nor processes of degradation by which land-based carbon is released to the atmosphere and/or the long-term reduction in the capacity of the land to remove atmospheric carbon and to store this in biomass and soil carbon, has been discussed comprehensively in previous IPCC reports." Not true, the TFI Wetlands Supplement looked extensively across wetland types. [, United States of America]	Accepted - text is revised.
22581	8	26	8	26	"is" should become "are" [Anastasios Kentarchos, Belgium]	Taken into account - text revised
24179	8	26	8	26	Overstocking and overgrazing have been a major source of land degredation in arid and semi arid areas, this has not been mentioned in this context,but should begiven its importance [Derek Berliner, South Africa]	Noted - this is dealt with in Chapter 3
1845	8	26	8	26	is not -> are not. [William Lahoz, Norway]	Taken into account - text revised
18349	8	26	8	27	As indicated previously, the big question absent here is if the changes soil organic carbon are directly related to changes in soil water retention. Decrements in land productivity could be linked to reductions in carbon stocks, consequent reductions in soil-water retention and, as a result, in available nutrients for crop development, released during soil-water contact. In my opinion, the reports on land dregadation needs to be focused on these links, not only on CO2 emissions from soils. [Gerardo Ojeda, Colombia]	Noted - relevant comment but not in this section
2645	8	26	8	28	I suggest inserting references on methods of assessment and quantification of biomass and carbon stocks such as the paper available at: https://doi.org/10.5772/48355 [Thiago Metzker, Brazil]	Rejected - we deal explicitly with IPCC reports in this section. But the reference may be important in other sections.

Comment No	From Page	From Line	To Page	To Line	Comment	Response
40183	8	38	8	40	It would be useful to provide the IPCC reated literature (e.g., efinitions and Methodological Options to Inventory Emissions from Direct Human-induced Degradation of Forests and Devegetation of Other Vegetation Types (IPCC, 2003). [Thelma Krug, Brazil]	Accepted - reference added
14469	8	41	8	41	How are peatlands defined here? Tropical peatlands are often overlooked systems but play a major role in C storage. [Janice Ser Huay Lee, Singapore]	Noted. Peatlands are defined in the glossary and discussed in detail in section on case studies.
33659	8	41	8	44	In the definition of land degradation, physical and chemical qualities and actual or potential productivities might be relevant factors. Since soil is an important component of land that has socioeconomic, cultural and ecological functioning to all terrestrial life (Lal 2008), considering the definition of "soil degradation might be relevant. Sometimes, the phrase "land degradation" and "soil degradation" are common terms. "Soil degradation, decline in its capacity to support functions and provide ecosystem services, is caused by accelerated erosion, salinization, elemental imbalance, acidification, depletion of soil organic carbon (SOC), reduction in soil biodiversity, and decline in soil structure and tilth" (Lal 2008). [, Norway]	Accepted. Soil degradation has been defined.
14459	8	42	8	44	It is great to see this definition of 'land degradation'. Would it be useful to define what 'value' it has to humans (e.g., socio-cultural and economic value'? [Janice Ser Huay Lee, Singapore]	Noted - Value to humans is expresssed through Ecosystem Services or Natures Contribution to People.
8983	8	42	8	44	The definition for land degradaton as used is improved on the FOD in that it is no longer ambiguous. However, the description as given in page 9 lines 22 to 23 is still in contradiction to the Boolean logic of the definition. More specifically, the use of OR means that if any one of the criteria is fulfilled degradation can be assumed. However, line 22-23 states "and any one of these changes need not be considered degradation". Although I like the interpretation in lines 22-23, this cannot be logically derived from the definition as it stands. I agree however with the sentiment of the explanation i.e. that human derived trade-offs need to be considered when deciding on if an area is degraded because complex trade-offs are involved. However, as it stands the definition appear to exclude this interpretation. As it stands the definition would imply that if ecological integrity is reduced there is degradation, and by implication then all land transformation to crop agriculture constitutes degradation. [Jean-Luc Chotte, France]	Accepted. Definition has been revised to address this ambiguity.
26155	8	45	8	45	Spell out SRCCL on first reference [Reid Detchon, United States of America]	Accepted
33217	8	45	8	45	Is SRCCL given in full before this point? I couldn't find it. [Stephen Prince, United States of America]	Accepted
3443	8	6	10	9	This section mainly emphasizes the characteristics of general land degradation. Since Chapter 3 deals with land degradation in dry-land regions, while Chapter 4 in non-dry-land ones, it is suggested that the introductory words on the general land degradation characteristics be placed in Chapter 1 rather than in Chapter 4, which would be, otherwise, illogical and easy to be misunderstood. [, China]	Taken into account - Ch 1 and Ch4 links have been strengthened
13187	8	41	10	9	this discussion on defintiations is very useful and the main poitns should be introduced already in chapter 1 [David Cooper, Canada]	Taken into account - the defintion has been included in Ch1, but the discussion about it remains in Ch 4.
39267	8	41	10	9	Consider moving Section 4.3.1 (with the definitions) to the front of the chapter, before the perspectives section (4.2.2), so readers are not waiting for the definitions. [, United States of America]	Accepted - we have moved the definition one step up. We think it is important for reader to get a good background on LD before the defintion.

Comment No	From Page	From Line	To Page	To Line	Comment	Response
31755	8	41	10	9	Section 4.3.1 Having given the definition it would be better to say that the report generally treats 'degradation' as a loosely related set of concepts rather observing this definition tightly – which seems to reflect what the rest of the chapter and the report actually does. It should also be noted that the definition is not particularly tight in any case – there are many different aspects of productivity, ecological integrity and value to humans. [Mike Morecroft, United Kingdom (of Great Britain and Northern Ireland)]	Rejected. As the reviewer remarks, the definition includes flexibility - allowing for trade-offs between the components. We apply the definition across the chapter, referring to the elements of the definition.
12869	8	41	10	9	Definitions of degradation are useful, but, again there's an organizational problem in that they should not come under "Previous IPCC Reports--section 4.3". [Robert Treuhaft, United States of America]	Accepted -now included in introduction
31753	8	6	13	41	Section 4.3 I find this a confusing and unhelpful section. For a start it is not clear that the sub sections 4.3.1–3 are really about the overall heading (land degradation in previous IPCC reports). [Mike Morecroft, United Kingdom (of Great Britain and Northern Ireland)]	Taken into account - the chapter has been restructured
33293	8	6	13	41	The first page in section 4.3 is relevant to its title, but the other 5 pages do not discuss IPCC reports . [Stephen Prince, United States of America]	Taken into account - the chapter has been restructured
13503	8	40	13	28	The subsections are far too long, It is suggested that they be condensed and also that, the different definitions be introduced in the Introduction In some cases, even the factors that define the successful implemtation of SLM are given. This kind of info [Lourdes Tibig, Philippines]	Accepted: the definitions section has been restructured and reduced. It has been included under the Introduction heading.
8659	8	41	13	41	I think SOIL degradation is only weakly defined and discussed, can this be elaborated ? [Louise Andresen, Sweden]	Accepted. Soil degradaiton has been defined.
7113	9	1	9	8	Since this is a direct quotation, it cannot have two different references. If 'IPCC WGII 2014' referenced 'UNCCD 1994, Article 1' as the source of the information, then only 'UNCCD 1994, Article 1' should be referenced here not 'IPCC WGII 2014'. [Debra Roberts, South Africa]	Accepted
31721	9	1	9	28	Why focus on SRCCL here, including ts definition, if this chapter is focusing on land degradation outside dryland, covered in Chapter 3? Rather confusing fo the reader. How relevant is it or should it be deleted? [Elizabeth Migongo-Bake, Kenya]	Noted. We think the reviewer meant to say "why focus on *UNCCD"*. We used this definition because it has the definition of land degradation embedded within it.
25089	9	1	9	46	In Liu and Clewell (2017), degradation was defined as "Gradual simplification of ecosystem structure, function, and species composition caused by disturbances that are too frequent for full recovery to occur between disturbances events, or by persistent, low-level disturbance." Liu J., Clewell A., 2017. Management of Ecological Rehabilitation Projects. Science Press. Beijing. ISBN : 9787030551368. [Junguo Liu, China]	Noted. We have based the SRCCL definition on UNCCD definition of desertification, also used by IPCC.
33153	9	1	9	47	Please replace "resulting" to result" and I humbly suggest you change "various" to "different". On line 35, there is need to replace "others" with another" and on line 42, change "class" to "calssify". And delete "an" after such. Please add comma after "chapter" on line 47. [Elohor Freeman Oluowo, Nigeria]	Rejected: this is a quote from UNCCD text
15033	9	2	9	2	The phrase 'Land degradation in arid, semiarid , and dry sub-humid areas' seems to be redundant. May be deleted. [Muhammad Mohsin Iqbal, Pakistan]	Rejected: this is a quote from UNCCD text
17029	9	9	9	9	The AR5 definition is not more detailed, but rather more restricted than the one given by the SRCCL report. [Roland Hiederer, Italy]	The UNCCD/AR5 definition provides detail with respect to land types and degradation processes. Nevertheless, the text have been deleted to simplify the sentence.
41561	9	15	9	16	Please,explain more why not is consider as land degradation natural processes as earthquakes,vulcanoes,tsunamis that [Cristobal Felix Diaz Morejon, Cuba]	Accepted. Sentence expanded to provide explanation

Comment No	From Page	From Line	To Page	To Line	Comment	Response
30285	9	15	9	46	This two paragraphs clearly show the scientific struggle with the value-loadedness of the term degradation, weighing individually perceived losses and gains. Further it shows the ambiguity on the applied baseline (one common global basline or varying per location). This ambiguity problem applies not only for this document and the LDRA, but is characteristic for the entire land degradation field, hampering a common language and consequently clear scientifically sound and consistent assessments for decades. See: I42I refer to the 3rd comment in line 17. [, Netherlands]	Noted - we acknowledge the complexity of defining land degradation due to its many facets, its context-specific nature, and divergent perspectives of stakeholders. We have attempted to minimise ambiguity be defining ladn degradation, and explaining aspects of the degradation, and expanding the text on baseline to be more explict.
887	9	15	9	46	Definition of land degradation is narrow and closeted. According to this definition, especially use of 'or' between 'ecological integrity and value to humans' makes it insulated from monitoring and recognising the ill effects on ecological integrity of increasing the productivity of land by excessive use of chemical pesticides and fertilisers. If the SRCCL definition of land degradation is taken to be correct, one may continue to reap the increasing harvest year after year by using chemicals till suddenly the irreversible ill effects of land degradation in terms of steep drop in productivity coupled with, by this time, highly negatively impacted ecological integrity, start showing up. This may be too late to reverse the trend of impaired ecological integrity and the land productivity. In view of this, better proposition would be to continuously monitor the ecological integrity along with the increasing productivity, and to take remedial measures if and when a significant impairment to the ecological integrity of the place is noticed. [Jagdish Kishwan, India]	Noted. The chapter describes overfertilization and eutrophication as processes of land degradation, and emphasises sustainable land management to address land degradation.
14335	9	21	9	23	this sentence seems confused and its writing needs to be improved for better comprehension [Samba Sow, Senegal]	Accepted. Passage revised and expanded to enhance clarity.
22583	9	21	9	24	These lines and definitions are confusing especially with respect to trade-offs. [Anastasios Kentarchos, Belgium]	Accepted. Passage revised and expanded to enhance clarity.
33661	9	23	9	24	This statement seems controversial with definition of land degradation; "- - - loss of the biological productivity of land, its ecological integrity -- - - ". 1) status of land degradation/quality should not only be evaluated from food production prospective but also from other ecological functioning, (2) Enhancing of sustainable food production should not be at the expense of reduction of ecological integrity as sustainability comprises environmental, social and economic, the three pillars of sustainability. [, Norway]	Noted. We agree that the status of land should not be evaluated only in relation to food production - indeed, the definition refers to three components: productivity, ecological integrity and value to humans. The reality of trade-off between ecological integrity and value to humans is discussed; it is not possible to achieve maximum ecological integrity and food production at any one location.
5805	9	23	9	24	"enhances sustainable food production" enhance or decrease! [Sanaz Moghim, Iran]	Rejected. The sentence is describing as an example a situation in which food production is enhanced.

Comment No	From Page	From Line	To Page	To Line	Comment	Response
33663	9	23	9	28	Please consider to include information regarding how land and soil degradation is affected by rainfall erosivity, soil erodibility, coverage and management practices. A study by Ozsahin et al (2018) has shown that soil loss facilitates land degradation, threatening both agricultural and natural environments. [Reference: Ozsahin et al (2018). Land Use and Land Cover Changes (LULCC), a Key to Understand Soil Erosion Intensities in the Maritsa Basin. Water 2018, 10(3), 335; doi:10.3390/w10030335]. Periodic modification of biomass e.g. logging may have an impact on the biogeochemistry of forest soils and nutrient flux because of physical disturbances (Kreutzweiser et al 2008). [Ref. Kreutzweiser et al 2008. Logging impacts on the biogeochemistry of boreal forest soils and nutrient export to aquatic systems: A reviewEnvironmental Reviews, 2008, 16(NA): 157-179, https://doi.org/10.1139/A08-006]. Please consider t0 include information about disturbance tolerant species. According to the "disturbance hypothesis" the invasion success non-native species is higher in highly disturbed than relatively undisturbed ecosystem [Nordheimer, R., & Jeschke, J. M. (2018). Disturbance hypothesis. Invasion Biology: Hypotheses and Evidence, 71]. [, Norway]	Noted. The processes of degradation are discussed in later section, including rainfall erosivity, nutrient loss and invasions.
26157	9	27	9	28	Change "productive potential" to "productivity" - as "a lower input more sustainable production system" would not have lost any productive potential [Reid Detchon, United States of America]	Accepted. Wording changed
13275	9	29	9	46	The views of the IPBES should be heeded. Perhaps if we were not experiencing a biodiversity crisis as serious for life on Earth as the Climate crisis there might be an excuse to ignore the impact of climate and other human actions on biodiversity decline? But, given that we likely have a similar time scale (a decade or so) in which to turn the trajectory on biodiversity loss and the decline in ecosystem integrity around and that the consequences for climate mitigation and adaptation of not doing so likely mean increases in GHG emissions and loss of carbon storage capacity sufficient to make limiting global warming to less than 2 degrees impossible, such a position seems unwise and unhelpful (IPCC 1.5 Report). [Aila Keto, Australia]	Noted. We agree that biodiversity is important, hence the definition of land degradaiton includes the component "ecological integrity". Text about IPBES definition has been deleted in reponse to other comments.
6183	9	29	9	46	Excellent very recent linked closely to biodiversity and ecosystem as whole [Sawsan Mustafa, Sudan]	Noted. The issue and proposed change is not clear.
31757	9	36	9	42	I can't accept the treatment of biodiversity in these lines. The quoted definition speaks of ecological integrity, in which species must surely be a major factor. It is also the case that many ecosystem services to people are dependent on aspects of biodiversity. There may need to be a trade-off between biodiversity and e.g. food supply, but loss of biodiversity is an aspect of degradation and should be avoided or minimised. The loss of biodiversity should be in scope for this report and chapter – and it is included in various places. [Mike Morecroft, United Kingdom (of Great Britain and Northern Ireland)]	Noted. We agree that biodiversity is important, hence the definition of land degradaiton includes the component "ecological integrity". Text about IPBES definition and LDRA report has been deleted in reponse to other comments.
33209	9	36	9	46	It is hard to know where to start in correcting this mischaracterization of the IPBES LDRA. Every statement here is incorrect: If there is any interest in a fair representation of IPBES LDRA, a much more thorough reading is essential! very unfortunate that the authors here seem to be unaware of the breadth of treatment in the IPBES LDRA. Similarly to say IPBES LDRA "..focusses conservation..." is a complete mischaracterization. [Stephen Prince, United States of America]	Noted. Text about IPBES definition and LDRA report has been deleted in reponse to other comments.
33211	9	37	9	39	I can find no basis for this statement in IPBES LDRA. Also Chapter 3 goes far beyond productivity. [Stephen Prince, United States of America]	Noted. Text about IPBES definition and LDRA report has been deleted in reponse to other comments.

Comment No	From Page	From Line	To Page	To Line	Comment	Response
12011	9	39	9	46	what is meant with " baseline for SRCCL is the condition at the start of the assessment" - what assessment is meant here? The SRCCL itself? [Hans Poertner and WGII TSU, Germany]	Accepted. Reworded to clarify.
33213	9	39	9	46	The meaning here is not clear. It seems to be saying IPBES LDRA only regards changes in biodiversity plus changes from a natural state as degradation. If this is what is intended, the mis-characterization is breathtaking! To select one erroneous aspect, Ch. 4 expressly rejects the use of a "natural baseline" although Ch 2 very briefly defends its use. Better alternatives for baselines include historical , current, present, and target. Each one is defined. Virtually the entire Asessment deals with either unspecified baselines or current degradation, not just biodiversity and comparisons with a supposed natural condition! [Stephen Prince, United States of America]	Noted. Text about IPBES definition and LDRA report has been deleted in reponse to other comments.
30281	9	42	9	44	This sentence is crucial but also ambiguous. Please be explicit about the baseline. What is 'the start of the assessment' ? If it is today, the current condition is 100% per definition and currently no degradation exist. If the start of the assessments is based on literature, the baseline will differ from publication to publication and disables a globally consistent assessment. See also comments on definition. [, Netherlands]	Accepted. Further detail about quantifying the baseline has been added.
30283	9	44	9	46	The words at the end should be added: In contrast, the IPBES LDRA discusses several alternative baselines, and tends to favour the natural state, consistent with the mission of IPBES, that focusses on conservation and sustainable use of biodiversity ' and ecosystem services' . Services are man-oriented, so the LDRA definition also includes loss and gains in LD components such as food and wood production, and trade offs between loss in biodiv integrity and human values are taken into account as well. [, Netherlands]	Noted, but this text has been deleted.
25435	9	45	9	45	Could you check if it is really "desertification" and not "degradation" ? [, France]	The reference seems to be incorrect as the word "degradation" does not appear on that line.
12013	9	47	10	2	This sentence should be at the start of this section, as the first definition that is introduced [Hans Poertner and WGII TSU, Germany]	Accepted - text has shifted
2303	9	9			"to replace this more detailed definition" - but this definition is of desertification which is different to land degradation so it wouldn't seem that the reader would think that it would replace it? [Nina Hunter, South Africa]	The UNCCD desertification definition has a definition of land degradation embedded. We thought it desirable to spell out this point.
33215	10	1	10	1	"Water" need to be clarified. Does it mean everything from streams, rivers (to what order?), natural freshwater lakes, man-made reservoirs and waterways included polluted ponds, saline estuaries, maybe to coastal too (page 15, lines 27 - 34, and p 17 lines 14-15 and page 37 Section 4.6.1.4 and 4.11.8 suggest coastal is included) although the Chapter title is "Land Degradation". [Stephen Prince, United States of America]	Rejected. As stated, land is the "terrestrial portion of the biosphere that comprises..., and water ... within that system"; therefore it is all water systems that are part of the terrestrial biosphere. Near-shore waters are also included, as they are strongly influenced by the land. We don't feel that further explanation is necessary.
4253	10	2	10	2	".....adapted from (FAO 2007; UNCCD 1994).", should be ".....adapted from FAO (2007) and UNCCD (1994)" [Lee-Sim Lim, Malaysia]	Editorial
8661	10	2	10	29	can the term 'pristine forest' be added to the primary forest definition ? [Louise Andresen, Sweden]	Rejected - the term pristine forest is just one of many terms that could be used. See Bernier et al 2017: The resulting inconsistency in reporting among countries is compounded by the use of other terms by other groups, often used interchangeably with, or treated as synonymous to, “primary forest,” such as “old-growth forest,” “virgin forest,” “untouched forest,” “primeval forest,” “pristine forest,” “ancient forest,” and “intact forest” .
7115	10	6	10	6	Add year of publication for WOCAT. [Debra Roberts, South Africa]	Accepted: added

Comment No	From Page	From Line	To Page	To Line	Comment	Response
12015	10	6	10	9	Suggest restructuring this sentence; it is very hard to read. [Hans Poertner and WGII TSU, Germany]	Accepted: sentence simplified
21995	10	6	10	9	Unclear sentence [Vanda Acácio, Portugal]	Accepted: sentence simplified
25437	10	10	10	10	To avoid the breaking of keywords, we suggest to use "sustainable land management [and][including] sustainable forest management". [, France]	Accepted - text revised
28325	10	10	10	37	first explain clearly that forest degradation is different from deforestation - the two are mixed up in later sections of this chapter [Barron Joseph Orr, Germany]	Accepted - distinction added to the text
889	10	10	10	39	Confining sustainable forest management and associated land use to be reflected only by quality of crown cover and quantity of carbon stocks against an agreed baseline may not portray the real picture of the health of the forest and forest land being managed. It will be advisable to monitor the status of biodiversity in the managed forests along with crown cover and carbon stocks. By focusing only on productivity in terms of quality of crown cover and quantity of carbon stocks in a forest, invitation is being made to convert the remaining scant natural forests over the globe to plantations, certainly degrading the forest lands. This wrong message needs to be corrected by including monitoring of biodiversity along with crown and carbon stocks in the managed forests to maintain the healthy status of such forest lands. [Jagdish Kishwan, India]	Noted – we agree with the reviewer that monitoring only forest cover (or carbon stocks) as it typically done in global assessments of forest status is inadequate for the assessment of the success of sustainable forest management. Throughout the section and Chapter 4 we have defined SFM consistently using multiple criteria, including ecological integrity, but we have also pointed out the difficulties in assessing some of these criteria, in particular in global-scale assessments and we have added new references to highlight the importance of native forests over plantations, in particular short rotation plantations with non-native species.
33283	10	13	10	13	What are the "special issues"? Would be useful to give a short list here before going into detail. [Stephen Prince, United States of America]	Accepted - the statement has been deleted
39271	10	15	10	15	"analogue" should be "analogous". [, United States of America]	Accepted - text has been revised
17471	10	16	10	16	Forest degradation should be seen as a decrease of the forest ecosystem biodiversity, its carbon stock and its ecosystem services. Reducing its role down to its productive capacity reduces its role to its economic value to humans. [Taehyun Park, Republic of Korea]	Accepted - note that the defintion of land (and forest) degradation addresses multiple cirteria and is not limited to the "productive capacity".
39273	10	17	10	17	"(Penman et al. 2003)" should be "Penman et al. (2003)". [, United States of America]	Accepted - text has been revised
39275	10	20	10	20	Not familiar with the term "tory methods". [, United States of America]	Accepted - text has been revised
14461	10	20	10	20	What does 'tory methods' mean? [Janice Ser Huay Lee, Singapore]	Accepted - text has been revised
12017	10	22	10	23	All of these examples should state "e.g.," because they are non-exhaustive [Hans Poertner and WGII TSU, Germany]	Accepted - text has been revised
33485	10	24	10	26	There are wilderness areas in North America and Siberia where natural disturbances are common, but this is not the case in most of Europe, so there is no "mosaic of stands of different ages and stages of stand recovery following natural disturbances". Forest landscapes are dominated by production forest of different ages, and a few per cent of set-aside forest. Forest disturbances are increasing but forest age distribution and the distribution of successional or developmental stages still depends on forestry, not disturbances, in most of Europe and other areas where forestry is extensive. It is a major issue in forest ecology and conservation of forest biodiversity that prevention of natural disturbances, such as fire prevention, have a negative influence on biodiversity. Consequently, prescribed burning, gap creation and killing of trees by imitating windthrows are now parts of forest restoration programmes e.g. in Finland. [Jenni Nordén, Norway]	Accepted with modification: We have revised the text stating that "In those managed forests where natural disturbances are uncommon or suppressed, harvesting is the primary determinant of forest age-class distributions." We appreciate the very European perspective on the ability of forest management to control natural disturbances, but for the vast majority of boreal forests (by area) natural disturbances are a major determinant of forest dynamics and the resulting age-class distributions. Biodiversity objectives are increasingly recognised as part of sustainable forest management practices. However, we have not included the specific example (as we do not have any literature on the science of this example).

Comment No	From Page	From Line	To Page	To Line	Comment	Response
33487	10	27	10	37	This reasoning assumes natural forest landscapes where natural disturbances govern the distribution of forest ages and successional stages. In most natural forest landscapes, young successional stages would cover a small fraction of the forest land (e.g. Lorimer and White 2003). However, in most of the forest landscapes, forestry is the dominant "disturbance" factor, and we have in practice permanently lost the primary forests that used to dominate. Forests affected by natural disturbances have clearly higher C stocks than production forests because in the former the biomass is not removed from the site. I don't think that assessing forest degradation by relating the forest age distribution in natural forest landscapes and production forest landscapes is therefore fair. A production forest has lost a part of its ecological integrity, ecosystem processes have changed, it has lost a most of its species, and part of its C stock, and value to humans. Why write about canopy cover here as it is not included in the definition of forest degradation? C stick is not directly part of the definition either, but links to it strongly, while canopy cover does not. Reference: Lorimer & White 2003. Scale and frequency of natural disturbances in the northeastern US: implications for early successional forest habitats and regional age distributions. Forest Ecology and Management 185: 41-64. [Jenni Nordén, Norway]	Noted - the paragraph states that it may be possible to define a baseline based on a landscape-level age-class distribution of the stands which is determined by (natural) disturbance regimes. This becomes even more complicated in cases where both natural and human disturbances interact. (Should human disturbances be part of a baseline?). Added reference to both natural and human disturbances and the reference to the text.
2309	10	27	10	37	"stand" is referred to frequently in this paragraph and beyond - is it possible to define it so that the meaning is clear [Nina Hunter, South Africa]	Rejected - this is not a text book and an internet search of "Forest stand definition" yields excellent answers
2647	10	27	10	37	I suggest inserting references on methods of assessment and quantification of biomass and carbon stocks such as the paper available at: https://doi.org/10.5772/48355 [Thiago Metzker, Brazil]	Rejected - this is not a methods guidance document
33279	10	29	10	29	This is one of several fleeting references to baselines. Baselines are needed for all types of degradation (degradation is a relative term - degraded from what condition?). Baselines are a fundamental principle for all statements that a condition has changed or exhibits a trend. As such it deserves to be in a section about all types of degradation, and early in the Chapter. Maybe section 4.2.2? This topic is discussed extensively in IPBES LDRA section 4.1.4. Here is a list of the types: Natural, Historical, Current, Ecological integrity, and Target. [Stephen Prince, United States of America]	Need to still check but the reference to baselines has been removed and moved to a later section where more appropriate
39277	10	30	10	30	The concept of an "intact" or "primary" forest is highly problematic since in many parts of the world it is not clear that the vegetation is in equilibrium with recent climate, and that even without climate change there may be continental-scale shifts in vegetation biogeography. Long-term human influence on forest fires further clouds the concept and makes it difficult to establish what is "natural" land and what are baseline conditions. [, United States of America]	Accepted - we completely agree that this is a problematic concept and we do not advocate for it here. The rest of the paragraph states that this concept does not apply in landscapes with natural disturbance regimes. Adjusted the wording.
33281	10	30	10	34	Add natural ecosystem dynamics, such as gap succession, in which changes in cover do not indicate degradation. This occurs in many ecosystems, not just forests. [Stephen Prince, United States of America]	Rejected - while the point is entirely valid, the statement here is about differences between stand and landscape-level assessments (baseline) and gap dynamics is a stand-level process. Adding a reference to gap dynamics would not add clarity.

Comment No	From Page	From Line	To Page	To Line	Comment	Response
13277	10	18	11	11	Sustainable Forest Management has never been demonstrated in complex tropical ecosystems (Zimmerman and Kormos 2012) and is increasingly being questioned in temperate and boreal systems (DellaSala 2011, Lindenmayer and Sato 2018). The scale of biodiversity decline, reduction in average carbon stock and reduction in water quality and other ecosystem services means that industrial logging of any area of primary forest is not sustainable over time scales relevant for climate mitigation (2050 (IPCC 1.5 Report)) and ecosystem integrity (CBD/COP/DEC 14 30). Increases in the rate of sequestration do not offset the reduction in carbon stock from any primary forest (Keith et al. 2015). • DellaSala, D.A. (ed. and co-author) (2011). Temperate and Boreal Rainforests of the World: Ecology and Conservation. Island Press. • Keith, H., Lindenmayer, D., Macintosh, A. and Mackey, B. (2015) Under what circumstances do wod products from native forests benefit climate change mitigation? PLoS ONE 10(10): e0139640. doi:10.1371/journal.pone.0139640. • Lindenmayer, D.B. and Sato, C. (2018) Hidden collapse is driven by fire and logging in a socioecological forest ecosystem. PNAS • Zimmerman, B.L., and Kormos, C.F. (2012). Prospects for sustainable logging in tropical forests. BioScience 62(5) [Aila Keto, Australia]	Rejected: we do not accept the perspective of the reviewer. We have added the following text to the chapter: "Forest certification schemes have been used to document SFM outcomes (Rametsteiner and Simula 2003) by assessing a set of criteria and indicators (e.g., Lindenmayer et al. 2000). While many of the certified forests are found in temperate and boreal countries (Rametsteiner and Simula 2003; MacDicken et al. 2015), examples from the tropics also show that SFM can improve outcomes. For example, selective logging emits 6% of the tropical GHG annually and improved logging practices can reduce emission by 44 % while maintaining timber production (Ellis et al. 2019). In the Congo Basin, implementing reduced impact logging (RIL-C) practices can cut half of the emission without reducing the timber yield (Umunay et al. 2019). SFM adoption depends on the socio-economic and political context and its improvement depend mainly on better reporting and verification (Siry et al. 2005)." References cited are in the chapter.
30287	10	10	12	39	The additional elaboration on forest is understandable for its relevance for climate, but LD definitions and baselines for forests are and should be identical to all other natural or use systems. [, Netherlands]	Noted - and we do not state otherwise. Obviously a baseline based on forest cover does not apply to non-forest lands.
39269	10	10	13	3	Section 4.3.2 on sustainable land and forest management lacks discussion about the role of fire as an important process in many forested ecosystems, and that lack of fire can actually lead to forest degradation. [, United States of America]	Noted but this level if detail is not included here - impacts of fire on land degradation are discussed elsewhere in the report,
33219	10	10	13	3	Somewhere the distinction between deforestation and forest degradation should be made. They are, of course, not the same. [Stephen Prince, United States of America]	Accepted - this is written in the ES as part of the definition introduction
28655	10	10		14	The explicit definition for forest degradation and sustainable forest management are not clearly defined, issues regarding forest degradation contributing to loss of land(Land degradation). I recommend specific adaptive measures should be defined in relation to forest degradation and sustainable forest management. Issues relating to sustainable land and forest management should be highlighted. [Abiodun Adegoke, Nigeria]	Noted but this level if detail is not included here - impacts of fire on land degradation are discussed elsewhere in the report,
8153	10	16			"Forest degradation is defined as a reduction in the productive capacity of forests." What is the key category of productive capacity? Reduction of forest cover, biomass, species diversity, etc..? [Haruni Krisnawati, Indonesia]	Accepted - text has been deleted
23195	10	20			What are "tory methods"? Inventory? [Kaoru Kitajima, Japan]	Accepted - text has been revised
2305	10	20			What are "tory methods"? [Nina Hunter, South Africa]	Accepted - text has been revised
17191	10	22			Replace "Insects" with "Forest Pests". It is more appropriate and global. [José Alfonso Domínguez-Núñez, Spain]	Accepted - text has been revised
2307	10	24			Is it possible to define "boreal" and "temperate" forest types? [Nina Hunter, South Africa]	Rejected - this is not a text book and those terms are well defined (and the exact definition has no material impact on this statement.
17193	10	31			Replace "Insects" with "Forest Pests". It is more appropriate and global. [José Alfonso Domínguez-Núñez, Spain]	Rejected - the wording "such as" implies that this is an example - forest pests was already added earlier on the same page

Comment No	From Page	From Line	To Page	To Line	Comment	Response
14463	11	0	11	0	The diagrams are useful. One suggestion would be to indicate when a land-use acts as a carbon source or sink. Perhaps instead of having the figure in blue, it could be separated in two colors to indicate when it acts as a sink or source, with a legend at the side. I also wonder if the terms 'source' and 'sink' have connotations of when carbon is released into the atmosphere (above the horizontal line, which may be intuitive) and when it is retained on earth (below the horizontal line). The current graph shows opposite ends as Carbon sink is used as a y-axis. [Janice Ser Huay Lee, Singapore]	Accepted - the figure has been completely revised taking into consideration all of the comments received on the Second Order Draft.
21877	11	1	11	1	In Fig. 4.1, the graphs on carbon sinks may be a bit misleading, as net sinks are typically denoted with a negative sign, so that increasing sinks are shown with decreasing values, unlike for carbon stocks. Moreover, it might be informative to show the fluctuation in cumulative carbon stock caused by harvest cycles, to show the impact of sustained management. [, Finland]	Accepted - the figure has been completely revised taking into consideration all of the comments received on the Second Order Draft. Whether sinks are shown as positive or negative values depends on the scientific community; the flux community shows a sink as a negative value while ecosystem scientists show positive values (increasing C stocks).
30289	11	1	11	12	The conversion of natural into cultivated land has a huge impact on its carbon content in soils, vegetation, its water holding capacity, soil stability and protection, local climate, biodiversity and various others functions and services, and ultimately global climate. The loss from natural to extensive use is much bigger than the loss from extensive to intensive use and from intensive use to entirely degraded. The loss is significant under SLM practice, and worse under non SLM practice. The latter especially because it requires additional conversion. A world that is converted entirely into SLM use is certainly not sustainable for 90% of the species and man. This key impact of land transformation as a large chunk of the land degradation process is not covered in this figure and a serious and dangerous flaw. The above also means that it is better to sustainably intensify the use, in order to reduce additional conversion to meet human needs . [, Netherlands]	Accepted - the figure has been completely revised taking into consideration all of the comments received on the Second Order Draft. However, with regard to this comment, we have removed the conversion from natural to managed landscapes and focus entirely on the imacts of climate change and management on land degradation processes.
33665	11	1	11	12	Figure 4.1: What does the figure below the horizontal lines of carbon sink indicate? Negative value? What doest it means degraded land/forest has negative carbon sink? The scale may need explanation (+,0 -) if it's relevant. [, Norway]	Accepted - the figure has been completely revised taking into consideration all of the comments received on the Second Order Draft.
33667	11	1	11	12	Figure 4.1: This illustration did not consider other land uses such as range land, settlement, etc. Probability, considering other driving factors like socio-economic (e.g. land tenure, marketing, institutional support, income and human health) and political (e.g. incentives, political stability) may be important for management of land uses (Ref: Sivakumar and Stefanski . Climate and land degradation- an overview [, Norway]	Noted - yes this figure does not consider other land uses - but as it is the figure was too complex and has been further simplified to highlight the key messages.
33669	11	1	11	12	Figure 4.1: Since sustainable management of land uses (forest/agriculture) are influenced by selected measures of climate change mitigation and adaptation, please consider to include this dimension in the conceptual illustration. Ideally the figure should show how the three factors (mitigation, adaptation and sustainable land use) interact with eachother. [, Norway]	Accepted - we added to the text that SLM can included measures aimded at achieving mitigation and adaptation objectives but this is not included in the figure itself which has been simplified.
33671	11	1	11	12	Please consider to include restoration as an additional variable in the figure, since land restoration and rehabilitation are defined differently from page 12 line 44 to 13 line 3. [, Norway]	Accepted - figure has been revised and restoration has been added.
39279	11	1	11	12	This figure is not very informative, and doesn't display the information that the caption describes. It is perhaps so broadly conceptualized that it lacks communicative value. [, United States of America]	Accepted - the figure has been completely revised taking into consideration all of the comments received on the Second Order Draft. We have focussed the figure to highlight the key points we are trying to make.

Comment No	From Page	From Line	To Page	To Line	Comment	Response
39281	11	1	11	12	Carbon sinks can often be greater in land and forests when they are degraded; however, Figure 4.1 shows the opposite relationship. [, United States of America]	Rejected - the strength of the carbon sink will depend entirely on the degree of land degradation. In severly degraded lands the carbon sink is going to be very small. And yes - this is a conceptual diagram and we are now showing a range of C sinks.
12019	11	1	11	12	Nice figure - the comparison of the same processes in different relevant land forms is intuitively understandable. Suggest swapping the graphs for carbon stock and carbon sink in the bottom box, to mirror the top box, thereby improve layout and visual impact of the figure [Hans Poertner and WGII TSU, Germany]	Accepted - the figure has been completely revised taking into consideration all of the comments received on the Second Order Draft.
8985	11	1	11	12	The carbon sink aspect of the graph should possibly need additional thought. My understanding and as emphasised in line 9 to 12 page 11, and later in the report (page 43 lines 20-30), is that the sink capacity is greatest at an intermediate point. The graph however makes it greatest at the full right. My thoughts on the matter are twofold. 1) it is actual movement from left to right on the graph that causes a sink and right to left that causes a loss of carbon. However, the inherent rate of a possible sink is probably changes and is highest somewhere in the middle. 2) I would assume that on the full left (totally degraded) there is zero sink (i.e. all carbon is lost – I do not see this as a negative sink though there might be a time lag between loss of above ground carbon and loss of soil carbon) at the total right I would also see the system as at zero sink. I.e. the fully mature forest is at equilibrium (from a carbon perspective). An exception would be in systems where peat beds are being build up. CO2 fertilisation effects, change in temperature and precipitation etc. may, of course, mean that equilibrium states are changing (and this could drive either positive or negative C changes). [Jean-Luc Chotte, France]	Accepted - the figure has been completely revised taking into consideration all of the comments received on the Second Order Draft. However, some aspects of this comment are rejected as the review appears to be confusing "stocks" and "sinks". The fact that fully degraded land has a small C stock does not say anything about its current fluxes - it may still be a source of carbon. And since the right hand side of the spectrum represents a sustainably managed forest (not an old-growth forest) it remains a C sink as harvesting is an ongoing process. In any case, this is a conceptual diagram and exceptions can always be sought and found.
12871	11	1	11	12	The message of the figure 4.1 is cryptic. Surely climate change, for example, affects both degraded and sustainably managed forest? Does a negative carbon sink mean a "carbon source"? [Robert Treuhaft, United States of America]	Accepted - the figure has been completely revised taking into consideration all of the comments received on the Second Order Draft.
39283	11	2	11	2	Figure 4.1 suggests climate change will necessarily reduce carbon stock but in some systems carbon stocks may increase due to increased productivity under a warmer climate. [, United States of America]	Accepted - as with every generalised conceptual figure, exceptions can be found. We have added a statement to the caption that in some cases climate change can lead to increased productivity, at least in the short term.
32741	11	2	11	2	The figure implies that in all ecosystems everywhere, climate change will cause land degradation. This is not necessarily true. In many ecosystem warming could, for example, enhnace productivity and reduce erosional losses. It is just too broad a statement. [Kate Lajtha, United States of America]	Accepted - text has been added to the figure caption stating that there will be examples where climate change can enhance productivity.
14261	11	2	11	2	Figure 4.1 I am wondering whether a not in the caption could define the “negative sink” as a “source” of C? [Lukas Van Zwieten, Australia]	Accepted - figure has been revised and labels have been added to clarify sink and source in the figure.
24181	11	2	11	12	the figure 4.1 fails to include the trajectory of biodiversity loss within this conceptual representation. The diagram is simplistic and not very helpful . [Derek Berliner, South Africa]	Accepted - the figure has been completely revised taking into consideration all of the comments received on the Second Order Draft. However, given the guidance to simplify the figure we did not add a new topic (biodiversity loss) to the figure.
18351	11	2	11	12	Probably is better to talk about "under permanent increment of temperature state, it will be possible to develop sustainable management of forestry and agricultural activities?" Until when? [Gerardo Ojeda, Colombia]	Noted but this comment is unclear.
4255	11	3	11	12	The caption for Figure 4.1 is too lengthy. I suggest to shift the explainantion " Climate change can exacerbate many .....and therefore contribute stronger carbon sinks, than natural forests" into the main text, than in the caption. [Lee-Sim Lim, Malaysia]	Rejected - we agree that the caption is long but moving it to the text will mean that these important explanations will not be read.

Comment No	From Page	From Line	To Page	To Line	Comment	Response
17473	11	9	11	12	However, decreasing existing forest carbon stocks should not be justified for increasing the sink potential of new planted forests as this can only have a positive carbon balance, if the harvested products are used in long-lasting products like building materials in a system with drastic measures of emission reductions and that supports a sustainable and decreased cascade use of wood based products. [Taehyun Park, Republic of Korea]	Accepted - at least in part. Obviously any form of forest management that involves harvest followed by replanting results in a reduction in C stocks (at the stand level) followed by C accumulation as forests regrow. And whether or not this does have a positive C balance depends on both the system boundaries (e.g. are subsitution benefits included) and the time horizon of the analysis.
7003	11	10	11	12	This statement " younger forests have a higher growth rate, and therefore contribute stronger carbon sinks, than natural forests" - is probably not true. Reading the book "The Hidden Life of Trees" by Wohlleben: new studies show older forests and older trees sequester more carbon than younger trees and forests. Author cites 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. Please also see Chapter 2, page 44, which talks about managed versus unmanaged forests. [Debra Roberts, South Africa]	Rejected. The reference provided here is based on the 2008 Nature paper by Luysseart et al. which clearly shows that older forests have a smaller C uptake rate (in their paper not zero but other papers show smaller or even negative C uptage (i.e. sources) in older forests. Older forests may contain more C but they have accumulated this over a long period of time. The incremental carbon gain is small and can be negative. References to back this up have been added to the section. It is also incorrect to state that "old growth forests are not included in international treaties". The managed forest (FL-FL) definition of national forest GHG inventories does not exclude the contribution (be it source or sink) of old-growth forests. However, it will be important to address this misunderstanding in a bit more detail. Lastly, chapter 2 p 44 speaks about "managed" vs. "unmanaged" forests from the perspective of GHG inventory reporting and this has nothing to do with the C removal rate of the two forest categories.
33673	11	11	11	12	If natural forests contribute lower carbon sink than young forest, should natural forest "disturbance at acceptable level" be encourage in SLM? [, Norway]	Accepted - we have reworded the caption to state more clearly that younger forests can have higher growth rates than older (natural) forests, but because this clearly depends on the ecosystem type and age ranges - we do not therefore want to categorically encourage "disturbance at acceptable levels", though this is implicit as SLM does involve forest harvest.
39285	11	13	11	14	This section equates selective logging with "high grading" and suggests it can lead to degradation. Note that, on p. 6-25, lines 23-26, "Selective logging ... can therefore offer potential co-benefits." Recommend clarifying that properly conducted selective logging (under the guidance of professional foresters) can be beneficial but, when improperly conducted, can be harmful. [, United States of America]	Accepted - revised text to emphasize that the range of possible outcomes from selective logging depends on the practices used.
12021	11	16	11	17	Statement needs a reference [Hans Poertner and WGII TSU, Germany]	Accepted and reference added.
23197	11	17	11	17	The sentence, "sustainable logging such as thinning can maintain and enhance fores tproductivity"is incorrect. Selective logging and thinning are two very different things. As part of sustainable forest management, thinning may be done, but it is not the same or part of selective logging. Whether it is sustainable or not hinges much more on logging intensity. See C. Romero and F.E. Putz (2018) Theory-of-Change Development for the Evaluation of Forest Stewardship Council Certification of Sustained Timber Yields from Natural Forests in Indonesia. Forests 9. [Kaoru Kitajima, Japan]	Accepted - text revised and reference added
31759	11		11		Fig. 4.1. This does not add value and only confuse matters. Carbon stock and carbon sink do not always follow parallel tracks. You can have a system with a high carbon stock that is a major source of C. I am also not at all clear where 'natural land' fits in. The diagram could be interpreted to mean that sustainable management will generally increase C stock relative to a natural state. That is virtually never true. [Mike Morecroft, United Kingdom (of Great Britain and Northern Ireland)]	Accepted - we have completely revised Figure 4.1 to focus on the impacts of climate change and land management actions on degraded or sustainable outcomes.

Comment No	From Page	From Line	To Page	To Line	Comment	Response
40619	11		11		Does climate change always go in the direction of land degradation? (a question about the signs of arrows in Fig 4.1). [Valerie Masson-Delmotte, France]	Accepted - in some cases climate change can in fact increase productivity and we have stated this in the figure caption. We did not add a second arrow head to the arrow because we consider the positive impacts the exception.
5377	11	18	12	11	In my view it is important not to conflate economic productivity (in a forest mainly growth of valuable timber, i.e. stemwood) with total ecosystem productivity that also includes growth of economically less or not valuable parts of the forest ecosystem. Forest management, and hence a lot of forestry science, is mainly interested in stemwood growth. Total forest ecosystem productivity is likely often beneficial for biodiversity, but optimization of stemwood growth may have detrimental effects on biodiversity, e.g. in the case of spruce monocultures optimized for straight stem production, instead of total ecosystem production. Also it is important not to equate C removal from the atmosphere with a forest's C sink, as the latter must also consider the C losses during the harvest of a forest, see Körner, C., 2003. Slow in, Rapid out-Carbon Flux Studies and Kyoto Targets. Science 300, 1242–1243. https://doi.org/10.1126/science.1084460 I agree with the authors, however, that definitions of forest degradation that classify any sign of management or human use of forests as "degradation" are not useful for a solid socio-ecological analysis of forest ecosystem degradation (lines 21ff) [Helmut Haberl, Austria]	Accepted - this comment was taken into consideration during the revisions of this section.
27061	11	1			Why is "Restoration" not mentioned in this figure? Please explain or revise the figure. [, Germany]	Accepted - figure has been revised and restoration has been added.
15131	11				Please, remember the source of the figure [Ibouraïma Yabi, Benin]	Noted - there is no source because the authors prepared the figure for this report.
24183	12	10	11	12	The relationship betweee forest productivity , harvesting intesity , type of harvest, timber vs , non timber products, and biodiversity loss have not been well articulated.Particualrly for tropical forest They need to refer to a number of studies that have looked at this for example : Nature. 2011 Sep 14;478(7369):378-81. doi: 10.1038/nature10425. Primary forests are irreplaceable for sustaining tropical biodiversity. Gibson L1, Lee TM, Koh LP, Brook BW, Gardner TA, Barlow J, Peres CA, Bradshaw CJ, Laurance WF, Lovejoy TE, Sodhi NS. [Derek Berliner, South Africa]	Accepted - revised the text to highlight problems in maintaining biodiversity in tropical timber production forests.
39287	12	1	12	1	Should Net Ecosystem Production be capitalized? [, United States of America]	Accepted - removed capitalization
32743	12	2	12	5	There is a statement here that isn't quite true. "Thus, the impacts of 3 sustainable forest management on one indicator (C stocks in the forested landscape) can be negative, 4 while those on another indicator (forest productivity and rate of C removal from the atmosphere) can 5 simultaneously be positive." The only thing that matters is NET removal from the atmosphere or NET addition. So if there is a huge addition to the atmosphere, it does not matter if then there is a smaller net accumulaton. This is like saying that if a bully pounds on a kid, then offers a bandaid to one of the wounds, then there is a positive that came from the bullying. If the initial harvest greatly reduced C stocks but all that wood were held in structures and did not degrade, and then the forest recoveed, this is a net sink and a net positive outcome. However, if most of the C from the harvest were lost to the atmosphere, then ecosystem recovery would help offset this loss, but would not necessarily represent a net positive. A true lifecycle assessment would have to be conducted to determine the C effects of forest harvest, but this statement as written is not accurate. [Kate Lajtha, United States of America]	Accepted - the sentence was unclear and has been revised

Comment No	From Page	From Line	To Page	To Line	Comment	Response
5807	12	2	12	5	"C stocks in the forested landscape" is not consistent with "forest productivity and rate of C removal from the atmosphere", if yes, sentence needs to be adjusted! [Sanaz Moghim, Iran]	Accepted - the sentence was unclear and has been revised
39289	12	3	12	3	Insert "e.g.," before "C stocks". [, United States of America]	Accepted - text revised
39291	12	4	12	4	Insert "e.g.," before "forest productivity". [, United States of America]	Accepted - text revised
39293	12	5	12	5	Impacts must be assessed on a consistent, long-term scale, since carbon fluxes are dynamic over time and depend on forest conditions. Impact assessment must include whole life-cycle of forest products, since biomass removed from forests can have highly divergent paths in the global carbon cycle. [, United States of America]	Accepted - text revised to indicate that fate of harvested biomass also determines impact on the atmosphere
39295	12	5	12	5	It's too simplistic to say that increased productivity is associated with reduction in biodiversity. It depends on the exact forest conditions, history and geography. [, United States of America]	Accepted - we now use the thinning as a specific example. Clearly there are other examples with both positive and negative impacts.
33491	12	5	12	6	It is well documented that forest management has a negative impact on forest species, including vertebrates, invertebrates, plants, saprotrophic fungi and mycorrhizal fungi, and through loss of species and changes in communities, on ecological processes such as nutrient cycling amd carbon sequestration. [Jenni Nordén, Norway]	Accepted - text revised to clarify that removal of trees in thinning reduces biodiversity and C stocks
2313	12	5	12	8	Initially it states that an increase in forest productivity results in a decrease in biodiversity but later the example of increased forest productivity is described as leading to an increase in biodiversity. Does this need to be rephrased? [Nina Hunter, South Africa]	Accepted - text revised to clarify that removal of trees in thinning reduces biodiversity and C stocks
21997	12	5	12	8	The end of the sentence (after the last comma) should be better linked to the text before, in order to clarify the message [Vanda Acácio, Portugal]	Accepted - text revised to clarify that removal of trees in thinning reduces biodiversity and C stocks
39297	12	7	12	7	In addition to snags and CWD, sometimes plant biodiversity is reduced from favoring specific tree species to the expense of other tree, shrub, and ground flora species. [, United States of America]	Noted - and while we agree, this is a level of detail that is not required here as this is not a textbook thatlists all possible impacts.
33489	12	7	12	8	Dead organic matter is also an important part of the forest C stock (Russel et al. 2015). References: Russell et al. 2015. Quantifying carbon stores and decomposition in dead wood: A review. Forest Ecology and Management 350: 107-128. [Jenni Nordén, Norway]	Accepted - added the statement and references.
30947	12	8	12	9	Reference needed. Additionally, given the very broad definition for sustainable forest management given in the glossary, which includes "…and at a rate, that maintains their biodiversity" there are questions as to whether that criterion has been filled. https://www.eea.europa.eu/soer-2015/europe/biodiversity [Kelsey Perlman, France]	Accepted - the discussion of sustainability has been further differentiated.
17475	12	8	12	9	This report should not give the impression to justify current unsustainable indutrial forestry practices. The economic sustainability might have been demonstrated in boreal and temperate forests. The management remains mostly guided by economic interests and is so far seldomly guided by climate change mitigation an the underlying science that aligns this approach with other goals of UN conventions (e.g. CBD) Therefore, the ecological integrity of most managed secondary forest in the boreal and temerate forest is more than questionable (https://storage.googleapis.com/planet4-international-stateless/2018/07/The-Impacts-of-Logging-in-the-Great-Northern-Forest-final-28-May-2018.pdf). And the restoration potential of degraded temperate and potentially also boreal secondary forests through natural management might be considerable though (https://www.oeko.de/fileadmin/oekodoc/Forest-Vision-Methods-and-Results.pdf) (GRISCOM). [Taehyun Park, Republic of Korea]	Rejected - but we have taken some of this comment into consideration and are now discussing the difference between sustainable timber yield (which is unquestionably achieved) vs losses in biodiversity.

Comment No	From Page	From Line	To Page	To Line	Comment	Response
25439	12	8	12	11	This sentence is highly arguable. At a minimum, the references on which it is based should be indicated. Models of sustainable forest management in the tropics are well documented, which seems to be the exact opposite of this sentence. Some references: - MacDicken, Kenneth G., et al. "Global progress toward sustainable forest management." Forest Ecology and Management 352 (2015): 47-56. - Siry, Jacek P., Frederick W. Cubbage, and Miyan Rukunuddin Ahmed. "Sustainable forest management: global trends and opportunities." Forest policy and Economics 7.4 (2005): 551-561. - McDonald, G. T., and Marcus B. Lane. "Converging global indicators for sustainable forest management." Forest policy and economics 6.1 (2004): 63-70. - Nasi, Robert, et al. "Sustainable forest management and carbon in tropical Latin America: the case for REDD+." Forests 2.1 (2011): 200-217. - Blaser, J., et al. "Status of tropical forest management 2011." ITTO technical series 38.June (2011): 376-384. [, France]	Accepted - we have modified the statements, and added references to several of these papers to the section
33287	12	10	12	10	Sect 4.3.2. Title. Why is "land" in the title? Lines 12-14 say it will not (and it isn't). Maybe note those statements about forest that apply to other/all land degradation. [Stephen Prince, United States of America]	Noted - other reviewers requested that land not only remain in the title but that it be made more explicit that we are referring to both sustainable land management and sustainable forest management.
39299	12	11	12	11	Suggest adding to end: "... as recent studies have estimated huge numbers of species are present, for example, in the Amazon." See recent Science article quoting an estimated 16,000 species of trees in Amazon. [, United States of America]	Accepted - added the statement and references.
33285	12	12	12	12	But baselines are needed. See comment on p10, line 29. [Stephen Prince, United States of America]	Accepted - we do not say that they are not needed but state that they need to be well defined.
25441	12	12	12	15	This sentence seems policy-prescriptive and should therefore be rewritten. [, France]	Accepted - this paragraph has been deleted.
29775	12	12	12	17	It is relevant to include mention of Indigenous and local knowledge here. [Tanya Smith, Canada]	Rejected - the human dimension is discussed in the next section (4.3.3. and later throughout the chapter)
2649	12	12	12	25	I suggest inserting references on methods of assessment and quantification of biomass and carbon stocks such as the paper available at: https://doi.org/10.5772/48355 [Thiago Metzker, Brazil]	Rejected - this is not a textbook and this is not the place to review methods - moreover this is the reviewer's own paper that is proposed here.
25443	12	15	12	32	All these paragraphs suffer from a serious lack of scientific references. [, France]	Accepted - text revised (in part deleted) and remainng text further supported by references.
33493	12	17	12	18	We have a lot of knowledge about the species communities in primary forests, we know what we lose when primary forests are converted to production forests or taken into some other use. E.g. in the Nordic countries, about half of the Red-Listed species are forest species that have declined because of the loss and fragmentation of primary forests. Normal production forests lack Red-Listed species and species specialised in certain microhabitats only found in primary forests.If a forest has lost all of the demanding species, it has lost a part of its ecological integrity, and ecosystem processes are likely affected. It is possible to alleviate the degradation of production forests by e.g. retention of large logs, and by replacing clear-cut forestry (the dominant form in the Nordic countries) with continuous cover forestry (the dominant form e.g. in Germany). [Jenni Nordén, Norway]	Accepted - text revised (in part deleted) and remainng text further supported by references.
11715	12	21	12	21	GHG concentrations : The Paris Agreement uses "emission level" (From the Paris Agreement 2015, UNFCCC) [Serah Kahuri, Kenya]	Accepted and text revised

Comment No	From Page	From Line	To Page	To Line	Comment	Response
33495	12	21	12	25	Food and shelter (last sentence) not relevant. Taking food from forests does not (usually) cause forest degradation. What is it meant with forest as a shelter for humans and this causing degradation? I don't think it is problematic to admit and accept that many (not all) forms of human exploitation of forests do affect forest productivity, ecological integrity or value to humans in a negative way. People can use forests, but sustainable land-use and land-management strategies should involve more set-asides and perhaps light management in a part of the landscape, instead of >95% of the landscape being intensively managed for forestry products. [Jenni Nordén, Norway]	Accepted - text revised to clarify that food refers to the conversion of forests to agricultural land and shelter (housing) requires wood products - we are not talking about shelter in the forest but use of forest products to provide shelter. The statement that >95% of the landscape being intensively managed for forest products depends entirely on national circumstances.
14465	12	26	12	39	A definition of SFM was provided for temperate forests. Could one be derived as well for tropical forests? Or is that definition menat to encompass tropical forests? In some cases there are as well unique cultural, spiritual or religious values forests have for society. These functions are not captured very much under these paragraphs. [Janice Ser Huay Lee, Singapore]	Noted - there is nothing in the definition provided here that states that this is specific to temperate forests - this SFM definition should apply to all forest biomes. However, we have added text that acknowledges that not all indicators can be equally sustained - some trade-offs are inevitable.
33675	12	30	12	32	Post-success or failure of forest ecosystem after disturbances depend on ecosystem resilience and resistance. Please consider to also include and highlight these dimensions when assessing if appropriate. [, Norway]	Noted - this is correct - but here we simply state that stainable forest management requires successful regeneration - and the reviewer's example of resiliance and resistance are noted but not added to the text.
33497	12	30	12	32	"Failure of forest to regrow following disturbances..." or forestry operations. Iceland represents an extreme example of failure with regeneration - it used to have a similar forest cover as Norway has today, but humans cut the trees and now the island is practically treeless. It is possible that the forests that today regenerate well may do so less well after several cutting cycles as the communities of mycorrhizal fungi are much affected by intensive forestry (Varenius et al. 2017). Reference: Varenius et al. 2017: Retention of seed trees fails to lifeboat ectomycorrhizal fungal diversity in harvested Scots pine forests. FEMS Microbiology Ecology, Volume 93, Issue 9, 1 September 2017, fix105, https://doi.org/10.1093/femsec/fix105 [Jenni Nordén, Norway]	Noted - the study by Varenius et al is interesting but does not materially influence the statement made in this paragraph that sustainable forest management requires successful regeneration - and the reviewer's example from Iceland is a good example of unsustainable forest management.
26159	12	31	12	31	Change "unstainable" to "unsustainable" [Reid Detchon, United States of America]	Accepted - text revised
40185	12	31	12	31	it might be better to refer to forest cover and not forest area, since if the land use is forest, the fact that the forest is not there does not reduce the forest as land use. But it alters the land cover. This is the conflict that normally exist between land use and land cover. [Thelma Krug, Brazil]	Accepted - added forest cover as an additional indicator (since some failure to regenerate can be due to deforestation - in which case it is both loss of forest area and forest cover.

Comment No	From Page	From Line	To Page	To Line	Comment	Response
13279	12	33	12	46	Enhanced sequestration and storage of atmospheric carbon is possible because ecosystems are below their natural carbon densities due to past land use. Thus, the potential scale of sequestration is directly coupled to past emissions — that is, land-use interventions aim to restore previously lost carbon (Houghton and Nassikas 2018). The historical carbon debt — the amount of carbon previously lost from the terestrial biosphere through land-use change — has been estimated at between 119–187 GtC since pre-industrial times (Arneth et al. 2017; Houghton and Nassikas 2017; Mackey et al., 2013; Arneth et al. (2017) suggest that processes previously not included in the land-use change flux mean the carbon debt could be substantially larger, putting the historical carbon debt at the upper end of this range, meaning a greater potential to restore carbon to the biosphere. • Arneth, A., Sitch, S., Pongratz, J., Stocker, B.D., Ciais, P., Poulter, B., Bayer, A.D., Bondeau, A., Calle, L., Chini, L.P., Gasser, T., Fader, M., Friedlingstein P., Kato, e., Li, W., Lindeskog, M., Nabel, J.E.M.S., Pugh, T.A.M., Robertson, E., Viovy, N., Yue, C. and Zaehle, S. (2017) Historical carbon dioxide emissions caused by land-use changes are possibly larger than assumed. Nature Geoscience 10(2): 1-8. • Houghton, R.A. and Nassikas, A.A. (2017) Global and regional fluxes of carbon from land use and land cover change 1850–2015: Carbon Emissions From Land Use. Global Biogeochemical Cycles 31(3): 456-472. • Houghton, R.A. and Nassikas, A.A. (2018) Negative emissions from stopping deforestation and forest degradation, globally. Global Change Biology 24(1): 350-359. • Mackey, B., Prentice, I.C., Steffen, W., House, J.I., Lindenmayer, D., Keith, H. and Berry, S. (2013) Untangling the confusion around land carbon science and climate change mitigation policy. Nature Climate Change 3: 552-557. [Aila Keto, Australia]	Noted - but the line numbers referred to in this comment are about the definition of Sustainable Forest Management. It is not apparent how or why this comment would relate to the SFM defintion.

Comment No	From Page	From Line	To Page	To Line	Comment	Response
33499	12	36	12	39	I think that this definition of sustainable forest management is good. If this IPCC report follows this definition of sustainable forest management, it should have more focus on forest degradation in terms of ecological integrity and human values. In Northern Europe, deforestation is not an issue, and forests are growing better than ever. Yet biodiversity decline is not slowing down. About half of the species in the national Red Lists are forest species. Production forests that cover ca. 95% of productive forest land, have smaller carbon stocks and much lower species diversity than set-asides. Thousands of forest species are dependent on dead wood, a C storage that may last for decades or even centuries, especially on large logs, that are almost absent from production forests. How ecosystem processes are influenced by the changed communities especially in the soils, and the changed structural features and local climate, is insufficiently known. The consequences of large-scale forest degradation because of forestry are however potentially large. Soils are the largest terrestrial carbon pool. There are indications that higher species richness of saprotrophic fungi lead to slower decomposition, i.e. better carbon sequestration (Ratcliffe et al. 2017). Lower species richness in production forests may therefore mean increased carbon emissions from dead wood and litter. Climate impacts on decomposition are deficiently known (Bradford et al. 2017). References: Ratcliffe et al. (2017). Biodiversity and ecosystem functioning relations in European forests depend on environmental context. Ecology Letters 20, 1414-1426. Bradford et al. 2014: Clim ate fails to predict wood decomposition at regional scales. Nature Climate Change volume 4, pages 625–630. [Jenni Nordén, Norway]	Accepted - we have revised the text and paid more attention to biodiversity losses even if timber yield has been sustained or even increased.
33289	12	40	12	40	These three terms should be defined at the start of the Chapter (or in a Glossary). They are out of place here. [Stephen Prince, United States of America]	Accepted - The definitions are already in the glossary and have been deleted from this section of the report.
24187	12	41	12	41	The definition given for "Land Potential " is very bad. Need to specify the context, ie potential for what . Need to reword [Derek Berliner, South Africa]	Noted - the comment has been forwarded to those dealing with the definitions in the glossary and the definition removed from this chapter.
30293	12	45	12	45	Please be more explicite what is meant with pre-existing state. Is this the pristine state (the state as it was before human interventions, or the potential state as it would be under current climate conditions in case no human interventions had been taken place other than human-induced climate change , or..?) It should be stressed that potentials and baselines are something different than targets. Targets are a political choice on a desired condition somewhere between zero and the baseline or potential condition, balancing socioeconomic and ecological costs. [, Netherlands]	Taken into account - the text has been revised. We dont use this term any longer
40621	12		12		I am nervous when I read a whole page with limited references. Is this an assessment, a framing, or are they normative statements from the author team? [Valerie Masson-Delmotte, France]	Accepted - the text has been revised considerably and references have been added.
6185	12	18	13	18	Biodiversity Achi targets [Sawsan Mustafa, Sudan]	Accepted and text revised
33677	12	44	13	3	Land restoration could be an additional variable in the Figure 4.1 illustration since land restoration and rehabilitation are defined differently. [, Norway]	Accepted - restoration has been added to Figure 4.2

Comment No	From Page	From Line	To Page	To Line	Comment	Response
6187	12	44	13	3	Restoration is defined as any intentional activity that initiates or accelerates the recovery of an ecosystem from a degraded state. This definition covers all forms and intensities of the degradation state and is in this sense inclusive of the definition adopted by the Society for Ecological Restoration (Fisher etal, 2018) Rehabilitation is used to refer to restoration activities that may fall short of fully restoring the biotic community to its pre-degradation state, including natural regeneration and emergent ecosystems (Fisher etal, 2018) Fisher etal,(2018): Fisher J., Montanarella, L., and Scholes, R. Chapter 1: Benefits to people from avoiding land degradation and restoring degraded land. In IPBES (2018): The IPBES assessment report on land degradation and restoration. Montanarella, L., Scholes, R., and Brainich, A. (eds.). Secretariat of the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem services, Bonn, Germany, [Sawsan Mustafa, Sudan]	Noted - the comment has been forwarded to those dealing with the definitions in the glossary and the definition removed from this chapter.
24185	12	17	18	12	The importance of monitoring biodiversity relative to forest degredation and forest use has not been well consi9dered here . While direct monitroing of forest biodiversity is difficult , there are good and reliable surrogates that can be used as recommended by Lindermayer, such as forest structure, connectictiy, forest edge sate etc. See for example Indicators of Biodiversity for Ecologically Sustainable Forest Management . David B. Lindenmayer Chris R. Margules Daniel B. Botkin. Conservation biology 2001 [Derek Berliner, South Africa]	Yes - surrogates are possible but the article referenced here also points out that they do not work very well … or at least are uncertain.
12023	12	4			Please clarify: does this refer to carbon in general or carbon dioxide? [Hans Poertner and WGII TSU, Germany]	Accepted - revised to CO2 - though either would have been fine
2311	12	5			"C" is refered to frequently in the chapter but to the non-scientific reader this can be confusing; please state in full throughout the chapter [Nina Hunter, South Africa]	Accepted - C changed to carbon
23199	12	16			Albedo can be reported, but adequately measured albedo data (such as T. Giambelluca et al. 1997 J. Climate) seem to be rather rare, and requires attention to seasonality. Also, albedo alone does not really give a full picture of the energy balance of forests because ET matterns a lot. [Kaoru Kitajima, Japan]	Accepted - we agree but this does not require a change to the statement made here. The test already states that these are examples of indicators, and the reviewer confirms that albedo can be measured (and there are additi+J471onal more recent publications that confirm this).
28657	12	41		46	Land is a capital based potential; Statements of purpose for land protection need to be highlighted in relation to land restoration and land rehabilitation. I recommend issues relating to Land restoration and land rehabilitation should be defined. Also recommend restoration and land rehabilitation process should be put in contex as an integral parts. [Abiodun Adegoke, Nigeria]	Noted - the comment has been forwarded to those dealing with the definitions in the glossary and the definition removed from this chapter.
14263	13	1	13	1	Figure x needs to be rectified in diagram [Lukas Van Zwieten, Australia]	Noted - but chapter 4 contains no reference to "Figure x" and certainly not at the line number listed here.
25445	13	4	13	4	To avoid any confusion, we suggest to use "land degradation and forest degradation". [, France]	Accepted
12873	13	4	13	4	Again section 4.3.3 does not seem to belong under heading 4.3. It would be better in section 4.4. [Robert Treuhaft, United States of America]	Accepted - headings have been revised
15363	13	4	13	41	Suggest considering Stafford-Smith et al. (2007) to demonstrate intimate linkages between the human and environmental components of grazing land management systems in Australia: Stafford-Smith et al 2007. Learning from episodes of degradation and recovery in variable Australian rangelands. Proceedings of the National Academy of Sciences, 104 (52) 20690-20695; DOI: 10.1073/pnas.0704837104 [, Australia]	Rejected - even if the reference is very good, it is very much drylands focused, hence Ch 3

Comment No	From Page	From Line	To Page	To Line	Comment	Response
14467	13	4	13	41	Would it be useful to bring in literature on the forest transition here and how forest trends change with societal development? The work from Jonathan Foley's 2011 paper in Science comes to mind. [Janice Ser Huay Lee, Singapore]	Noted - this is discussed elsewhere in the chapter
32463	13	4	13	41	These are important findings that should be better reflected in the SPM, also because they have consequences for the definitions of SFM and SLM in general. See also Curtis, 2018. [Simone Lovera-Bilderbeek, Paraguay]	Accepted - the executive summary has been revised
30507	13	4	13	42	need also to recognise the historical context cultural heritage can provide e.g. through archaeological understanding of changes in people and environmental relationships through time. [Hannah Fluck, United Kingdom (of Great Britain and Northern Ireland)]	Accepted - a paragraph was added
8663	13	10	13	10	scientism' the word just reminds me of a magazine discussion, do we need the sentence 9-10 ? [Louise Andresen, Sweden]	Taken into account - the text is revised
33221	13	12	13	15	Add a note on the"Target" baseline concept and its derivation from the land users expectations (IPBES LDRA Ch 4.1.4) [Stephen Prince, United States of America]	Rejected - baselines are discussed elsewhere in Ch 4
6189	13	22	13	38	This paragraph was woman biased it should be focused on gender (woman, men, youth elders and so on) [Sawsan Mustafa, Sudan]	Taken into account - the text is revised
33223	13	35	13	35	"Context specific "is jargon that may not be understood by those outside the field. "depends on...." might be better. [Stephen Prince, United States of America]	Accepted - text is revised
25447	13	38	13	40	Could you check if "community" would not be preferable to "indigenous" here ? [, France]	Accepted
33291	13	43	13	43	Although the title of sect 4.4. is said to be climate, the first 9 pages (out of 13) is general information about degradation of forests with no mention of climate. It belongs in a separate section with all the other non-climate specific material. In fact, most of the section could be summarized into a couple of paragraphs with a reference to IPBES LDRA, where there is a more comprehensive account of degradation, not just forests. [Stephen Prince, United States of America]	Noted. Text now focuses more on climate
8665	13	45	13	45	instead of the words 'borrows from' can you say 'build on' [Louise Andresen, Sweden]	Taken into account - the text is revised
40623	13		13		"a narrow focus on population growth". This would require a detailed assessment, and the conclusions to be expressed clearly. I am struck by some statements which appear to contain implicit value jugdment (e.g. scientism) and also the fact that the first paragraph relies on literature already available at the time of AR5. Why? IS there new relevant knowledge which can contribute to this? Same remark about gender, "many oft-cited sweeping statements about womens's subordination...". Please check carefully the tone, neutrality and objectivity. Having a final section on knowledge gaps could help capture the essence of limits to the assessment due to lack of evidence in literature in a more neutral way. [Valerie Masson-Delmotte, France]	Taken into account - the text is revised
31681	13	9	14	3	Water should be considered [, Brazil]	Rejected - water is part of the assessment but in other sections of this chaper

Comment No	From Page	From Line	To Page	To Line	Comment	Response
28327	13	44	14	26	This section presents a confusing description of the DPSIR framework and terminology, and how it applies to land degradation. It is inconsistent with the LDN conceptual framework (Orr et al 2017; Cowie et al 2018), that maps the DPSIR framework to land degradation. Responses should include policies and interventions. Processes are confusingly described as direct mechanisms by which land is degraded, but then also claimed to be equivalent to "state" in the DPSIR terminology. Rather, state is the condition, while processes are the causal link between pressures and state. Exact demarcation between drivers and processes is said to be impossible; but if processes are direct (biophyical) mechanisms of degradation then drought and wildfire are clearly drivers, while prescribed burning is a pressure. The relevant degradation processes associated with drought and fire include wind erosion and loss of vegetation and organic matter. [Barron Joseph Orr, Germany]	Taken into account - the text is revised
166	13	5		7	very long statement. Make sentence simple and readable [Chukwuma Anoruo, Nigeria]	Rejected
27063	13	27			Please specify these "several other factors" [, Germany]	Accepted - text is revised
2315	13	27			"several other factors" - could you give examples of such factors? [Nina Hunter, South Africa]	Accepted - text is revised
12025	13	38			It is unclear whether "indigenous" here refer to "indigenous forest" or to "indigenous maganement systems" - could you rephrase the expression for more clarity? [Hans Poertner and WGII TSU, Germany]	Taken into account
33155	14	15	13	16	Please add comma after "decision making" on line 15. [Elohor Freeman Oluowo, Nigeria]	Accepted
30295	14	1	14	1	Figure 2: "disruption of water cycles" and "habitat degradation" should be moved from Impact to State. Impacts are impacts on people and relate to ecosystem services. Every circle in the DPSIR chain has a past, present and future 'state'. Future 'impacts' on the water cycle and habitat (degradation) are therefore part of the (future) State. Loss of water availability and access or food production are typically Impacts. Climate can be seen as State but also as Impact being a 'service' of land. A matter of definition. [, Netherlands]	Noted - This section has been removed
4257	14	1	14	1	Remember to update "Table 4.1 and Figure 4.x" in the text of of "State" in Figure 4.2 [Lee-Sim Lim, Malaysia]	Noted - This section has been removed
12875	14	1	14	1	Figure 4.2 is confusing. Doesn't climate change result from agricultural practice, which in turn reuslts from land use policies? Why isn't there red in the Pressures balloon? The bottom State balloon says Land Degradation while the arrow pointing to it says "reverse land degradation". I suggest eliminating this figure and the DPSIR framework. It adds little and actually confuses, as presented. [Robert Treuhaft, United States of America]	Accepted - This section has been eliminated
21733	14	1	14	12	It is unclear why the DPSIR framework as presented uses degradation processes in the STATE field as in most instances state is used to refe to the state of the biophysical (or social-economic) environment. [Graham von Maltitz, South Africa]	Noted - This section has been removed
8993	14	1	14	12	The use of "state" in the DPSIR framework for the land degradation process, rather than the state of the land seems out of keeping with the normal use of "state" in DPSIR type frameworks. [Jean-Luc Chotte, France]	Noted - This section has been removed
39301	14	2	14	2	Put 'LD' in parentheses after 'land degradation' (acronym occurs in Figure 4.2). [, United States of America]	Noted - This section has been removed
2317	14	2	14	3	Please insert source for the figure information which is cited on the previous page [Nina Hunter, South Africa]	Noted - This section has been removed

Comment No	From Page	From Line	To Page	To Line	Comment	Response
33501	14	2	14	9	Pressures' should include also forestry practices. Impacts should include biodiversity decline and disrupts in critical ecosystem services and processes. In the text, processes are said to link the pressures to state, but in the figure, processes are under state. [Jenni Nordén, Norway]	Noted - This section has been removed
8667	14	12	14	12	the Millenium Ecosystem Assessement' the reference is missing [Louise Andresen, Sweden]	Accepted - reference was added
21799	14	13	14	14	How comprehensive is the list of processes in table 4.1. given the huge number of prosesses in the literature, does 4.1 cover all processes? [Graham von Maltitz, South Africa]	Noted - the list is developed on the basis of the chapter team's scientific understanding.
33225	14	15	14	17	A couple of examples of indirect drivers would help here. [Stephen Prince, United States of America]	Accepted - exampels are provided
30297	14	24	14	26	Climate change is a process indeed. For climate and land to interact CC and LD can have two positions in the DPSIR frame, dependent on the aim of the assessment. CC is a driver of LD (State), and LD is a driver of CC (State or Impact). The opposition 'climate change is either a process or a driver of LD' is not appropriate. [, Netherlands]	Noted - This section has been removed
40625	14		14		I find Figure 4.2 quite different to apprehand. Climate change is only displayed through atmospheric aspects (what about sea level rise, glacier retreat, permafrost thawing…)? Permafrost degradation does not involve pressures, so that the arrows may not work as displayed. Please check carefully. [Valerie Masson-Delmotte, France]	Noted - This section has been removed
27065	14	1			Please mention "Mitigation of climate change" as in the oval on "Responses" as this is the most important option along with "adaptation". [, Germany]	Noted - This section has been removed
13281	15	1	15	16	Whilst the biophysical processes involved in land and forest degradation were given substantive attention the absence of any mention of the specific impacts of human drivers of roads and fragmentation is concerning given the growing evidence that, e.g., mineral and hydrocarbon extraction and infrastructure are increasingly significant drivers of forest loss (thereby carbon stocks), greenhouse gas emissions, and threats to the rights of forest communities in forested areas of Amazonia, Indonesia, and Mesoamerica (Bebbington et al. 2018). The lasting impacts of fragmentation, including from infrastructure, on resilience of ecosystems and their biodiversity and their capacity for climate change mitigation are well known (Haddad et al. 2015), The scale of the problem has been clearly demonstrated and the facilitation by roads of 'contagious development' has been recognised (Ascensão et al. 2018; Ibisch et al. 2016). • Ascensão, F., Fahrig, L., Clevenger, A.P., Corlett, R.T., Jaeger, J.A.G., Laurance W.F. and Pereira, H.M. (2018). Environmental challenges for the Belt and Road Initiative. Nature Sustainability 1: 206-209. • Bebbington, A.J., Bebbington, D.H., Sauls, L.A, Rogan, J., Agrawal, S., Gamboa, C., Imhof, A., Johnson, K., Rosa, H., Roya, A., Toumbourou, R. and Verdum, R. (2018). Resource extraction ad infrastructure threaten forest cover and community rights. PNAS 115(52): 13164-13173. • Ibisch P.L., Hoffmann, M.T., Kreft, S., Pe'er, G., Kati, V., Biber-Freudenberger, L., DellaSala, D.A., Vale, Mariana M., Hobson, P.R. and Selva, N. (2016). A global map of roadless areas and their conservation status. Science 354(6318): 1423-1427. [Aila Keto, Australia]	Accepted - text is inserted

Comment No	From Page	From Line	To Page	To Line	Comment	Response
33157	15	1	15	48	Please replace "lead" on line 1 to "led" for it best link the cited work to the present report. The sentence on line 23 from after " include would need some clarity, and I have suggest it reads " …includes impacts on transport and deposition areas as well as, deposition areas having their soils improved by these inputs, although less common. On line 28, replace "particularly" with "particular" or possibly replace the entire statement after processes on line 23 to "... with substantive reports linking it to climate change." And please replace "range" on line 40 with "such as", and delete "from" and the comma after "depletion" on line 41 So also, add "a" before "more" on line 42. And on line 48, please replace "process" with "processes" [Elohor Freeman Oluowo, Nigeria]	Accepted - "lead" changed, erosion sentence fixed by the use of "detachment" instead of "erosion", "particulalry" changed, and the rest of the comments included
33227	15	2	15	2	Much of the IPBES LDRA catalogs this "..large array...". A citation would be appropriate. [Stephen Prince, United States of America]	NOTED - We still want to present them here in the face of their specific links to climate change
33679	15	3	15	6	Initially, soil degradation starts from detachment of soil particles (e.g. modifies soil structural unit), splash erosion and sheet erosion and develops to rill, gully formation and bank. Detachment of particles can be initiated by both biotic and biotic agents and transported and deposited in-site and/or off-site. Thus, including of these steps and process might be important here. Refer (Lal 2001. land degradation & development. Land Degrad. Develop. 12: 519-539 (2001) DOI: 10.1002/ldr.472) Soil erosion involves `work' through a three-stage process: (1) detachment, (2) transport, and (3) deposition of soil. There are four principal sources of energy: physical such as wind and water, gravity, chemical reactions, and anthropogenic perturbation such as tillage [, Norway]	ACCEPTED - Detachment is used in the new version for more clarity
12877	15	4	15	5	"ecological integrity" and "human value" are not technically defined. They are mentioned repeatedly, and always together, but their exact, precise meaning is not defined. Does ecological integrity mean "able to host proeductivity? Maintain diverse habitats to sustain biodiveristy? Imprecise verbiage without definitions shoud be avoided. [Robert Treuhaft, United States of America]	NOTED - These two concepts were expanded in the text and also more clearly explained in the definition section above this one
15365	15	9	15	13	Suggest clarifying that SOM will not only be affected by rising temperature - Precipitation and soil wetness are also important variables to explain spatial patterns of SOC: Ise and Moorcroft (2006), The global-scale temperature and moisture dependencies of soil organic carbon decomposition: An analysis using a mechanistic decomposition model, Biogeochemistry, 80, 217– 231. Viscarra Rossel et al 2014. Baseline map of organic carbon in Australian soil to support national carbon accounting and monitoring under climate change. Global Change Biology, 20(9), pp.2953-2970. [, Australia]	NOTED - GCB reference added and text includes now precipitation shifts
33503	15	9	15	13	Forestry leads to lower organic matter pools in the soils, which may affect productivity. References: Ochoa-Hueso 2019: Ecosystem type and resource quality are more important than global change drivers in regulating early stages of litter decomposition. Soil Biology and Biochemistry 129: 144-152. Achat et al. 2015: Forest soil carbon is threatened by intensive biomass harvesting. Sci Rep. 2015; 5: 15991. [Jenni Nordén, Norway]	NOTED - Forestry effects can go in multiple directions, effects are noted in TABLE 4.2
21119	15	12	15	14	I would question using the reference Bellamy et al 2005 here as the climate warming cause of carbon loss has been disputed. See: https://doi.org/10.1111/j.1365-2486.2007.01458.x https://doi.org/10.1111/ejss.12253 [, United Kingdom (of Great Britain and Northern Ireland)]	ACCEPTED - We changed that reference for Crowther et al, which is newer and has more robust evidence

Comment No	From Page	From Line	To Page	To Line	Comment	Response
21735	15	17	15	20	The entire logic of the “entry point’ used in table 1.1. and most of section 4.4.1.1 is unclear as a classifier for degradation processes. Many erosion processes derive from vegetation change and it is not clear how “erosion” is an entry point, rather it would be a consequence. Given the diverse drivers of erosion it is also not a useful way of consolidating an understanding of processes. [Graham von Maltitz, South Africa]	ACCEPTED - We changed "entry point" with "focus" indicating that is the component of the system in which degradation is being looked at but not necessarely the component in which the initial pressure on the system was exerted
8995	15	17	15	20	Just a note: soil as an "entry" point is difficult as soil processes typically are closely linked to vegetation and animals. For instance soil erosion is often a consequence of vegetation change and the reduction in vegetation cover. Although biotic processes are mentioned later, this section covers vegetation clearing, but seems to skip simple vegetation reduction from factors such as overgrazing, harvesting of trees etc. [Jean-Luc Chotte, France]	NOTED - We agree that the "ultimate" entry point is always hard to define, and in many cases soil process are initiated by vegetation changes. Yet, they can start directly at the soil as it happens in many agricultural systems. We link the following biotic processes, when appropriate, to erosion, offering the possibility of arriving to erosion from a biotic entry point. Overgrazing and tree harvesting are now included in table 4.1.
8669	15	18	15	18	delete the words 'or major entry points' [Louise Andresen, Sweden]	Taken into account - the text is revised
33229	15	18	15	18	Maybe worth noting that a single human activity can result in several "entry points" . [Stephen Prince, United States of America]	ACCEPTED - We changed "entry point" with "focus" indicating that is the component of the system in which degradation is being looked at but not necessarely the component in which the initial pressure on the system was exerted
8671	15	21	15	21	instead of the word 'cultivation' can you say 'agriculture' ? [Louise Andresen, Sweden]	ACCEPTED - word changed

Comment No	From Page	From Line	To Page	To Line	Comment	Response
6701	15	22	15	27	In its present state, a clearer text on land degradation, soil erosion and sediment transport is missing. I would suggest to complete 3.8.8.1 and 4.4.1.1. subsections. I can further interact with you to clearly separate the two contributions from the following suggestion: "Land degradation by accelerated erosion (Lal, 2001; Poesen, 2018) can be studied with care from sediment transport in streams and sediment budgets. On a global scale, the flux of particles from rivers to the sea is estimated at 20 Gt of sediments per year (Ludwig and Probst 1998, Walling 2009, Ouillon 2018), i.e., 630 tonnes per second, which correspond on average to a net denudation of a ~6.2 cm thick layer on all soils every 1000 years (Inman and Jenkins 2003). This flux is of the order of 13 to 40% of the particles eroded in watersheds (total soil loss estimated between 40 and 75 Gt yr-1), the difference being explained by the massive downslope deposition of particles eroded within basins prior to their arrival at the marine interface, which is shaping landscapes (Robinson 1977, Walling and Webb 1996, Wilkinson and McElroy 2007, Warrick et al. 2014, FAO 2015). Despite its global importance, estimates of soil erosion differ significantly, depending on scale, study period and method used (Boix-Fayos et al., 2006, García-Ruiz et al., 2015). Sediment budgets have been strongly constrained by human settlements and other activities since man settled in the Neolithic (Hooke, 2000; Meybeck, 2003; Syvitski et al., 2005; Reusser et al. 2015). Human activities have both increased soil erosion (Milliman et al. 1987, Wilkinson 2005), and decreased sediment supply to the oceans due to dam retention (Syvitski et al., 2005; Syvitski and Kettner, 2011). The recent decrease in river particulate discharges due to reservoirs can reach 75% like in the Mekong River (Ha et al., 2018) or 95% like on the Nile and Ebro rivers. It is estimated at 25–30% of the total or 4–5 Gt yr−1 at global scale (Vörösmarty et al., 2003). In addition to changes which are attributed to anthropogenic actions such as intensification of agriculture, deforestation, forest fires, urbanization, river-training structures, bank revetments, climate change is strongly impacting erosion (Zhang and Nearing, 2005; Ziadat and Taimeh, 2013; Li and Fang, 2016). Enhanced erosion may be directly caused by an increase of precipitation, by increasing precipitation variability, even in the case of decreasing rainfall, due to increased frequency of large storms (Zhang and Nearing, 2005) which increases the susceptibility of soils to erosion (Vachtman et al., 2012), such as it was already shown in Algeria (Achite and Ouillon, 2007, 2016; Megnounif and Ghenim, 2016). However, soil management measures can be applied regionally to reduce soil erosion such as increasing the spatial extent of forests, rehabilitating degraded forests, erosion control,	NOTED - We appreciated this detailed comment, however many comments have indicated the need to focus on climate change-relevant degradation processes. This addition would take away the focus from there into more detailed aspects of sediment transport
39303	15	24	15	27	The process of soil erosion has three components: detachment, transport and deposition. Here the term soil erosion seems to only indicate detachment and needs to be corrected. [, United States of America]	ACCEPTED - "Detachment areas" is used now
8673	15	25	15	25	explain here what siltaion is [Louise Andresen, Sweden]	ACCEPTED - explained
21947	15	26	15	26	Long-distance transport of dust from e.g. the Sahara could be added after dune field expansion/displacement. [Anna Tengberg, Sweden]	ACCEPTED - Africa-Amazon dust fertilization is now presented
40187	15	29	15	29	land-ocean interphase?? [Thelma Krug, Brazil]	ACCEPTED - now "coastal areas"
26161	15	33	15	33	Insert "moderate" before "sea level rise" [Reid Detchon, United States of America]	ACCEPTED - word included
17031	15	38	15	38	subsidence is not necessarily caused by the deplition of ground water, but more generally when lowering the ground water table , as in areas of peat. The terms "depeltion" should be modified accordingly. [Roland Hiederer, Italy]	ACCEPTED - we changed depletion by level lowering

Comment No	From Page	From Line	To Page	To Line	Comment	Response
33505	15	44	15	45	Forestry leads to reduced organic matter pools in the soils, which may affect productivity. The effect is stronger if logging residues and stumps are collected for biofuel. References: Ochoa-Hueso 2019: Ecosystem type and resource quality are more important than global change drivers in regulating early stages of litter decomposition. Soil Biology and Biochemistry 129: 144-152. Achat et al. 2015: Forest soil carbon is threatened by intensive biomass harvesting. Sci Rep. 2015; 5: 15991. [Jenni Nordén, Norway]	ACCEPTED -Achat reference is now included
39305	15	44	15	48	Although the major chemical degradation process in the context of climate change is depletion of organic matter (although this can be associated with physical and biological degradation as well), acidification is also quite relevant, often occurring as carbonates are lost via CO2 evolution from acidifying soils. [, United States of America]	ACCEPTED - We now included this process in the table citing recent literature (Ahmad et al. 2015 - Soil Research)
21121	15	47	15	48	I would suggest deleting the Bellamy et al 2005 reference as the findings that climate warming is the cause of most of this loss has been disputed. See: https://doi.org/10.1111/j.1365-2486.2007.01458.x https://doi.org/10.1111/ejss.12253 [, United Kingdom (of Great Britain and Northern Ireland)]	ACCEPTED - We now cite Crowther et al. 2016 - Nature
17033	15	48	15	48	This is not what the paper from Bellamy et al. 2005 stated. Rather, the autors saw the effect of climate change as a possibility of the losses in SOC found in the data analysed. The paper was criticised by Smith et al, 2007 and Potte et al., 2009. No change in topsoil OC levels of soil samples for GB was found by Chamberlain et al., 2010. In a later article (Kirk and Bellamy, 2010) the authors state explicitly: "Therefore, in agreement with Smith et al. (2007), we rule out a direct temperature effect as the main explanation for the observed carbon changes. " [Roland Hiederer, Italy]	ACCEPTED - Bellamy et al paper has been removed and the statement adjusted with more references
17035	15	48	15	48	Smith, P., Chapman, S. J., Scott, W. A., Black, H. I. J., Wattenbach, M., Milne, R., Campbell, C. D., Lilly, A., Ostle, N., Levy, P. E., Lumsdon, D. G., Millard, P., Towers, W., Zaehle, S., and Smith, J. U.: Climate change cannot be entirely responsible for soil carbon loss observed in England and Wales, 1978–2003, Global Change Biol., 13, 2605–2609, 2007. Potts, J. M., Chapman, S. J., Towers, W., and Campbell, C. D.: Comments on 'Baseline values and change in the soil, and implications for monitoring' by RM Lark, PH Bellamy & GJD Kirk, Eur. J. Soil Sci., 60, 481–483, 2009. Kirk, G. J. and Bellamy, P. H. (2010), Analysis of changes in organic carbon in mineral soils across England and Wales using a simple single-pool model. European Journal of Soil Science, 61: 406-411. doi:10.1111/j.1365-2389.2010.01242.x [Roland Hiederer, Italy]	ACCEPTED - Bellamy et al paper has been removed and the statement adjusted with more references
1847	15	48	15	48	process -> processes. [William Lahoz, Norway]	Accepted
40627	15		15		Again, references in the first paragraph are from 2005 and 2007. No recent literature on this topic? What new knowledge has emerged? This section (pages 15-17) would deserve to provide clear links to other chapters, in particular chapter 3 (overlaps). [Valerie Masson-Delmotte, France]	ACCEPTED - Newer references are now included
13505	15	1	16	47	Far too long. Can it possibly be condensed and still convey the information? [Lourdes Tibig, Philippines]	NOTED - We shortened the section, yet many other comments ask for the inclusion or even expansion of the processes discussed

Comment No	From Page	From Line	To Page	To Line	Comment	Response
33681	15	35	16	3	The mentioned physical degradation processes cause soil structural deterioration and this is main problem parallel to the expansion of modern agriculture (e.g. use of heavy machineries). This can modify the physio - biochemical properties of soils such as organic matter content (OMC) and carbon sequestration, soil moisture and nutrient contents, soil productivity, etc. Moreover, structural deteriorated soils are most likely susceptible to degradation. Please consider to address the relationships or effect of soil structural deterioration on different soil properties and even economic implications (e. g., associated with fertilizer requirement to compensate nutrient losses and other). (Ref: Hamza and Anderson 2005, Soil compaction in cropping systems: A review of the nature, causes and possible solutions, https://doi.org/10.1016/j.still.2004.08.009 [, Norway]	ACCEPTED - reference added and sentence expanded
33683	15	40	16	42	Please consider including leaching, a process of losing of some elements due to (excessive) water/RF, is an additional chemical degradation process, e. g. acidification or groundwater quality change. This has an implication on ecological functioning and agricultural productivity. A study has confirmed that leaching losses are particularly important for the carbon balance of agricultural systems (Kindler et al 2011, Dissolved carbon leaching from soil is a crucial component of the net ecosystem carbon balance, https://doi.org/10.1111/j.1365-2486.2010.02282.x [, Norway]	NOTED - We had to exclude many specific processes in order to maintain the section more compact
8675	15	47	16	3	I think the authors should take a look at the paper by van Gestel et al. 2018 doi:10.1038/nature25745Brief Communications Arising. Also for construction the Process of Organic matter decline in table 4.1. The perspective from natural ecosystems is missing from the current text. [Louise Andresen, Sweden]	Accepted - the reference is used
33231	15	1	29	36	Section 4.4 takes the biophysical process approach rather than the causes and activities of humans. IPBES LDRA Ch 4 does the same by dealing with these two approaches separately in the two major chapter sections (4.2 and 4.3). Once again some cross-referencing would enhance both Reports. [Stephen Prince, United States of America]	NOTED - IPBES LDRA is cited in the chapter now
2319	15	36			Please define "pore volume" [Nina Hunter, South Africa]	ACCEPTED - changed to porous space crucial for holding and exchanging air and water
2321	15	43			Please define "cation depletion" [Nina Hunter, South Africa]	ACCEPTED - now exemplified to clarify
2323	15	43			"N" is refered to frequently in the chapter but to the non-scientific reader this can be confusing; please state in full throughout the chapter [Nina Hunter, South Africa]	Accepted - N (nitrogen) is explained
23201	15	45			The topic of soil organic matter can be linked to discussion in Chapter 2. Throughout the chapter, carbon emission from permafrost melting is mentioned, but carbon loss from peatlands is missing in this chapter. Peatland degradation should be assessed somewhere in this chapter. [Kaoru Kitajima, Japan]	Taken into account - degradatoin of peatlands is covered in section 10
33159	16	1	16	28	I respectfully suggest a revision of line 1 from "having in turn cascading negative effects.." to "their consequnt negative effect on their pathways on ..." Please capitalized "S" of soil organic matter. And delete "also" on line 2. And please replace "with" with "to". And on line 28, add "any" before "significant" [Elohor Freeman Oluowo, Nigeria]	ACCEPTED - corrections included
21949	16	2	16	2	Examples of the "hub" of degradation processes linked to the depletion of SOM could be given, as for example P-fixation and Al toxicity. [Anna Tengberg, Sweden]	Accepted , examples provided
33235	16	4	16	4	"Not all" implies soil is the most important. [Stephen Prince, United States of America]	ACCEPTED - wording changed

Comment No	From Page	From Line	To Page	To Line	Comment	Response
33685	16	4	16	18	Please consider the effect of water utilization for irrigation on soil and water quality. Expansion of irrigation schemes in water scarce environment, arid and semiarid and use of saline/sodic (unsuitable for irrigation) and groundwater might be additional factor for salinisation. Thus, soils are most likely to be affected by high concentration of cations, such as Nå+, Ca+, Mg+ are accumulated because of high evapo-transpiration. Salic and sodic soil horizons can develop because of the processes of salinasation and sodification, respectively. These processes are both influenced by degradation processes and climate change or vice versa! Ref. Lal (2008) "Climate change affects and is affected by soil degradation through a positive feedback due to increase in mineralization of SOC pool and the radiative forcing. [, Norway]	NOTED - In the table irrigation is mentioned in multiple ocassions
26163	16	4	16	18	This discussion should also include salinization due to subsurface saltwater intrusion near coastlines due to sea level rise (e.g., in Florida) - as well as in Table 4.1. [Reid Detchon, United States of America]	ACCEPTED - Colombani et al. 2016 reference added
18353	16	9	16	9	A reference is required here. [Gerardo Ojeda, Colombia]	ACCEPTED reference added
33687	16	11	16	14	Please reflect different views related to the findings of forest clearing and groundwater level, relevant references might be; 1) increases of groundwater levels in clearcutting (Stasik and Korytowski 2015, Analysis of groundwater level changes in clearcutting area of chosen forest habitats. 2) A study has shown that recharge tends to decrease with the increase in the density of vegetation (grassland to woodland) Oliveira S et al 2017, Groundwater recharge decrease with increased vegetation density in the Brazilian cerrado, https://doi.org/10.1002/eco.1759. 3) A study in Finland by Mannerkoski et al (2005) show that "clear-cutting did not significantly affect groundwater levels in the wells". Please consider to show wether the relationships are positively, negatively or neutral. (Additional ref: Stasik et al 2015. Trends in groundwater level changes in small forest catchments of wielkopolska. J. Ecol. Eng. 2016; 17(4):99–106 [, Norway]	NOTED - No room to expand this aspect
39307	16	19	16	39	This assumes that species changes result in ecosystem service changes. However, overall services can be maintained with different key species (system resiliency), but this is not considered. [, United States of America]	REJECTED - We just state that species composition changes can lead to degradation, not that it always does so
891	16	19	16	39	Human element and greed also need to be covered prominently in the SRCCL, being associated with processes of land degradation. Recent phenomenon of commercialisation of agriculture by companies on foreign lands is an eye-opening example in this respect. Multinational companies (MNCs) and enterprises supported by their governments have acquired huge land assets in Africa and South America. The aim is purely commercial- to maximise output in the shortest possible time by use of chemicals- fertilisers and pesticides. This in long term will negatively impact the productivity and the ecological integrity of the local landscape. A mention needs to be made in the SRCCL warning against such land acquisitions by companies for purely commercial purposes bereft of concern for local environment and ecological integrity. [Jagdish Kishwan, India]	Noted - we bring up these issues but we must not be policy prescriptive
33507	16	23	16	23	Also forest degradation in the form of forestry leads to net C losses from the soil pool, dead wood and other vegetation than trees, as well as animals and fungi. [Jenni Nordén, Norway]	REJECTED - Not all forms of forestry result in degradation, following sections give more detail on this and introduce the concept of sustainable forest management
40189	16	23	16	23	clearing processes ARE [Thelma Krug, Brazil]	ACCEPTED - correction made
33237	16	24	16	24	"Bush encroachment" is a widely used term, much more so than "thicketization" - could add it here. [Stephen Prince, United States of America]	Accepted

Comment No	From Page	From Line	To Page	To Line	Comment	Response
33689	16	29	16	32	How is "stable compositions" defined? Disturbance can facilitate the dominance of disturbance-tolerant native and invasive species (Berhane et al 2015, DOI: 10.1016/j.jaridenv.2014.11.001). Moreover, selective grazing can also facilitate dominance of invasive species. [, Norway]	NOTED - notion of stability removed
33239	16	29	16	32	Thresholds exist for many other grassland degradation processes, not just species composition. [Stephen Prince, United States of America]	NOTED - not clear what change is requested
33691	16	31	16	32	Please consider to explain further how selective grazing is related to higher carbon sequestration potential. Depending on the intensity of grazing and grazers, selective grazing may increase dominance of unpalatable species relative to palatable species. Species in the early stage, young are most likely to be palatable than mature stages (unpalatable). On the other hands, carbon sequestration are relatively higher at young stages than late stages. The former have relatively fast growth rate. A study in Norway in the tundra vegetation has shown that the impact of grazing on above- ground carbon and below ground soil carbon stocks did not depends on the grazing intensity but site (Ylänne et al 2018, Consequences of grazer-induced vegetation transitions on ecosystem carbon storage in the tundra). Carbon sequestration might also be affected by rangeland types (e.g. shrub dominated rangeland) and intensity and frequency of grazing. In general, the relationship between grazing and SOC are complex (Piñeiro et al 2010). [, Norway]	Accepted - clarifying text has been added
39309	16	32	16	32	Expand upon the rationale behind "selective logging" as a pervasive cause of degradation. In other chapters, it is part of sustainable forest management practices. Ideally selective logging can provide many different ecosystem benefits if done properly. Perhaps selective logging is not the intent in this section? Recommend clarifying that only poorly planned/executed selective logging is harmful. [, United States of America]	ACCEPTED - we use the word "extractive"
23205	16	32	16	34	It is misleading to state that selective logging is a perfasive cause of degradation. Bad selective logging is, but reduced impact logging and other sustainable forest management can make difference in degrees of forest degradation. Perhaps a matter of specifying what kind of selective logging leads to degradation. For example, conventional selective logging, unplanned selective logging, selective logging without management plans. [Kaoru Kitajima, Japan]	ACCEPTED - we use the word "extractive"
33693	16	34	16	39	Biological invasion is one of the environmental challenge that is likely to affect ecosystems functioning such as carbon pool, nutrient and water dynamics. Peltzer et al (2010) reviewed on the impacts of biological invasive species showed that the direct effects of invaders on forest C are often smaller and shorter-term than their indirect effects caused by altered nutrient availability, primary productivity or species composition, all of which regulate long-term C pools and fluxes.Please consider to describe the relationship between biological invasion and land degradation. [, Norway]	ACCEPTED - point included together with suggested reference
24189	16	37	16	38	The importance of alien invasive plants in tropical an sub tropical forests has been underplayed, if mentioned at all. In Sout Africa it is a major factor causing forest degrdation , in particualrly of forest margins that become infested with highly flamable alien plant material. In addition aline creepers get intot the top canopy and can eventualy kill canopy trees. (documented by Berliner, 2009) [Derek Berliner, South Africa]	ACCEPTED - forests are now included
33695	16	42	16	42	Please consider to include eutrophication in the SRCCL SOD Glossary. [, Norway]	ACCEPTED - eutrophication defined
33509	16	42	16	44	Also forestry causes shifts in soil microbial and mesofaunal composition. [Jenni Nordén, Norway]	NOTED . A whole line of biotic changes in the soil has been added

Comment No	From Page	From Line	To Page	To Line	Comment	Response
2859	16	47	16	47	Please consider adding "Rodriguez-Caballero et al., 2018" as a second reference after Reed et al., 2012. [Bettina Weber, Germany]	ACCEPTED - very relevant reference, it was added
2861	16	47	16	47	Rodriguez-Caballero, E., J. Belnap, B. Büdel, P. J. Crutzen, M. O. Andreae, U. Pöschl, and B. Weber, 2018: Dryland photoautotrophic soil surface communities endangered by global change. Nat. Geosci., 11, 185-189. [Bettina Weber, Germany]	ACCEPTED - very relevant reference, it was added
12027	16	3			If these specific mitigation options are dealt with later on in the chapter, please provide a link to the relevant section. if not, consider either removing statement or providing more details on the mitigation options [Hans Poertner and WGII TSU, Germany]	ACCEPTED - mitigation sentence removed
21999	16	7			Correct "(…) and ecosystems", the word "and " does not make sense [Vanda Acácio, Portugal]	ACCEPTED - correction made
12029	16	15			Jargon, explain paludification [Hans Poertner and WGII TSU, Germany]	ACCEPTED - word eliminated
17195	16	32			Did you mean "extractive logging"? [José Alfonso Domínguez-Núñez, Spain]	ACCEPTED - we use extractive to make clear that it is a non sustainable selective use of the forest
3247	16	34			Given the definition provided for land degradation, and the clarification that negative impacts of invasive species are considered land degradation, a discussion of the consequences of climate change on invasive species is strangly lacking (apart from a brief mention 36 - 39). See Hellman et al, 2008 - Five potential consequences of climate change for invasive species for review). The impact of climate change on invasive species is nuanced. In some cases, invasive plants may store more carbon than displaced natives (see Liao et al 2008, Altered ecosystem carbon and nitrogen cycles by plant invasion: a meta-analysis) and Davidson et al, 2018, Differential effects of biological invasions on coastal blue carbon: A global review and meta-analysis). Indeed, in some cases, invasive species may be considered positive for climate mitigation and adaptation (e.g. bigger and faster growing coastal plants that will ameliorate sea level rise) but this is controversial. [John Devaney, Ireland]	Accepted - text and references have been added
2325	16	42			Please define "eutrophication" [Nina Hunter, South Africa]	ACCEPTED - text fixed
41643	17	1	17	10	The drought induced by climate change direct influences over land degradation processes [Cristobal Felix Diaz Morejon, Cuba]	NOTED - this effect is mentioned throughout the chapter
21737	17	1	17	20	Changes in NPP from climate change seem to be missing, this will be particularly relevant to areas that get both dryer and hotter. Also climate variability is missing, and the impacts of climate change on climate variability. More intense but less frequent rainfall could, for instance, have major erosion impacts. [Graham von Maltitz, South Africa]	NOTED - this was included in the table, which now has more accompanying text
8997	17	1	17	20	Changes in NPP from climate change seem to be missing, this will be particularly relevant to areas that get both dryer and hotter. Also climate variability is missing, and the impacts of climate change on climate variability. More intense but less frequent rainfall could, for instance, have major erosion impacts. [Jean-Luc Chotte, France]	NOTED - this was included in the table, which now has more accompanying text

Comment No	From Page	From Line	To Page	To Line	Comment	Response
893	17	2	17	20	Although formal studies are lacking, it is being observed in many parts of India that human-wildlife conflict is on the rise because of stresses brought about by climate change. Non-availability of adequate food and water for the wild animals due to water and heat stress possibly because of climate change compels them to venture out of their habitats and raid agricultural crops in the nearby villages. Some of the villages in Uttarakhand State of India have been so badly impacted by rising population of monkeys and wild pigs destroying agricultural crops that many villagers have been forced to abandon agriculture and their village to migrate to nearby cities to earn livelihood. These lands are no longer producing agricultural crops, but are gradually being taken over by natural vegetation. This loss of productivity due to climate change according to SRCCL definition will mean degradation of land, and therefore needs to be flagged in the SRCCL. [Jagdish Kishwan, India]	NOTED - yet, not included for space reasons
33511	17	4	17	10	Forestry and climate change affect the communities of soil saprotrophs and mycorrhizal fungi, as well as dead wood (C stock) volumes in forests. How changes in soil communities affects cricitical processes such as carbon sequestration is not well known, but there are indications of higher species richness leading to higher sequestration (e.g. Ratcliffe et al. 2017). Production forests may therefore have higher C emissions from soil than natural forests. Warming temperature and increased precipitation may lead to higher CO2 respiration rates from the soil, but this is not certain, as it depends on how the communities in the soil will change. Reference: Ratcliffe et al. (2017). Biodiversity and ecosystem functioning relations in European forests depend on environmental context. Ecology Letters 20, 1414-1426. [Jenni Nordén, Norway]	NOTED - reference and topic added
1849	17	5	17	5	Elsewhere you have salinisation, instead of salinization. [William Lahoz, Norway]	ACCEPTED - now is sallinization
39311	17	8	17	8	Increases in wildfire frequency and severity is another important entry point, and have interactions with the other entry points, such as insect and pathogen outbreaks and soil erosion. [, United States of America]	NOTED- the issue is included as a full line in the table
28329	17	10	17	10	deforestation is a pressure not a LD process, according to the definition given on page 14, as direct mechanisms by which land is degraded [Barron Joseph Orr, Germany]	ACCEPTED - deforestation has been removed
13507	17	11	17	20	Where are the traceable accounts? [Lourdes Tibig, Philippines]	NOTED - the text supporting the table has been expanded and references added
23203	17	15	17	17	Peatland degradation should be mentioned here. [Kaoru Kitajima, Japan]	ACCEPTED - peatland degradation is now included
33513	17	18	17	19	"(i.e. croplands", forests [Jenni Nordén, Norway]	REJECTED - not clear
40629	17		21		I have a major concern with the long table here. How traceable is this table and its material to the assessed literature? What is the associated confidence level (evidence, agreement) for each item? What belongs to natural climate variability and human induced climate change? Are impacts observed or potential, projected? [Valerie Masson-Delmotte, France]	ACCEPTED - accompanying text now introduces references
2327	17	6			Please define "sodification" [Nina Hunter, South Africa]	ACCEPTED - introduced in the accompanying text
18355	18	1	18	7	Table 4-1, Processes: Water erosion, Impacts of climate change-Other pressures: illegal minery or legal minery but whithout following enviromental care measures [Gerardo Ojeda, Colombia]	REJECTED - we cannot cover all cases here
15367	18	1	18	7	Suggest clarifying in Table 4.1 how wind erosion will have a climate change consequence of enhanced weathering. [, Australia]	NOTED - enhanced weathering removed

Comment No	From Page	From Line	To Page	To Line	Comment	Response
15369	18	1	18	7	Suggest increasing the amount of discussion on acidification in Table 4.1 (where only salinity is discussed in detail). Currently, acidification is only discussed with respect to nitrogen fertilization. However, there is also a potential for drought-induced acidification of riparian zones where acid sulfate soils are present: Hall et al (2006). "Distribution of inland wetlands with sulfidic sediments in the Murray–Darling Basin, Australia." Science of the Total Environment 370: 235-244. [, Australia]	NOTED - case of sulfidic wetlands added
30299	18	1	18	7	How to deal with land conversion (natural to cultivated land)? Or is that covered by a combination of the listed processes in the left column? [, Netherlands]	NOTED - land conversion has been much more discussed in chapter 2, here we opted to focus on degradation processes beyond land conversion
33697	18	1	18	7	Some of soil process such as leaching, humification, aggregation, formation of secondary carbonates processes can have effect on land degradation and climate changes or visa-versa (Lal 2008). [, Norway]	NOTED - yet, we cannot enter in too much detail for space reasons
33699	18	1	18	7	Table 4.1. Wind erosion is influenced by relief (mostly high in flat areas) and soil structural properties. Structural deteriorated and loss soils are susceptible to wind erosion. Moreover, dust can also act as a "condensation nuclei". [, Norway]	NOTED - dust effects on climate added
33701	18	1	18	7	Table 4.1. Water erosion is also influenced by slop-length (SL) (mostly high in sloppy areas) and soil erodibility. [, Norway]	NOTED - yet, fixed context variables are not discussed here
39313	18	1	18	7	Likely more correct to replace term "redeposition" with "deposition" unless another meaning is relevant? [, United States of America]	ACCEPTED - change made
14471	18	1	18	7	Under the intensity of effects ('feedbacks on climate change') - would it help to have a rough estimate of what 'low', 'medium' and 'high' entails? For example some values of GHG emissions that are considered low, medium and high. [Janice Ser Huay Lee, Singapore]	NOTED- It is difficult to have a unique scale given the fact that both biophysical and GHG effects are considered, we opted for a qualitative scale which allows to rank process rather than to make absolute estimates. For absolute estimates, see other chapters, particularly chapter 2
1851	18	1	18	7	Indicate in the caption to Table 4.1 that you write some terms in red and blue. [William Lahoz, Norway]	NOTED - makes reference to cooling/warming effects
8677	18	7	18	7	in the caption you talk about consequences on climate change, but in the table this category is not presented, do you mean this is the same as Impacts of climate cange ? [Louise Andresen, Sweden]	NOTED - now clarified
40291	18	12	18	12	The text in chapter 2 does not include grassland /savannah (see page 7 lines 23-23 in chapter 2). [Thelma Krug, Brazil]	Noted - unclear comment
17329	18		18		Table 4.1:Using red font for "high" impact and black bold for "medium" is a good visual way to quickly assess the impact in Table 4.1. However this should be homogenized throughout Table 4.1 (which is not the case at this point). [Maria Helena Cruz de Carvalho, France]	NOTED - this coding was improved
2949	18		18		Into the table, the impacts of climate change on water erosion include “Increasing rainfall intensity (high confidence on effect and trend). Indirect effects of climate change on fire frequency/intensity, permafrost melting, biomass production are likely to be more important.” Indirect effects of climate change on seasonal snow melting followed by runoff should be taken into account for the near future, though such impact can be neglected for the far future. [Qiang Yu, China]	NOTED - not included for space reasons
39315	18	1	20	7	Climate change consequences could also include "under soil nutrient depletion, greater use of synthetic fertilizers (e.g., N), accelerated acidification and consequent lime applications (leading to CO2 evolution), greater nitrous oxide emissions". Water logging could increase nitrous oxide emissions. [, United States of America]	NOTED - lime case added
27067	18	1	21	1	Please indicate the levels of scientific knowledge possibly by adding an additional column in the grey and the blue box each. In the blue box, please indicate if the feedback is positive or negative. [, Germany]	rejected - even if we agree with the comment, we have decided not to do so because it would make the already very complex and big table even bigger and hard to read.

Comment No	From Page	From Line	To Page	To Line	Comment	Response
33703	18	1	21	1	The authors should consider explanation why the entry points (proximity, dominance), intensity of chemical, physical and biological effects are represented by different color (e. g. coastal erosion-red, Woody encroachment-blue and black). [, Norway]	NOTED - makes reference to cooling/warming effects
39317	18	1	21	1	Change "permafrost melting" to "permafrost thawing" throughout the table. [, United States of America]	ACCEPTED - change made
39319	18	1	21	1	It is unclear what the font color differences represent. [, United States of America]	NOTED - makes reference to cooling/warming effects
39321	18	1	21	1	Include drainage of wetlands in this table. [, United States of America]	NOTED - it is already in. "Drying of continental waters/wetlands/lowlands"
39323	18	1	21	1	It is unclear what the term "ambiguous" means in Table 4.1. Would it be better indicated as "unknown" or "not much known"? [, United States of America]	ACCEPTED - change made
12031	18	1	21	1	This table is very long (4 pages) which does not make it very helpful. Having to read sideways does not improve it. Could it be moved to the Supplementary Material, and could perhaps a simpler figure take its place in the chapter that then refers to details provided in the Sup. Mat? The easiest change might be to replace the ratings high, medium, low etc. by symbols. Please also stick to the IPCC styleguide for Figures & Tables when formatting tables. The current format is difficult to read [Hans Poertner and WGII TSU, Germany]	NOTED - accompanying text has been added
12033	18	1	21	1	Confidence language is used very inconsistently throughout the table. Where confidence statements are used in the table, it is unclear where they originate from - could the relevant sections within Chapter 4 please be indicated [Hans Poertner and WGII TSU, Germany]	Taken into account - confidence language has been changed and made more consistent
12035	18	1	21	1	It is unclear in what order the processes are arranged - importance? Area affected? [Hans Poertner and WGII TSU, Germany]	NOTED - the sequence follows the type of focus point moving from soil to water to biota
12037	18	1	21	1	Please ensure this table is streamlined with Table 4.2 to avoid repetition/redundancy. Please consider the use of symbols/icons in that table [Hans Poertner and WGII TSU, Germany]	NOTED - symbols used
33241	18	1	21	1	A very useful table! The entire chapter might be better and more to the point if it was organized like this, with each process followed by climate impacts and feedbacks. It would maintain the climate focus and reduce some of the material on processes that are not affected by, or affect, climate. (Note, this is a much more serious problem in the current version of Chapter 3) [Stephen Prince, United States of America]	NOTED - thanks
17477	18	1	21	1	The degradation of intact AND managed secondary forests is missing in this table. Illegal logging and road building play a major role for the degradation of intact forest landscapes. The overuse through industrial and often so called "sustainable forest management" also leads to a degradation of managed forests. Especially degraded forestry plantation landscapes lack the resilience to climate change and can cause severe dangers to local populations due to increased fire risks. The attempt to increase the resilience to land degradation of degraded secondary forests through more ecological management, including restoration towards more natural forest structures, should be included in this table. [Taehyun Park, Republic of Korea]	Noted - deforestation was included as degradation process but was taken out after the FOD review. We consider forests degradation and deforestation as processes which can lead to degradatation but they are not inherently degradation.
21797	18	1	21	30	This table is not referenced and it is unclear as to how it was derived. Is this simply the author teams perspectives or was there some rigerouse aproach to defining elimants in the table? This needs to be specified. [Graham von Maltitz, South Africa]	NOTED - the table comes from the literature assessment and the team effort to synthesize, references are now added in accompanying text

Comment No	From Page	From Line	To Page	To Line	Comment	Response
12879	18	1	21	44	Table 4.1 rolls out way too many features to be digested by the reader. The 5 most important processes should be mentioned and explained in technical detail. No references are given. Where do these assessments come from? How can we be sure they are correct? There is a real danger of making the story too complex. No one will retain all of the processes enumerated. I strongly recommend simplifying and reworking Table 4.1. It will not speak to many people. [Robert Treuhaft, United States of America]	NOTED - reference added in accompanying text and discussion of the most relevant process in terms of effects on CC and susceptibility to CC have been added
41565	18		21		Table 4.1 - I suggest include the extraordinary events - the effects over lands and soils of hurricanes, earthquakes, [Cristobal Felix Diaz Morejon, Cuba]	NOTED - not room for all possible extreme events, yet extreme events are highlighted
15133	18		21		It is important to specify the sources of the information and data contained in Table 4.1 [Ibouraïma Yabi, Benin]	NOTED - accompanying text shows them now
4259	18		21		Table 4.1 is very good, successfully summarise all the listed land degradation processess with assessment on a few aspects to estimate its impact to climate change. [Lee-Sim Lim, Malaysia]	NOTED - thanks
2329	18		21		Why are some responses highlighted in red and others in blue? Please explain in the table heading what the meaning of red and blue highlighted words is. [Nina Hunter, South Africa]	NOTED - makes reference to cooling/warming effects
12039	18	7			"Specific consequences on climate change are highlighted" - do you mean speicfic feedbcks [Hans Poertner and WGII TSU, Germany]	ACCEPTED - change made
6191	19	7	21	1	Improve table illustration, it seems not informative [Sawsan Mustafa, Sudan]	NOTED - table has been improved
2951	20		20		Into the table, the impacts of climate change on permafrost melting include “Warming (very high confidence on effects and trends)”. Here we have to consider the climate change impact on the seasonal snow melting (incased the rainfall erosivity), which results from extreme weathers such as intensive temperature fluctuations. [Qiang Yu, China]	ACCEPTED - point made in text
28331	20				deforestation/land clearing is a pressure not a LD process [Barron Joseph Orr, Germany]	ACCEPTED - this line was removed
33515	21	1	21	1	Species loss and compositional shifts as a result of loss and fragmentation of primary forests, and forest degradation, caused by forestry, is well documented. This concerns both aboveground communities and belowground communities.For instance, for deadwood-dependent species (thousands of species in the Nordic countries only), production forests are non-habitat. [Jenni Nordén, Norway]	NOTED - the line is focused on compositional shifts without land use conversions suchs as deforestation
31683	21	18	21	18	Have low average food crop productivity - might present agronomical or biological degradation [, Brazil]	REJECTED - not clear
2953	21		21		Into the table, the impacts of climate change on increasing burning include “Warming, drought, shifting precipitation regimes (high confidence on effects and trends)”. Actually, in Australia, a wetter spring is more dangerous than a drier spring, as more rainfall results in more fuel load to burn in summer and autumn. [Qiang Yu, China]	Taken into account, text revisited

Comment No	From Page	From Line	To Page	To Line	Comment	Response
6819	21	1	26	42	Page 29, 38 to 34-42, 4.5 Status and current trends of land degradation, first of all, an assessment of past land degradation, how to attribute it, and currently placing attribution at the front of the state and change, causing a logic error. In the proposed outline of chapter 4 for this report, the order is :current, current trends and future projections of land degradation linked to climate change, globally and regionally Attribution: distinguishing between climatic- and human-induced changes It is recommended to put 4.4.3 Attribution in the case of land degradation after 4.5 Status and current trends of land degradation Attribution: distinguishing between climatic- and human-induced changes, mainly to assess how much land degradation has been attributed to climate change and human activities over the past few decades. The main impacts of climate change on land degradation processes are evaluated here. No regional and global land degradation attribution analysis has been conducted. [Changke Wang, China]	Noted - the sequence of the sections follow a logical order. The attribution section discusses the challenges of attributing land degradation to climate change. We can attribute certain changes in drivers of LD, but the actural outcome is often impossible to attribute.
33705	22	1	22	7	Figure 4.3 Mirzabaev et al (2016) argues that the differences in methods and datasets play a crucial role in explaining the diverging findings. In the final draft therefore, a conceptual figure should be consider reflecting both internal and external drivers. Mirzabaev A., Nkonya E., Goedecke J., Johnson T., Anderson W. (2016) Global Drivers of Land Degradation and Improvement. In: Nkonya E., Mirzabaev A., von Braun J. (eds) Economics of Land Degradation and Improvement – A Global Assessment for Sustainable Development. Springer, Cham. [, Norway]	Taken into account - the illustration has been changed and references to Mirzabaev have been included
33707	22	1	22	7	Both ecosystem and social dynamics are general and complex terms. Therefore, it might be relevant explaining how they might interact and especially how they affect land degradations. [, Norway]	Accepted - included in the new figure
5379	22	2	22	8	I think this figure (4.3-) is quite useful as a heuristic concept guiding the development of the ideas in this section. It very obviously builds upon, but does not cite, work of the Institute of Social Ecology on socio-ecological interactions and heuristic models to guide interdisciplinary research in this field. In fact, a very similar concept of society-nature interaction has guided much of the work of this Institute over the last 3 decades. I think the authors of this chapter could profit from having a look at that literature, and perhaps find it justified to cite some of that. These refs might be useful: Fischer-Kowalski, M., Weisz, H., 1999. Society as hybrid between material and symbolic realms. Advances in Human Ecology 8, 215–251, Haberl, H., Fischer-Kowalski, M., Krausmann, F., Weisz, H., Winiwarter, V., 2004. Progress towards sustainability? What the conceptual framework of material and energy flow accounting (MEFA) can offer. Land Use Policy 21, 199–213. https://doi.org/16/j.landusepol.2003.10.013, Erb, Karl-Heinz, et al. 2013. A conceptual framework for analysing and measuring land-use intensity. Current Opinion in Environmental Sustainability, 5(5), 464-470, Haberl, H. et al. (eds.), 2016. Social Ecology, Society-Nature Interaction Across Time and Space. Springer Nature, Cham. [Helmut Haberl, Austria]	Taken into account - the figure has been replaced by a relevant figure (modified)
17341	22	4	22	4	In the sentence "(…) keep in mind that both natural and human drivers can drive both degradation and improvement" the use of the words "drive/driver" together could be avoided. I suggest replacing "drivers" by "factors" which would change the sentence to "(…) keep in mind that both natural and human factors can drive both degradation and improvement [Maria Helena Cruz de Carvalho, France]	Accepted

Comment No	From Page	From Line	To Page	To Line	Comment	Response
4261	22	6	22	6	Figure 4.3 should be modified as the current illustrated relationships does not clearly represent the interactions between the land degradation and the social and ecosystem dynamics. For example, I personally do think external drivers affect ecosystem dynamics too. [Lee-Sim Lim, Malaysia]	Accepted - the figure has been changed
12881	22	6	22	6	Figure 4.3 is cryptic and unclear. Don't social dynamics drive politics and technology? Why isn't there an arrow pointing from the social dynamics circle back to external drivers. Figure 4.3 has almost no information. [Robert Treuhaft, United States of America]	Accepted - the figure has been changed
17339	22	7	22	7	Legend of Fig 4.3. as is in its present form should not be "Drivers of land degradation" since this figure works for both degradation and improvement. I would suggest changing the title to "drivers of land changes" [Maria Helena Cruz de Carvalho, France]	Accepted - the figure has been changed
28333	22	13	22	13	clarify that the storm causes an LD process - such as removal of topsoil or triggering a landslide [Barron Joseph Orr, Germany]	Accepted
33161	22	13	22	29	Please I suggest you delete "an" on line 13. On page 16, I respectfully suggest you revise "studies suggest for example.." to read "Few studies have suggested for example, that erosion rates …." And I suggest you replace "of" after gradual changes on line 27 to "in" [Elohor Freeman Oluowo, Nigeria]	Accepted
33709	22	18	22	22	How far tolerable rate of soil erosion does exceed rate of soil erosion might be explained by erosion hazard index (EI), rate of soil formation (T)/rate of soil erosion (A), EI= T/A. Consider also including actual/potential global soil loss and compare with actual or potential soil formation rate, e.g. the report by Verhijen et al. (2009) on rate on tolerable soil erosion reported (0.3 - 1.4 t ha yr-1) for Europe. [, Norway]	Noted - the problem is that soil formation rates are slow and cannot be easily determined. RPC Morgan in his seminal book has a paragraph on this. This discussion has been moved to sectino 4.10
39327	22	19	22	20	U.S. guidelines don't 'typically' use 11/tons/ha . 11 is typically the maximum or "up to 11" or 1-5 tons/acre/year. [, United States of America]	Taken into account - the text has been revised and this particular discussion has been moved to Section 4.11
21123	22	20	22	22	Suggesting that a tolerable rate of soil erosion has been 'recommended' given it comes from one research paper is a bit strong. Suggest changing 'recommended' to 'proposed'. [, United Kingdom (of Great Britain and Northern Ireland)]	Taken into account - the text has been revised and this particular discussion has been moved to Section 4.13
12043	22	23	22	26	The connection between these two examples should be provided. Is it irreversibility? Is is persistence of erosion? [Hans Poertner and WGII TSU, Germany]	Taken into account - the text has been revised and this particular discussion has been moved to Section 4.14
39329	22	27	22	29	Include wind as well as temperature and precipitation. Also increase in CO2 (fertilization effect) should be mentioned. [, United States of America]	Accepted
39325	22	1	23	45	Section 4.4.2 is a mix up of trend information and examples, rather than a salient discussion of drivers. Also, there is much focus on the importance of temperature as a driver for land degradation, which should be an important summary point. [, United States of America]	Taken into account - the text has been revised
13509	22	1	23	45	Same commennt regarding the length of the discussion It is suggested that it be brief and concise, without losing the important considerations in this subsection. [Lourdes Tibig, Philippines]	Noted
33711	22	27	23	3	Both increase/land improvement and decrease/land degradation are reported in the high latitudes and tropical regions, respectively. Please consider to include information about net gain or loss of landareas suitable for agricultural purposes because of climate change? How does this relate to other land use changes like e.g. forestry and urban settlement? According to IPCCs SR15-SPM about 4% of global terrestrial land area are projected to undergo a transformation of ecosystems from one type to another at 1ºC of global warming and 13% at 2ºC (B3.2 page 10 in final version). [, Norway]	Taken into account - the text is revised and the section restructured

Comment No	From Page	From Line	To Page	To Line	Comment	Response
15371	22	27	23	45	Suggest incorporating the following research conducted by Australian scientists on El Nino and drought: Palmer et al (2015) "Drought variability in the eastern Australia and New Zealand summer drought atlas (ANZDA, CE 1500–2012) modulated by the Interdecadal Pacific Oscillation." Environmental Research Letters 10, no. 12: 124002. Suggest also incorporating the impact of cyclones (expected to increase in frequency and intensity with climate change) on forests: Lin, et al 2017. Impacts of increasing typhoons on the structure and function of a subtropical forest: reflections of a changing climate. Scientific Reports, 7(1), 4911. [, Australia]	Taken into account - the first reference rejected (not relevant in this section), the second reference accepted and incorporated
7117	22	31	23	4	Is there a time period associated with this projection? [Debra Roberts, South Africa]	Accepted -
40631	22		23		The narrative in this section 4.4.2 could be improved. Lack of assessment of confidence. Lack of accuracy (e.g. "recent" = when?). Some wording is not adequate for an assessment (e.g. "bleak picture"). Lack of key finding. [Valerie Masson-Delmotte, France]	Taken into account - the text is revised and restructured
22001	22		23		I miss a more clear structure for the whole subchapter on drivers of land degradation; information is disperse [Vanda Acácio, Portugal]	Accepted - the section is restructured
23207	22	27	24	25	This topic (climate change accelerating degradation) is also discussed in 2.3. [Kaoru Kitajima, Japan]	Noted
28661	22	18		22	The rate of soil formation varies by landscape, for example the soil formation and the gridlines in the USA exceeds formation rate. In europe there is no universally accepted level. Tbis is inconclusive a analysis. I strongly recommend that various regions should be highlighted a d analysis should be on Africa, South America and South-east Asia. [Abiodun Adegoke, Nigeria]	Taken into account - the text has been revised and this particular discussion has been moved to Section 4.10
12041	22	19			It might be useful to include the soil types for these minimum and maximum rates [Hans Poertner and WGII TSU, Germany]	Taken into account - the text has been revised and this particular discussion has been moved to Section 4.12
23555	22				non-profit organizations? [Huai Jianjun, China]	Unclear
30301	23	4	23	7	In this respect the loss of the so called 'biotic pump' and the 'rainfall cascade' might be interesting to address here too. [, Netherlands]	Noted - we refer to Chapter 2
23209	23	5	23	5	It is hard to understand what is meant by "the vegetationd egradation is coupled to decline in amount of rainfall in some areas". [Kaoru Kitajima, Japan]	Accepted - the text is removed
15035	23	5	23	5	The word 'coupled to' is suggested to be changed to 'coupled with'. [Muhammad Mohsin Iqbal, Pakistan]	Rejected - beyond the scope of this section, reference is made to Ch 2
15037	23	7	23	7	The word 'are' is suggested to be replaced with 'as'. [Muhammad Mohsin Iqbal, Pakistan]	Accepted - the text is removed
15039	23	10	23	10	Please insert the word 'a' between 'can be' and 'sign of'. [Muhammad Mohsin Iqbal, Pakistan]	Accepted
21739	23	14	23	19	The potential role of CO2 fertilization in offsetting some of this impact should be mentioned. [Graham von Maltitz, South Africa]	Taken into account - the text has been revised and restructured
4263	23	16	23	16	It should be "Barbosa et al. (2015) used the Sea Surface ....." [Lee-Sim Lim, Malaysia]	Taken into account - the text has been revised and restructured
28335	23	16	23	19	What did this study show about LD? (ie how is this relevant?) [Barron Joseph Orr, Germany]	Taken into account - the text has been revised and restructured
12045	23	16	23	19	Is this the only example? There are other regions where El Nino is linked to drought, e.g. Southern Africa, Australia - why was this particular example selected? [Hans Poertner and WGII TSU, Germany]	Taken into account - the text has been revised and restructured

Comment No	From Page	From Line	To Page	To Line	Comment	Response
12883	23	17	23	17	Define or explain Nino 3.4 region and Atlantic Dipole…the general reader will not know what these regions are. [Robert Treuhaft, United States of America]	Taken into account - the text has been revised and restructured
27069	23	17	23	19	Please describe causal relationship between El Ninos and droughts that lead to land degradation more precisely. [, Germany]	Taken into account - the text has been revised and restructured
1853	23	18	23	18	Strictly speaking, it should be “El Niño”. [William Lahoz, Norway]	Taken into account - the text has been revised and restructured
41567	23	20	23	29	Cuba suffered the impact of hurricanes that have destroyed the coffee and cacao plantations and the same in other [Cristobal Felix Diaz Morejon, Cuba]	Noted
5109	23	20	23	29	The example about the impact of climate change on coffee cultivation seems not to have strong connections with land degradation; and therefore request inclusion of a more direct example that explains how altering regional suitability of various crops will lead to land degradation. [, Japan]	Taken into account - the text has been restructured and moved
33713	23	20	23	29	Productivity of plant are affected by pollination services and pollinator are also affected by various factors such climate change, pollution, etc. Pollinator dynamics might be a (in)direct driving factor for yield deterioration, e.g. coffee. Please consider to include information about pollinators in your assessment. [, Norway]	Taken into account - pollination is mentioned elsewhere but beyond the scope of this section
12047	23	20	23	29	Paragraph does not deal with a driver but with a result of degradation - this paragraph should be moved to a more appropriate section and omitted here [Hans Poertner and WGII TSU, Germany]	Taken into account - the text has been restructured and moved
22585	23	24	23	28	These two sentences may seem to give contrasting messages. Could be made clearer. [Anastasios Kentarchos, Belgium]	Taken into account - the text has been restructured and moved
33163	23	25	23	37	I suggest a comma after mesoamerica. Please delete "can" and add "s" to "improve" on line 25. On line 27, I humbly suggest "will" be deleted and replace ""of" with "in". So also on line 31, please add "s" to technological change" to read changes. And replace "of" on line 31 with "in" [Elohor Freeman Oluowo, Nigeria]	Editorial
40191	23	28	23	29	suggestion : render unsustainable previously sustainable land use and land management practices and vice versa [Thelma Krug, Brazil]	Accepted
8723	23	30	23	39	The impact of human activities in relation with production and consumption patterns could be better highlighted as an indirect driver of land degradation, especially if we think that landfills can be seen as a type of "lost soil" [Mihaela Stefanescu, Romania]	Noted
30303	23	40	23	41	Land degradation can also be affected indirectly by climate change through changing patterns of … LD can be affected? [, Netherlands]	Taken into account - the text has been removed
12049	23	40	23	41	"changing patterns of wildlife habitats" - this does not make sense. Suggest changing patterns of wildlife distribution? or movement? [Hans Poertner and WGII TSU, Germany]	Taken into account - the text has been removed
12051	23	40	23	41	This (single-sentence) paragraph is very vague. Please refer to the section on wildlife and desertification in the First Order Draft version of SRCCL Chapter 3 - there was some useful information on change of habitat use under climate change because of the way water sources are used by large animals. [Hans Poertner and WGII TSU, Germany]	Taken into account - the text has been removed
5809	23	42	23	43	it is good to add climate-induced extremes (weather) as one of the important linkages [Sanaz Moghim, Iran]	Taken into account - this is discussed elsewhereq
33715	23	46	23	46	Land degradation might be associated with socioeconomic factors, conflict, increasing demand of agricultural and forest products, etc. Please consider to include additional human factors as drivers for land degradation. [, Norway]	Rejected - beyond the scope of this section

Comment No	From Page	From Line	To Page	To Line	Comment	Response
28663	23	1		3	Climate Change will increase the area suitable for agriculture in northern high latitudes by 16per cent while tropical regions will experience loss. Climate differential and weather patterns changes over time. I recommend the reference of(Ramankutty et.all 2002and Zabel et.all 2014), should be clearly analysed and regions should be highlighted for government and policy makers to acts accordingly. Climate Change on agriculture, weather patterns and climate differential will not only affects high latitudes and tropical regions bjt all regions will be affected. [Abiodun Adegoke, Nigeria]	Noted - there is not space enough to elaborate on these particular findings
2331	23	5			"the vegetation degradation is coupled to decline in amount of rainfall in some areas" - meaning is unclear, please rephrase [Nina Hunter, South Africa]	Accepted - the text is removed
39331	24	1	24	1	Consider renaming Section 4.4.3 to something more direct, such as" Climate Change as a Driver of Land Degradation". [, United States of America]	Taken into account - the section has been restructured
8679	24	1	24	1	title can better be: 'Attribution of land degradation' [Louise Andresen, Sweden]	Taken into account - the section has been restructured
33243	24	1	24	1	Title is a bit obscure. Does it mean "Causes"? [Stephen Prince, United States of America]	Taken into account - the section has been restructured
12885	24	1	24	3	Sentence starting with "the question here"….climate has already been idetified as a driver of land degradation in the previous section. Why is it still a question? How is ""Attribution in the case of …" differeent from "Drivers of land degradation"? The structure of the arguments presented seems disorganized. [Robert Treuhaft, United States of America]	Taken into account - the section has been restructured
12053	24	3	24	6	Repeats previous sections - can be omitted [Hans Poertner and WGII TSU, Germany]	Taken into account - the section has been restructured
33245	24	3	24	7	The point is the degradation can have multiple causes which makes identification of any climate contribution difficult. Maybe add "...complex phenomenon often affected by multiple drivers such as.... [Stephen Prince, United States of America]	Accepted
33165	24	6	24	6	Please add "solely" after degradation to read "…land degradation solely to climate change." [Elohor Freeman Oluowo, Nigeria]	Rejected - not necessary
33247	24	11	24	11	Instead would be better replaced with "However, we may be..." [Stephen Prince, United States of America]	Accepted
12055	24	11	24	12	"we may be able" - are you, or are you not able? This information is key to the assessment [Hans Poertner and WGII TSU, Germany]	Accepted - sentence is repharsed
33253	24	14	24	14	Is Section 4.4.3.2. also going to be based on " theoretical understanding..." ? Or is it going to deal with observations rather than theoretical findings? The distinction between topics is confusing. Specifying topics much more specifically would help and make the structure and clarity better. [Stephen Prince, United States of America]	Taken into account - text is revised and restructured
39333	24	17	24	17	Only rainfall is generally discussed. Most of the points made about changing rainfall patterns can be said for snowfall too, and melting of snow. One way to address this would be to change "rainfall" to "precipitation" throughout, but the authors should also consider some direct discussion on how important changing snowfall patterns and timing of melts will be in the future. [, United States of America]	Accepted - and we have inserted refernence to snow melt
12057	24	17	24	32	When citing IPCC reports - either cite SPM or cite the Chapter (and if possible the relevant section), not an entire report, and not the page number (unless it is a direct quote) [Hans Poertner and WGII TSU, Germany]	Accepted
33331	24	24	24	28	This paragraph is on linkages (i.e. degradation) with climate change, but these lines are only on climate change with no mention of "linkages". [Stephen Prince, United States of America]	Noted
1855	24	31	24	31	You have not introduced ENSO (admittedly, it is a well-known acronym). [William Lahoz, Norway]	Noted - inserted reference to Glossary

Comment No	From Page	From Line	To Page	To Line	Comment	Response
33517	24	36	24	36	"… changes in vegetation cover and composition". Again, as elsewhere where vegetation is mentioned, I think it is equally important to acknowledge the belowground key players of the ecosystem, saprotrophic and mycorrhizal fungi and soil fauna. About 90% of land plants have mycorrhizal symbionts that they depend on. Saprotrophic fungi govern nutrient cycle and C sequestration. Soil communities are certainly affected by changing regional rainfall regimes. Reference: Meisner et al. 2018: Drought Legacy Effects on the Composition of Soil Fungal and Prokaryote Communities. Front Microbiol. 2018; 9: 294. [Jenni Nordén, Norway]	Accepted - text was insterted
28337	24	40	24	40	Sentence is hard to follow [Barron Joseph Orr, Germany]	Accepted -text is revised
40633	24		25		I have a serious concern with this section. It seems quite superficial about changes in the water cycle and human induced climate change. Please get in touch with authors of AR6 WGI chapter 8 (water cycle) who have started their assessment of the current state of knowledge and could help ensure coherency. This could also benefit from insights of authors of SRCCL chapter 2. Again, I do not understand the use of literature from periods before SREX or AR5, why? The storyline needs to be improved to clarify what is observed, attributed to human induced climate change, projected, possibly also refering to the time of emergence of climate signals against natural variability for regions. [Valerie Masson-Delmotte, France]	Taken into account - the text has been revised, more and recent references have been added, and links have been made to Ch 2
5111	24	1	26	42	Suggest replacement or integration of contents of 4.4.2 and 4.4.3. as both section 4.4.2 and section 4.4.3 cover the impact of climate change on land degradation. For example, section 4.4.2 (P4-22, Line 27 – 29) says "The climate change related drivers of land degradation are both gradual changes of temperature and precipitation....", and section 4.4.3 (P4-24, Line 17 – 18) states, "The most important direct impacts of climate change on land degradation are the results of increasing temperatures, changing rainfall patterns, and intensification of rainfall". If these statements are intended to have different implications, please make the differences clearer. [, Japan]	Taken into account - the section has been restructured
27071	24	16	26	41	Please refer to the analysis presented in chapter 2 and avoid duplication in sections 4.4.31. and 4.4.3.2. [, Germany]	Taken into account - text is revised and restructured
28665	24	17		18	Chanve in weather patterns wilm lead to an increase in temperature, change in rainfall pattern, regional and local weather data collection should be properly analysed for future reference. I recommend Regional Weather Integration. [Abiodun Adegoke, Nigeria]	Accepted - we have revised the text, and throughout the chapter information is provided on ways to avoid, reduce and reverse land (and forest) degradation.
12059	24	39			"reasons to believe" sounds inappropriate and not very confident. Suggest "evidence" instead [Hans Poertner and WGII TSU, Germany]	Accepted - text is revised
13511	25	1	25	2	Delete "to our knowledge". [Lourdes Tibig, Philippines]	Accepted
33249	25	1	25	2	Needs a citation. [Stephen Prince, United States of America]	Accepted
2333	25	1	25	4	Is the database documented in Garcia Ruiz? The database needs to be referenced so that it is clear how it can be accessed. [Nina Hunter, South Africa]	Taken into account - the database is available as supplementary information to the article
13513	25	3	25	9	Please shorten the discussion of the findings of the paper-be brief. [Lourdes Tibig, Philippines]	Rejected - this is a very important discussion
8681	25	3	25	43	only here the N and C cycling are mentioned but this should be elaborated, at least to cover also results from field scale warming experiments from natural ecosystems [Louise Andresen, Sweden]	Taken into account - this is discussed in Chapter 2, to which we reference
23863	25	5	25	8	Remove / after the numbers 1,2,3,4 [, India]	Accepted

Comment No	From Page	From Line	To Page	To Line	Comment	Response
2955	25	9	25	14	“Some important findings for the link between soil erosion and climate change can be noted from erosion measurements: erosion rates tend to increase with increasing mean annual rainfall…” Water erosion almost caused by large storm events rather than the annual average or long term rainfall amount. In other words, it mainly affected by the rainfall intensity rather than the rainfall amount. Some studies applied radar rainfall / tipping bucket rain gauges, estimated near real-time soil loss and measured the higher erosion rates after intensive storm events (Fischer et al, 2016; Zhu et al, 2018). It would be more clear if we could revise the sentence as “….erosion is caused by a few high intensity storm events”, rather than “a few annual events”. references: Fischer, F., Hauck, J., Brandhuber, R., Weigl, E., Maier, H., & Auerswald, K. (2016). Spatio-temporal variability of erosivity estimated from highly resolved and adjusted radar rain data (RADOLAN). Agricultural and Forest Meteorology. 223, 72–80. https://doi.org/10.1016/j.agrformet.2016.03.024 Zhu, Q., Yang, X., Yu, B., Tulau, M., McInnes-Clark, S., Nolan, R., Du, Z. and Yu, Q. (2018). Estimation of storm event-based rainfall erosivity from weather radar data for post-fire erosion monitoring. Land Degradation & Development. Vol,30, no.1, pp,33-48. https://doi.org/10.1002/ldr.3146 [Qiang Yu, China]	Accepted - text is revised and refernces added
13515	25	9	25	18	make the discussion more concise to present the relationship between ranfall characteristics and soil erosion. [Lourdes Tibig, Philippines]	Rejected - the relationships between rainfall and erosion is highly complex and should not be reduced
33251	25	13	25	13	"...a few extreme events, which often at an annual frequency..." [Stephen Prince, United States of America]	Taken into account - text is revised
33717	25	19	25	25	Siltation is a serious challenge in temperate, tropical and sub-tropical regions. What is the interaction between siltation and carbon pools? If appropriate please consider to include information regardring this. [, Norway]	Accepted - text is added
13517	25	19	25	25	Synthesize the findings. [Lourdes Tibig, Philippines]	Rejected - already very succinct
15041	25	21	25	21	The word 'a' is suggested to be replaced with 'are'. [Muhammad Mohsin Iqbal, Pakistan]	Accepted
21125	25	23	25	25	I don't think that describing off-site soil erosion impacts as 'often a greater concern' in temporate regions is correct. I would suggest instead that the 'off-site costs of soil erosion are a greater concern'. See: https://doi.org/10.1016/j.ecolecon.2015.07.026 [, United Kingdom (of Great Britain and Northern Ireland)]	Accepted
15043	25	26	25	27	The sentence 'The distribution over time of wet and dry spells is also expected to be affected although uncertainties still remain - -' is suggested to be re-phrased as The distribution of wet and dry spells also affects land degradation althoughuncertainties remain - -'. [Muhammad Mohsin Iqbal, Pakistan]	Accepted
7361	25	30	25	31	Chronological order is needed for (Li and Fang 2016; Nearing et al. 2004b). This is also valid for several references. [Erhan Akca, Turkey]	Editorial
527	25	33	25	38	Concerningg the change in surface wind, the synthesis by McVicar et al should be mentionned. Most of the studies in the litterature investigate changes in the mean wind and not in "erosive winds" (i.e. wind speeds higher than the erosion threshold) which makes even more uncertain teh detection of any long term trend. [Beatrice Marticorena, France]	Accepted - text is revised
2337	25	33	25	38	At the end of the paragraph I suggest stating: "therefore the wind erosion findings are inconclusive" or similar [Nina Hunter, South Africa]	Accepted
15045	25	34	25	35	'- - winds across coastal regions worldwide have increased with climate change' - in intensity or frequency? [Muhammad Mohsin Iqbal, Pakistan]	Noted

Comment No	From Page	From Line	To Page	To Line	Comment	Response
23499	25	35	25	38	It would be good to note in this paragraph that the lack of detection is due to inadequate measurements and a reliance on models that do not represent the pertinent processes. A major research problem if we are to understand future trends of wind erosion. Webb NP, Pierre C, 2018. Quantifying anthropogenic dust emissions. Earth's Future. Vol. 6, 286-295. doi:10.1002/2017EF000766 [Nicholas Webb, United States of America]	Accepted
33257	25	37	25	37	"A lack of vegetation cover..." [Stephen Prince, United States of America]	Noted
33519	25	40	25	43	"in soils..." through the activities of fungi, soil fauna and bacteria. I think it is important to mention the agents here. Reference: Pritchard 2011: Soil organisms and global climate change. Plant Pathology 60:82-99. Solly et al. 2017: Experimental soil warming shifts the fungal community composition at the alpine treeline. New Phytologist 215: 766-778. [Jenni Nordén, Norway]	Accepted - text is revised
15047	25	41	25	41	'warming alters the cycling of nitrogen (N) and carbon (C) in soils'. In what way this relates to land degradation? [Muhammad Mohsin Iqbal, Pakistan]	Noted
33521	25	44	25	46	Climate change, including elevated CO2, affects also the composition and functions of soil fungal communities that are linked with vegetation through mycorrhiza or the nutrients that the saprotrophic fungi release for the benefit of the plants. Fungi affect conditions for land degradation through their effects on plants, and they have important independent effects on the soil conditions, respiration, and nutrient cycle including leaching of nutrients to connected aquatic systems. References: Fransson 2012: Elevated CO2 impacts ectomycorrhiza-mediated forest soil carbon flow: fungal biomass production, respiration and exudation. Fungal Ecology 5: 85-98. Tu et al. 2015: Fungal Communities Respond to Long-Term CO2 Elevation by Community Reassembly. Appl Environ Microbiol 81:2445–2454. [Jenni Nordén, Norway]	Rejected -not relevant in this section, but added elsewhere
15049	25	47	25	47	The phrase '- - pathways Friend et al. (Friend et al. 2014) found - -' is suggested to be re-written as ' - - pathways, Friendet al.(2014) found - -. [Muhammad Mohsin Iqbal, Pakistan]	Accepted
13519	25	26	26	28	Delete "for example" [Lourdes Tibig, Philippines]	Accepted
23213	25	44	26	6	Topic of CO2 fertilization to vegetation producivity can be referred to 2.2? [Kaoru Kitajima, Japan]	Accepted
33167	25	5	47	25	Please on page 5, replace "highlight" to "highlighted". Delete "were" on line 5. And I suggest a revision to line 10, from "can be noted from erosion measurement …." to "was accounted for through erosion measurement; the rates tend to increase with increasing annual mean rainfall....." On line 18, I suggest you add "useful" immediately after "is", and to read "...land measurement is useful for controlling erosion". And on line 21, you can please, change "dorminate" to dorminance" and delete "and". and to read to line 22 "....."...soil erosion dorminance is manifested in very high rates leading to soil losesand in some cases exceeding 100 tons ha ..... And line 47, after "concentration pathway" there should be a full stop. Please delete the first Friend et al... reference and be reversed as .."Friend et al. (2014) observed that all previous models predicted increasing ..... [Elohor Freeman Oluowo, Nigeria]	Editorial - some accepted, but not all
7455	25	2			The information that has been shown seems insufficient. It is indicated that there are 4377 data entries and 'majority from North America and Europe'. I think it would be necessary to complete the information, providing at least one frequency table by regions to know more about the database. In this table it is important to differentiate the method used and the measure units of the entries, e.g.: tn/ha/year; % of surface affected by erosion, estimation of erosion using models. [Rafael Blanco-Sepulveda, Spain]	Accepted

Comment No	From Page	From Line	To Page	To Line	Comment	Response
12061	25	11			Confidence statement needs references [Hans Poertner and WGII TSU, Germany]	Accepted
23211	25	30			"evapoaration (evapotranspiration and evaporation)" should be rephrased as "evaporation and transpiration". [Kaoru Kitajima, Japan]	Accepted
2335	25	30			"evaporation (evapotranspiration and evaporation)" - why not rephrase to "changes in evapotranspiration and evaporation"? It is confusing as to why both terms are in parentheses after "evaporation". [Nina Hunter, South Africa]	Accepted
168	25	44		45	this statement seems to contradict the use of greening in carbon capture and storage. Access to literature will make clear this hypothesis [Chukwuma Anoruo, Nigeria]	Unclear
2651	26	1	26	1	I suggest inserting references on methods of assessment and quantification of biomass and carbon stocks such as the paper available at: https://doi.org/10.5772/48355 [Thiago Metzker, Brazil]	Rejected - beyond the scope of this section
33169	26	1	26	27	I suggest line one be revised as "Vegetation carbon storage, however with a substantial variation between models" And on line 9, please add "alone" after Climate Change and "still " after "is" and to now read "climate change alone is very challenging because of the the importance of land management." [Elohor Freeman Oluowo, Nigeria]	Editorial - some accepted other not
28339	26	2	26	3	more important with respect to what? [Barron Joseph Orr, Germany]	Accepted - text is clarified
33259	26	7	26	7	Better to summarize the stated topic of the section, i.e., "In summary, theoretical studies suggest that rainfall changes...." [Stephen Prince, United States of America]	Rejected - both theoretical and empirical studies agree
33719	26	7	26	11	Vegetation dynamics are related to rainfall dynamics. However, the response of rainfall is most likely to differ at different temperature scenarios. With increasing temperature- It's expected to increase risks of drought and deficit and excessive of precipitation (depending on region), and flood hazards. Please consider to include information regarding how the spread of terrestrial invasive species differs at different temperature levels. [, Norway]	Rejected - outside the scope of this section
13521	26	7	26	11	Reverse the order in the calibrated uncertainty language. [Lourdes Tibig, Philippines]	Accepted
13523	26	10	26	11	In the preceding discussion, rainfall changes have been shown to be ttributable to climate change, but not changes in moosoons and ENSO events . [Lourdes Tibig, Philippines]	Noted - beyond the scope of this chapter
39335	26	12	26	42	An important indirect linkage is the role of fire and the importance of things like "mega-fires" in North America. [, United States of America]	Taken into account - the text is revised and fire has been included.
21777	26	18	26	18	line 18 page 26 and line 12 page 29 appear to contradict. [Graham von Maltitz, South Africa]	Rejected - cannot see any contradiction
28341	26	19	26	20	intensification of land use elsewhere, either into natural ecosystems… That is cropland expansion, not intensification. [Barron Joseph Orr, Germany]	Accepted
15051	26	25	26	30	The para is suggested to be shifted to 'Knowledge Gaps and Uncertainties'. [Muhammad Mohsin Iqbal, Pakistan]	Accepted
33523	26	25	26	37	Everything in this paragraph is at least equally important in connection to fungi. I think it is dangerous to forget about the belowground communities that have such an important role in the ecosystems. [Jenni Nordén, Norway]	Accepted - the role of mycorrhiza has been included in several places in Ch 4, as well as some links to Ch 2
40639	26	25	26	37	Ensure coherency with chapter 2. The framing in hazard change may be relevant? [Valerie Masson-Delmotte, France]	Noted - Ch2 and Ch 4 links have been strengthened
39337	26	27	26	27	Consider citing Kerns et al. REF: U.S. exposure to multiple landscape stressors and climate change. Regional environmental change 16(7): 2129-2140. [, United States of America]	Accepted

Comment No	From Page	From Line	To Page	To Line	Comment	Response
40637	26		26		I would not call changes in monsoon and ENSO "climate change impacts". They are changes in climate dynamics or modes of variability. [Valerie Masson-Delmotte, France]	Rejected - there is a discussion to what extent monsoons and ENSO are impacted by climate change (low confidence)
15373	26	43	27	21	Suggest clarification that while there is an emphasis on NDVI, since ~2000, this index has been superseded by the EVI. [, Australia]	Rejected - there is a continuous discussion about pros and cons different vegetation indices. But NDVI is the most widely accepted and used vegetation index
12887	26	44	27	2	Remote sensing of structure is absolutely key to land degradation mapping and it is not mentioned here. See Chapter 2, where it is mentioned. Lidar and interferometric radar are among the cleanest discriminators of vegetation change. Perhaps this section should be rewritten including structural remote sensing. [Robert Treuhaft, United States of America]	Taken into account - the section has been revised and shortened. Lidar is now mentioned
33307	26	43	29	36	There is no discussion of the need for baselines and the various types available. Strictly speaking, any statement about a change or a trend has no meaning without a reference or baseline. In fact, any use of the term "degradation" implies a non- or less-degraded condition. (see comments on page 4, line 1ff and page 10, line 29.) Probably, as a consequence of this, the Local NPP Scaling method (LNS) is not mentioned which uses RS to estimate a non-degraded reference. Following is a short account of LNS: " Local NPP Scaling (LNS) identifies reference sites without the need for external knowledge of non-degraded or fully degraded sites offers an alternative approach (Ivits and Cherlet, 2013a; Jackson and Prince, 2016; Noojipady et al., 2015; Prince et al., 2009). It starts with classification of the entire study area into homogeneous land capability classes (LCCs) using all available environmental factors that affect productivity, other than anthropogenic degradation. It is assumed that all pixels in an LCC would have the same productivity in the absence of degradation. A frequency distribution of the productivity of all pixels in each LCC is used to identify those with the maximum productivity - usually above an arbitrary limit rather than the absolute maximum to suppress outliers. This maximum productivity is used as the reference, and the degree of degradation is determined by subtraction of the productivity of every pixel from the reference. LNS has an important advantage owing to its explicit recognition of spatial differences in potential for production. Without the LCCs, there would be a danger of mixing potentially more with less productive land. For example, the low productivity and apparent degradation of a large Navaho reservation in SW USA was shown to be a large area of intrinsically lower productivity resulting in the erroneous conclusion that the entire reservation was severely degraded (Noojipady et al., 2015). LNS has another useful feature since degradation is expressed in terms of productivity. The principal drawbacks of LNS are the assumptions that the LCCs are sufficiently internally homogeneous and that the maximum productivity in each LCC is the potential". - Ivits, E., Cherlet, M., 2013a. Land-productivity dynamics towards integrated assessment of land degradation at global scales. https://doi.org/doi:10.2788/59315 - Jackson, H., Prince, S.D., 2016. Degradation of net primary production in a semiarid rangeland. Biogeosciences 13, 4721–4734. https://doi.org/10.5194/bg-13-4721-2016 - Noojipady, P., Prince, S.D., Rishmawi, K., 2015. Reductions in productivity due to land degradation in the drylands of the southwestern United States. Ecosyst. Heal. Sustain. 1. https://doi.org/10.1890/EHS15-0020.1 - Prince, S.D., Becker-Reshef, I., Rishmawi, K., 2009. Detection and mapping of long-term land degradation using local net production scaling: Application to Zimbabwe. Remote Sens.	Taken into account - we have discussed the imporance and problems of using baselines (4.2.3 4.3.4, and 4.4.1

Comment No	From Page	From Line	To Page	To Line	Comment	Response
7647	26	44	29	36	There are various aproaches to assessing land degradation. It is urgent now to show the world the plight of coastal people, for example, of Bangladesh, for that matter occurring in other parts of the world. There are many studies on the issues mentioned in 4.4.4 can be found in the literature not only for Bangladesh, for South Pacific vulnerable island nations too. The UN bodies trying to introduce various steps to address the problems of SLR, for example, building resilient communities and ways of adaptation from climate change. For global awareness campaign proposed approach may be considered too. In this new approach, making short documentary film can be considered for the coastal areas using the new drone technology for letting the world know how SLR, well and truly, making the people being evicted from their land and make them destitute. In other words, losing once a decent livelihood and now destroying families for good. [Md Hossain, Australia]	Taken into account - the text has been removed
8159	26	43	32	23	In the "Approaches to assessing land degradation" need to include approach for assessing forest degradation as this activity contribute largely to land degradation. Example of such approach has been developed and used for assessing forest degradation (see. Krisnawati et al (2015) for case study in Indonesia (http://www.incas-indonesia.org/publication/standard-methods-estimating-greenhouse-gas-emissions-forests-peatlands-indonesia-version-2/), Global Forest Observation Intitative (GFOI)'s Method and Guidance Document (https://www.reddcompass.org/documents/184/0/MGD2.0_English/c2061b53-79c0-4606-859f-ccf6c8cc6a83). You may consider these references. [Haruni Krisnawati, Indonesia]	Rejected - The definition of land degradation includes forest degradation, thus the assesment of LD includes forest degradation assesment
30305	27	1	27	9	Using a combination of remote sensing data, biogeographical/topological, climate and land use data, and models should be added in this list of methods to map land condition. See Stoorvogel et al 2017a and 2017b and Van der Esch et al 2017 in combination (full references can be found in anothger comment). [, Netherlands]	Accepted
27073	27	3	27	4	This sentence is unclear, please revise. [, Germany]	Taken into account - the text has been revised
33263	27	3	27	5	...yet vast areas were shown as having no agreement. Quote from Gibbs and Salmon's 2015 Abstract: "...Global estimates of total degraded area vary from less than 1 billion ha to over 6 billion ha, with equally wide disagreement in their spatial distribution." I suggest this quotation is added to the text with a correction of the statement about their findings. A "holistic evaluation" is exactly what they did not find! [Stephen Prince, United States of America]	Accepted - the text has been revised and we have added (very low confidence) to this particular sentence.
30307	27	16	27	16	Indicate that NDVI is most of all a good measure for land cover, an important factor for soil protection, and as NPP and biomass, a proxy of the resource of SOC. [, Netherlands]	Taken into account - we have stressed the importance of the NDVI
27075	27	25	27	27	We suggest improving readability by splitting into two sentences and refining "critical limitation to such disentangling". The first sentence would read: "The interaction of different determinants of primary production is not well understood." The second sentence would read: "A key barrier to this is a lack of understanding of the inherent inter-annual variability of vegetation." [, Germany]	Accepted - text has been corrected according to the suggestions
30309	27	30	27	30	This has been done also in Van der Esch et al 2017 Annex A3 at a resolution of 5 arc minutes for the first edition of the UNCCD Global Land Outlook. [, Netherlands]	Accepted - reference is now included
39339	27	30	27	30	Vegetation models are getting finer resolution than 0.5 degrees now. [, United States of America]	Accepted we have included Modis that have a finer resolution

Comment No	From Page	From Line	To Page	To Line	Comment	Response
23215	27	33	27	37	Rain Use Efficiency may be a useful concept in semi-arid to arid areas, but not in humid regions. [Kaoru Kitajima, Japan]	Taken into account - we have pointed out more limitations in the use of RUE and redece the reference to the use of this models
22587	27	33	27	42	The paragraph could menation the reasons why the use of the RUE may not be reliable, e.g., the length of time when the rains fall and also the assumption that rainfall is the only variable that affects biomass production. There are many oversimpifcations such that the results could be misleading. [Anastasios Kentarchos, Belgium]	Taken into account - we have stressed the assumtions of the RUE model
33303	27	33	27	42	RUE/RESTREND apply to interannual variation in rainfall (and other weather variables), NOT TO CLIMATE! Climate is the 30 year average, not the rainfall in a single year. The distinction should probably made multiple times to correct this common error and its consequent confusions. [Stephen Prince, United States of America]	Taken into account - we have specified that this models apply to interannual variation (in fact, RUE shows the NPP relationship with rainfall for individual years). Thus ,we have highlighing the importance of take this limitation into account.
39341	27	38	27	38	First time NPP acronym used. Define at first callout. [, United States of America]	Rejected - NPP is already defined in line 17
21741	27	43	27	43	It is not clear what "in theory " means. Also note that the definition as used does not make this a logical consequence of degradation. i.e. this potential outcome of degradation is not common to all types of degradation. [Graham von Maltitz, South Africa]	Taken into account - the text has been revised
27077	27	46	27	46	ANPP has to be introduced in full writing. [, Germany]	Accepted - text has been deleted
39343	27	46	27	46	First time ANPP used. Define at first callout. [, United States of America]	Accepted - text has been deleted
40641	27		27		check through chapters for reference to NDVI and ensure coherency. (e.g with chapter 2). Maybe having a box on the RESTREND method used in ch 3, 4 and maybe others (6?) would be relevant. This could be introduced in chapter 1 if common to several chapters and to the tools used to separate drivers and responses in a complex system. [Valerie Masson-Delmotte, France]	Taken into account - Ch 3 and Ch 4 have coordinated the discussion about RUE and RESTREND
40193	27	38	28	38	suggest to replace measure to estimate [Thelma Krug, Brazil]	Accepted - text has been corrected
33265	27	45	28	6	A better statement on the difference between Le Houerou's RUE and the use discussed here: "While frequently attributed to Le Houérou (1984), there is an important distinction between that and its use in detection of degradation. Le Houérou noted the biogeographic relationships of average productivity with climatological precipitation at a regional scale, as have others (e.g., Ruppert et al., 2012), but the application of RUE to degradation involves detection of differences at the scale of individual pixels and over short periods of time " - Le Houérou, H. N. (1984). Rain use efficiency: a unifying concept in arid-land ecology. Journal of Arid Environments, 7, 213–247. - Prince, S. D., De Colstoun, E. B., & Kravitz, L. L. (1998). Evidence from rain-use efficiencies does not indicate extensive Sahelian desertification. Global Change Biology, 4(4), 359–374. https://doi.org/10.1046/j.1365-2486.1998.00158. - Ruppert, J. C., Holm, A., Miehe, S., Muldavin, E., Snyman, H. A., Wesche, K., & Linstädter, A. (2012). Meta-analysis of ANPP and rain-use efficiency confirms indicative value for degradation and supports non-linear response along precipitation gradients in drylands. Journal of Vegetation Science, 23(6), 1035–1050. https://doi.org/10.1111/j.1654-1103.2012.01420.x [Stephen Prince, United States of America]	Accepted - text has been deleted
12063	27	18			Define NPP - net primary productivity [Hans Poertner and WGII TSU, Germany]	Accepted - refrence made to glossary
12065	27	46			Define ANPP [Hans Poertner and WGII TSU, Germany]	Taken into account - ANPP is not mentioned

Comment No	From Page	From Line	To Page	To Line	Comment	Response
6405	28	13	28	21	This is a very narrow description of one not commonly used forest degradation assessment method. To make sure the IPCC SR text is relevant and provides a good reflection of the state-of-art of forest degradation assessment the following addition is suggested: Detecting forest disturbances through automatic classification of medium resolution optical satellite images (Landsat) can be extremely challenging as it is often difficult to distinguish forest degradation from seasonal phenological variations and inter-annual natural variability, i.e. years of extreme drought. To overcome this challenge, one can analyse the dynamics of satellite dense time series to identify changes in the phenological patterns (e.g. BFAST, LandTrendr). Verbesselt et al. (2010), Dutrieux et al. (2015) and DeVries et al. (2015) used Breaks for Additive Seasonal and Trend (BFAST) to demonstrate that time series can be decomposed into trend, seasonal, and remainder components and that the time and number of changes can be detected at high temporal resolution (i.e. repeated images with 16 day time intervals), enabling detection of tree cover change and separation from phenology signal. In addition, combining observations from multiple optical and synthetic aperture radar (SAR) satellites can provide temporally dense and regular information at medium resolution scale, which are promising for detecting forest degradation (Reiche et al 2018). Forest disturbance can also be assessed through visual interpretation of sample plots with freely available satellite imagery, including high resolution imagery, through Collect Earth (Bey et al 2016). This approach was used by Mongolia, Papua New Guinea and Panama in their forest degradation assessment for their REDD+ Forest Reference (Emission) Level submissions to the UNFCCC (FAO 2018). The main challenge for developing countries to analyse remote sensing data for their (national and other) assessments of degradation (and deforestation) is often internet speed and computing power. Therefore, it may be useful to add the following information and references: Accessing and processing satellite data is often obstructed in developing countries due to poor internet connections and low computing power or storage space on local computers. To overcome this barrier, FAO, through financial support of Norway, has developed a System for Earth Observation Data Access, Processing and Analysis for Land Monitoring (SEPAL), which helps countries access and process satellite data for use in forest/land resources monitoring. SEPAL (https://sepal.io) is a big-data processing platform that combines super-computing	Noted - We appreciated this detailed comment, however according to our definition for SRCCL, land degradation includes, but is not limited to forest degradation. Land degradation includes a serie of factors, such as the value for human, that cannot been assesed by remote sensing. Thus, provide a holistic solution, as suggested, to a complex problem cannot be done with the avaible technology. However, we taken into account provide more specific trends in the study of LD.
33267	28	18	28	19	A more accurate statement of the use of NDVI: "...only sensitive to vegetation "greeness", from which primary production can be modeled, VOD..." [Stephen Prince, United States of America]	Accepted - text has been corrected as suggested
39345	28	20	28	21	How might these corrections be done for rainfall variation? [, United States of America]	Rejected - beyond the mandate of the report. References can be consulted to expand the information
23221	28	22	28	26	Some new references that use combinations of remotely sensed images and ground surveys can give improved estimates of carbon stocks and tree biociversity. Here are a couple examples. Imai N, Seino T, Aiba S, Takyu M, Titin J, Kitayama K. 2012. Effects of selective logging on tree species diversity and composition of Bornean tropical rain forests at different spatial scales. Plant Ecology 213: 1413-1424. Fujiki S, Aoyagi R, Tanaka A, Imai N, Kusma AD, Kurniawan Y, Lee YF, Sugau JB, Pereira JT, Samejima H, Kitayama K. 2016. Large-Scale Mapping of Tree-Community Composition as a Surrogate of Forest Degradation in Bornean Tropical Rain Forests. Land 5. [Kaoru Kitajima, Japan]	Accepted - very useful references has been added
12889	28	22	28	26	See references on lidar or interferometric SAR. For example, Lei et al 2018 clearly sees selective logging with the German X-band interferometer, TanDEM-X. [Robert Treuhaft, United States of America]	Accepted - reference is now included

Comment No	From Page	From Line	To Page	To Line	Comment	Response
33269	28	24	28	26	Productivity is a useful index (and widely used - it is to be an SDG 15.1 metric) since, beyond productivity, it can be used as an integrator different aspects of degradation. A better statement would be: "...among others, can only be inferred indirectly..." [Stephen Prince, United States of America]	Accepted - text has been corrected
21743	28	27	28	35	One problem of trend techniques is that degradation may have taken place prior to our current imagery. We are therefor tracking post degradation responses (which in some cases might be recovery trends) but are unable to identify that the land at the start of the imagery series is already in a badly degraded state. For policies like LDN this does not help us identify land where interventions might be most appropriate. [Graham von Maltitz, South Africa]	Noted - as we define in the 4.3.1 section "… the baseline for SRCCL is the condition at the start of the assessment, as it refers only to the trend during the period of interest"
8999	28	27	28	35	One problem of trend techniques is that degradation may have taken place prior to our current imagery. We are therefor tracking post degradation responses (which in some cases might be recovery trends) but are unable to identify that the land at the start of the imagery series is already in a badly degraded state. For policies like LDN this does not help us identify land where interventions might be most appropriate. [Jean-Luc Chotte, France]	Noted - as we define in the 4.3.1 section "… the baseline for SRCCL is the condition at the start of the assessment, as it refers only to the trend during the period of interest"
33271	28	29	28	31	The very low repeat cycle of Landsat and SPOT makes them useless for much beyond annual assessments. Furthermore, because of those low frequencies, it is rare to be able to get the same seasons in successive years. The new Sentinel system is quite different and can provide data twice every 5 days with 10m resolution. [Stephen Prince, United States of America]	Accepted - as with every generalised conceptual figure, exceptions can be found. We have added a statement to the caption that in some cases climate change can lead to increased productivity, at least initially.
39347	28	32	28	32	Insert: "… , including the …" [, United States of America]	Accepted - text has been corrected
23501	28	33	28	44	This section only mentions water erosion and would be much more balanced if it included discussion of available tools to assess wind erosion (e.g., WEPS, WEMO) and national efforts to support wind erosion assessment, e.g.: Webb NP et al., 2016. The National Wind Erosion Research Network: Building a standardized long-term data resource for aeolian research, modeling and land management. Aeolian Research, Vol. 22, 23-36. doi:10.1016/j.aeolia.2016.05.005 and Webb NP, Van Zee JW, Karl, JW, Herrick JE, Courtright EM, Billings BJ, Boyd R, Chappell A, Duniway MC, Derner JD, Hand, JK, Kachergis E, McCord SE, Newingham BA, Pierson FB, Steiner JL, Tatarko J, Tedela NH, Toledo D, Van Pelt RS, 2017. Enhancing wind erosion monitoring and assessment for US rangelands. Rangelands, Vol. 39, 85-96. doi:10.1016/j.rala.2017.04.001 [Nicholas Webb, United States of America]	Accepted - text has been corrected and references added
39349	28	35	28	35	Also mention the combination of remote sensing (including merging of sensor data like SAR and Landsat) and other spatial attributes like topography, soils maps, vegetation classifications, historical time series remotely sensed data, etc. [, United States of America]	Accepted - text has been corrected

Comment No	From Page	From Line	To Page	To Line	Comment	Response
33721	28	36	28	44	Probably, the WaTEM/SEDEM model can be used as an alternative approach for assessing land degradation issues, specially estimation of the potential net soil and SOC losses by erosion. This model addresses both soil loss which is computed according to RUSLE and displaced soil amount (gross erosion). Applying this model may help to overcome the limitation of RUSLE that does not predicted sediment. (Ref: Borrelli et al 2018, A step towards a holistic assessment of soil degradation in Europe: Coupling on-site erosion with sediment transfer and carbon fluxes. Environmental Research Volume 161, Pages 291-298, https://doi.org/10.1016/j.envres.2017.11.009. Application of Ecosystem service (ESS) model might be another alternative approaches for assessing land degradation. This model considers important physical processes (sediment erosion and nutrient export) and the equivalent ecosystem services (sediment and nutrient retention) to assess land degradation (Cerretelli, S. et al 2018, https://doi.org/10.1016/j.scitotenv.2018.02.085. [, Norway]	Accepted - text has been corrected and references added
15375	28	37	28	44	Suggest broadening the research. Currently there appears too much reliance on RUSLE-modelled water-borne erosion estimates globally. It is well known that there are large discrepancies between these and actual sediment load measurements—not only in Ireland (p. 4-28). Suggest an approach to estimate water-borne erosion by combining multiple lines of evidence/data: Bartley et al 2015. Combining contemporary and long-term erosion rates to target erosion hot-spots in the Great Barrier Reef, Australia. Anthropocene, 10, 1-12. Bui et al (2011). 'Tolerable' hillslope soil erosion rates in Australia: linking science and policy. Agriculture, Ecosystems & Environment, 144(1), 136-149. [, Australia]	Taken into account - we have tuned-down the use of RUSLE due to inherent limitations, affecting its reliability
39351	28	44	28	44	In a heavily degraded regional watershed in Central America, USLE may overestimate erosion rates. REF: Kim, J.B., Saunders, P. and Finn, J.T., 2005. Rapid assessment of soil erosion in the Rio Lempa Basin, Central America, using the universal soil loss equation and geographic information systems. Environmental Management, 36(6), pp.872-885. [, United States of America]	Taken into account - we have tuned-down the use of RUSLE due to inherent limitations, affecting its reliability
170	28	22		26	should be linked with page 27, line 10-22. this will make so clear the message [Chukwuma Anoruo, Nigeria]	Accepted - we have rewritten the first line to link the messages
2339	28	32			"are in development the high (fine) spatial resolution" - meaning is unclear, please rephrase [Nina Hunter, South Africa]	Accepted - text is clarified
74	28				4. Pg 28, l 10-27: very poorly presented; too much conjecture and speculation but not nearly enough facts. Why is there no mention of soil carbon pools and mitigation through carbon sequestration? This section must ne totally revised. [Julian Dumanski, Canada]	the comment is out of context
33273	29	3	29	4	Is this a (veiled) reference to the need for baselines in order to assess degradation? I have not noticed this critical topic elsewhere in the chapter, other than a few words here and there - maybe it follows... Baselines are discussed extensively in IPBES LDR section 4.1.4. [Stephen Prince, United States of America]	Accepted - Text has been deleted, since according to our definition: the baseline for SRCCL is the condition at the start of the assessment, as it refers only to the trend during the period of interest
30313	29	3	29	8	The change in biomass of the vegetation is a relevant one too. It is the key factor of life, and determines amongst other the capacity of C-storage, nutrient content, water holding capacity, evapotranspiration and energy content, all biological and climate relevant factors [, Netherlands]	Accepted - text has been corrected
23217	29	9	29	21	Perhaps, this paragraph on SOM and microbial interactions can be referred to 2.2 and vice versa. [Kaoru Kitajima, Japan]	Accepted

Comment No	From Page	From Line	To Page	To Line	Comment	Response
15053	29	13	29	13	The word 'on' is suggested to be changed to 'in'. [Muhammad Mohsin Iqbal, Pakistan]	Accepted - text has been corrected
5811	29	16	29	20	"negative" should be positive!climate change and land degradation increase .. [Sanaz Moghim, Iran]	Accepted - text has been corrected, thanks
17037	29	17	29	17	Change "negative" to "negatively" or "adversely". [Roland Hiederer, Italy]	Accepted - text has been corrected
39353	29	20	29	20	Parenthesis missing somewhere. [, United States of America]	Accepted - text has been corrected
30315	29	22	29	29	Indicators of biodiversity are Mean Species Abundance (Alkemade et al, 2009 Globio3: A framework to investigate options for reducing global terrestrial biodiversity loss. Ecosystems, 12 (3): 374-390., and remaining natural land, wilderness area and Red List Index. These indicators are highly complementary and common in global assessments of UNEP (UNE), OECD, IPBES, FAO, CBD and UNCCD. [, Netherlands]	Accepted - reference is now included
15055	29	30	29	30	The word 'because' is suggested to be changed to 'as', and word 'single' is suggested to be added between 'no' and 'method'. [Muhammad Mohsin Iqbal, Pakistan]	Accepted - text has been corrected
33233	29	30	29	30	Meaning of "normative"? Suggest you replace it with more widely understood adjective. [Stephen Prince, United States of America]	Accepted - text has been corrected
40643	29	30	29	36	is this statement true? What about maps used in chapter 6? I would suggest to sharpen the assesment on progress in concepts and methods, and use a last section on knowledge gaps to capture some elements here. [Valerie Masson-Delmotte, France]	Noted - Land degradation as a complex process can not be caotured by a single method, the combined use of different approaches and scales can provide us a holistic aproximation
40195	29	31	29	31	suggest to repace measure to estimate [Thelma Krug, Brazil]	Accepted - text has been corrected
33275	29	33	29	36	"corroborate" implies they are right and RS is less so. Yet, field measurements typically lack any spatial dimension and are therefore severely limited for geographic monitoring. This point needs to be made clearly to correct the common opinion that field data are "correct". Of course,remote sensing can be complementary with other types of assessments (e.g., field observations...." I have not yet seen this stated in the chapter. [Stephen Prince, United States of America]	Accepted - text has been corrected
33309	29	38	29	38	Parts of section 4.4.4. are repeated here, some verbatim, others on the same topic.. [Stephen Prince, United States of America]	Noted - section 4.4.4 discusses how assessments can be made while 4.5 discusses the results of various attempts to assess LD. No repetitions found
33311	29	38	29	38	There is a lot of discussion of forest degradation (and deforestation) in the literature. Whether it is small compared with other types I don't know, but forest degradation is far from "excluded". [Stephen Prince, United States of America]	Noted - we maintain that land degradation is often discussed separately from forest degradation, and vice versa
30311	29	42	29	42	In addition, see the global assessment of land condition of Van der Esch et al 2017 which mapped the change in a number of soil proporties, land cover, NPP, water holding capcity, C storage and related impacts on climate, biodiversity, food and river discharge at a high resolution (30 arc sec to water basin level for major rivers) for the undisturbed state (=baseline), present and 2050 under the SSP2 scenario. [, Netherlands]	Rejected - the report has mainly unsubstantiated sources concerning the state of land degradation
33313	29	43	29	44	Cite Prince 2016 as well, since it deals with some maps not included in Gibbs and Salmon, and uses quantitative comparison methods. [Stephen Prince, United States of America]	Accepted

Comment No	From Page	From Line	To Page	To Line	Comment	Response
895	29	43	30	35	It is a fact that reliable data and maps depicting land degradation are not available across the globe. Reason being that this aspect is considered as a non-essential expenditure by most of the developing countries. Most developing countries have neither human nor technical and financial resources for undertaking such mapping. This challenge will always remain unless a reputed organization like FAO of the UN initiates a programme to undertake global study to map the dynamics of degradation of land world-wide. [Jagdish Kishwan, India]	Rejected - the reasons are primarily methodological and conceptual
30317	29	38	32	23	See recent estimates of change in LD components:: Stoorvogel JJ, Bakkenes M, Temme AJ, Batjes NH and Ten Brink BJE. (2017a). S-World: A Global Soil Map for Environmental Modelling. Land Degradation & Development. 28: 22–33. AND Stoorvogel JJ, Bakkenes M, Ten Brink BJ and Temme AJ. (2017b). To What Extent Did We Change Our Soils? A Global Comparison of Natural and Current Conditions. Land Degradation & Development. AND: Van der Esch et al (2017) Exploring future changes in land use and land condition and the impacts on food, water, climate change and biodiversity; Scenarios for the UNCCD Global Land Outlook (Chapter 4); And: First edition of the Global Land Outlook of the UNCCD (2017). AND: Caspari et al 2014 Review of global assessments of land and ecosystem degradation and their relevance in achieving the land-based Aichi Biodiversity targets. ISRIC, UWA, PBL, WRI. [, Netherlands]	Taken into account - some of the recommended references have been used when revising the text
39357	29	42	32	23	Emphasis entirely on carbon, however, land degradation can also impact nitrous oxide emission, for example, through increasing reliance on N fertilizer. [, United States of America]	Accepted - but we primarily refer to Chapter 2 for discussion on the fluxes of N2O and CH4
3445	29	43	32	23	Section 4.5.1 mainly assesses global land degradation, but does not clearly distinguish between non-arid land degradation and arid land degradation. For example, in "general greening in the Sahel probably as a result of increasing rainfall and atmospheric CO2, and advancing treelines in mountain regions (Song et al. 2018)" (lines 10-12, page 31), Sahel, which is an arid region, does not fall within the scope of Chapter 4, which assesses land degradation in non-arid areas. So it is suggested that the words on the assessment of global land degradation in dry-land regions in this section be placed in Chapter 3. [, China]	Rejected - some overlap between Ch 3 and Ch 4 is inevitable
39355	29	38	34	22	A well-written information section that brings together relevant literature. [, United States of America]	Noted
33297	30	3	30	3	Scale in degradation is addressed in: Prince, S. D. (2002). Spatial and temporal scales of measurement of desertification. In M. Stafford-Smith & J. F. Reynolds (Eds.), Global desertification: do humans create deserts? (pp. 23–40). Berlin: Dahlem University Press. [Stephen Prince, United States of America]	Taken into account - we have used another reference here
33299	30	8	30	8	"One review of different...." There are more than one. [Stephen Prince, United States of America]	Accepted
31723	30	8	30	19	Given that the focus of chapter is land outside drylands, is it possible to provide global statistic of the chapter's landscape focus? E.g. statement on lines 12 -13 .."suggested that soil erosion is mainly caused in areas of crop land expansion, particularly in sub-Saharan Africa, south America and Southeast Asia", and line 18-19..."The study also suggested, contrary to 18 earlier assessments (Middleton and Thomas 1997), that drylands were not among the most affected regions", include or relate to drylands [Elizabeth Migongo-Bake, Kenya]	Taken into account - we have tried to make a quantitative estimation based on several global studies
33301	30	10	30	11	This repeats p 27 lines 3-5. The same comment made there applies here [Stephen Prince, United States of America]	Accepted

Comment No	From Page	From Line	To Page	To Line	Comment	Response
33315	30	13	30	14	Better "One comprehensive attempt at a global assessment..." It is remarkable for its global extent, but subject to many of the uncertainties noted elsewhere in the Report. [Stephen Prince, United States of America]	Accepted - text revised
39359	30	16	30	19	Which periods are being reported here: 1983 to 2006 or 2006 to 2011 or both? [, United States of America]	Accepted - text revised
33317	30	20	30	22	"Many" not "Several". The use of this method is large and increasing. [Stephen Prince, United States of America]	Accepted
28345	30	23	30	23	The World Atlas of Desertification comprises a lot more than a global map of land productivity! [Barron Joseph Orr, Germany]	Accepted
33319	30	23	30	23	Specify WAD 3rd edition [Stephen Prince, United States of America]	Accepted
28343	30	23	30	24	except that the WAD actually says on that page that it should NOT be interpreted as LD [Barron Joseph Orr, Germany]	Accepted - the text is clear about this
33321	30	23	30	24	"...one useful proxy for land degradation. However the trends reported could be the result of factors other than degradation, most obviously variations in precipitation and temperature. ..." [Stephen Prince, United States of America]	Noted - correct. This is the reason why it is important to not call it land degradation but a proxy.
21715	30	23	30	35	Although the World Atlas of Degradation WAD includes (not comprises) a map of land productivity, it is careful to emphasise that this is not a map of land degradation. Changes in land productivity may be indicative of degradation, but could also be as a result of many other factors. The WAD is has a clear message that local contextual information is required before degradation can be assumed. It is also important to point out that many areas showing increased productivity may be showing a response to global CO2 fertilization effects (or climate change) rather than improvements to land quality from sustainable land management. [Graham von Maltitz, South Africa]	Accepted - the text is clear about this
4265	30	26	30	26	The citation (JRC 2018), JRC should be write in full, at least in the Reference Section. [Lee-Sim Lim, Malaysia]	Accepted
39361	30	30	30	35	What do the percentages next to the land uses indicate? The percent of those land uses on the planet? Also, what does the asterisk next to declining mean? Finally, it is not clear what is meant by "increasing." Does that mean the land use has X% of land that has increasing productivity over whatever time frame (also not mentioned in the figure caption)? Also consider including the reference in the caption. [, United States of America]	Taken into account - text and figure has been changed
21719	30	30	30	35	No reference to where the data was obtained. [Graham von Maltitz, South Africa]	Accepted
4267	30	31	30	31	What does the percentage beside the land types at the vertical axis of Figure 4.4 indicated? Probably need to justify in the caption [Lee-Sim Lim, Malaysia]	Taken into account - text and figure has been changed
12069	30	31	30	35	Indicate source of figure and define the categories in the legend - how were they assessed? [Hans Poertner and WGII TSU, Germany]	Taken into account - text and figure has been changed
39363	30	35	30	35	Note what the percentages mean on the y-axis. [, United States of America]	Taken into account - text and figure has been changed
40645	30		30		Fig 4.4. Source of data? Confidence? Uncertainty? Trend over which time period? Please be more rigorous. [Valerie Masson-Delmotte, France]	Taken into account - text and figure has been changed
12067	30	7			Correct title: "IPBES Assessment Report on Land Degradation and Restoration". Please ensure citations are correct and appropriate [Hans Poertner and WGII TSU, Germany]	Accepted
2341	30	35			Please insert source of figure information - it is already stated in the text but needs to be included here. [Nina Hunter, South Africa]	Taken into account - text and figure has been changed
21127	31	23	21	29	Rapid rates of soil erosion and the implications should be stated more explicitly in the ES and SPM. [, United Kingdom (of Great Britain and Northern Ireland)]	Accepted
39365	31	19	31	19	Paragraph is repetitive from one earlier. [, United States of America]	Accepted - text changed in other places

Comment No	From Page	From Line	To Page	To Line	Comment	Response
13525	31	19	31	26	Reverse the order of the calibrated uncertainty language [Lourdes Tibig, Philippines]	Accepted
33723	31	23	31	24	Please check and revise the values. If the ratio referring to net rate of soil loss in agricultural fields in tilled field (1.52), then rate of soil erosion is in between 380 (1.52/0.004) and 16 (0.065/0.004) times the natural rate of soil formation. [, Norway]	Accepted
17041	31	27	31	27	The estimates cover soil to a depth of 1 m and do not represent an estimate of the total soil carbon stock, as suggested by the text. The depth should be added to the text to avoid confusion with other estimates. [Roland Hiederer, Italy]	Accepted - text revised
23219	31	27	31	29	There are new references on global soil carbon stocks (see 2.2) [Kaoru Kitajima, Japan]	Taken into account - the text has been revised based on more recent estimates
17039	31	27	31	29	The estimates given by Lal, 2004 originate from the Global soil Data Task Group: Global Soil Data Task Group: Global Soil Data Products CD-ROM (IGBP-DIS), Available from Oak Ridge National Laboratory Distributed Active Archive Center, Oak Ridge, Tennessee, USA, available at: http://www.daac.ornl.gov, 2000. One should use the original source. [Roland Hiederer, Italy]	Accepted
39367	31	30	31	30	What is the data source for this figure? [, United States of America]	Accepted - text is revised
40647	31		31		Fig 4.5. Confidence in trends? [Valerie Masson-Delmotte, France]	Taken into account - the figure is discussed in the text
40649	31		31		I find overalp with chapter 2 on soil carbon, erosion. Could a cross chapter mechanism be identified so as to have an overview of soil carbon across chapters? This would help also distillate common messages to ES and SPM. [Valerie Masson-Delmotte, France]	Taken into account - no cross chapter mechanism has been developed but we are checking consistency between chapters

Comment No	From Page	From Line	To Page	To Line	Comment	Response
687	31	29	32	3	The figures cited in the sentence from p 31 l.29 to p. 32, l. 3 are not supported by either the literature cited or by other pertinent literature: "Estimates of the magnitude of loss varies (Jackson et al. 2017; Murty et al. 2002; Guo and Gifford 2002) but is larger in tropical regions, about 75%, than in cool climates, about 40 – 60% (Murty et al. 2002; Lal, 2003; Crews et al. 2018; Soussana et al. 2006). "Figures from authors cited in the section: Jackson et al 2017: These authors cite Wei et al. 2014 (see below) and cite an average loss of 43.1 ± 1.1% of original topsoil Soil Organic Carbon (SOC). Murty et al. 2002: In their meta-analysis they present a loss of SOC due to conversion of forest to cultivated land of 30%, and (when appropriate corrections for bulk density are applied) this drops to 22%. Guo and Gifford 2002: After a meta-analysis these authors state that there is an average loss of 42% for conversion of forest to cultivated land. Lal 2003: Lal states that most soils lose ½ to 2/3 of SOC within 5 years in Tropics and 50 years in temperate region. However the source he cites is Davidson and Ackermann (1993), who calculate a mean loss of C inventory ranging from 24% to 43%, with a total solum loss of 30% of original C inventory. Crews et al. 2018: this has not been published and hence cannot be assessed. Soussana et al. 2006: In the list of citations the actual date is 2004; the 2004 article is a modeling study on sequestration and no estimate of loss is given. Three major meta-analyses were not cited: Poeplau et al. 2011: Global Change Biology 17: doi: 10.1111/j. 1365-2486.2011.02408.x After a meta-analysis these authors cite losses of 32 ±20% after deforestation and 36 ±5% after grassland conversion to cultivated land. Wei et al. 2014: Nature Scientific reports 4: DOI: 10.1038/srep 04062 These authors perform a meta- analysis for SOC losses for conversion of forests to agricultural land. They present an average loss of 43.1% of SOC stocks (> 50 years after conversion). Losses are greatest in Temperate regions (52%) followed by Tropical (41%) and finally Boreal forests (31%). Li et al. 2018: Global Change Biology 24: DOI:10.1111/gcb.14328. These authors perform a meta-analysis for land use change in grasslands. The conversion of grassland to cultivated land causes an average SOC loss of 40% of initial SOC over 134 years. No	Accepted - text is revised
12071	31	28			"vegetation of the world" - terrestrial only, or terrestrial and aquatic? [Hans Poertner and WGII TSU, Germany]	Accepted - terrestrial
7119	32	1	32	1	It might be helpful to provide the range of the values. [Debra Roberts, South Africa]	Taken into account - the text is revised
8683	32	1	32	4	this comparison is not clearly written [Louise Andresen, Sweden]	Taken into account - the text is revised
17043	32	2	32	3	Murty et al., 2002 give a range of 0% - 60% (mean -30.3% after 10 years) for the conversion of forest to cultivated land, which is outside the range indicated in the text. Soussana etal., 2004 estimate from modelled changes in SOC for the conversion of grassland to cropland for temperate climates losses of -25% +/- 7%. Potter etal., 2000 give a decline of 25 - 43% in soil carbon stocks for the conversion of grassland to arable use (120 cm) for the USA. A range of -42 to -59% in loss of SOC is given by Gou and Gifford, 2002 for the conversion of forest and pasture to crop. [Roland Hiederer, Italy]	Accepted - text is revised

Comment No	From Page	From Line	To Page	To Line	Comment	Response
17045	32	3	32	3	Reference for comment: Potter KN Torbert HA Johnson HB & Tischler CR 2000. Carbon storage after long-term grass establishment on degraded soils. Soil Science 164, 718-725. [Roland Hiederer, Italy]	Rejected - text revised and several meta studies have been inserted instead of individual investigations
28347	32	4	32	6	is this due to change in SOC stocks that indicates the SOC level is not in equilibrium? If so, that is a function of the time since clearing or conversion from pasture. [Barron Joseph Orr, Germany]	Taken into account - this discussion has been moved to 4.10
7121	32	14	32	14	Consider replacing 'extend' with 'extent'. [Debra Roberts, South Africa]	Accepted
39369	32	14	32	14	Do the authors mean "extent" rather than "extend"? [, United States of America]	Accepted
28349	32	14	32	15	What do you mean by "no consistent maps"? Perhaps, that there are no recent, or regularly updated, or uncontested maps? Or that due to the complexity of LD it is not possible to generate a meaningful global map? If the latter, refer to the recently published World Atlas of Desertification (3rd edition) to support this view. [Barron Joseph Orr, Germany]	Accepted - text is revised
22589	32	14	32	23	Attribution of land degradation to climate change is difficult to disentangle because there are no global uniform comparable methodologies to take into account the many contextual factors i.e. socio-economic, political, anthropogenic etc. [Anastasios Kentarchos, Belgium]	Noted
5113	32	14	32	23	This summary of section 4.5.1 sums up the method for estimating the area of land degradation, which is already explained in section 4.4.4; and therefore, suggest explaining trends of land degradation and productivity to summarize section 4.5.1. [, Japan]	Taken into account - text is revised in 4.5.1 and 4.4.4
21129	32	15	32	17	Further clarificaiton would be helpful here. Does this mean that attribution is not possible at all, or would it be possible when combining satellite data with other data sets or model outputs? [, United Kingdom (of Great Britain and Northern Ireland)]	Accepted - text is revised
33323	32	15	32	23	If lines 15-17 are true, then lines 17-23 cannot be valid! The first statement that is too broad. I suggest: "...attribution of the observed changes in.....or other drivers is generally difficult and currently subject to significant biases and inaccuracies. [Stephen Prince, United States of America]	Taken into account - the text is revised
13527	32	17	32	23	Same comment as above. [Lourdes Tibig, Philippines]	Noted
39371	32	24	32	24	Edit section carefully for English and redundancy. [, United States of America]	Noted
6913	32	25	32	27	Dezécache, C., J.-M. Salles, and B. Hérault, 2018: Questioning emissions-based approaches for the definition of REDD+ deforestation baselines in high forest cover/low deforestation countries. Carbon Balance Manag., 13, 21, doi:10.1186/s13021-018-0109-1. https://cbmjournal.biomedcentral.com/articles/10.1186/s13021-018-0109-1 [Georgii Alexandrov, Russian Federation]	Noted - and interesting paper, but we are not discussing the merit of baselines for REDD+ in this section.
33325	32	25	32	27	Degradation is not one phenomenon, so one should not expect ONE definition. There are many types of forest degradation with different causes and consequences, hence multiple measurement techniques are used. [Stephen Prince, United States of America]	Noted - it would not be helpful to have multiple (perhaps conflicting) definitions of forest degradation. Our definition has multiple criteria, reflecting multiple values) but not all can be measured with remote sensing data. And we have revised the openeing paragraphs to clarify this.
2653	32	25	32	47	In this case, I believe that there are some references to the potential of carbon stocks in the Amazon and the Brazilian Atlantic Forest. Especially on the Amazon is important to relate papers of Carlos Nobre and the global impacts associated with the deforestation/degradation of the Amazon. In other topics, there are references about the carbon potential of Amazonian soils, but there is a lack of data on carbon stocks in the vegetation. [Thiago Metzker, Brazil]	Noted - but we have generally removed references to individual countries in this section and focus on regions or groups of countries.

Comment No	From Page	From Line	To Page	To Line	Comment	Response
32765	32	27	32	29	A more recent reference can be added to this sentence to support agriculture and logging as key drivers of forest loss: Curtis, P.G., Slay, C.., Harris, N.L., Tyukavina, A., Hansen, M.., 2018. Classifying drivers of global forest loss. Science 361, 1108–1111. [Dooley Kate, Australia]	Accepted -cited and information added.
2343	32	27	32	29	"deforestation … logging)" - is this in commercially established forests, natural forests or both? [Nina Hunter, South Africa]	Noted - Deforestation estimates do not normally distinguish whether the event occurs in natural or comercially established forests.
6407	32	29	32	33	It is a missed opportunity to compare FRA2015 country reported data on forest area change with a RS study on tree cover change, while a RS study on global forest area change is available. I would therefore suggest the following change to the text to make it more relevant and accurate: Keenan et al. (2015) and Sloan and Sayer (2015) studied the 2015 Forest Resources Assessment of the FAO (FAO 2015) and found that the total forest area from 1990 to 2015 declined by 3%, an estimate that is supported by a global remote sensing assessment of forest area change finding a 2.8% decline between 1990-2010 (FAO 2017, Lindquist and D'Annunzio 2016). The trend in deforestation is however contradicting between these two global assessments with FAO (2015) suggesting deforestation is slowing down while the remote sensing assessments finds it be accelerating (FAO 2017). Song et al. (2018) studying global tree cover suggests global tree cover to have increased over the period 1982-2016, which contradicts the forest area dynamics assessed by FAO (2015, 2017). The loss rate in tropical forest areas from 2010 to 2015 is 5.5 M ha per year (FAO 2015). New references: FAO, 2017. Global forest land-use change from 1990 to 2010: an update to a global remote sensing survey of forests. d'Annunzio, R., Lindquist, E., Macdicken, K. Forest Resources Assessment Working Paper 187, FAO Rome, 2017. http://www.fao.org/3/a-i5098e.pdf Lindquist, E., D'Annunzio, R., 2016. Assessing Global Forest Land-Use Change by Object-Based Image Analysis. Remote Sens. 2016, 8, 678; doi:10.3390/rs8080678 [Marieke Sandker, Italy]	Accepted and thanks for both the text and the references.
39373	32	33	32	33	Change "form" to " from". [, United States of America]	Accepted.
4269	32	33	32	33	typo: "The global natural forest area also declined from 3961 Mha to 3721…" [Lee-Sim Lim, Malaysia]	Accepted.
40197	32	33	32	33	… declined FROM [Thelma Krug, Brazil]	Accepted.
1857	32	33	32	33	form -> from. [William Lahoz, Norway]	Accepted.
33171	32	33	32	47	I guess a typgraphical error on line 33, please replace "form" 33 with "from". On line 39, please add "the" after "of" and replace "are" with were". On line 47, I respectfully suggest a revision from " this overuse of forest " to read "this overuse of forest areas may have resulted from extensive illegal crop planting' [Elohor Freeman Oluowo, Nigeria]	Accepted - but some text has been deleted and comment is no longer applicable.
11717	32	40	32	41	The carbon stocks were less than two thirds of their natural conditions mainly due to logging (Putz et al. 2008). Have read this article and the cited figures do not appear in the whole article [Serah Kahuri, Kenya]	Accepted - text deleted
39375	32	41	32	41	The main conversion of forests in Indonesia and Malaysia over the past decade is draining of tropical peatland forests and converting to oil palm (not sure if "planted forest" characterizes this) which has a large negative impact on both above and below ground carbon. [, United States of America]	Accepted - the text referenced here has been deleted
23865	32	43	32	43	Delete "by" to read as: It is reported (FAO 2010) [, India]	Accepted

Comment No	From Page	From Line	To Page	To Line	Comment	Response
14473	32	43	32	43	Consider replacing the term 'planted forest' with 'planted tree crops'. Some relevant references include Abood et al. (2015) Conservation Letters, Miettinen et al. (2010) Global Change Biology, rubber expansion (include references) [Janice Ser Huay Lee, Singapore]	Accepted with modification - we have deleted the text (but not added the new references)
4271	32	43	32	43	typo: "It is reported by FAO (2010)....." [Lee-Sim Lim, Malaysia]	Accepted
6409	32	43	32	45	This information is outdated (based on FRA2010 instead of FRA2015) and therefore incorrect (countries correct their data retrospectively as better data and analyses become available). This should be corrected to 48.2 million ha (Brazil), 4.5 million ha (Venezuela) and 3.3 million ha (Mexico) for the current period 1990-2010 used. The authors can also opt to use the more recent period 1990-2015 from FRA2015. [Marieke Sandker, Italy]	Accepted - we have revised the text and refer to estimates from FRA2015 and other recent publications instead.
39377	32	43	32	47	Combine and rewrite last 2 sentences for clarity. [, United States of America]	Accepted -
15057	32	45	32	47	The sentences 'This deforestation - - - illegal crop planting etc. (Willaarts et al. 2014)'is suggested to be rewritten as 'This deforestation is is due mainly to conversion of natural forests and shrubs to pastures for use for extensive livestock grazing, ets. (Willaarts et al. 2014). [Muhammad Mohsin Iqbal, Pakistan]	Accepted with modification - we have deleted the text
39379	32	47	32	47	Refrain from ending a sentence with "etc."; indicate what the other factors are. [, United States of America]	Accepted with modification - we have deleted the text
28351	32	25	33	28	First 2 pars are poorly expressed, hard to follow and overlap with the rest of the section. The section heading is Forest degradation but deforestation is also frequently discussed, in a manner that fails to distinguish clearly between forest degradation and deforestation. [Barron Joseph Orr, Germany]	Accepted with modification. We have repeated the distinction between deforestation and degradation. We have substantially revised the two paragraphs but it is not possible to always distinguish in the available estimates the contributions to emissions from deforestation and degradation though we have improved the separation as far as possible.
40651	32		33		What are the regional hotspots and why? Several chapters have elements related to Brazil and Amazon, please check for overlap / consistency. [Valerie Masson-Delmotte, France]	Accepted with modification - we have deleted the text
15377	32	24	34	22	Suggest including the recent IUFRO report (noting the 2018 IPBES LDRA has been cited) to improve the discussion on changes in global warming- induced water balances on forests: Creed and van Noordwijk (eds.), 2018. Forest and Water on a Changing Planet: Vulnerability, Adaptation and Governance Opportunities. A Global Assessment Report. IUFRO World Series Volume 38. Vienna. 192 p. [, Australia]	Noted - we considered the report but decided against inclusion as it is primarily focussed on the forest/water nexus with barely any mention of land degradation.
15379	32	24	34	22	Suggest incorporating the 2018 global carbon budget, from The Global Carbon Project, in 4.5.2. [, Australia]	Noted and considered - but the Global Carbon Budget estimates are already introduced in Chapters 1 and 2 so it will not be included also in Chapter 4.
21745	32	24	34	22	Recent literature has suggested a slowing down of the rate of deforestation over the past few years. This is potentially an important finding that seems to have been missed. (e.g. FAO state of forest reports) [Graham von Maltitz, South Africa]	Accepted - we have pointed later in the section that in fact some developing countries are showing increases in forest area.
13283	32	24	34	46	The shift from primary to secondary forest is a clear example of forest degradation in all forest biomes. A substantial body of literature addresses forest degradation in terms of depletion of forest ecosystem carbons stocks and ecosystem integrity particularly with respect to micro-climate stability, nutrient conservation and loss of biodiversity. This has already been discussed, including references, in Chapter 1, page 14, line 37 [Aila Keto, Australia]	Accepted with modification - while we agree that the shift from primary to secondary (managed) forests can be an example of forest degradation (e.g. in the Tropics where differences between native forests and non-native plantatios are very large with regard to carbon stocks and ecological integrity) land productivity can actually increase. In boreal regions with fire-prone forests and high natural disturbances, the differences between "natural" and managed forests (which are always planted to the same native species) can be quite small and is not considered degradation. We expanded the text accordingly.

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24961	32	7			The relation between tree encroachment and land decradation should be developped. Increase of atmospheric CO2 promotes a better growth of C3 plants vs C4 (tropical grasses) and is promoting bush/tree encroachment in rangeland (Midgley &Bond, 2015). If tree encroachment has a positive effect on above ground biomass and soil carbon content (meta analysis from Li et al., 2016) it may have a negative effect by changing the water interception, creating preferential stemflow and subsurface flows and modifying the structure stability. The consequence is an increasing runoff and erosion potential (Muñoz-Robles et al., 2011; Majoro et al., 2011; Grellier et al., 2012; 2013; Podwojewski et al., 2014). [Pascal Podwojewski, France]	Noted - important and relevant primarily for drylands (Chapter 3). The suggested references deal with drylands (semi-arid to sub-humid).
2345	32	30			"total forest area" - is this in commercially established forests, natural forests or both? [Nina Hunter, South Africa]	Both, as implied by the term "total"
2347	32	43			"However there is an increase in the planted forest" - where is this increase? More information is necessary here. [Nina Hunter, South Africa]	Accepted with modification - we have deleted the text
22003	32	43			The link between the first sentence of this line and the previous and subsequent sentences is not clear [Vanda Acácio, Portugal]	Accepted with modification - we have deleted the text
7123	33	1	33	1	This seems to be an incomplete sentence. [Debra Roberts, South Africa]	Accepted with modification - we have deleted the text
25449	33	1	33	28	This paragraph is confusing and difficult to read. Would it be possible to clearly separate what is at the global level from what is at the regional level, particularly the Brazilian Amazon? [, France]	Accepted - the paragraph has been completely rewritten and some information deleted.
15191	33	4	33	7	The relationship between REDD+ policy implementation and increased site-level deforestation in Indonesia is not self-evident hence should be explained here [Daniel Zarin, United States of America]	Accepted - this was an erroneous interpretation of the orignial paper and the text has been revised.
25451	33	4	33	7	Could you check if this sentence is correct? It should also be clarified. REDD++ should be replaced by REDD+. [, France]	Accepted - this was an erroneous interpretation of the orignial paper and the text has been revised.
39381	33	4	33	7	Insert: "… , respectively." Clarify how REDD+ did so much to increase deforestation. Consider providing addional information and a citation. [, United States of America]	Accepted - this was an erroneous interpretation of the orignial paper and the text has been revised.
27079	33	5	33	5	REDD+ instead of REDD++. [, Germany]	Accepted
28353	33	5	33	7	meaning not clear [Barron Joseph Orr, Germany]	Accepted - this was an erroneous interpretation of the orignial paper and the text has been revised.
27081	33	5	33	7	Please explain more clearly whether poor policies, poor implementation or the impact of other policies, not directed towards REDD+, are the cause of increased site specific deforestation. Also please clarify whether it is meant that overall deforestation has decreased, but on specific sites it has become more intensive, or if overall deforstation has increased, or what exactly is meant by this. [, Germany]	Accepted - this was an erroneous interpretation of the orignial paper and the text has been revised.
39383	33	6	33	6	Deleting "viz. a. viz" and change to "by". [, United States of America]	Accepted

Comment No	From Page	From Line	To Page	To Line	Comment	Response
6411	33	9	33	13	CORRECTION is proposed. Baccini assesses gross forest emissions from deforestation and degradation for the tropics only, they then find degradation consists of 70% expressed as a percentage of total emissions from forest (i.e. of total emissions from deforestation + degradation), this is compared against Houghton and Nassikas 2018 estimate of total gross emissions from forests globally and expressed as percentage of total antropogenic emissions, so the comparison refers to two very different percentages, which can impossibly give a meaningful range. An alternative formulation is proposed as follows: However, the contribution to carbon emissions of degradation as percentage of total forest emissions (degradation and deforestation) are uncertain, with estimates varying from 25% (Pearson et al 2017) to nearly 70% of carbon losses (Baccini et al. 2017). The “25%” estimate refers to an analysis of 74 developing countries for the period 2005-2010 while the “70%” estimate refers to an analysis of the tropics for the period 2003-2014 but by and large the scope of these studies is the same. References used are already in reference list [Marieke Sandker, Italy]	Accepted - thank you for the comment and proposed text which we have incorporated.
3481	33	19	33	24	This sentence is not enough rigorous. The reference (Pearson et al. 2017) only focused on the 74 developing countries within tropical and subtropical regions and the other developing countries (such as China) is actually not included. The sentence therefore needs to be modified and specified. [Jianqi Sun, China]	Accepted and the text has been revised accordingly
32465	33	29	33	39	It would be good to include the findings of more critical literature about the role of harvested wood products, e.g. Keith et al., 2015 and Law et al., 2018. [Simone Lovera-Bilderbeek, Paraguay]	Accepted with modifications - the role of sustainable forest management, HWP and substitution benefits has been covered in the revised section 4.9.4 (new numbering) which is also taking a more critical approach now). We have also added a statement highlighting the very large regional differences in the length of HWP storage.
27083	33	31	33	34	We suggest inserting the word "potential" so that the sentence would read “Forest management and the use of wood products in GHG mitigation strategies result in changes in forest ecosystem C stocks, changes in harvested wood product (HWP) C stocks, and potential changes in emissions resulting from the use of wood products and forest biomass that substitute for other emissions-intensive materials such as concrete, steel and fossil fuels ... .” From the point of view of carbon debt and payback time, significant additional CO2 emissions are explicitly to be expected for the energetic use of harvested wood. Searchinger et al. (2018) state that, assuming a payback time of 60 years after 30 years (e.g. 2021 to 2050), wood energy in power generation emits 1.5 times more GHG emissions than coal (-50%) and 3 times more GHG emissions than natural gas (-200%). (Searchinger TD, Beringer T, Holtsmark B, Kammen DM, Lambin EF, Lucht W, Raven P, van Ypersele J-P(2018): Europe’s renewable energy directive poised to harm global forests. Nature Communications Volume 9, Article number: 3741, https://www.nature.com/articles/s41467-018-06175-4). [, Germany]	Accepted - we have inserted as suggested the word potential.

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6915	33	31	33	35	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; 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 [Georgii Alexandrov, Russian Federation]	Accepted - thank you for pointing out the Iordan reference which we have added to the paper. The Grassi et al paper is not appropriate in this context.
32767	33	31	33	39	It is important to also include here studies which dispute the value of Harvested Wood Products. When discussing HWP as a mitigation option, the limits and caveats must be well understood. See: Keith, H., Lindenmayer, D., Macintosh, A., Mackey, B., 2015. Under What Circumstances Do Wood Products from Native Forests Benefit Climate Change Mitigation? PLOS ONE 10, e0139640. https://doi.org/10.1371/journal.pone.0139640 Law, B.E., Hudiburg, T.W., Berner, L.T., Kent, J.J., Buotte, P.C., Harmon, M.E., 2018. Land use strategies to mitigate climate change in carbon dense temperate forests. Proceedings of the National Academy of Sciences 115, 3663–3668. https://doi.org/10.1073/pnas.1720064115 [Dooley Kate, Australia]	Rejected - we have added the statement and provided citations that the duration of wood product C storage differs greatly by region. And this entire topic is covered in more depth in Section 4.9.4 where is it covered in more depth.
17479	33	31	33	39	The defined knowledge gaps on the net impact of forest ecosystem C stock changes/ decreases in relation to potential C substitution for HWP or bioenergy should lead to a precautionary approach to the expansion on substitution measures with short life spans (e.g. bioenergy) vs substitution effects with long product storage life spans (through eg. timber used for building). The differentiation of these substitution effects is potentially not reflected enough in this text. [Taehyun Park, Republic of Korea]	Noted - this should be stated more clearly
7125	33	33	33	33	Drop 'HWP' as the acronym is not used elsewhere in the chapter. [Debra Roberts, South Africa]	Accepted
39385	33	40	33	47	It may be worth noting "land use" here in addition to "canopy density" or "canopy cover" as this distrinction may help to inform whether the cover change really resulted in degradation or deforestation or, in fact, contributed to maintaining the current land use. [, United States of America]	Rejected - remote sensing detects land cover and not necessarily "land use". An area without tree cover can still be a forest … but remote sensing cannot determine this. The point of this sentence is that
8685	33	43	33	43	references need to be added [Louise Andresen, Sweden]	Accepted
40199	33	43	33	43	suggest to change sinks to pools (this is the language of the IPCC in the methodological reports) [Thelma Krug, Brazil]	Accepted (though we changed stocks to pools).
5813	33	44	33	47	is it right to use "all" in the last sentence "deforestation will reduce all ecosystem carbon pools", any indicator or reference! [Sanaz Moghim, Iran]	Accepted - deleted "all"
40201	33	46	33	47	"… while deforestation will reduce all ecosystem carbon pools". This might not be necessarily true, since harvested wood product is also considered to be a carbon pool and, with deforestation, might increase.. [Thelma Krug, Brazil]	Accepted - deleted "all"
8155	33	5			REDD++ should be REDD+ [Haruni Krisnawati, Indonesia]	Accepted
12073	33	43			"defined by the IPCC" - please specify which definition is being referred to here (Which chapter of which report) [Hans Poertner and WGII TSU, Germany]	Deleted reference to IPCC - there are multiple GHG Inventory reports - but this is actually not relevant here - The point is made that aboveground biomass is not sufficient to determine ecosystem carbon stock changes (and emissions).
40203	34	1	34	1	suggest to rephrase as : Deforestation, degradation and some forms of forest management have resulted in carbon… [Thelma Krug, Brazil]	Noted - the section referred to here has been rewritten and moved.
13285	34	1	34	3	Agree [Aila Keto, Australia]	Noted

Comment No	From Page	From Line	To Page	To Line	Comment	Response
25453	34	1	34	13	Here is an additionnal that should be discussed: - Naudts, Kim, et al. "Europe's forest management did not mitigate climate warming." Science 351.6273 (2016): 597-600. [, France]	Noted - the section referred to here has been rewritten and moved.
27085	34	2	34	2	"-21 to 38%" is unclear whether this implies stock reductions up to 21% and stock increases up to 38%, or if it implies stock reductions from 21% to 38%. Please modify accordingly or provide further explanation. Particularly if stocks can also increase, please add clarification since this would be counterintuitive. [, Germany]	Accepted - the estimate of stock reductions was corrected and is about 50% using the Erb et al 2018 reference.
32769	34	2	34	3	See also - Keith, H., Mackey, B.G., Lindenmayer, D.B., 2009. Re-evaluation of forest biomass carbon stocks and lessons from the world's most carbon-dense forests. Proceedings of the National Academy of Sciences 106, 11635–11640. https://doi.org/10.1073/pnas.0901970106 - which in the SI provides an extensive collection of carbon density in natural forest ecosystems, suggesting the upper end and beyond of the 21-38% carbon stock reductions referenced in this sentence. [Dooley Kate, Australia]	Accepted - the estimate of stock reductions was corrected and is about 50% using the Erb et al 2018 reference, a global study unlike the references provided below.
27087	34	3	34	5	This statement is rather obvious, please add by how much it increased and from which of the two sectors. [, Germany]	Noted - but the sentence was deleted (see next comment).
39387	34	3	34	5	Consider delteting sentence, as information seems self explanatory. [, United States of America]	Accepted - this sentence was deleted.
40205	34	4	34	4	suggest to use CROPLAND to be consistent with IPCC usage in methodological reports [Thelma Krug, Brazil]	Accepted - this sentence was deleted.
2351	34	5	34	8	Are there any similar findings from developing countries? [Nina Hunter, South Africa]	Noted - we have removed the reference to a small European country and report only the global estimates of Erb et al 2018
40207	34	7	34	7	suggest to use CROPLAND to be consistent with IPCC usage in methodological reports [Thelma Krug, Brazil]	Accepted
40209	34	7	34	7	suggest to replace grazing land to grassland to be consistent with reference in IPCC methodological reports [Thelma Krug, Brazil]	Rejected - we keep the terminology used in the cited publication
28355	34	9	34	9	Explain Biomass Production Efficiency (eg give units) [Barron Joseph Orr, Germany]	Accepted - definition inserted
12079	34	11	34	13	The message of this statement is not clear [Hans Poertner and WGII TSU, Germany]	Accepted - added clarifying statement.
7127	34	19	34	19	Are these opportunities in both developed and developing countries? [Debra Roberts, South Africa]	Accepted - statement clarified.
13287	34	19	34	22	Agree [Aila Keto, Australia]	Noted - thanks
6917	34	19	34	22	Bernal, B., L. T. Murray, and T. R. H. Pearson, 2018: Global carbon dioxide removal rates from forest landscape restoration activities. Carbon Balance Manag., 13, 22, doi:10.1186/s13021-018-0110-8. https://cbmjournal.biomedcentral.com/articles/10.1186/s13021-018-0110-8 ; Sanquetta, C. R., A. P. Dalla Corte, A. L. Pelissari, M. Tomé, G. C. B. Maas, and M. N. I. Sanquetta, 2018: Dynamics of carbon and CO2 removals by Brazilian forest plantations during 1990–2016. Carbon Balance Manag., 13, 20, doi:10.1186/s13021-018-0106-4. https://cbmjournal.biomedcentral.com/articles/10.1186/s13021-018-0106-4 [Georgii Alexandrov, Russian Federation]	Thank you for the additional references which we added to the chapter.
40211	34	20	34	20	suggest to replace … through avoidance of deforestation by through the reduction of deforestation and forest degradation … [Thelma Krug, Brazil]	Accepted - wording revised.
25455	34	24	34	24	The main findings of 4.6 should be illustraed by maps and/or synthesized in a comprehensive map. [, France]	Noted - we have tried to find a good graphic illustration which can be supported by science, but failed.
33327	34	38	34	38	Aren't avoid and prevent the same? Add mitigate? [Stephen Prince, United States of America]	Accepted
529	34	41	34	43	The sentence should also include the possible changes in high surface winds responsible for wind erosion. [Beatrice Marticorena, France]	Accepted

Comment No	From Page	From Line	To Page	To Line	Comment	Response
1859	34	42	34	42	HŰVE capitalized. [William Lahoz, Norway]	Accepted
33525	34	43	34	46	The same uncertainties concern also soil fungi that the vegetation depends on - 90% of land plants have fungal symbionts, and saprotrophic fungi make nutrients available for plants - and that have a crucial role in soil processes. [Jenni Nordén, Norway]	Taken into account - the text is revised
33329	34	44	34	45	These are not all the probable types of change. Change to "...as a result of changes in climate such as changes in rainfall..."? [Stephen Prince, United States of America]	Accepted
6821	34	24	39	6	Of the potentials of the ecosystems (eg water, soil and soil carbon, biodiversity) and impacts on socio-ecological systems (for example, impacts on Vulnerable communities, poverty, food security, livelihoods, and migration). Currently, the estimates are not related to the assessment of the effects of further global and regional systems on global and regional land degradation under future climate change, and the lack of the assessment land degradation at future global increases 1.5℃-2 ℃ and its effects ,please add it. [Changke Wang, China]	Noted
39389	34	24	39	6	Section 4.6 is missing many climate-based projections about the future. Consider incorporating. [, United States of America]	Noted and to some extent taken into consideration - we have focussed on how various drivers of land degradation may change with climate change. Many future climate projections do not have the details necessary for assessing how land degration will be affected.
897	34	24	39	6	This whole section deals with the direct and indirect impacts of climate change on land degradation, but does not take into account the contribution of adaption or protective measures taken by governments and communities across the globe to reduce the negative impact of climate change on land degradation. Certainly, the role and contribution of windbreaks, shelterbelts, soil and water conservation measures, introduction of agroforestry practices, etc, however small, need to be included in this section. It is suggested that a new sub-paragraph “4.6.3 Role and contribution of adaptation measures in checking land degradation” may be added highlighting the existing measures, and the need to upscaling the same in view of the impending land degradation due to climate change. [Jagdish Kishwan, India]	Rejected - we refer to Section 4.10 where actions to address LD are discussed
28781	34	1		3	This estimate of forest carbon losses strikes me as low. These metrics are problematic as they do not necessarily take all relevant factors into account, including for example, indirect impacts. [REFERENCES FOLLOWING] [Rachel Smolker, United States of America]	Accepted - the estimate of stock reductions was corrected and is about 50% using the Erb et al 2018 reference, a global study unlike the references provided below.
28783	34	1		3	- Keith, H., Mackey, B.G., Lindenmayer, D.B., 2009. Re-evaluation of forest biomass carbon stocks and lessons from the world’s most carbon-dense forests. Proceedings of the National Academy of Sciences 106, 11635–11640. https://doi.org/10.1073/pnas.0901970106 - which in the SI provides an extensive collection of carbon density in natural forest ecosystems, suggesting the upper end and beyond of the 21-38% carbon stock reductions referenced in this sentence. [Rachel Smolker, United States of America]	References only for previous comment.
28785	34	1		3	A. Noormets, D. Epron, J.C. Domec, S.G. McNulty, T. Fox, G. Sun, J.S. King, Effects of forest management on productivity and carbon sequestration: A review and hypothesis, Forest Ecology and Management,Volume 355, 2015, Pages 124-140, ISSN 0378-1127, https://doi.org/10.1016/j.foreco.2015.05.019. [Rachel Smolker, United States of America]	References only for previous comment.
12075	34	4			"increased carbon" please specify the magnitude of increase [Hans Poertner and WGII TSU, Germany]	Accepted - this sentence was deleted.

Comment No	From Page	From Line	To Page	To Line	Comment	Response
2349	34	5			"Studies of" - Is it possible to start the sentence by saying "on the contrary" or similar to show that the findings that follow show the opposite? [Nina Hunter, South Africa]	Accepted - the text has been revised by inserting an additional sentence prior to this one.
12077	34	7			Please specify the magnitudes of increase and decrease [Hans Poertner and WGII TSU, Germany]	Accepted - magnitudes of changes have been added.
2353	34	9			"Biomass Production Efficiency" - defined as? [Nina Hunter, South Africa]	Accepted - definition inserted
2355	34	33			It is not clear how it would feed back into the climate system. How would land degradation reinforce or balance ongoing climate change? Could this be made clearer? [Nina Hunter, South Africa]	Taken account of - refer to Section 4.8
13531	35	16	9	36	It is suggested that a synthesis be done in presenting the findings on the relationship between land degradation and rainfall. [Lourdes Tibig, Philippines]	Taken into account - a synthesis is provided at the end
13529	35	1	35	3	Same comment as above [Lourdes Tibig, Philippines]	Noted
30319	35	1	35	10	Loss of vegetation, independently from climate change or land use, may have an impact on local and continental climate as such, especially moisture and rainfall. Refer to recent insights on the rainfall cascade and the biotic pump. [, Netherlands]	Taken into account - we refer to section 4.8. The biotic pump concept is avoided because of controversies (Meesters, A. G. C. A., A. J. Dolman, and L. A. Bruijnzeel. "Comment on" Biotic pump of atmospheric moisture as driver of the hydrological cycle on land" by AM Makarieva and VG Gorshkov, Hydrol. Earth Syst. Sci., 11, 1013–1033, 2007." Hydrology and Earth System Sciences 13.7 (2009): 1299-1305.)
23503	35	11	35	11	It would be helpful to specify in the section heading that this section relates specifically to water erosion risk as it does not deal with wind erosion. [Nicholas Webb, United States of America]	Accepted
39391	35	12	35	15	It seems that this statement, though very critical, is repeated many times in this chapter. [, United States of America]	Noted
2957	35	16	35	19	"Modelling of changes in land degradation as a result of climate change alone is hard because of the importance of local contextual factors. As shown above, actual erosion rate is extremely dependent on local conditions, primarily vegetation cover and topography (García-Ruiz et al. 2015)." In Australia, temperatures tend to increase and rainfall tends to decrease with increasing larger intensity storm events. Drier soil and hotter temperature result in more extreme fires. Actually, the interaction and influence of climatic factors on local vegetation cover and topography make soil erosion modelling and soil degradation change simulation more complicated, geospatial datasets with higher spatio-temporal resolution are required. For example, more frequent storm events and bushfire result in the higher risk of soil erosion as they flow/remove the topsoil. However, they also potential lead to the rapid vegetation recovery after fire (Gordon et al, 2017). references： Gordon, C. E., Price, O. F., Tasker, E. M., & Denham, A. J. (2017). Acacia shrubs respond positively to high severity wildfire: Implications for conservation and fuel hazard management. Science of the Total Environment, 575, 858–868. https://doi.org/10.1016/j.scitotenv.2016.09.129 [Qiang Yu, China]	Noted - no change because the reference is about drylands (Ch 3)
39393	35	23	35	23	Was there any spatial information from the Li and Fang paper? Where is erosion increasing most/least? [, United States of America]	Taken into account - climate change impacts on soil erosion is highly localised, therefore it is not possible to make any geographic generalisations
21131	35	23	35	25	On what basis is 1 t ha-1 'often assumed to be the upper limit for acceptable soil erosion'? This is inconsistent with earlier text at p22 line 19 to 22. Suggest deleting text in brackets. [, United Kingdom (of Great Britain and Northern Ireland)]	Taken into account- 1 t/ha/year is assumed to be the upper limit in Europe, while the US has 11 t/ha/year (which is much larger than rates of soil formation)

Comment No	From Page	From Line	To Page	To Line	Comment	Response
7129	35	23	35	27	It might be useful to indicate the conditions on which the projections were based. [Debra Roberts, South Africa]	Noted - too complex to review in detail, but some more info has been added
11713	35	38	35	38	Serpa and colleagues (2015) Cite unifpormly ie Serpa et al 2015 [Serah Kahuri, Kenya]	Accepted
39395	35	38	35	40	How typical is this example, or is it rare? [, United States of America]	Noted - representative for Mediterranean conditions
33333	35	39	35	39	Should be "..spatially explicit..." [Stephen Prince, United States of America]	Noted
7131	35	42	35	42	Contrasting 'traditional' with 'profitable' gives the impression that the traditional approach cannot be made profitable. In addition, it emphasis only the financial component of the change. [Debra Roberts, South Africa]	Taken into account - the section has been revised substantially
4273	35	11	36	12	This topic is very important but the examples gave in the discussion is just focus on the areas in Europe. What about also include the findings based on other Geographical areas, Latin Americas, Southern Hemisphere, Equatorial range, polar regions etc. [Lee-Sim Lim, Malaysia]	Accepted - a better geographical spread of results have been added
1451	35	38	36	9	These two studies (i.e. Sherpa et al., 2015 and Mullan et al., 2012) can hardly be considered representative for all . First of all, both studies were performed in a very small spatial domain, i.e. a catchment size smaller than 10 km2. Furthermore, Sherpa et al. (2015) makes use of the delta change method to bias-correct the climate model output, which does not account for changes in precipitation frequency which are expected under future climate change (Eekhout & De Vente, 2019). The most accurate soil erosion projections may have been made with in studies that used a bias-correction or statistical downscaling method that accounts for changes in the precipitation distribution, in combination with a process-based soil erosion model. Most of these studies project an increase of soil erosion under climate change (Garbrecht et al, 2015; Garbrecht & Zhang, 2015; Garbrecht et al, 2016; Michael et al, 2005; O'Neal et al, 2005; Routschek et al, 2014; Lacoste et al, 2015; Anache et al, 2018; Paroissien et al, 2015; Op de Hipt et al, 2018; Op de Hipt et al, 2019; Simonneaux et al, 2015; Rodriguez-Lloveras et al, 2016; Azim et al, 2016; Adem et al, 2015; Zhou et al, 2017; Phan et al, 2011; Li & Fang, 2017; Parajuli et al, 2016; Ren et al, 2017; Eekhout et al, 2018; Marshall & Randhir, 2008; Gould et al, 2016) in a wide range of climates and locations, such as USA, Germany, France, Brazil, Burkina Faso, Marocco, China, Spain, Canada, Vietnam, Pakistan and Ethiopia. Several studies even show that soil erosion may increase when a decrease of annual precipitation sum is projected, as a result of an increase of rainfall intensity (Lacoste et al, 2015; Paroissien et al, 2015; Simonneaux et al, 2015; Eekhout et al, 2018) References (with doi): Eekhout & De Vente (2019): 10.1002/esp.4563, Garbrecht et al, 2015: 10.1016/j.wace.2015.06.002, Garbrecht & Zhang, 2015: 10.13031/aea.31.10998, Garbrecht et al, 2016: 10.13031/aea.32.11613, Lacoste et al, 2015: 10.1111/ejss.12267, Paroissien et al, 2015: 10.1016/j.jenvman.2014.10.034, Op de Hipt et al, 2018: 10.1016/j.catena.2017.11.023, Op de Hipt et al, 2019: 10.1016/j.scitotenv.2018.10.351, Simonneaux et al, 2015: 10.1016/j.jaridenv.2015.06.002, Zhou et al, 2017: 10.3390/w9120966, Li & Fang, 2017: 10.1016/j.geomorph.2017.06.005, Eekhout et al, 2018: 10.5194/hess-22-5935-2018, Marshall & Randhir, 2008: 10.1007/s10584-007-9389-2, Gould et al, 2016: 10.1016/j.jhydrol.2016.02.025, Micheal et al, 2005: 10.1016/j.catena.2005.03.002, O'Neal et al, 2005: 10.1016/j.catena.2005.03.003, Routscheck et al, 2014: 10.1016/j.geomorph.2013.09.033, Anache et al, 2018: 10.1016/j.scitotenv.2017.11.257, Rodriguez-Lloveras et al, 2016: 10.1016/j.catena.2016.04.012, Azim et al, 2016: 10.1016/j.ijsrc.2015.08.002, Adem et al, 2015: 10.1007/978-3-319-18787-7_28, Phan et al, 2011: 10.1134/S0097807811060133, Parajuli et al, 2016: 10.1016/j.agwat.2016.02.005, Ren et al, 2017: 10.2112/SI80-006.1 [Joris Eekhout, Spain]	Taken into account - the section has been substantially revised
39397	36	7	36	7	Not familiar with the term "sub-days". [, United States of America]	Taken into account - text revised
39399	36	13	36	22	The use of fire or climate-induced wildfires should be mentioned here. [, United States of America]	Accepted - fire has been included
13533	36	13	36	22	How do forests influence storage and flow of water in the cited references? Confidence levels? [Lourdes Tibig, Philippines]	Taken into account, that section has been removed

Comment No	From Page	From Line	To Page	To Line	Comment	Response
33527	36	14	36	22	Soil fungi play an important role in water runoff and nutrient leaching from soils to aquatic systems. References: Asghari & Cavagnaro 2012: Arbuscular Mycorrhizas Reduce Nitrogen Loss via Leaching. PloS ONE 2012; 7(1): e29825. Mardhiah et al. 2016: Arbuscular mycorrhizal fungal hyphae reduce soil erosion by surface water flow in a greenhouse experiment. Applied Soil Ecology 99: 137-140. [Jenni Nordén, Norway]	Taken into account - interaction betwen above and below ground has been mentioned
40213	36	18	36	18	change keys to key [Thelma Krug, Brazil]	Taken into account - the paragraph is revised
33335	36	18	36	19	The distinction between forest degradation and deforestation is not often clear in the Report, especially Ch. 4. Here I think it is forest degradation, but is it also relevant to deforested areas? [Stephen Prince, United States of America]	Taken into account - the paragraph is revised
8157	36	23	36	25	It is stated that "Climate change affects forests in both positive and negative ways", however role of forests on climate change is not much explained. There are some discussion in 4.8 related to impact of land degradation on climate change, but not specific to forests (very little discussion on this, paticularly on tropical region) [Haruni Krisnawati, Indonesia]	Noted - the role of forests is primarily dealt with in Chapter 2, whereas here we focus on land/forest degradation
13535	36	23	36	47	A synthesis of both the negative and positive impacts of climate change on forests from the literature review is recommended.; [Lourdes Tibig, Philippines]	Noted - forests in general is primarily dealt with in Chapter 2, whereas here we focus on land/forest degradation
33337	36	25	36	25	How does warming increase WUE? Through increased plant growth (due to warming or inc CO2?) with no change in precipitation? [Stephen Prince, United States of America]	Taken into account - we refer to Chapter 2 for a more detailed discussion of processes
33339	36	29	36	29	Shouldn't it be "...at least until 2030..."? [Stephen Prince, United States of America]	Rejected - the literature we refer to says until 2030
17047	36	31	36	31	Change "changing a magnitude" to "changing at a magnitude". [Roland Hiederer, Italy]	Accepted
33341	36	31	36	31	"an order of magnitude..." [Stephen Prince, United States of America]	Taken into account - text is corrected
39401	36	32	36	33	Isn't this true outside pan-tropics too? [, United States of America]	Taken into account - the text is removed
14475	36	41	36	47	Peat fires in Southeast Asia contribute significantly to carbon emissions and are strongly influenced by the onset of drought events such as El Nino. How climate change affects El Nino frequency and intensity would have a direct effect on fires over peatlands. [Janice Ser Huay Lee, Singapore]	Taken into account - this is dealt with in other parts of the chapter, notably 4.11.4
25457	36	43	36	45	The concept of forest die-back should be discussed here. Some references: - Cox, Peter M., et al. "Amazonian forest dieback under climate-carbon cycle projections for the 21st century." Theoretical and applied climatology 78.1-3 (2004): 137-156. - Steinkamp, Jörg, and Thomas Hickler. "Is drought-induced forest dieback globally increasing?." Journal of Ecology 103.1 (2015): 31-4 [, France]	Accepted
23867	36	45	36	45	Change 'cause' to 'caused' [, India]	Accepted
40215	36	45	36	46	please review the phrase - as is, it does not make sense [Thelma Krug, Brazil]	Noted, text revised

Comment No	From Page	From Line	To Page	To Line	Comment	Response
25459	36	45	36	47	More recent references should be used about forest fires and climate change. A word should be said on very recent mega-fires, including 2017 and 2018, even if it is only to say that scientific knowledge of these very recent events is still too limited to be included in this report. A mention of the Cross Chapter Box 3 on Fire and Climate Change should be added. Some references: - Seidl, Rupert, et al. "Increasing forest disturbances in Europe and their impact on carbon storage." Nature climate change 4.9 (2014): 806. - Seidl, Rupert, et al. "Forest disturbances under climate change." Nature Climate Change 7.6 (2017): 395. - Stevens-Rumann, Camille S., et al. "Evidence for declining forest resilience to wildfires under climate change." Ecology letters 21.2 (2018): 243-252. - Young, Adam M., et al. "Climatic thresholds shape northern high-latitude fire regimes and imply vulnerability to future climate change." Ecography 40.5 (2017): 606-617. [, France]	Taken into account - the old reference have been taken out and we refer to the cross chapter box on forest
27089	36	12	37	22	The first and the last paragraph of this section are identical (please compare page 36 lines 14-22 with page 37 lines 15-22). Please delete one of these paragraphs. [, Germany]	Taken into account - the last paragraph is revised
22005	36	13	37	22	The first paragraph of this subchapter (4.6.12) is repeated in the end of the subchapter. The title is on vegetation changes but the text only refers forests and rangelands, lacking a more consistent and structured context. The link with land degradation is also missing (or not clear enough) [Vanda Acácio, Portugal]	Taken into account - the paragraph is revised
172	36	15			"and is" not "are" [Chukwuma Anoruo, Nigeria]	Taken into account - the paragraph is revised
2357	36	19			Please define "transpiration" [Nina Hunter, South Africa]	Rejected - this is a common term
12081	36	30			"decrease" - please clarify - a decrease in temperature or in productivity? [Hans Poertner and WGII TSU, Germany]	Accepted - text is clarified
17197	36	38			Replace "Insects" with "Forest Pests". It is more appropriate and global. [José Alfonso Domínguez-Núñez, Spain]	Accepted
30535	37	37	23	34	A bit surprising a paragraph about hydrological regime changes is so synhetic and focusing only in some parts of the worlds (australia, africa mainly or in some type of watershed (mountainous). I would suggest to deepen the processes omplied by climate change and land degradation through e.g. extreme hydrological events see eg https://dialnet.unirioja.es/descarga/articulo/4997441.pdf [Guillaume Bertrand, France]	Taken into account - the section was removed because it is not central to land degradation
8687	37	1	37	1	this sentence goes where ? [Louise Andresen, Sweden]	Unclear what is meant
33529	37	1	37	6	Soil fungi play an important role in water runoff, soil erosion and nutrient leaching from soils to aquatic systems. References: Asghari & Cavagnaro 2012: Arbuscular Mycorrhizas Reduce Nitrogen Loss via Leaching. PloS ONE 2012; 7(1): e29825. Mardhiah et al. 2016: Arbusular mycorrhizal fungal hyphae reduce soil erosion by surface water flow in a greenhouse experiment. Applied Soil Ecology 99: 137-140. [Jenni Nordén, Norway]	Taken into account - this is discussed elsewhereq
39403	37	3	37	6	This study may not be reliable worldwide, as increased heat will increase evapotranspiration and evaporation such that the gain from increased WUE will be negated. [, United States of America]	Accepted - we have revised the text in order to show the complexity of responses
39405	37	4	37	6	Question whether or not transpiration would decrease (as stated here), particularly as vigor and growth may be stimulated by increased levels of atmospheric CO2. [, United States of America]	Accepted - we have revised the text in order to show the complexity of responses

Comment No	From Page	From Line	To Page	To Line	Comment	Response
21747	37	7	37	14	Changes to species composition, woodyness and palatability could also be added. NPP might go up, but the value to grazing decline. [Graham von Maltitz, South Africa]	Accepted - we have revised the text in order to show the complexity of responses
33531	37	10	37	10	Nutrient cycling is mediated by fungi which are affected by elevated CO2. References: Fransson 2012: Elevated CO2 impacts ectomycorrhiza-mediated forest soil carbon flow: fungal biomass production, respiration and exudation. Fungal Ecology 5: 85-98. Tu et al. 2015: Fungal Communities Respond to Long-Term CO2 Elevation by Community Reassembly. Appl Environ Microbiol 81:2445–2454. [Jenni Nordén, Norway]	Rejected - outside the scope of this section
39407	37	15	37	15	Same paragraph repeated above at the beginning of the section. Delete the dupe. [, United States of America]	Accepted - the paragraph has been removed
21951	37	15	37	16	Recent research shows that it is necessary to think beyond the watershed to understand where water comes from. Through evapotranspiration (ET) trees recharge atmospheric moisture, contributing to rainfall locally and in distant locations, and it is therefore important to consider the hydrological space and identify what share of rainfall comes from ET. (see Ellison et al. 2017. Global Environmental Change 43. [Anna Tengberg, Sweden]	Noted - the pragraph has been removed
22591	37	15	37	22	This whole paragraph in repeated in on page 36 lines 14 - 22. [Anastasios Kentarchos, Belgium]	Accepted - the paragraph has been removed
7133	37	15	37	22	This paragraph is the same as the one on p36 lines 14-22. [Debra Roberts, South Africa]	Accepted - the paragraph has been removed
25461	37	15	37	22	There are some elements in this paragraph that are repeated from paragraph lines 14-22 page 4-36. [, France]	Accepted - the paragraph has been removed
33533	37	15	37	22	The same text is on page 36, first paragraph of the section. Soil fungi play an important role in water runoff and nutrient leaching from soils to aquatic systems. References: Asghari & Cavagnaro 2012: Arbuscular Mycorrhizas Reduce Nitrogen Loss via Leaching. PloS ONE 2012; 7(1): e29825. Mardhiah et al. 2016: Arbuscular mycorrhizal fungal hyphae reduce soil erosion by surface water flow in a greenhouse experiment. Applied Soil Ecology 99: 137-140. [Jenni Nordén, Norway]	Accepted - the paragraph has been removed
33343	37	15	37	22	This is an exact repeat of p 36, lines 14-22. [Stephen Prince, United States of America]	Accepted - the paragraph has been removed
23869	37	16	37	16	Change the sentence to 'Important for regulating the climate change impact on landscapes' [, India]	Noted - the pragraph has been removed
8689	37	20	37	22	this is repeated sentences from p 36 L 20 delete one of those [Louise Andresen, Sweden]	Accepted - the paragraph has been removed
33345	37	23	37	23	There are several discussions earlier in the chapter of changes in hydrological regimes in forests. Maybe move them to here? [Stephen Prince, United States of America]	Taken into account - the section was removed because it is not central to land degradation

Comment No	From Page	From Line	To Page	To Line	Comment	Response
25091	37	23	37	34	The runoff change on a global scale is recommended to be added here. Below are some findings. Gosling et al. (2017) presented "one of the first climate change impact assessments on river runoff using an ensemble of global hydrological models (Glob-HMs) and an ensemble of catchment-scale hydrological models (Cat-HMs), across multiple catchments: the upper Amazon, Darling, Ganges, Lena, upper Mississippi, upper Niger, Rhine and Tagus". Relative changes in simulated mean annual runoff (MAR) and four indicators of high and low extreme flows are compared between the two ensembles. The ensemble median values of changes in runoff with three different scenarios of global-mean warming (1, 2 and 3 °C above preindustrial levels) are generally similar between the two ensembles, although the ensemble spread is often larger for the Glob-HM ensemble. In addition, the ensemble spread is normally larger than the difference between the two ensemble medians. Whilst we find compelling evidence for projected runoff changes for the Rhine (decrease), Tagus (decrease) and Lena (increase) with global warming, the sign and magnitude of change for the other catchments is unclear. Our model results highlight that for these three catchments in particular, global climate change mitigation, which limits global-mean temperature rise to below 2 °C above preindustrial levels, could avoid some of the hydrological hazards that could be seen with higher magnitudes of global warming." Detail finds please refer to Gosling, S. N., Zaherpour, J. J., Mount, N. J., Hattermann, F. F., Dankers, R., Arheimer, B., Breuer L., Ding J., Haddeland I., Kumar R., Kundu D., Liu J., van Griensven A., Veldkamp T.I.E., Vetter T., Wang X., Zhang X., 2017. A comparison of changes in river runoff from multiple global and catchment-scale hydrological models under global warming scenarios of 1°C, 2°C and 3°C. Climatic Change 141 (3): 597–598 [Junguo Liu, China]	Taken into account - the section was removed because it is not central to land degradation
22031	37	23	37	34	The link with land degradation is missing [Vanda Acácio, Portugal]	Taken into account - the section was removed because it is not central to land degradation
12083	37	24	37	25	How are the hydrological regimes altered? What are the consequences? [Hans Poertner and WGII TSU, Germany]	Taken into account - the section was removed because it is not central to land degradation
247	37	25	37	25	Recommend clarification: "Many impacts may be further intensified by changing seasonality and magnitude of winter snowpack and spring snowmelt dynamics on patterns of plant available water and ecosystem water balance." (citation: Brown, RD and Mote, PW. 2009. The Response of Northern Hemisphere Snow Cover to a Changing Climate. Journal of Climate 22: 2124–2145, doi:10.1175/2008JCLI2665.1 [Matthew Petrie, United States of America]	Taken into account - the section was removed because it is not central to land degradation
13537	37	26	37	34	To make the discussion more concise, a synthesis is recommended. [Lourdes Tibig, Philippines]	Taken into account - the section was removed because it is not central to land degradation

Comment No	From Page	From Line	To Page	To Line	Comment	Response
2959	37	27	37	31	“Comparisons of different hydrological models and different climate models suggest that the variability in the runoff results is considerably larger between climate models than the variability among hydrological models (Gosling et al. 2011; Teng et al. 2012). Such studies in Australia predict a drier future for the Southeastern part of the continent and that the hydrological response of reduced rainfall is amplified (Teng et al. 2012).” I know here we discussed the change of hydrological regimes in this section, but temperature shouldn’t be neglected. Climate tends to be warmer and drier in Southeastern Australia. Snow cover is projected to decrease as well as the snowmelt. Current research found that the snowmelt impact on erosivity and erosion can be negligible at the timescale due to the higher temperature projected with decreasing snow cover in far future (after 2040). [Qiang Yu, China]	Taken into account - the section was removed because it is not central to land degradation
15059	37	39	37	39	The word 'increase of' is suggested to be replaced with 'increase in'. [Muhammad Mohsin Iqbal, Pakistan]	Accepted
39409	37	35	38	21	There is no specific mention of the degradation of permafrost along Arctic coastlines. [, United States of America]	Taken into account - the text is revised to include this
12085	37	35	38	21	Please ensure that the messages of this section are and remain aligned with the contents of SROCC [Hans Poertner and WGII TSU, Germany]	Noted
3361	37	36	38	21	Most references cited here are a little old. Up to 2018, a lot of related papers have been published since 2013. [Rongshuo Cai, China]	Accepted - more recent references have been added
13539	37	45	38	2	What is this relationship as indicated in the studies (refer to cited references). [Lourdes Tibig, Philippines]	Taken into account - the sentence is removed
2359	37	24			"more precipitation tend to fall as rain instead of snow" - is this as a result of climate change (warming)? If so this needs to be stated. [Nina Hunter, South Africa]	Taken into account - the section was removed because it is not central to land degradation
13541	38	3	38	5	Considering the importance of coastal erosion happening in developing countries where vulnerability is high and where the poorest of the poor live (in particular, informal settlers), confidence levels must be considered. [Lourdes Tibig, Philippines]	Taken into account - we have increased the discussion about this
2867	38	3	38	5	I believe it would be more correct to write 'in some regions also in combination with the changes in atmopheric conditions (McInnes et al. 2011; Mori et al. 2010)' [Luca Castrucci, United States of America]	Rejected - we mean explicitly increase in ocean waves due to e.g. more intensive storms

Comment No	From Page	From Line	To Page	To Line	Comment	Response
7539	38	3	38	11	Emphasize that reduced Arctic sea ice allows greater swell of waves in the Arctic Ocean, which can further disrupt sea ice and accelerate breaking up of ice, becoming a positive feedback loop; see Thomson J. & Rogers W. E. (2014) Swell and sea in the emerging Arctic Ocean, GEOPHYSICAL RESEARCH LETTERS 41:3136–3140, 3136 ("Ocean surface waves (sea and swell) are generated by winds blowing over a distance (fetch) for a duration of time. In the Arctic Ocean, fetch varies seasonally from essentially zero in winter to hundreds of kilometers in recent summers. Using in situ observations of waves in the central Beaufort Sea, combined with a numerical wave model and satellite sea ice observations, we show that wave energy scales with fetch throughout the seasonal ice cycle. Furthermore, we show that the increased open water of 2012 allowed waves to develop beyond pure wind seas and evolve into swells. The swells remain tied to the available fetch, however, because fetch is a proxy for the basin size in which the wave evolution occurs. Thus, both sea and swell depend on the open water fetch in the Arctic, because the swell is regionally driven. This suggests that further reductions in seasonal ice cover in the future will result in larger waves, which in turn provide a mechanism to break up sea ice and accelerate ice retreat."). At the same time, reduced sea ice provides favorable conditions for cyclone development and increased intensity of cyclones, which can also facilitate break-up of sea ice; see Day J. J. & Hodges K. I. (2018) Growing Land-Sea Temperature Contrast and the Intensification of Arctic Cyclones, GEOPHYSICAL RESEARCH LETTERS 45:3673–3681, 3680 ("Further, because climate change is increasing land-sea contrasts in the Arctic, it seems highly likely that the circulation patterns typical of years with strong AFZ will become more common as the climate warms. Indeed, strengthening of the mean temperature gradients in the AFZ is a robust feature of future climate projections as is an increase in the strength of the Arctic Front Jet (Mann et al., 2017; Nishii et al., 2014). This study shows that this linkage between surface temperature gradients and atmospheric circulation is important for Arctic cyclones, adding weight to previous studies."). Loss of Arctic sea ice is estimated to occur within 15 years, according to Overland and Wang (2013) When will the summer Arctic be nearly sea ice free?, GEOPHYSICAL RESEARCH LETTERS 40:2097–2101, 2097 ("Time horizons for a nearly sea ice-free summer for these three approaches [for estimating future ice loss covered in the study] are roughly 2020 or earlier, 2030 ± 10 years, and 2040 or later."). Also include the implications of increased climate forcing from reduced Arctic sea ice, which will be more extreme as less and less ice exists in the Arctic; see Pistone K., et al. (2014) Observational Determination of Albedo Decrease Caused by Vanishing Arctic Sea Ice, PROC. NAT'L. ACAD. SCI. 111(9):3322–3326. [Durwood Zaelke, United States of America]	Taken into account - but most of this important discussion is beyond the scope of this report. We refer to IPCC SROCC
7615	38	3	38	11	Emphasize that reduced Arctic sea ice allows greater swell of waves in the Arctic Ocean, which can further disrupt sea ice and accelerate breaking up of ice, becoming a positive feedback loop; see Thomson J. & Rogers W. E. (2014) Swell and sea in the emerging Arctic Ocean, GEOPHYSICAL RESEARCH LETTERS 41:3136–3140; see Day J. J. & Hodges K. I. (2018) Growing Land-Sea Temperature Contrast and the Intensification of Arctic Cyclones, GEOPHYSICAL RESEARCH LETTERS 45:3673–3681. [Kristin Campbell, United States of America]	Taken into account - but most of this important discussion is beyond the scope of this report. We refer to IPCC SROCC
33347	38	3	38	11	Some repetition of text in p 37, lines 36-40. [Stephen Prince, United States of America]	Taken into account - text is revised
15061	38	11	38	11	The word 'also' seems to be redundant, may be deleted. [Muhammad Mohsin Iqbal, Pakistan]	Accepted
22593	38	16	38	16	"one magnitude of order" should read "one order of magnitude" [Anastasios Kentarchos, Belgium]	Accepted
33725	38	18	38	21	Please give emphasis to the most vulnerable areas. As indicated in the IPCC SR1.5 SPM B.2.3, besides to low-lying coastal areas, small islands are highly exposed to climate change since sea level rise can increase the incidence of saltwater intrusion, flooding and damage infrastructure. The report has also confirmed that the risk is most likely to increase with increasing temperatures. [, Norway]	Taken into account - we make reference to the special section dealing with this (4.11.8)

Comment No	From Page	From Line	To Page	To Line	Comment	Response
13543	38	18	38	21	References ? [Lourdes Tibig, Philippines]	Rejected - this is a synthesis paragraph from above
22595	38	20	38	21	It is not clear if the phenomenon of "reduced sediment loads and land subsidence" is ubiquitous. [Anastasios Kentarchos, Belgium]	Noted - due to lack of space we cannot elaborate on the regional differences.
39411	38	21	38	21	There should be some review of the literature on land degradation of coastal ecosystems such as mangroves and sea grass. These types of ecosystems are being converted to other land uses at an alarming rate. Not sure where to put this discussion but here might be a good spot. [, United States of America]	Noted - beyond the scope of this report, it is covered in details by the SROCC
25489	38	22	38	22	We suggest to consider in section 4.6.2 of Chapter 4 (page 4-38) the indirect impacts on land degradation, induced by biodiversity loss. See GENERAL COMMENT ON BIODIVERSITY. [, France]	Rejected - this is beyond the scope of this report. It is covered in details by the IPBES report LDRA
33349	38	30	38	30	Is tropical agriculture mostly affected by soil nutrient losses due to cropping? If so, it would be useful to note it here. [Stephen Prince, United States of America]	Accepted
32243	38	38	38	43	In the study "Diverging importance of drought stress for maize and winter wheat in Europe" (Webber H. et al., 2018) results reveal that for the current genotypes and mix of irrigated and rainfed production, climate change would lead to yield losses for grain maize and gains for winter wheat. Across Europe, on average heat stress does not increase for either crop in rainfed systems, while drought stress intensifies for maize only. In low-yielding years, drought stress persists as the main driver of losses for both crops, with elevated CO2 offering no yield benefit in these years. [Carmela Cascone, Italy]	Noted - but beyond the scope of this chapter
39413	38	38	38	43	Model predictions have also shown increases in crop yields when CO2 fertilization effects are included in climate change scenarios. [, United States of America]	Taken into account - the text is removed and we refer to Chapter 5
13545	38	38	38	43	There are more recent studies on global crop yields. [Lourdes Tibig, Philippines]	Accepted
15063	38	38	38	43	The paragraph does not seem directly related to land degradation. May be shifted to Section 4.9.2 Food Security. [Muhammad Mohsin Iqbal, Pakistan]	Taken into account - text is deleted and replaced by a reference to Ch 5
7135	38	40	38	40	Consider replacing 'declined' with 'declines'. [Debra Roberts, South Africa]	Taken into account - text is removed
39415	38	40	38	43	Citation missing for maize and bean statement. Each ADDITIONAL day above 30? Is this correct? Provide information on where this study was done and how. [, United States of America]	Taken into account - text is removed
40653	38	44	38	45	Almost single reference to different implications of different levels of warming. This needs to be more explciit in all references to future climate change. What are implications of low vs high levels? Are there regional "hotspots" or tipping points? Why refer here only to 3 papers while there are more in the literature? [Valerie Masson-Delmotte, France]	Taken into account - Porter et al is an IPCC Assessment (AR5, Ch 7), we have added reference to SR1.5
2361	38	11			"lithostratigraphy" - please define [Nina Hunter, South Africa]	Taken into account - the word has been replaced
27091	38	32			This is a very old reference (from 2003), newer ones are available (see https://www.ipbes.net/assessment-reports/ldr), please revise. [, Germany]	Accepted - newer references added
27093	38	43			No reference mentioned, please add a suitable reference concerning this matter. [, Germany]	Taken into account - text is removed
33351	39	3	39	4	Throughout this section, land use changes caused by reduced crop production caused (indirectly) by climate changes several times. Better put together. [Stephen Prince, United States of America]	Noted - this is a synthesising paragraph
13547	39	3	39	6	Reverse the order of the confidence level [Lourdes Tibig, Philippines]	Accepted
25491	39	8	39	8	We suggest that this title be rewritten to better reflect the content of the section, particularly with regard to forestry activities. [, France]	Accepted. Title broadened.

Comment No	From Page	From Line	To Page	To Line	Comment	Response
25493	39	8	39	8	The typology of forest activities in this section is not consistent with those used in other chapters (2 and 6, in particular). See GENERAL COMMENT ON THE TYPOLOGY OF FOREST ACTIVITIES. [, France]	Taken into account - the text is revised
25463	39	9	39	9	This paragraph should more clearly address the issues raised by the BECCS (including using explicitly the word). [, France]	Accepted. BECCS is now specifically mentioned.
33353	39	10	39	11	add pastoralism [Stephen Prince, United States of America]	Taken into account - agriculture includes pastoralism; don't think we need to add it explicitly.
28357	39	10	39	21	True, but not relevant to this section. [Barron Joseph Orr, Germany]	Accepted. Text deleted.
12089	39	10	39	21	Suggest this information could be integrated into section 4.9 subsection on natural systems [Hans Poertner and WGII TSU, Germany]	Noted. Text deleted.
33359	39	10	39	21	First 2 paragraph are not about NETs. Should be moved to a section on ecosystem responses. [Stephen Prince, United States of America]	Noted. Text deleted.
39417	39	12	39	12	What are these biome shifts? Include information on projections. [, United States of America]	Taken into account - the text is revised, biome shifts have been taken out.
33355	39	12	39	21	Biome shifts are not as simple as might be assumed. It is thought that climate changes will result in new types of ecosystems. One reason is fragmentation of forests and other natural land-covers, which can reduce "jumping" owing to prevention of seed and other propagules crossing interspersed unsuitable habitats. Another is the unlikely spread of suitable soils, topography etc.. And another will be competition between mature ecosystem species and the pioneers that may out-compete and so prevent establishment of migrants from less-suitable climates. [Stephen Prince, United States of America]	Noted. Expansion of this point not appropriate in this section.
33357	39	13	39	13	Here are some citations for ecological responses: - Walther, G., Post, E., Convey, P., Menzel, A., Parmesan, C., Beebee, T. J. C., Fromentin, J., I, O. H., & Bairlein, F. (2002). Ecological responses to recent climate change. Nature, 416, 389–395. - Walther, G.-R. (2010). Community and ecosystem responses to recent climate change. Philosophical Transactions of the Royal Society B: Biological Sciences, 365(1549), 2019–2024. https://doi.org/10.1098/rstb.2010.0021 - Louzao, M., Gallagher, R., García-Barón, I., Chust, G., Intxausti, I., Albisu, J., Brereton, T., & Fontán, A. (2019). Threshold responses in bird mortality driven by extreme wind events. Ecological Indicators, 99, 183–192. https://doi.org/10.1016/j.ecolind.2018.12.030 [Stephen Prince, United States of America]	Noted, but out of scope for the topic of this section
33361	39	22	39	22	I am not sure, but I don't recall a definition of NET yet. Also add abbreviation in brackets for later deference. [Stephen Prince, United States of America]	NET is defined in the glossary. The term is written in full and the abbreviation given.The land-based NETS are now described.
40217	39	22	39	22	in some or in most?? [Thelma Krug, Brazil]	Accepted. Changed to most.
13549	39	22	39	24	It is suggested that "(NETS)" be inserted after the word "technologies" as this acronym will be used in the subsection [Lourdes Tibig, Philippines]	Already in section heading

Comment No	From Page	From Line	To Page	To Line	Comment	Response
5381	39	22	39	26	While I agree that this is the case in many of these scenarios, there is also a substantial body of work showing that the necessity of implementing large-scale land-demanding NETs can be minimized or even avoided for deep decarbonization scenarios if stringent efforts are undertaken to reduce resource demand and with it GHG emissions by focusing on the demand side. See e.g. Creutzig, F., et al. 2016. Beyond Technology: Demand-Side Solutions for Climate Change Mitigation. Annual Review of Environment and Resources 41, 173–198. https://doi.org/10.1146/annurev-environ-110615-085428, Grubler, A., et al., 2018. A low energy demand scenario for meeting the 1.5 °C target and sustainable development goals without negative emission technologies. Nature Energy 3, 515. https://doi.org/10.1038/s41560-018-0172-6, Cullen, et al. 2011. Reducing Energy Demand: What Are the Practical Limits? Environ. Sci. Technol. 45, 1711–1718. https://doi.org/10.1021/es102641n; 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. https://doi.org/10.1111/gcb.12160 [Helmut Haberl, Austria]	Accepted. Text modified to acknowledge this point.
7541	39	22	39	32	Conceptualize the amount of land required in something tangible outside of pure numbers; for example, sing BECCS to draw down the between 2 and 10 Gt CO2 annually that is mentioned in IAM reports would require the dedication of land equivalent to the size of India. See Anderson K. & Peters G. (2016) The trouble with negative emissions, Science 354:182–183, 183. Land requirements for BECCS could accelerate loss of forest and grassland, leading to more species loss than scenarios without BECCS. See Williamson P. (2016) Emissions reduction: Scrutinize CO2 removal methods, Nature Comment. Large-scale BECCS could put significant strains on global freshwater use, land-system change, biosphere integrity, and biogeochemical flows. Vera Heck et al. (2018) Biomass-based negative emissions difficult to reconcile with planetary boundaries, Nature Climate Change. [Durwood Zaelke, United States of America]	Accepted. Cropland area added for comparison; discussion on potential impacts of NETS expanded.
7617	39	22	39	32	Conceptualize the amount of land required in something tangible outside of pure numbers; for example, sing BECCS to draw down the between 2 and 10 Gt CO2 annually that is mentioned in IAM reports would require the dedication of land equivalent to the size of India. See Anderson K. & Peters G. (2016) The trouble with negative emissions, Science 354:182–183. Land requirements for BECCS could accelerate loss of forest and grassland, leading to more species loss than scenarios without BECCS. See Williamson P. (2016) Emissions reduction: Scrutinize CO2 removal methods, Nature Comment. Large-scale BECCS could put significant strains on global freshwater use, land-system change, biosphere integrity, and biogeochemical flows. Vera Heck et al. (2018) Biomass-based negative emissions difficult to reconcile with planetary boundaries, Nature Climate Change. [Kristin Campbell, United States of America]	repeats comment 7541

Comment No	From Page	From Line	To Page	To Line	Comment	Response
33535	39	23	39	23	The kind of biofuel that is increasingly collected especially in Finland and Sweden, logging residue and stumps, does not seem to be mentioned yet. Forestry combined with biofuel extraction have the potential of affecting soil communities in possibly irreversible ways. Timber and biofuel extraction remove nutrients and carbon from the forest, which then need fertilisation, which in turn increases nutrient leaching into connected aquatic systems. Reference: Walmsley & Godbold 2010: Stump Harvesting for Bioenergy – A Review of the Environmental Impacts. Forestry: An International Journal of Forest Research, Volume 83, Issue 1, 1 January 2010, Pages 17–38. de Jong 2017: Realizing the energy potential of forest biomass in Sweden – How much is environmentally sustainable? Forest Ecology and Managent 383: 3-16. [Jenni Nordén, Norway]	Accepted. Sentence added.
33727	39	26	39	30	The quote from SR15 given here referes to the first SR15 SPM, which has since been corrected to given other ranges than those quoted here. [, Norway]	Accepted - corrected
30321	39	26	39	32	Please clarify. Text can be interpreted in different manners in terms of what changes into what. [, Netherlands]	Text has been revised - see comment 33727
13551	39	26	39	32	Replace "The Summaryfor Policymakers of the IPCC SR 1.5 states" with " IPCC 2018 highlights that"and delete (IPCC 2018)" at te end of the statement for brevity. [Lourdes Tibig, Philippines]	Taken into consideration. Sentence modified.
39419	39	33	39	33	Suggest using the acronym "NET" at first usage and thereafter where appropriate. As written negative emission technologies is spelled out several places before "NET" is used. [, United States of America]	Accepted
32771	39	33	39	36	Dooley and Kartha (2018) is the wrong reference to refer to the amount of NETs required for 1.5C and 2C IAM pathways. This sentence should refer to Rogelj 2015 as is noted, and Rojelj 2018 for 1.5C pathways. I believe the amount of NETs is slightly above 1000 GtC in Rogelj 2018, so please check the most recent range for NETs in these 1.5C pathways. Dooley and Kartha (2018) is the correct reference for the next sentence, which begins “Estimates of the biophysical possibilities… - please add this citation to the quoted numbers of 370-480 GtCO2. In addition, Dooley and Kartha (2018) can be used to refer to the trade-offs inherent in land-based NETs for sustainable development, perhaps by adding it to the list of references for the next sentence. Rogelj, J., Popp, A., Calvin, K.V., Luderer, G., Emmerling, J., Gernaat, D., Fujimori, S., Strefler, J., Hasegawa, T., Marangoni, G., Krey, V., Kriegler, E., Riahi, K., van Vuuren, D.P., Doelman, J., Drouet, L., Edmonds, J., Fricko, O., Harmsen, M., Havlík, P., Humpenöder, F., Stehfest, E., Tavoni, M., 2018. Scenarios towards limiting global mean temperature increase below 1.5 °C. Nature Climate Change 8, 325–332. https://doi.org/10.1038/s41558-018-0091-3 [Dooley Kate, Australia]	This text has been deleted as it is peripheral to this section. Mitigation potential through NETs is discussed in ch 2 and 6.
27095	39	33	39	38	A compact version of this information should be put into a bold statement for the Executive Summary as well as SPM. This statement gives evidence that is very relevant for management and political decision making. It states that the biophysical range of potential CDR is 370-480 Gt and that social and ethical considerations might cause this range to be much lower. This is in stark contrast to the range required in the IAM scenarios, the upper end of which is at least twice as high as what might be feasible according to this statement. Please see also our comment on the SPM regarding this issue. [, Germany]	Accepted - the discusson of these numbers have been expanded and incorporated into the SPM
39421	39	35	39	36	Not clear how these biophysical estimates differ from previous estimates given. Previous are technical/cost-derived? Make this clear. [, United States of America]	Noted. Text deleted.
17481	39	35	39	36	Dooley and Kartha (2018) should be the reference for the following sentence. [Taehyun Park, Republic of Korea]	Noted. Text deleted.

Comment No	From Page	From Line	To Page	To Line	Comment	Response
12087	39	9			Section needs to actually explain/give examples for NETs (or provide a link to the section where this is done) before assessing assessing their value/impacts - is there information in SR15? [Hans Poertner and WGII TSU, Germany]	Accepted. NETs have been described.
25465	40	1	40	1	This section should add an explicit mention of the word "BECCS". [, France]	Accepted. BECCS is now specifically mentioned.
39423	40	2	40	4	The statement "large-scale implementation of high-intensity energy crops ... can contribute to increases in the area of degraded land" is not supported by literature citations, and it is difficult to tell whether this is based on experience, research results, or speculation. [, United States of America]	Taken into consideration. Sentence modified and linked to next sentence to clarify the basis of this assertion.
33363	40	2	40	8	Once again, this material belongs with the Sections devoted to the topic, not here where it muddles the narrative. [Stephen Prince, United States of America]	Rejected. These LD processes are likely to result from land use change and intensification of existing land use in order to supply biomass for bioenergy/BECCS.
17485	40	3	40	3	This chapter gives the impression that industrial tree plantations with a most optimized age class for the production of substitution products are the definition of SFM. A stronger consideration of biodiversity and ecosystem services would be desired to recognize the wider scope of issues to consider for the best case forest management model. [Taehyun Park, Republic of Korea]	Noted. SFM is discussed explicitly in later section; it would be repetitive to expand discussion on SFM here. Issue of biodiversity is raised.
17049	40	4	40	4	Suggested to use "soil organic C pools" to avoid confusion with inorganic soil C. [Roland Hiederer, Italy]	Wrong line? Perhaps refers to line 37, which has been reworded.
33537	40	5	40	8	And negative changes in the composition and function of soil communities. [Jenni Nordén, Norway]	Rejected. This sentence is about afforestation/reforestation of degraded land; this is not likely to cause negative impacts on soil biology.
33729	40	9	40	13	The applicability of the statement "reforestation and afforestation are at lower risk to contributing to land degradation and may in fact reverse degradation", depends on the types of species planted and dominance. The ecological functioning of monoculture plantation is different from multiculture plantation. Moreover, the ecological functioning might be structured by specific species dominance. Selected species for bio-energy for example, may influnce hydrological dynamics, modifies the water yield due to change in transpiration rates. (Ref. Caldwell, P.V. 2018. Woody bioenergy crop selection can have large effects on water yield: A southeastern United States case study. Biomass and Bioenergy, Volume 117,, p180-189. https://doi.org/10.1016/j.biombioe.2018.07.021) Relative to a short term rotation, a long term rotation might facilitate recruitment of different species and enhance biodiversity. Moreover, a study in Brazil has shown that planting, e. g., Eucalyptus trees, can influence soil quality. The study has confirmed that removing harvest residues without supplying nutrients via fertilizers will cause a decrease in productivity of successive rotations due to nutrient removal. https://www.narcis.nl/publication/RecordID/oai:pure.knaw.nl:publications%2F15ebd62c-9252-40d6-b54e-12f1d592ecbc contradictory effect on fast growing plantation. 1) Potentially, fast growing plantations can attain a short or middle term ecological (e. g. carbon removal from the atmosphere) and economic (e. g. bioenergy) functions because of fast growing species have high resources utilization. 2) The issues of water users conflict in moisture limited ecosystems. Thus, due to introduction of fast growing forest plantation, downstream water supplies might be reduced and lead to social conflict. https://doi.org/10.1016/j.ejrh.2018.06.007 [, Norway]	Accepted. Potential issues for biodiversity and hydrology are mentioned and the suggested references have been added.
25467	40	12	40	13	Other parts of the report should be better consistent with this sentence. [, France]	Taken into account - Due to other comments we have added caveats to this sentence - ie diminished its significance.

Comment No	From Page	From Line	To Page	To Line	Comment	Response
39425	40	14	40	14	What models? This is important since the inherent biases of different models can lead to different outcomes. [, United States of America]	Taken into consideration. Clarified that this refers to integrated assessment models.
40219	40	17	40	17	… at risk OF degradatio [Thelma Krug, Brazil]	Accepted
32773	40	18	40	19	The last sentence of this paragraph could be improved and made more robust by adding a reference to Dooley et al (2018). This paper compares land area change for NETs from IAM models too sustainability constraints from the literature on land-use change and concludes that even the median values from IAM models for RCP2.6 are unsustainable – median values for RCP1.9 are slightly higher. Dooley, K., Christoff, P., Nicholas, K.A., 2018. Co-producing climate policy and negative emissions: trade-offs for sustainable land-use. Global Sustainability 1. https://doi.org/10.1017/sus.2018.6 [Dooley Kate, Australia]	Taken into consideration. Text has been modified in response to other comments.
40221	40	18	40	19	suggest that this phrase is re-drafted. Suggestion: if sustainable land management pratices are changed to implement large-scale bioenergy plantations, and a poor governance of the land is in place, then there are potential environmental and socio-economic risks. This formulation seems to be more consistent with AR5 WG III, SR 1.5oC and Chapter 7 of this report.. [Thelma Krug, Brazil]	Taken into account - the section has been revised
25469	40	20	40	20	This section should add an explicit mention of the word "BECCS". [, France]	Accepted. Energy crops and BECCS specifically mentioned.
17483	40	20	40	20	This chapter does not differentiate enough between reforestation and afforestation measures. If reforestation and afforestation should contribute to land restoration efforts and increase the ecosystem's resilience, more should be said about how such measures are driven by good ecological assessments on what native tree or crop species are planted and in what diversity. Monoculture energy plantation with non-native and potentially fast burning species will most likely have multiple negative side effects on the local ecosystem services, biodiversity and local communities [Taehyun Park, Republic of Korea]	Accepted. Mention of the benefit of using local species to enhance biodiversity and ecosystem services outcomes has been added.
5815	40	21	40	23	How "NETs has significant potential risks"! [Sanaz Moghim, Iran]	Taken into consideration. Risks of different NETs are now explained.
21133	40	27	40	28	The presentation of the findings of Gibbs and Salmon differs here from how it was presented at p30 line 10. In particular the lower value has changed from <1 billion ha to 1,000 Mha. The correct lower value should include 'less than' and is significantly less than for some of data used by the authors, but it would also be better to stick to the same units. [, United Kingdom (of Great Britain and Northern Ireland)]	Accepted - We understand that all areas need to be converted to km2. I added "less than"
33365	40	27	40	28	Give a reference to the section (4.4.4., 4.5.1. and maybe others that deal with area of degradation. [Stephen Prince, United States of America]	Accepted
32775	40	28	40	29	The 'also' should be removed from this sentence. Gibbs and Salmon describe the area of degraded lands - they do not imply that all of these lands are suitable or available for restoration, as this sentence implies. [Dooley Kate, Australia]	Accepted
13553	40	35	40	43	Can be improved to be more concise, possibly with confidence levels on the impacts on greenhouse gas benefits. [Lourdes Tibig, Philippines]	Taken into consideration. Reworded to condense. The mitigation potential from individual NETs is given in chapters 2 and 6.
28833	40	36	40	39	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]	Rejected - I don't count REDD+ as NET - it could involve increasing forest C stocks but that is not the primary objective.
17051	40	39	40	40	Suggested to change "soil carbon stocks" to soil organic C stocks". [Roland Hiederer, Italy]	Accepted - Sentence reworded to condense in reponse to other comments.

Comment No	From Page	From Line	To Page	To Line	Comment	Response
27097	40	39	40	43	The references given don't seem to support use of the term "typical" here regarding over-compensation of soil-carbon loss from native (!) grasslands through afforestation. Most of them describe specific and hardly comparable cases, partly they only refer to soil-carbon or just assume an increase in sequestered carbon. Moreover one of the underlying studies here, Shi et al. 2013, state a reduction in SOC after afforestation of grassland (referring to 63 sites) (Quote): "The SOC in soil depth layers of 0–10, 10–20, 20–40, 40–60 and 60–80cm were reduced with afforestation of grassland but not significantly (p>0.05), while conversion of cropland to forests (trees or shrubs) increased SOC significantly for each soil depth layer up to 60cm depth (p<0.05). Significant relationships of SOC change rate were found between topsoil (0–20cm) and deeper soil layers (20–40 and 40–60cm)." --> Cases where over-compensation is evident should be marked as such as well as the knowledge gaps regarding framework conditions where the loss of native grassland (with its potentially high biodiversity trade-offs) could be justified as assumed to be over-compensated by significantly increased and long-term carbon sequestration through afforestation (see 4.7.6 Lines 10-14) [, Germany]	Noted. The reviewer seems to have misunderstood the text, which says that the loss in SOC is compensated by the increase in biomass.
899	40	1	41	11	Even if higher side of projections for bringing land under energy crops (700 Mha) and increase in forests (1,000 Mha) is considered (Page 39, Line 27 to 32), 1,700 Mha of land will be required for planting energy crops and new forests to keep the temperature rise below 1.5 °C. This seems doable keeping in view the estimates of degraded land, 1,000 to 6,000 Mha available across the globe (Page 40, Line 27). Many countries have committed in their NDCs under Paris Agreement (Article 5) to increase the forest carbon stocks substantially. With a little nudge and financial incentive, it may not be difficult to persuade the developing countries to bring ~1,000 Mha of degraded land under new forests by 2040. Thus, the negative impact of planting high intensity energy crops (Page 40, Line 2 to 4) on lands can be contained to a significant extent. This fact needs to be flagged in Para 4.7.2, Page 40, 'Potential risks of land-based NET impacts on land degradation' to alleviate the apprehension of large-scale land degradation in planting high intensity energy crops. [Jagdish Kishwan, India]	The area of potentially available land is now added immediately after the projected area of energy crops and reforestation. NDCs are now mentioned with initiatives suporting implementaiton of NETs.

Comment No	From Page	From Line	To Page	To Line	Comment	Response
5383	40	20	41	11	I completely agree that, in principle, there can be synergies between restoration of degraded land and implementation of bioenergy or NET. However, there is a large debate on the ignorance of existing land uses in allegedly or truly degraded landscapes. This is here only referred to - without reference - in lines 31-34. I think that the political construction of "wastelands" as a means to justify measures that are detrimental to traditional societies (herders, agro-pastoralists, etc.) living in this lands (sometimes "invisible" as they are only minimally involved in the monetary economy and hence not represented e.g. in census statistics) is an important aspect that needs being mentioned. See e.g. Baka, J., 2013. The Political Construction of Wasteland: Governmentality, Land Acquisition and Social Inequality in South India. Development and Change 44, 409–428. https://doi.org/10.1111/dech.12018; Baka, J., 2014. What wastelands? A critique of biofuel policy discourse in South India. Geoforum 54, 315–323. https://doi.org/10.1016/j.geoforum.2013.08.007. In some cases, implementing market-driven bioenergy development may not only destroy local livelihoods, it may also reduce bioenergy production for local populations, and bioenergy production at large , see Baka, J., Bailis, R., 2014. Wasteland energy-scapes: A comparative energy flow analysis of India's biofuel and biomass economies. Ecological Economics 108, 8–17. https://doi.org/10.1016/j.ecolecon.2014.09.022. For a hugely important critique of top-down assessments of spare land see Young, A., 1999. Is there Really Spare Land? A Critique of Estimates of Available Cultivable Land in Developing Countries. Environment, Development and Sustainability 1, 3–18. The acknowledgement that lands identified as "unused" in remote-sensing based assessments and maps has resulted in the development of the "biomass balance model" BioBaM that consistently integrates feed demand sourced from pasture/grassland areas into assessments of bioenergy potentials. See e.g. Erb, K.-H., et al. 2012. Dependency of global primary bioenergy crop potentials in 2050 on food systems, yields, biodiversity conservation and political stability. Energy Policy 47, 260–269. https://doi.org/10.1016/j.enpol.2012.04.066; Haberl, H., et al., 2011. Global bioenergy potentials from agricultural land in 2050: Sensitivity to climate change, diets and yields. Biomass and Bioenergy 35, 4753–4769. https://doi.org/16/j.biombioe.2011.04.035. Tradeoffs between bioenergy and pressure on land systems are discussed in Haberl, H., et al. 2013. Bioenergy: how much can we expect for 2050? Environ. Res. Lett. 8, 031004. https://doi.org/10.1088/1748-9326/8/3/031004 [Helmut Haberl, Austria]	Accepted. Point added where "available" land first discussed.
33367	40	44	41	4	Is this relevant to land restoration? [Stephen Prince, United States of America]	Taken into consideration: text added to explain relevance
28767	40	12		14	"Other NETS…." This should be phrased differently to encapsulate the fact that while perhaps Afforetation and Reforetation can reverse degradation under some circumstances, it also can HINDER it if forest plantations are intensively managed, short rotations and especially, if they prevent and displace regeneration of natural diverse forest as is very often the case. IPCC should be emphasizing the restoration and natural regeneration of species diverse forests, not tree plantations. - for reasons related not only to carbon but also to biodiversity, water, soil protect and nutrients, and human rights since plantations are generally commercially owned and operated rather than for public/communal benefit. [Rachel Smolker, United States of America]	Taken into account - this particular section has been revised. The concerns expressed in this comment are discussed partly in the revised text and partly in the succeding section .
28769	40	14		19	IPCC seems to entirely shy away from any assessment of potential areas that could be harmed by large scale land based NETS. Yet a following lengthy section details potential benefits to land restoration. This is unbalanced and misleads. Also a recent reference is relevant [REFERENCE FOLLOWING] [Rachel Smolker, United States of America]	Taken into consideration. The potentially large land areas and risks were already discussed. The discussion on concerns is now expanded and the Heck reference added.

Comment No	From Page	From Line	To Page	To Line	Comment	Response
28771	40	14		19	Vera Heck, Dieter Gerten, Wolfgang Lucht, Alexander Popp (2017): Biomass-based negative emissions difficult to reconcile with planetary boundaries. Nature Climate Change. [DOI: 10.1038/s41558-017-0064-y] Weblink to the article: http://dx.doi.org/10.1038/s41558-017-0064-y "We show that while large-scale BECCS is intended to lower the pressure on the PB for climate change, it would most likely steer the Earth system closer to the PB for freshwater use and lead to further transgression of the PBs for land-system change, biosphere integrity and biogeochemical flows" [Rachel Smolker, United States of America]	Part of comment 28769
27099	41	5	41	7	No reference mentioned, please add suitable reference concerning this matter. [, Germany]	Taken into consideration. Reference added.
39427	41	8	41	9	Include citations. [, United States of America]	Citations added
27101	41	8	41	11	The Bonn Challenge and the New York Declaration on Forests refer to climate and biodiversity goals at the same time, which has effects on the measures, available area, adaptability and resilience of the restored area (permanence), etc., so conflicts can also arise between NET and the two declarations on natural forest and biodiverse grassland. Therefore, the perspective provided in the current draft that synergies may increase the financial resources available does not reflect the full picture. Please provide a more a differentiated discussion. [, Germany]	Accepted. The trade-off between carbon sequetraiton and biodivesrity is now mentioned.
8161	41	13	41	14	It is stated that "More than half (around 55%) of all the wood harvested worldwide is for fuelwood…". Utilization of wood harvested worldwide for fuelwood seems too high, considering countries producing wood products are mostly not using the wood product for fuelwood. How was this figure generated? Which countries contribute to this value? These data may need to be compared with harvested wood for timber. [Haruni Krisnawati, Indonesia]	Accepted The section has been substantially revised. This statement has been corrected.
4277	41	13	41	14	The two cited documents (Bailis et al 2015, Masera et al 2015) are not the primary source of the written statement. If you check the points made by both of the documents, actually the articles also citing the same statement from Doc 1>FAOSTAT Forestry Production and Trade (UN FAO, 2013); http://faostat3.fao.org/faostat-ateway/go/to/download/F/*/E 2>Renewable Energy Policy Network for the 21st century (REN21) Renewables Global Status Report: 2013 Update Report No., 177 (REN21 Secretariat, 2013 3>Grubler A, Johansson TB, Mundaca L, Nakicenovic N, Pachauri S, et al. 2012. Energy primer. See Johannson TB, Nakicenovic N, Patwardhan A, Gomez-Echeverri L, eds. 2012. Global Energy Assessment:Toward a Sustainable Future . Cambridge, UK: Cambridge Univ. Press, pp. 99–150 4> Smith P, Bustamante M, Ahammad H, Clark H, Dong H, et al. 2014. Agriculture, forestry and other land use (AFOLU). In Working Group III: Mitigation of Climate Change, ed. O Edenhofer, R Pichs-Madruga, Y Sokona, pp. 811–922. Bonn: IPCC. Therefore, the above listed documents should be cited rather than Bailis et al 2015 and Masera et al 2015. [Lee-Sim Lim, Malaysia]	Taken into consideration. The text has been revised substantially. Original sources are cited for the statistics.
13555	41	13	41	31	If this whole paragraph is presented as a synthesis, it would be shorter and more concise and easier for policymakers and practitioners to read and understand. [Lourdes Tibig, Philippines]	Taken into consideration. The section has been revised substantially.
40223	41	15	41	15	… heating and cooking, generally in an inefficient way (…), [Thelma Krug, Brazil]	Taken into consideration. The section has been revised substantially.

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28359	41	20	41	21	Meaning not clear [Barron Joseph Orr, Germany]	Taken into consideration. The section has been revised substantially.
32777	41	21	41	23	An old reference is used here, and it is no longer true that biomass demand for traditional bioenergy is one of the man drivers of global forest loss. The sentence should be altered to reflect that this is still a significant driver of deforestation and degradation in some regions, and more recent references included, e.g: Curtis, P.G., Slay, C.., Harris, N.L., Tyukavina, A., Hansen, M.., 2018. Classifying drivers of global forest loss. Science 361, 1108–1111. Lambin, E.F., Meyfroidt, P., 2011. Global land use change, economic globalization, and the looming land scarcity. Proceedings of the National Academy of Sciences 108, 3465–3472. https://doi.org/10.1073/pnas.1100480108 [Dooley Kate, Australia]	Taken into consideration. The section has been revised substantially including mention of drivers of deforestation. This sentence has been deleted. We haven't added the Curtis and Lambin references as they are relevant to discussion on what causes deforestation, not the impacts of traditional woodfuel.
21749	41	21	41	23	There is still a lot of uncertainty as to the impact of bioenergy / woodfuel harvesting on deforestation rates. This is because in many cases other factors such as clearing for agricultural crops may be the main drivers. Despite a lot of anecdotal accounts of woodfuels driving deforestation, within the African context studies that un-equivocally support this based on objective data are surprisingly few. [Graham von Maltitz, South Africa]	Taken into consideration. The section has been revised substantially and this driver has been added..
30951	41	21	41	23	"Bailis et al 2015 (referenced in the next sentence) do however state that 'traditional bioenergy demand does not drive deforestation, but several studies argue that it contributes to degradation, leading to reductions in biomass stock and productivity'. See also: Curtis, P. G. et al. (2018) Classifying drivers of global forest loss. Science. 3611108–1111. Available from: https://www.ncbi.nlm.nih.gov/ pubmed/30213911" [Kelsey Perlman, France]	Taken into consideration. The section has been revised substantially including mention of drivers of deforestation.
30323	41	29	41	31	Message is unclear, please clarify [, Netherlands]	Taken into consideration. The section has been revised substantially.
39431	41	29	41	31	The way this sentence is phrased is somewhat confusing, recommend revising. [, United States of America]	Taken into consideration. The section has been revised substantially.
13557	41	32	41	47	Same comment as above [Lourdes Tibig, Philippines]	Taken into consideration. The section has been revised substantially.
27103	41	44	41	44	Please provide an assessment of the information available and more explanation for the understanding of the following policy interventions: fuel substitution; production efficiency; controlling harvest while avoiding policy prescriptive language. [, Germany]	Taken into consideration. The text has been revised.
40225	41	47	41	47	chang to biomass [Thelma Krug, Brazil]	Sentence has been deleted.
39429	41	12	42	5	Section 4.7.4 would benefit from some English editing. [, United States of America]	Accepted. Whole section has been thoroughly edited
28793	41	21		23	Also see: Lambin, E.F., Meyfroidt, P., 2011. Global land use change, economic globalization, and the looming land scarcity. Proceedings of the National Academy of Sciences 108, 3465–3472. https://doi.org/10.1073/pnas.1100480108 [Rachel Smolker, United States of America]	Is there another section where Lambin ref could be added?
12091	41	32			"such an improved stove" not described yet - please include explanation [Hans Poertner and WGII TSU, Germany]	The section has been revised substantially. This sentence has been deleted.
2363	41	32			"improved stove" - Is this a stove that does not use wood or that still uses wood? In the closing paragraph of this section there is reference to "alternate stoves" and it is not clear if this is what is meant here. [Nina Hunter, South Africa]	The section has been revised substantially. This sentence has been deleted.
5817	42	1	42	2	"unsustainable use of vegetation resources" better to change this phrase, any reference. [Sanaz Moghim, Iran]	The section has been revised substantially. This sentence has been deleted.

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12093	42	1	42	5	This paragraph could be a good basis to develop IPCC uncertainty statements that summarise this subsection [Hans Poertner and WGII TSU, Germany]	Used as basis for summary par in the ES
14691	42	2	42	5	"Enhanced forest protection, improved forest management, and provision of alternate cooking and heating devices to reduce traditional use of fuelwood and charcoal can reduce pressure on forests with additional co-benefits such as improved human health." Suggest including examples of health co-benefits (e.g., improved respiratory diseases). [, Canada]	Taken into consideration. Mention of reduced respiratory disease as co-benefit has been added earlier in the section.
25471	42	6	42	6	Angelsen et al. references should be more used in this section: - Angelsen, A., et al. "Transforming REDD+: Lessons and new directions." (2018). - Angelsen, Arild, et al., eds. Analysing REDD+: Challenges and choices. Cifor, 2012. - Angelsen, Arild, ed. Realising REDD+: National strategy and policy options. Cifor, 2009. [, France]	Accepted - recent Angelsen work referenced
33539	42	8	42	8	"enhancement of forest carbon stocks" e.g. through increasing the volume of large (slowly decomposing) dead wood in forests and increasing rotation times in forestry. [Jenni Nordén, Norway]	Noted - this is discussed later in the chapter and this level of detail is not required in the opending sentence. There are many ways in which carbon stocks can be enhanced
40227	42	12	42	12	what is meant by "… in the preparation of the Paris Agreement…"?? [Thelma Krug, Brazil]	Accepted - revised text and removed that statement.
6413	42	13	42	14	Suggest to delete this phrase as it does not fit in this context and is not confirmed in the quoted source. Aleman et al 2018 suggest long-term historical deforestation and degradation in Africa (since 1900) has been over-estimated. The current phrasing in this chapter suggests African reference levels for REDD+ should be adjusted downward, the contrary would likely be true with most countries in Africa seeing an upward trend in deforestation (see data from Hansen et al 2013 accessible at https://www.globalforestwatch.org/countries/) [Marieke Sandker, Italy]	Accepted with modifications - we maintained the sentence but clarified the statement to better reflect the content of the study.
40229	42	18	42	19	Please review the phrase as it does not make sense as is. "Natural regeneration of second-growth forests contributes significant and annually increasing carbon sinks to the global carbon budget". [Thelma Krug, Brazil]	Accepted - sentence was reworded to increase clarity and accuracy of the statement.
40231	42	21	42	23	Does the value provided consider that not all of the natural regeneration (assisted or not) does not remain in this condition, particularly in tropical countries where land is set aside for 5-7 years and then converted back to other land-use categories (cropland, grassland)? can the source be provided? [Thelma Krug, Brazil]	Accepted - we have added the reference. And the study assumes that forests in the 1-20 and 20-60 year age classes continue to grow. Most of this area is well above 5-7 years and thus not subject (in the scenario) to deforestation.
15065	42	22	42	22	Please see if the phrase 'in aboveground biomass' is repetition. Suggested to be deleted. [Muhammad Mohsin Iqbal, Pakistan]	Accepted - sentence has been reworded.
40233	42	26	42	26	please check if land sector as a carbon sink is consistent with Chapter 2 [Thelma Krug, Brazil]	Noted and confirmed that Chapter 2 also concludes that the global land sector is a sink. This is also confirmed for decades by multiple other publications, including the global carbon project.
39433	42	30	42	30	Urbanization needs to be represented more across this document as well as wetland conversions (not all wetlands are forested). [, United States of America]	Accepted - urbanisation covered in more depth, e.g. in the section on traditional biomass - urbanisation causing a large increase in demand for charcoal with implications for deforestation and land degradation.
40235	42	32	42	32	change studies to study [Thelma Krug, Brazil]	Accepted - editorial
22597	42	34	42	36	" two enabling institutional configurations: (1) the presence of already initiated policy change; and (2) scarcity of forest resources combined with an absence of any effective forestry framework and policies" - I do not understand these two points. They seem to be contradicting each other. [Anastasios Kentarchos, Belgium]	Rejected - the authors of the paper we cite identify the positive push (policy) or the negative stress (resource scarcity) as conditions that can contribute to REDD+ success - if also combined with other factors.

Comment No	From Page	From Line	To Page	To Line	Comment	Response
6415	42	39	42	41	The current formulation is focused on REDD+ projects on the voluntary carbon market, that is not the transformation REDD+ as suggested by the preceding paragraph. It would be relevant here to give an overview of how government participation in REDD+ is evolving, through the reporting to the UNFCCC. The following text is suggested for addition to make this section more relevant: In 2018, 34 countries have submitted a REDD+ forest reference level and/or forest reference emission level to the UNFCCC and 5 countries submitted REDD+ results in the technical annex to their BUR totalling an emission reduction of 6.3 billion tCO2 (FAO 2018). Of these REDD+ reference levels, 95% included the activity "reducing deforestation" while 34% included the activity "reducing forest degradation". New reference: FAO, 2018. From reference levels to results reporting: REDD+ under the UNFCCC. 2018 update. Rome, Food and Agriculture Organization of the United Nations (FAO). http://www.fao.org/3/CA0176EN/ca0176en.pdf [Marieke Sandker, Italy]	Accepted - thank you for this suggestion - we have incorporated the proposed text and the reference.
27107	42	41	42	42	REDD+ as a (sub) national approach only exists since the establishment of the Warsaw Framework for REDD+ in 2013. What did Olson compare in 2014? Voluntary REDD+ projects? Please add clarification. [, Germany]	Accepted - we have deleted that sentence.
25473	42	42	42	45	To be more balanced, this sentence should also mention and discuss REDD+ safeguard clauses. For more information, please consult dedicated UNFCCC website: https://redd.unfccc.int/fact-sheets/safeguards.html. [, France]	Accepted - we have deleted that unbalanced sentence and added earlier in the text explicit reference to the Cancun safeguards.
27109	42	45	42	46	Leakage is a minor problem for a national approach but more relevant for project approaches like CDM or voluntary markets. The concepts used under the term REDD+ are not quite clear in this paragraph. Please clarify whether subnational or international leakage is meant. [, Germany]	Accepted - clarified that we are referrring to subnational leakage.
40237	42	45	42	46	for REDD+ as agreed under the Climate Change Convenion (where it was borne), leaage is NOT a problem since the REDD+ approach is national. So, the reduction of emissions from deforestation, for instance, is estimated considering the entire national territory. This explain why the REDD+ provisions under the COnvention do not consider the issue of leakage, since what matters is the national reduction. What could constitte a problem is international leakage, bu even this issue did not evolve in the netotiations, since it is hard to associate cause and effect. The reason why so many authors write about leakage in REDD+ is that some projects self-nominate tham REDD+, when in fact there are no REDD+ projects per se. There is only a national REDD+ with national results. [Thelma Krug, Brazil]	Accepted - text revised and leakage is describes now as a subnational issue related to voluntary carbon market projects - not national programs such as REDD+.
14477	42	52	42	52	studies' to 'study' [Janice Ser Huay Lee, Singapore]	Accepted - editorial (in line 32)
27105	42	6	43	2	In Section 4.7.5, please include an assessment of the information available on REDD+ emission reduction by Brazil, as well as recent publications of CIFOR on REDD+. [, Germany]	Accepted - we added recent FAO references, and several references to work published by CIFOR
13559	42	6	43	2	Same comment on the need for a ynthesis with calibrated language. [Lourdes Tibig, Philippines]	Accepted - the section has been substantially updated
33369	42	6	43	2	This overall section (4.7.) heading is about bioenergy, so is this title appropriate? [Stephen Prince, United States of America]	NOTED - but this section addresses ways in which bioenergy providion impacts can be avoided

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1437	42	39	43	2	Potential negative impacts of REDD+ are widely recognised, which explains why parties to the UNFCCC agreed to a set of safeguards for REDD+. These are known as the Cancun Safeguards. Suggest you refer to these. Note that countries implementing REDD+ are required by UNFCCC decisions to establish a safeguards information system and to report on their implementation of the safeguards. See https://redd.unfccc.int/fact-sheets/safeguards.html [Henry Scheyvens, Japan]	Accepted - explicit mention of Cancun Safeguards for REDD+ projects has been added.
17501	42	45	43	2	When raising concerns about leakage, it would be appropriate to explain that national-level implementation of REDD+ in accordance with the Warsaw Framework for REDD+ partly addresses leakage, while the leakage risk is much higher for project implementation. [Dirk Nemitz, Germany]	Accepted - text revised and leakage is describes now as a subnational issue related to voluntary carbon market projects - not national programs such as REDD+.
6385	42	25	44	16	This is a useful box, but it would be helpful to include in the box how sensitive African food security is to climate change, and what the specific climate-related challenges would be. [, Gambia]	This comment has the incorrect line numbers - not clear what box the reviewer is referring to.
28659	42	11		17	Miles and Co-authors(2015) in the preparation of Paris Agreements developed technical mitigation potential in tropical forest. I recommend the statement of purpose and mitigating strategy should be highlighted for the purpose of the second draft of the IPCC. Tropical rainforests are one the most important region forests restoration and a major contributor to our ecosystem and biodiversity. [Abiodun Adegoke, Nigeria]	Accepted - throughout the chapter we make references to the importance of forest restoration, which is not limited to tropical rainforests. However, even greater and faster mitigation outcomes are achieved through reduction of deforestation and degradation.
25475	43	3	43	3	Some recent references should be used to improve this section: - Luyssaert, Sebastiaan, et al. "Trade-offs in using European forests to meet climate objectives." Nature 562.7726 (2018): 259. - Naudts, Kim, et al. "Europe's forest management did not mitigate climate warming." Science 351.6273 (2016): 597-600. - Valade, Aude, et al. "Carbon costs and benefits of France's biomass energy production targets." Carbon balance and management 13.1 (2018): 26. [, France]	Accepted with modifications - we did add some (but of all of the references) and we did improve the text.
30509	43	3	43	47	need to include reference to cultral practices and Indigenous knowledge in sustainable forest management [Hannah Fluck, United Kingdom (of Great Britain and Northern Ireland)]	Rejected - this is already covered in other sections of Chapter 4.
40239	43	4	43	4	suggest to change avoiding deforestation to reducting deforestation [Thelma Krug, Brazil]	Rejected - while in general and in the previous section we do speak about reducing deforestation, in this specific sentence we truly mean avoiding deforestation. Reducing deforestaton implies that there is still some deforestation going on.
27111	43	4	43	7	Why does avoiding forest degradation and deforestation only help in the short term, whereas it is suggested that the commercial use of forests (sustainable forest management) is required for long term success; this reflects very well interest and standpoints of the forest sector. Please add further clarification as to why. [, Germany]	Rejected - the sentence and the associated references already state clearly that we sustaining the forest (and its management) for timber and non-timber resources helps sustain communities. Commercial interests can be associated with non-timber resource uses.
5473	43	4	43	9	It would be interesting to examine the differences between mature and young forests according to other functions, they provide. [, Hungary]	Noted - yes - there are many other possible aspects that can be examined - but here we are providing a high-level synthesis.
30943	43	4	43	9	Avoiding deforestation and forest degradation is a key component of achieving not only short-term goals as acknowledged here, but also long-term goals. Avoiding deforestation in itself should not be separated from the other (economically-motivated) actions listed, and indeed must be the main goal. [Kelsey Perlman, France]	Rejected - there are many commercial and non-commercial uses of forests, including parks and other recreational uses. Where people and forests mix, some form of forest use to sustain livelihoods will be required - even in hunter-gatherer societies.
15265	43	10	43	19	Some of the more recent research and recommendations should be included here, in particular the recommendations for forest management suggested by UK Forest Research in their report on the impacts of biomass (pages 7-9) https://europeanclimate.org/wp-content/uploads/2018/05/CIB-Summary-report-for-ECF-v10.5-May-20181.pdf [Andrew Dugan, United Kingdom (of Great Britain and Northern Ireland)]	Accepted with modification - these recommendations are very specific but some of the overall observations on the importance of biomass sources are relevant - the study has been cited in the appropriate section.

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39437	43	14	43	14	It also requires an understanding of the global market forces and their impacts on regional market pricing, and their interaction with climate change (Kim et al. 2017, Tian et al. 2016). REFS: Tian, X., Sohngen, B., Kim, J.B., Ohrel, S. and Cole, J., 2016. Global climate change impacts on forests and markets. Environmental Research Letters, 11(3), p.035011. Kim, J.B., Monier, E., Sohngen, B., Pitts, G.S., Drapek, R., McFarland, J., Ohrel, S. and Cole, J., 2017. Assessing climate change impacts, benefits of mitigation, and uncertainties on major global forest regions under multiple socioeconomic and emissions scenarios. Environmental Research Letters, 12(4), p.045001. [, United States of America]	Noted - but this is not relevant here. Global market forces are simply one of many drivers of the rates of harvest - and here we do not discuss the drivers but the outcomes of changes in harvest rates.
30949	43	14	43	14	The idea that moving from natural to managed forests, a process which may result in reduced forest stock, has climate benefits, is not accurate. Reducing the forest stock, even if the overall sink increases in size, is not a sustainable long-term climate mitigation action - we should be ensuring that forests stand in the long-term. Körner, C., 2017: A matter of tree longevity. Science 355, 130–131. https://doi.org/10.1126/science.aal2449 [Kelsey Perlman, France]	Rejected - numerous studies have shown that in the long term the sinks in forests, HWP and avoided emissions through substitution benefits do provide GHG benefits. We can argue about the time frame but in the long term this is the climate action that is required.
33541	43	14	43	16	"… the magnitude of which depends on" the amound of woody debris left. Harvest rotation times are also very important, and currently decreasing in Fennoscandia. I think that it is problematic to refer to the frequency of natural disturbances because it has varied through time, partly because of humans (e.g. human indced frequent fires vs. efficient fire suppression by humans), and especially because forestry is much more extensive and cuttings occur much more frequently than any natural disturbance would. Reference: Clear et al. 2014. Holocene fire in Fennoscandia and Denmark. International Journal of Wildland Fire 23(6) 781-789. [Jenni Nordén, Norway]	Accepted with modifications. We have added to the text that not only the frequency but also the intensity of harvest (i.e. amount removed) matter.
32779	43	14	43	19	The argument made here is misleading. A reduction in the forest carbon stock, even while increasing the sink, will not lead to long-term mitigation benefits. It is the longevity of the forest carbon stock which is most important to climate mitigation. See recent paper: Körner, C., 2017. A matter of tree longevity. Science 355, 130–131. https://doi.org/10.1126/science.aal2449 [Dooley Kate, Australia]	Rejected - many papers have demonstrated that an assessment of the climate migitation benefits cannot be based on an assessment of the forest carbon stock alone (e.g. IPCC AR4, Nabuurs et al. 2007) and many papers since then. However, we did add additional text to explain why different studies may come to different conclusions.
32467	43	14	43	19	The assumption that the transition from natural forests into managed forests could enhance the forest carbon sink is based on the disputed assumptions aboud harvested wood products that are criticized in, amongst others, Luyssaert et al., 2008, Keith et al., 2015, Martin et al., 2015, Boettcher et al., 2018, Law et al., 2018, Pingoud et al., 2018, . Moreover, the most important factor in climate change mitigation is the longevity of the forest carbon stock (see also Korner, 2017). [Simone Lovera-Bilderbeek, Paraguay]	Rejected - there are numerous papers, including Pingoud et al 2018 cited here and others that are now added to the revised text that demonstrate clearly the contributions of sustainably managed forests to climate change mitigation. However, we do differentiate more carefully that a climate benefit depends on many factors, and that not all such transitions are climate beneficial.

Comment No	From Page	From Line	To Page	To Line	Comment	Response
5385	43	17	43	47	It is correct that replacing natural forests (with high C stocks and low or no net yearly C uptake) with younger forests can create a C sink (i.e. a forest with net C uptake from the atmosphere). However, this is not necessarily beneficial for the climate, as claimed here. In fact, this is only the case if the initial C loss is overcompensated by the C benefits of the consequent managed forest, taking into account the initial C loss ("slow in, fast out", Körner, C., 2003. Slow in, Rapid out-Carbon Flux Studies and Kyoto Targets. Science 300, 1242–1243. https://doi.org/10.1126/science.1084460). Even if parts of the C are incorporated in long-lived socioeconomic C stocks (Lauk, C., et al. 2012. Global socioeconomic carbon stocks and carbon sequestration in long-lived products 1900-2008. Environmental Research Letters, 7, 034023 doi: 10.1088/1748-9326/7/034023), this C loss to the atmosphere is substantial and must not be neglected. Only a fraction of the biomass of a harvested forest is incoroporated in high-value timber, usually far more than 50% are lost (left on site, twigs, bark, undergrowth, etc.) or lost due to soil warming after canopy removal, etc., or used for short-lived products from which the C is quickly released to the atmosphere as well. We cannot cherisch C sinks of young forests without also accounting these "fast out" losses. Hence this formulation needs to be revised in a manner that does not lend itself to misinterpretation. Strict use of a consistent language in terms of stocks and flows of C as well as consideration of the entire cycle of events are key here. The "fast out" component must not be conceiled. While I agree that replacing steel-reinforced concrete in buildings with wood is in many cases a useful thing to do, the cited literature (see also ch11 in AR5, WGIII, 2014) also shows that there are complex interdependencies that must not be neglected in order to avoid "solutions" that lack the desired climate benefit. In order to be balanced, I therefore think that this assessment must also reflect the discussion on C payback times of initial C losses, see e.g. articles by Sebastiaan Luyssaert, Beverly Law, Bjart Holtsmark, Ernst D. Schulze, Kim Pingoud and others [Helmut Haberl, Austria]	Accepted and the text has been revised and expanded to address many of these issues. However, the fundamental conclusion remains after reviewing additonal literature. Climate effictive sustainable forest management strategies exist, and can be identified through analyses that take into consideration changes in ecosystem C stocks, HWP C stocks and subsitution benefits.
39441	43	22	43	23	Consider replacing "measurements" with "estimates" here and elsewhere as the term "measurements" gives a false sense of certainty. In this particular case, measurements of tree attributes are used in allometric models to estimate tree volume (or tree mass directly) and those volume estimates are used with wood and bark specific gravity estimates to convert to mass and that mass is then converted to carbon by using an estimate of carbon content in the bark and wood. [, United States of America]	Accepted - text revised.
39443	43	24	43	24	The debate is still out on how big of carbon sinks old-growth forests are. Many of the old-growth forests such as the Gao et al. reference here only go up to 210 years. Forests can be much older and others have shown they continue to be important sinks that could turn into large sources if disturbed (e.g. Luyssaert et al. 2008, Nature 455: 213-215). [, United States of America]	Noted and we have further refined the text. However the statement that the rate of sink decreases with age as is clearly supported by the reference provided by the reviewer.
27113	43	24	43	27	When stating "…sink strength is diminishing…" it should be made much clearer that this can be (and often is) a century long-process with important implications in terms of a carbon focus in management decisions. Luyssaert et al. state (Quote): Here we report a search of literature and databases for forest carbon-flux estimates. We find that in forests between 15 and 800 years of age, net ecosystem productivity (the net carbon balance of the forest including soils) is usually positive. (Luyssaert et al. 2013, Old-growth forests as global carbon sinks) [, Germany]	Rejected - the term "diminish" means that the size of the sink strength decreases and that does occur over time. Yes, it may take centuries (in some forest types but not in others) to reach zero but here we do not speak about when this occurs. This is a general (and correct) statement that the rate of sink decreases with age as is clearly supported by the reference provided by the reviewer.

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39445	43	28	43	30	This statement from seems to contradict what is depicted in Figure 4.1. [, United States of America]	Accepted - we have revised the figure to more clearly show a gradient in land degradation status and show that less degraded lands (with regard to their PRODUCTIVITY) can have both higher carbon stocks and higher carbon sinks then more degraded lands.
17487	43	28	43	30	This depends very much on whether only climate benefits or benefits for biodiversity and ecosystem services are also taken into account. To create degradation-prone and resilient forest ecosystem the latter is key. [Taehyun Park, Republic of Korea]	Comment unclear but we have further refined the text to more clearly discuss the range of issues.
13289	43	28	43	47	The value of maintaining and enhancing C stocks (and reducing emissions from relatively stable ecosystems like primary forests) will be critically important until at least 2050. So too will ensuring the resilience and stability of forest restoration – which can best be achieved if natural forests are allowed to recover (to the extent possible) their natural carbon carrying capacity and fragmentation and other non-climate disturbances are minimized during recovery to maximize ecosystem integrity (Missing Pathways to 1.5˚C). • Dooley, K., Stabinsky, D., Stone, K., Sharma, S., Anderson, T., Gurian-Sherman, D. and Riggs, P. (2018). Missing Pathways to 1.5˚C: The role of the land sector in ambitious climate action. CLARA: Climate Land Ambition and Rights Alliance. [Aila Keto, Australia]	Noted and we have added references (e.g. Lewis et al 2019) about the importance of primary forests. However, the conclusion that conservation is best depends on many factors, including the risk of natural disturbance, the initial state of the landscape etc as now elaborated in the revised text.

Comment No	From Page	From Line	To Page	To Line	Comment	Response
13335	43	28	43	47	The value of maintaining and enhancing C stocks (and reducing emissions from relatively stable ecosystems like primary forests) will be critically important until at least 2050. So too will ensuring the resilience and stability of forest restoration – which can best be achieved if natural forests are allowed to recover (to the extent possible) their natural carbon carrying capacity and fragmentation and other non-climate disturbances are minimized during recovery to maximize ecosystem integrity (Missing Pathways to 1.5˚C). • Dooley, K., Stabinsky, D., Stone, K., Sharma, S., Anderson, T., Gurian-Sherman, D. and Riggs, P. (2018). Missing Pathways to 1.5˚C: The role of the land sector in ambitious climate action. CLARA: Climate Land Ambition and Rights Alliance. Most wood products are relatively short lived with the default values utilized by the IPCCC being 2 years for paper, 25 years for composite wood-based panels, and 35 years for sawnwood (IPCC 2014 Revised supplementary methods and good practice guidance arising from the Kyoto Protocol). In climate time scales these are very short time frames. This is particularly relevant when considering the atmospheric lifetime of fossil fuel carbon dioxide (Archer et al. 2009). • Archer, D., Eby, M., Brovkin, V., ridgwell, A., Cao, L., Mikolajewiecz, U., Caldeira, K., Matsumoto, K., Munhoven, G., Montenegro, A. and Tokos, K. (2009) Atmospheric lifetime of fossil fuel carbon dioxide. Annu. Rev. Earth Planet. Sci. 37:117-134. Wood that is burned is obviously an instant emission only theoretically offset when the source forest has regrown to the harvest age. Replacing coal with a material that is more emissive per unit of energy than coal (Booth 2018) will make solving the climate challenge more difficult over the short term. Add to this the well documented criticisms of forest carbon accounting rules that mean emissions when forests are logged may not be properly accounted and you have at best a highly problematic and at worst a potential serious problem for reigning in GHG emissions into the atmosphere in relevant time frames. • Booth, M.S. (2018) Not carbon neutral: Assessing the net emissions impact of residues burned for bioenergy. Environmental Research Letters 13: 035001. https:doi.org/10.1088/1748-9326/aaac88. [Aila Keto, Australia]	Noted - this is partly the same comment as the previous one. We also acknowledge and have added text about the importance of assessing the time dynamics of carbon sinks and sources. However the contributions of wood product C storage and substitution benefits to climate change mitigation are suppored in many publications and we have added further recent papers.
32781	43	30	43	30	Also add as a reference here: Körner, C., 2017. A matter of tree longevity. Science 355, 130–131. https://doi.org/10.1126/science.aal2449 [Dooley Kate, Australia]	Rejected - this paper is a commentary and not a scientific analysis.
33731	43	31	43	47	What should be prioritized in sustainable forest management, biodiversity or carbon pool and carbon sink? Carbon sink is an inversely related to age stands and carbon removal is a directly related to age. However, how is age related to biodiversity? What is the relationship between carbon sink /removal and biodiversity? A positive relationship between carbon stocks and biodiversity was reported by Lecina-Diaz et al 2018. The positive carbon stocks–biodiversity relationship in forests: co-occurrence and drivers across five subclimates. https://doi.org/10.1002/eap.1749 [, Norway]	Accepted with modification - we have added a sentence on the need to also assess biodiversity outcomes and have added the suggested I1227 reference.
27117	43	36	43	36	Please amend the text as follows: "The use of these wood products can further contribute to GHG emission reduction goals by avoiding the emissions from the products with higher embodied emissions that have been displaced (Nabuurs et al. 39 2007a; Lemprière et al. 2013)". Rationale: The GHG emission reduction also depends on emissions that would be caused by the substituted products. [, Germany]	Accepted.

Comment No	From Page	From Line	To Page	To Line	Comment	Response
32783	43		43	34	There is much literature that would provide an alternative view to the idea that increased forest harvest, and maintaining younger forest stands will benefit the climate. See the following sources, which all suggest significant reductions in harvest rates and lengthened rotation cycles to increase the forest carbon stock. Please reflect the more recent literature on forest management for climate mitigation more fully: Pingoud, K., Ekholm, T., Sievänen, R., Huuskonen, S., Hynynen, J., 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 Law, B.E., Hudiburg, T.W., Berner, L.T., Kent, J.J., Buotte, P.C., Harmon, M.E., 2018. Land use strategies to mitigate climate change in carbon dense temperate forests. Proceedings of the National Academy of Sciences 115, 3663–3668. https://doi.org/10.1073/pnas.1720064115 Böttcher, H., Hennenberg, K., Winger, C., 2018. Forest Vision Germany. Oko Institut, Berlin. Houghton, R.A., Nassikas, A.A., 2018. Negative emissions from stopping deforestation and forest degradation, globally. Global Change Biology 24, 350–359. https://doi.org/10.1111/gcb.13876 And for tropical regions, Sustainable Forest Managment has been shown to not work, resulting in a decrease in forest carbon stock: Luyssaert, S., Schulze, E.-D., Börner, A., Knohl, A., Hessenmöller, D., Law, B.E., Ciais, P., Grace, J., 2008. Old-growth forests as global carbon sinks. Nature 455, 213–215. https://doi.org/10.1038/nature07276 Martin, P.A., Newton, A.C., Pfeifer, M., Khoo, M., Bullock, J.M., 2015. Impacts of tropical selective logging on carbon storage and tree species richness: A meta-analysis. Forest Ecology and Management 356, 224–233. https://doi.org/10.1016/j.foreco.2015.07.010 Lutz, J.A., Furniss, T.J., Johnson, D.J., Davies, S.J., Allen, D., Alonso, A., Anderson-Teixeira, K.J., Andrade, A., Baltzer, J., Becker, K.M.L., Blomdahl, E.M., Bourg, N.A., Bunyavejchewin, S., Burslem, D.F.R.P., Cansler, C.A., Cao, K., Cao, M., Cárdenas, D., Chang, L.-W., Chao, K.-J., Chao, W.-C., Chiang, J.-M., Chu, C., Chuyong, G.B., Clay, K., Condit, R., Cordell, S., Dattaraja, H.S., Duque, A., Ewango, C.E.N., Fischer, G.A., Fletcher, C., Freund, J.A., Giardina, C., Germain, S.J., Gilbert, G.S., Hao, Z., Hart, T., Hau, B.C.H., He, F., Hector, A., Howe, R.W., Hsieh, C.-F., Hu, Y.-H., Hubbell, S.P., Inman-Narahari, F.M., Itoh, A., Janík, D., Kassim, A.R., Kenfack, D., Korte, L., Král, K., Larson, A.J., Li, Y., Lin, Y., Liu, S., Lum, S., Ma, K., Makana, J.-R., Malhi, Y., McMahon, S.M., McShea, W.J., Memiaghe, H.R., Mi, X., Morecroft, M., Musili, P.M., Myers, J.A., Novotny, V., de	Noted and our text has been revised to point out the range of possible outcomes and the factors that contribute to diverging views in the literature. It is important to recognise, however, that many of the papers that argue strongly for conservation over forest management tend to ignore C storage in harvested woo+l1232d products and the substitution benefits achieved from wood use.
39435	43	3	44	3	What about shifting to different species due to future changes in climate? It may not always be appropriate to plant the same species after harvest and it is not possible to manage carbon if the trees don't survive. [, United States of America]	Accepted - we have made reference to assisted migration (shifting of species in response to anticipated climate change) in the resilience section of Chapter 4.9.3
39439	43	20	44	3	This description suggests that all forests are even-aged and rates of carbon removal are driven exclusively by tree age. Multi-aged forests are common in many parts of the world and these forests may be functioning quite differently than "young" or "medium" aged forest ecosystems, and created and maintained through very different disturbance regimes. Suggest revision and elaboration here that rates of carbon removal are not just age-related but, in fact, controlled by many biophysical factors and human activities. Further, tree- and/or stand-age are convenient metrics to predict many of the processes described in this section. That said, in practice, tree- and/or stand-age are challenging (in the case of multi-aged forests) and expensive (in the case of field inventories) to characterize. [, United States of America]	Accepted and text revised

Comment No	From Page	From Line	To Page	To Line	Comment	Response
27115	43	31	44	3	REDD+ as a strategy for conservation and sustainable use was criticised (see previous page) for its impact on biodiversity. However, a carbon focused, sustainable forests management strategy which prefers young stands over old growth forests (with its high biodiversity) was not assessed regarding its effects on biodiversity. This seems unbalanced and should be addressed equally for both concepts. Please provide further clarification accordingly. [, Germany]	Accepted and this is already discussed earlier in the chapter but we have added an additional statement on the importance of assessing other cirteria of SFM including the impacts on biodiversity.
14479	43	31	44	3	The examples given are from temperate forestry practices. Consider including tropical forest management practices. Often invasive species are used for timber plantations in tropical regions. This could pose a problem for biodiverse tropical regions. [Janice Ser Huay Lee, Singapore]	Accepted - we have expanded test to include more tropical examples and references.
32785	43	39	44	3	The argument made in this section, that transition to sustainable forest management provides mitigation benefits, even if occurring an initial carbon debt, is outdated, and this section relies on old literature. This needs to be updated with the critiques of sustainable forest management, and the benefits of ecosystem based approaches, that prioritise maintaining natural ecosystems over production forests wherever possible, for greater climate and biodiversity benefits. This should be referred to as ecosystem based approaches, under the more general heading of sustainable management of forests (not SFM). CBD, 2014. Connecting biodiversity and climate change mitigation and adaptation: report of the second Ad Hoc Technical Expert Group on Biodiversity and Climate Change. Secretariat of the Convention on Biological Diversity. CBD, 2016. Decision XIII/5. Ecosystem restoration: short-term action plan (No. CBD/COP/DEC/XIII/5). Convention on Biological Diversity. [Dooley Kate, Australia]	Noted - we have updated the literature - but we do not share the conclusion of this reviewer. We have updated the text to further discuss the complexities and range of possible outcomes.
28775	43	10		19	Here and elsewhere in the report reference to harvested wood products as displacing GHG emissions from building materials and other. This is hugely problematic as it presumes that the scale of demand for building materials can be significantly ramped up to displace those from other materials without seriously compromising efforts to slow and halt deforestation, and prevent natural forests from being replaced by tree farms. There are limits to the amount of wood that can be produced sustainably while meeting other SDGs. When the scale of demand is unsustainable, no standards can render it sustainable. The issue of scale of demand for wood must be addressed holistically taking all of the demands into consideration simultaneously. [Rachel Smolker, United States of America]	Noted but we are not discussing here the scale at which actions will be implemented (this is discussed in chapter 6).
28777	43	10		19	Some more critical perspective on harvested wood products: Keith, H., Lindenmayer, D., Macintosh, A., Mackey, B., 2015. Under What Circumstances Do Wood Products from Native Forests Benefit Climate Change Mitigation? PLOS ONE 10, e0139640. https://doi.org/10.1371/journal.pone.0139640 [Rachel Smolker, United States of America]	References only for previous comment.
28779	43	10		19	Law, B.E., Hudiburg, T.W., Berner, L.T., Kent, J.J., Buotte, P.C., Harmon, M.E., 2018. Land use strategies to mitigate climate change in carbon dense temperate forests. Proceedings of the National Academy of Sciences 115, 3663–3668. https://doi.org/10.1073/pnas.1720064115 [Rachel Smolker, United States of America]	References only for previous comment. This reference has also been added to the chapter.I1167

Comment No	From Page	From Line	To Page	To Line	Comment	Response
28795	43	20		30	It is problematic that old growth forests, or old trees are somehow less valuable for climate because they are not "active sinks". First of all there are studies demonstrating that old trees continue to sequester carbon. [REFERENCE FOLLOWING] And secondly the long term storage of "already sequestered" carbon is at least as important as ongoing sequestration. Releasing carbon that is long stored within old trees is clearly not "good for the climate" whether or not "new" carbon is being added to the store. This misconception that young trees are "better for the climate" is incentive for cutting, and for replacing old growth forests with short rotation tree plantations. [Rachel Smolker, United States of America]	Noted and the text has been revised to strengthen the arguments provided. We do not speak about the "value" of old growth forests which is clearly defined by more than their contribution to C sinks. However, their contribution to the carbon balance needs to be considered if the goal is to design mitigation strategies aimed at contributing to net negative emissions, the subject of this section of chapter 4.
28797	43	20		30	Körner, C., 2017. A matter of tree longevity. Science 355, 130–131. https://doi.org/10.1126/science.aal2449 [Rachel Smolker, United States of America]	Noted - belongs to the previous comment.
28799	43	20		30	Köhl M, Neupane PR, Lotfiomran N (2017) The impact of tree age on biomass growth and carbon accumulation capacity: A retrospective analysis using tree ring data of three tropical tree species grown in natural forests of Suriname. PLoS ONE 12(8): e0181187. [Rachel Smolker, United States of America]	Noted - belongs to the previous comment - and note that this paper talks about the C accumulation rates in individual trees but these need to be evaluated at the stand or landscape level as the number of trees per ha decreases with tree size.
17463	44	44	4	45	This paragraph should emphasize, that the potential climate change degradation of the carbon stocks in these wild and semi-wild ecosystems should not be further increased by human induced degradation of these remaining wild and intact ecosystems. Therefore, the needed protection of wilderness - especially the last ancient forests on this planet - should be highlighted more predominantly by this report. [Taehyun Park, Republic of Korea]	NOTED - this section however introduces the degradation processes not the solutions or actions to prevent them
39447	44	11	44	11	Changes to "processes". [, United States of America]	ACCEPTED - change made
39449	44	11	44	11	This statement is not necessarily true as permafrost thawing can lead to large fluxes of methane and agricultural production large fluxes of carbon dioxide. So, in many cases, the exact opposite is true. [, United States of America]	NOTED - paragraph changed and permafrost thawing and CH4 case made more clear
7543	44	11	44	18	Permafrost is also a source of methane, which is slowly released into the atmosphere as the permafrost thaws and has a far greater impact on warming than CO2, especially in the near-term, because of its larger GWP. See 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 - we don't consider part of land degradation, it is treated in Chapter 2 and even more in the SROCC report
7619	44	11	44	18	Permafrost is also a source of methane, which is slowly released into the atmosphere as the permafrost thaws and has a far greater impact on warming than CO2, especially in the near-term. See 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 - we don't consider part of land degradation, it is treated in Chapter 2 and even more in the SROCC report
13561	44	11	44	18	Traceable accounts/references [Lourdes Tibig, Philippines]	NOTED - references added
23517	44	13	44	13	Please use the term wildfire [Renata Libonati, Brazil]	ACCEPTED - change made
40241	44	13	44	13	suggest to include land before degradation processes (land degradation processes) [Thelma Krug, Brazil]	ACCEPTED - change made
40243	44	15	44	15	suggest to include land before degradation processes (land degradation processes) [Thelma Krug, Brazil]	ACCEPTED - change made

Comment No	From Page	From Line	To Page	To Line	Comment	Response
5819	44	15	44	18	"Many degradation ...often opposed to those of greenhouse gases" in what way it opposed to GHGs? [Sanaz Moghim, Iran]	NOTED - point clarified
39451	44	17	44	17	Throughout the chapter, it is very curious as to where confidence (and likelihood) is inserted. Some places have confidence, some places have confidence and likelihood and then some places where is seems obvious that there should be a statement nothing exists. The chapter would benefit from a consistent treatment. Consider focusing on the major conclusions. [, United States of America]	NOTED - uncertainty language made more uniform in this section
39453	44	20	44	20	Valid statement, but this contrary to what is above (permafrost thawing). [, United States of America]	NOTED - contradiction eliminated after changing paragraph above
33543	44	20	44	20	and soil communities [Jenni Nordén, Norway]	ACCEPTED - biota added
39455	44	30	44	34	Major impact of soil erosion is decreased soil depth and therefore rooting depth, water holding capacity leading to decreased productivity, and carbon inputs. [, United States of America]	NOTED - the overall chain of efects is introduced
40657	44		44		I do not understand the title of 4.8 (why climate systemS not global and regional climate)? Again, the section is built on citing (not assessing) quite ancient publications, not recent references, why? [Valerie Masson-Delmotte, France]	NOTED - references updated and assessment made more prominent
13563	44	19	45	28	As many readers are not experts, on land degradation but still need to be able to advise policymakers, it is quite important that the scientific information in this assessment report be an easy read; hence the need for the synthesized material, preferably with uncertainty lnguage. [Lourdes Tibig, Philippines]	NOTED - whole text made more clear
6193	44	27	45	45	For abbreviations write full word at first time for the benefits of non-scientist readers For example : Pg C yr-1 [Sawsan Mustafa, Sudan]	ACCEPTED - change made
22599	45	5	45	7	"It is important to highlight that the direct C-sequestration benefits of no-till practices (i.e. tillage elimination favoring crop residue retention in the soil surface) which were seen with high optimism at the onset of this technology appear uncertain after recent assessments" This sentence seems to be standing alone with no connection to the sentence that follows it. The linkage with the previous sentence is not clear either. Rearranging the paragraph could make it flow better. [Anastasios Kentarchos, Belgium]	NOTED - paragraph changed
39457	45	5	45	7	Explain why C-sequestration benefits of no-till are now uncertain. [, United States of America]	NOTED - sentence changed
27119	45	5	45	8	No-tillage/soil conservation technics are still relevant and contribute to C-sequestration (see: http://kulunda.eu/?q=de/content/modern-cropping-systems-and-technologies-soil-conservation-siberian-agriculture). Please provide more detailed information on the no-tillage/soil conservation techniques. [, Germany]	Taken into account - the text has been revised and we discuss various forms of reduced till agriculture
21135	45	5	45	8	Should probably cross reference Chapter 2 Section 2.7.1.1. It is also interesting that here the benefits of no till are 'uncertain' but in Chapter 2 there is medium evidence of the benefit. Need to have a consistent message. Suggest the only change here is the cross reference. [, United Kingdom (of Great Britain and Northern Ireland)]	NOTED - common references and more common message added
39459	45	8	45	10	This statement should also be summarized/included in Table 4.1. [, United States of America]	NOTED - table would be too long if we add to many processes or management interventions, we opted to skip this one
39461	45	23	45	23	Fires are a natural occurrence with various return intervals over much of the planet. Depending on the ecosystem, they are not necessarily a land degradation but a long-term enhancement for many ecosystem services including carbon. [, United States of America]	NOTED - wording change to give room to the point made

Comment No	From Page	From Line	To Page	To Line	Comment	Response
33733	45	23	45	28	The authors may need to support with qualitative data how much C are released because of forest /rangeland fires. What is the interaction between carbon release and biological invasions? A study in China has shown that perennial forb invasions increased soil CO2 and N2O (but not CH4) emissions (Zhang et al 2018). https://doi.org/10.1016/j.aquabot.2016.11.012 [, Norway]	NOTED - Chapter 2 deals with this estimates
33735	45	23	45	28	Future directions international published a report on global wildfires, carbon emissions and the climate change indicated that carbon emissions from all sources of fire amount to between 2 and 4 billion tonnes each year. Deforestation burning contributes 650 million tonnes. http://www.futuredirections.org.au/publication/global-wildfires-carbon-emissions-and-the-changing-climate/ [, Norway]	NOTED - yet, chapter 2 and chapter 6 deal with the global estimates
39465	45	30	45	30	This statement may not be correct. Wetlands tend to have greater fluxes overall depending on location. For Minnesota, Wisconsin, and Michigan for example, wetlands have higher fluxes than those associated with livestock. (Chen, Z., T.J. Griffis, J.M. Baker, D.B. Millet, J.D. Wood, E.J. Dlugokencky, A.E. Andrews, C. Sweeney, C. Hu, and R.K. Kolka. 2018. Source partitioning of methane emissions and its seasonality in the U.S. Midwest. Journal of Geophysical Research -- Biogeosciences. 123: 646--659. https://doi.org/10.1002/2017JG004356) [, United States of America]	NOTED - shared importance of wetlands and ag are now highlighted
28361	45	30	45	41	Par is hard to follow, not clearly worded. [Barron Joseph Orr, Germany]	NOTED - paragraph has been restructured
40245	45	42	45	42	change degradations to degradation [Thelma Krug, Brazil]	ACCEPTED - change made
5821	45	42	45	44	"Hydrological degradations" needs to be replaced by "Environmental degradation"! [Sanaz Moghim, Iran]	ACCEPTED - change made
39463	45	29	46	4	This seems to be a very small section on non-CO2 GHGs. This should be expanded particularly with respect to agricultural impacts, N use efficiency. [, United States of America]	NOTED - yet, chapter 2 deals with this in much greater detail
27121	45	31			Please add NH3 (ammonia) as a climate active substance emitted by manure disposal. [, Germany]	ACCEPTED - ammonia added
17053	46	1	46	1	"out-compensated" is an unusual term. Could be "more than compensated for…". [Roland Hiederer, Italy]	ACCEPTED - change made
21137	46	3	46	4	It is not just a pulse of methane emissions but restoration of drained northern peatlands by rewetting has been found to increase CH4 emissions. https://doi.org/10.1002/ece3.2469 . 'Pulse' implies short term increase, but increased CH4 found 30 years after rewetting - https://doi.org/10.5194/bg-12-4361-2015 . Suggest amending sentence to 'can increase CH4 emissions' and add the above reference. [, United Kingdom (of Great Britain and Northern Ireland)]	ACCEPTED - change made
22601	46	13	46	15	" which can overwhelm the net radiative effect of the associated C release to the atmosphere " This part of the sentence could be made clearer, perhaps by replacing "overwhelm". [Anastasios Kentarchos, Belgium]	ACCEPTED - change made
28363	46	23	46	24	The sentence is hard to follow. Do you mean albedo INCREASE? The cited paper shows that when forest is converted to cropland, in this dry environment, the increase in albedo offsets the warming effect of deforestation (due to C release) by 25-50%. [Barron Joseph Orr, Germany]	NOTED - change made

Comment No	From Page	From Line	To Page	To Line	Comment	Response
11703	46	32	46	41	This discussion is imcomplete: Aside from albedo and dust there are other important effects, namely the change in surface roughness with land degradation that affects drag and thus the strength of turbulent exchanges which has a huge effect on aerodynamic resistance and the ability to dissipate surface heat by sensible and latent heat fluxes. Another important change is the effect of land degradation on the partitioning of net surface energy between sensible and latent (evapotranspiration) heat fluxes, which has further important implications for temperature, humidity, atmospheric stability and boundary layer development. [Paul Dirmeyer, United States of America]	NOTED - these additional effects have been included with a brief text addition (no room for more)
25477	46	43	46	43	An effort could be made to ensure consistency between this section and the analyses presented in Chapters 6 and 7, making greater use of the concepts of ecosystem services, nature's contribution to people and sustainable development objectives in presenting the impacts of degradation. [, France]	Taken into account - we have inserted some references to Chapter 6
40659	46		46		I suggest to sharpen the links with chapter 2 on this. Someone needs to check all references to albedo in all chapters and ensure coherency. [Valerie Masson-Delmotte, France]	noted- doesn't seem to request any change
27123	46	43	49	2	Please add the impacts of fire on people in section 4.9 (or elsewhere in chapter 4) also accessing impacts on economy and human security. (This issue of wild fire impacts on people is mentioned in the SPM on page 7, line 46 albeit wrongly referring to chapter 4.4 where no such information can be found.) [, Germany]	rejected - beyond the scope of this chapter and this section has now been removed altogether. Fire is dealt with in other parts of chapter 0
3447	46	43	52	36	The content of this section is inconsistent with the title since this section only describes the land degradation in the context of past climate change. So it is suggested to supplement the natural and human impacts of future land degradation under different climate change scenarios. [, China]	noted, and the lack of forward projections linking land degradation, climate change and poverty has now been added within the text
4279	46	43	52	36	This is an important section as it is discussing how the climate change related land degradation affecting the biota on Earth, both human and the nature. Well done! [Lee-Sim Lim, Malaysia]	noted, thanks
13567	46	43	52	36	The findings of the studies in these subsections are of vital importance to the countries where land degradation have been seen to be accelerating; hence a synthesis of these impacts on people and nature will be a much needed resource. [Lourdes Tibig, Philippines]	noted- doesn't seem to request any change
12095	46	43	52	37	The entire section 4.9 including subsections has not changed at all since the First Order Draft - and it still does not contain calibrated IPCC assessment language. [Hans Poertner and WGII TSU, Germany]	noted - first point is rejected as it is incorrect -various text was traded with ch 3, new refs were added and all comments targeting this section were addressed since the FOD. Second point is accepted - IPCC assessment language was indeed provided in the executive summary only so we have now added it into section 4.9
2365	46	2			"anaerobiosis" - please define [Nina Hunter, South Africa]	ACCEPTED - now defined
28837	46	12		16	Please consider also the following paper for the albedo effect: Pinty, B., J.-L. Widlowski, M. M. Verstraete, I. Andredakis, O. Arino, M. Clerici, T. Kaminski, and M. Taberner (2011), Snowy backgrounds enhance the absorption of visible light in forest canopies, Geophys. Res. Lett., 38, L06404, doi:10.1029/2010GL046417. [Inge Jonckheere, Italy]	ACCEPTED - reference added and sentence expanded
2367	46	17			"tundra" - please define [Nina Hunter, South Africa]	ACCEPTED - change made
6195	47	9	11	47	This statement (In general terms, the climate (and climate change) can increase human and ecological communities' exposure and sensitivity to land degradation, with land degradation then leaving livelihoods more sensitive to the impacts of climate change and extreme climatic events).was confused rewrite [Sawsan Mustafa, Sudan]	Accepted - now two sentences and ref added
5823	47	11	47	13	reference for this sentence! [Sanaz Moghim, Iran]	Accepted - sentence modified and reference added

Comment No	From Page	From Line	To Page	To Line	Comment	Response
33737	47	14	47	14	Human population is an important factor in explain both land degradation and poverty. So, it is suggestible to consider how the human population growth is related to poverty, land degradation and climate change. Please consider illustrating in a conceptual model. (ref: 1) Bremner, J., López-Carr, D., Suter, L. and Davis, J. (2010) 'Population, poverty, environment, and climate dynamics in the developing world', Interdisciplinary Environmental Review, Vol. 11, Nos. 2/3, pp.112–126. 2) Barbier, E. B., & Hochard, J. P. (2018). Land degradation and poverty. Nature Sustainability, 1(11), 623. [, Norway]	Accpeted - some of these references have been added and this entire section has been rewritten.
39467	47	37	47	37	The reference provided does not seem correct. [, United States of America]	noted - lines 1-13 are now different as this section was entirely rewritten, new literature added.
4281	47	37	47	37	Typo: "Altieri et al (Altieri and Nicholls 2017)" should be written as "Altieri and Nicholls (2017)". Another thing, this document is not listed in the References Section. [Lee-Sim Lim, Malaysia]	rejected - Formatting amended and it does appear in the references section
40663	47		47		Lines 1-13 : repetition of earlier sections on atribution, missing link to risk framework and ch 7. Bottom of page : quite ancient literature, what is new knowlege on the topic? [Valerie Masson-Delmotte, France]	Noted - figure removed as whole section rewritten
901	47	14	49	2	Vulnerable communities may not necessarily be poor, but poor communities will generally be more vulnerable to impacts of climate change. Therefore, it will be in the correctness of approach to focus first on poor people in the landscapes likely to be most impacted by climate change. Studies will need to be commissioned by the national governments, international financial institutions and other relevant organizations to identify the most vulnerable landscapes with respect to climate change. Next, the focus will be on addressing the poverty of the communities inhabiting these vulnerable landscapes by providing alternative avenues of income generation and additional livelihood options. [Jagdish Kishwan, India]	Noted
24847	47	14	49	2	The entire section is not well-written. The header suggests the section will discuss the impacts of climate-related land degradation on poverty, livelihoods, and vulnerability. However, the content of the section does not provide evidence of the relationship between the variables. What it does do is explain what livelihood and poverty are...which don't really add much value. There is sufficient science (environment-poverty nexus) which should be useful to this section and which the authors need to draw on. In the next draft please make the variables, relationships, and outcomes of research clear in this section. [Justice Issah Musah Surugu, Germany]	accepted - the header has been altered to reflect the necessary content of the section in relation to the scoping document. It now reads Impacts of climate related land degradation on poverty and livelihoods. New references have been included to highlight the knowledge gaps, as well as present the state of the art in understanding the links between climate and poverty and land degradation and poverty.
24849	47	14	49	2	Authors must check the executive summary to make sure there is consistency in the (as yet insufficient) evidence about the variables and relationships and results of climate-land change and poverty, livelihoods, etc. Section 4.9.1 is not yet congruent with executive lines 44-45 (states high confidence) on page 5. [Justice Issah Musah Surugu, Germany]	accepted - format changed
22007	47	8			This reference may be interesting to add or to check for other relevant references: Acácio et al 2017 Global Change Biology 23:1199-1217 [Vanda Acácio, Portugal]	rejected - doesn't seem relevant to the argument being made in the place indicated
12891	48	19	48	19	The caption should give some idea of what the message of Figure 4.6 is. It is not obvious. [Robert Treuhaft, United States of America]	Noted - figure removed as whole section rewritten
1861	48	19	48	19	The quality of Fig. 4.6 is a bit poor. Could the authors improve it? Check other figures too. [William Lahoz, Norway]	Noted - figure removed
40665	48		48		Figure from a 2008 paper. No new knowledge developments in the last decade? [Valerie Masson-Delmotte, France]	noted - figure removed as part of overall rewriting of this section

Comment No	From Page	From Line	To Page	To Line	Comment	Response
25479	49	3	49	3	The issue of food security and forest degradation should be discussed. Some classical references and recent references: - Lipper, L. "Forest degradation and food security." Unasylva (English ed.) 51.202 (2000): 24-31. - Pimentel, David, et al. "The value of forests to world food security." Human ecology 25.1 (1997): 91-120. - Shackleton, Charlie M. "Non-timber forest products in livelihoods." Ecological Sustainability for Non-timber Forest Products. Routledge, 2015. 26-44. - Hickey, Gordon M., et al. "Quantifying the economic contribution of wild food harvests to rural livelihoods: A global-comparative analysis." Food Policy 62 (2016): 122-132. [, France]	Noted -chapter 5 covers food security in more detail and there is little quantitative information that explicitly links the terms land degradation and food security in the literature, largely because food security isn't just about production but also consumption. As such no action has been taken beyond noting this as a research gap.
30325	49	3	49	38	Would be of great additional value if more quantitative information was given on the impacts on food security in space, time and extent. [, Netherlands]	accepted and actioned
24853	49	3	49	38	Section 4.9.2 -- reword the subheading from "Food security" (current) to "impact of climate-related land degradation on food security". That is how other subsections have been worded in the chapter (and other chapters). See for example 4.9.3 [Justice Issah Musah Surugu, Germany]	Noted - we have added in some references and note that the role of forests in food security (and by extension, the role of forest degradation) is poorly understood
24855	49	8	49	12	Move these lines to section 4.12 because it focuses on knowledge gaps and uncertainties. [Justice Issah Musah Surugu, Germany]	rejected - although this can indeed be considered as knowledge gap, it is a very specific one and hence, we would prefer keeping it here.
39469	49	9	49	9	Reference should just be (Hecht 1983), the initials are S.B. and needs to be corrected in the references. [, United States of America]	accepted and amended
27125	49	16	49	17	Please describe more exactly, preferably with numbers: e.g. loss of crop yields between 10 and 50 %, please look at IPBES (see https://www.ipbes.net/assessment-reports/ldr). [, Germany]	noted - but no changes made as expected crop changes vary between crop types and simulation models, so it would be misleading to add figures when there is such difference between them
24857	49	21	49	24	How is this sentence related to the subheading? Consider revision [Justice Issah Musah Surugu, Germany]	rejected - food security and transport are closely related
11719	49	21	49	24	Climate sensitive transport infrastructure is also problematic for food security……I feel that such a strong statement should have a reference [Serah Kahuri, Kenya]	accepted - references added
24859	49	27	49	31	Consider moving to 4.12 because it deals with knowledge gaps. This comment exposes the entire subsection 4.9.2 which requires a complete overhaul -- pls provide more evidence about the relationship of the variables and the outcomes in the literature, and reorganize the subsection. [Justice Issah Musah Surugu, Germany]	taken into account - research gap is very specific, so rather keep it here. Empirical evidence (especially quantiative) is lacking so we have noted this and also refer the reader to ch 5 where some of these issues are covered in more depth.
114	49	33	49	35	large scale speculation on global food markets is a further source of vulnerabiity on the demand side because it can lead toexponential price rises, and this should be mentioned here. Compare Chpt 5 p51 L7 [Thomas Reuter, Germany]	Accepted - included, also cross ref to ch 5
40667	49		49		Overlaps with other chapters, check. "great level of maturity" : really? [Valerie Masson-Delmotte, France]	Noted - yes this is correct
40669	49		50		Section 4.9.3 needs to be considered carefully (migration and conflict), considering cross chapter aspects (especially coherency / redundancy with chapter 3). There are truisms in the paragraph (not outcomes of literature assessment). Link to SR15 needed too (very cautious assessment there in chapter 3). [Valerie Masson-Delmotte, France]	taken into account

Comment No	From Page	From Line	To Page	To Line	Comment	Response
5475	49	39	51	4	The whole subchapter is a bit too cautious in its phrasing; the reader cannot decide what is the main conclusion (it is understandable that the complex nature of the issue cannot allow straight drawings of conclusion but a bit more clear result would be useful). On the other hand, concrete solutions, local, on-the sport interventions, support measures should be beneficial to be intoduced. [, Hungary]	Noted and adjusted - yet, concrete local solutions are beyond the scope here (space limitations!) and section 4.10 considers on the ground actions
5477	49	39	51	4	There is a lack of recommendations for the destination countries and regions where migration causes severe problems and challenges. [, Hungary]	noted - but no changes were made given that recommendations typically require to be destination-specific.
24863	49	40	51	4	Cross check chapter 7 which also has a subsection on migration to ensure consistency and that all the relevant evidence has been considered either in Ch4 or Ch7 [Justice Issah Musah Surugu, Germany]	Taken into account - we have check for consistency
12097	50	1	50	14	Streamline this section/paragraph with information in Chapter 3, where drylands are assessed [Hans Poertner and WGII TSU, Germany]	Taken into account - the text on drylands is removed
12897	50	2	50	2	UNCCD is not defined. [Robert Treuhaft, United States of America]	Taken into account - the text on drylands is removed
2369	50	2	50	7	Strictly speaking this section belongs in chapter 3 - is there an example that is in non-dryland areas? [Nina Hunter, South Africa]	Taken into account - the text on drylands is removed
4283	50	15	50	15	Typo: "commonplace" should be "common place". [Lee-Sim Lim, Malaysia]	Rejected
24861	50	15	50	24	Remove, doesn't add anything because the section focuses on land degradation, migration-conflict interaction. However, these lines appear not to convey any evidence around these variables. [Justice Issah Musah Surugu, Germany]	accepted - paragraph has been removed
39471	50	41	50	41	Such as what context factors? [, United States of America]	accepted - this is now specified
7315	50	10			Ecuador rather than Equator? [Debra Roberts, South Africa]	Accepted
39473	51	3	51	3	Should "ensure" be "ensue"? [, United States of America]	Accepted
30511	51	5	51	47	It is not just cultural practices that are affected but also cultural heritage - archaeological sites, landscapes, places, buildings etc. (e.g. Ref Heathclote, J, Fluck, H. and Wiggins, M. 2017. Prediting adn responding to climate change: challenges for teh historic Environment (in The HIstoric Environemtn Policy and Practice) Fluck, H. and Wiggins, M. 2017. Climate Change, heritage policy and practice in England: Risks and oportunities.(Archaeological Review from Cambridge32:2); Fluck, H. 2016 - Historic England Cliamte change adaptation report. [Hannah Fluck, United Kingdom (of Great Britain and Northern Ireland)]	Noted - beyond the scope of this chapter
4285	51	11	51	11	"diverse" in terms of cultural? Or ethnics? Please justify. [Lee-Sim Lim, Malaysia]	Accepted - Justified that Ethiopia and China are examples from which there is literature to support this assertion
24841	51	14	51	25	How does encroachment relate to climate change? What evidence can the authors provide to support that encroachment is attributable to climate change. Suggestion: include evidence and references or reword. [Justice Issah Musah Surugu, Germany]	Taken into account - the sentence is removed because it refers to drylands
39475	51	15	51	15	Botswana spelling [, United States of America]	Rejected - refers to Batswana ethnic group, not the country
24843	51	26	51	37	No evidence of climate change affecting existing gender norms has been provided in this literatre [Justice Issah Musah Surugu, Germany]	Rejected - The whole paragraph from line 26-37 is elaborating the literature that highlights how "The nature of people's relationship with land is also determined by gender and cultural norms" (the paragraph sentence). It elaborates the relationship between land and gender which is then elaborated in the following paragraph in terms of climate change impacts

Comment No	From Page	From Line	To Page	To Line	Comment	Response
24845	51	26	51	37	Please cross check Chapter 3.5.2 and Chapter 7 (maybe others) which also have sections on gender, and often suffer a similar lack of evidence about what pre-existing gender norms have been in different geographic / cultural regions, and evidence of how climate land affect gender norms and gender-differentiated impacts. [Justice Issah Musah Surugu, Germany]	Noted - we have checked for consistency
32533	51	32	51	32	It is unclear what 'development world' refers to in this line. Clarification is required. [Hanna Paulose, United States of America]	Accepted - clarified
32535	51	41	51	43	The 2018 State of Food and Agriculture (SOFA) Report by FAO suggest that migration in the context of agriculture and climate change is context specific and who moves seeking economic opportunity (women vs. men) depends upon regional and cultural context. It will be important to reflect that in the context of discussion on human mobility. SOFA makes the following conclusion in the executive summary on page xviii: "Migration can also lead to changes in the intrahousehold division of labour along gender and generational lines. Often male out-migration leads to an increased role of women in agriculture in terms of greater workloads, but also of potentially more decision-making power. However, this feminization" of agriculture is not universally observed and in many societies female out-migration is more prevalent than male out-migration." Link to the report: http://www.fao.org/3/I9549EN/i9549en.pdf [Hanna Paulose, United States of America]	Accepted - reference addeed
15067	51	42	51	42	The word 'preference' may be changed to 'prefer'. [Muhammad Mohsin Iqbal, Pakistan]	Rejected
2371	51	32			"development" - should it not be "developing"? [Nina Hunter, South Africa]	Accepted
39477	52	1	52	1	Rename Section 4.9.5. Impacts on "nature"?? Are the authors talking about natural systems rather than managed systems? Do they mean biodiverity? What does "nature" mean? This is an odd section with only a handful of references ... not sure what the main point is. [, United States of America]	Noted, this section has been removed as a stand alone section, with pertinent aspects integrated into other sections
28365	52	1	52	36	Impact on "nature" is a broad, vague topic, that is given narrow consideration. Is there anything here that isn't covered elsewhere in the chapter? Maybe restrict the section to biodiversity impacts? [Barron Joseph Orr, Germany]	Accpeted, this section has been removed as a stand alone section, with pertinent aspects integrated into other sections because the reviewer is correct, it doesn't' really add anothing that isn't covered elsewhere in the chapter.
12099	52	1	52	36	Impacts on nature: It is very conceptual and vague - be more specific and provide an actual assessment of what has happened and is projected to happen. What were the actual impacts of land degradation on nature? How exactly is biodiversity affected? Which species (animals or plants) are most vulnerable to land degradation and why? In which places? Is this due to habitat loss from degradation? Lack of food resources? Perhaps try to link to IPBES assessments. The references provided for this section are old, over 10 years by the time SRCCL is published. Please provide a more thorough assessment of newer literature. Please focus on findings within AR5, and thereafter. [Hans Poertner and WGII TSU, Germany]	Noted, this section has been removed as a stand alone section, with pertinent aspects integrated into other sections
12101	52	1	52	36	Please crosslink this section also to other sections, e.g. the case studies, where applicable [Hans Poertner and WGII TSU, Germany]	Noted, though this section has now been removed
12103	52	1	52	36	Suggest that the section should also address biological invasions and biodiversity loss. For example, there is a wide body of literature covering the interactions between climate change and species invasions [Hans Poertner and WGII TSU, Germany]	Noted, but this section has now been removed and invasives are covered elsewhere in ch4.
39479	52	2	52	2	Excellent to have an indicator of the importance of mangroves. [, United States of America]	noted, though this section has been removed

Comment No	From Page	From Line	To Page	To Line	Comment	Response
2869	52	6	52	8	I think a reference that supports the theory of climate change causing an higher frequency of extreme events is needed. [Luca Castrucci, United States of America]	rejected- this section has been removed
13291	52	9	52	22	This section deserves more prominence as the principle that biodiversity and ecosystem integrity increase the resilience, resistance, stability and adaptive capacity of ecosystems applies across the board (CBD Technical Series 43; Ajani et al.2013). It is especially important that climate action in land and forests support biodiversity and ecosystem integrity in light of the interactions between both problems (and solutions). Forest restoration is one of several key natural approaches to climate mitigation and adaption, recovering biodiversity, ecosystem integrity, ecosystem services and sustainable development Cohen-Shacham 2016). These points are well made on Page 29 lines 29-32 where the benefits of integration begin to be acknowledged. • Ajani, J.I. et al. (2013). Comprehensive carbon stock and flow accounting: A national framework to support climate change mitigation policy. Ecological Economics. 8961-72. Available from: http://linkinghub.elsevier.com/retrieve/pii/S092180091300030X. • Cohen-Shacham, Emmanuelle & Walters, Gretchen & Maginnis, Stewart & Janzen, Christine. (2016). Nature-based Solutions to address global societal challenges. 10.2305/IUCN.CH.2016.13.en. [Aila Keto, Australia]	Noted, but this section has now been removed
33739	52	15	52	30	Consider a new concept on biodiversity effects on ecosystem functioning (B→EF) developed by Hisano et al (2018) that have used to examine the potential for biodiversity to mitigate climate change impacts on forest ecosystem functioning. Moreover, the authors have illustrated the theoretical diversity–productivity relationships under climate change. Hisano, M., Searle, E. B., & Chen, H. Y. (2018). Biodiversity as a solution to mitigate climate change impacts on the functioning of forest ecosystems. Biological Reviews, 93(1), 439-456. [, Norway]	rejected- this section has been removed
17491	52	17	52	22	In consideration of the global biodiversity crisis through the mass extinction of species (the second planetary crisis besides climate change that humanity is facing) and the process to set new biodiversity goals during the CBD CoP in Beijing in 2020, this line "the more biodiverse ecosystems are, the lower the impact of extreme events on those systems and therefore the less vulnerable systems are to climate driven degradation (resilience)'" should be a key outcome message of this report! [Taehyun Park, Republic of Korea]	Noted - This section has now been removed in response to other reviewer comments
39481	52	36	52	36	No confidence statements in Section 4.9. Need to include. [, United States of America]	accepted - this has been addressed
39483	52	39	52	39	Reword: time immemorial. [, United States of America]	Accepted - text is revised
12107	52	42	52	46	To improve regional coverage, please also provide an example for a system in Africa in this statement [Hans Poertner and WGII TSU, Germany]	Accepted - references added
2373	52	44	52	45	Please state "SE" in full [Nina Hunter, South Africa]	Accepted

Comment No	From Page	From Line	To Page	To Line	Comment	Response
40673	52	39	53	39	"since time immemorial". Vague. We have historical data, information from natural archives, archeology. Either drop or provide an assessment of the recent literature for mutiple regions. The flow of information in this section is hard to follow. What is assessed, why? There are elements of framing, normative statements (it is important to ...). What are the limits to traditional knowledge posted by novel climatic conditions? This is not assessed but highly relevant. [Valerie Masson-Delmotte, France]	Taken into account - the section is revised substantially
12105	52	38	65	11	The entire section 4.10 is lacking calibrated IPCC assessment language. [Hans Poertner and WGII TSU, Germany]	Taken into account - text is revised
22009	52	9			See also the above mentioned reference (Acácio et al 2017) and references therein for impacts of wildfires, anthropogenic and climatic drivers on land degradation and land use changes in the Mediterranean [Vanda Acácio, Portugal]	rejected- this section has been removed
11721	53	3	53	4	Table 4.2: The Blue upright arrows do not appear in the legend. The two different sizes should be explained. The red arrows used in the table are not explained in the legend. [Serah Kahuri, Kenya]	Taken into account - the table has been revised
40247	53	3	53	5	… the use OF available land [Thelma Krug, Brazil]	Accepted
28367	53	17	53	20	Different to definition given on p10. Use consistent definitions across the chapter. [Barron Joseph Orr, Germany]	Accepted - definition is now consistent with glossary
22603	53	21	53	22	"It is important to stress that farming systems are often shot through with local/traditional knowledge" It should be clarified, avoiding the use of "shot through". [Anastasios Kentarchos, Belgium]	Accepted - text is revised
28369	53	22	53	22	meaning not clear [Barron Joseph Orr, Germany]	Accepted - text is revised
39485	53	22	53	22	The meaning of the the term "shot through" is unclear. [, United States of America]	Accepted - text is revised
22011	53	33			Maybe add a page number to inform where Table 4.1. is in the report [Vanda Acácio, Portugal]	Accepted
15381	54	1	2	54	Suggest clarifying the acronym MADLF in table 4.2. [, Australia]	Taken into account - the table has been revised
39487	54	1	54	1	What does MADLF relate to on this table? [, United States of America]	Taken into account - the table has been revised
33371	54	1	54	1	What do M, A, D, L, and F mean? [Stephen Prince, United States of America]	Taken into account - the table has been revised
28373	54	1	54	2	Table 4.2 How is bioenergy an indirect driver of increasing fire frequency? [Barron Joseph Orr, Germany]	Taken into account - the table has been revised
39489	54	1	54	2	Table 4.2 layout is confusing. Not sure what lower section of Table is about. Further explanation/clarification? [, United States of America]	Taken into account - the table has been revised
14481	54	1	54	2	The table attempts to pull together key land degradation issues and the impacts, drivers and management options. I think it's as good attempt at an overview but it does seem messy and too much information. There is no explanation on what M, A, D, L and F stand for. The comments section highlights some aspects of the land degradation issue but are they meant to be solutions to the problem? Also, I think each degradtion issue is context specific and the overall drivers and management options may vary from site to site. Depending on what the table should be used for, thea uthors may want to consider how much details this table shoukd encapsulate. [Janice Ser Huay Lee, Singapore]	Taken into account - the table has been revised
5825	54	1	54	2	In Table 4.2: Why "degradation of agricultural soils, overgrazin, firewood and charcoal production cause albedo reduction! [Sanaz Moghim, Iran]	Taken into account - the table has been revised
33741	54	1	54	4	Table 4.2. Consider clarification for example, what does 'M', 'A','D','L','F" stand for and what do the different size and color of arrow illustrate? Other degradation components such as salination, landslides, desertification, soil-water pollution. [, Norway]	Taken into account - the table has been revised

Comment No	From Page	From Line	To Page	To Line	Comment	Response
39491	54	1	54	4	Good to see something related to peat soil (i.e. wetland) degradation. [, United States of America]	Noted
39493	54	1	54	4	The columns with MADLF are not defined. [, United States of America]	Taken into account - the table has been revised
12109	54	1	54	4	Please ensure this table is streamlined with Table 4.1 to avoid repetition/redundancy [Hans Poertner and WGII TSU, Germany]	Taken into account - the table has been revised
33545	54	1	54	4	Forest degradation is missing. What do the letters M, A, D, L and F mean, above the arrows? [Jenni Nordén, Norway]	Taken into account - the table has been revised
4287	54	1	54	4	Table 4.2 is indeed very effective and efficient table to show the relationships of key land degradation issues with the causes, impacts and suggestion of solutions. However, why does the red reflective arrow representating albedo decrease rather then albedo increase? And why does the green reflective arrow representing albedo increase rather than albedo decrease? [Lee-Sim Lim, Malaysia]	Taken into account - the table has been revised
4289	54	1	54	4	The abbreviation of options in the "Response options impact on Climate Change" column (e.g. M, A, D, L, F) is not explained. [Lee-Sim Lim, Malaysia]	Taken into account - the table has been revised
8691	54	1	54	4	in black and white print it is not possible to distinguish the colours of albedo increase and albedo decrease, give instead one of them a structure such as dots or stripes. [Louise Andresen, Sweden]	Taken into account - the table has been revised
8693	54	1	54	4	it is not possible to know what the Response options are, you need to explain these letters 'M A D L F' [Louise Andresen, Sweden]	Taken into account - the table has been revised
12893	54	1	54	4	The symbols and categories of Table 4.2 are not defined. What is MADLF? What is Table 6.3? What do the widths of the arrows mean? These explanations must be added for this Table to have any impact. Or delete the table. [Robert Treuhaft, United States of America]	Taken into account - the table has been revised
28371	54	2	54	2	Not just climate change - Table 4.2 (columns 7-11) seems to cover all the "five land challenges" addressed in ch 6. The options column refers to Table 6.3 but these terms are not consistent with SOD Ch 6. [Barron Joseph Orr, Germany]	Taken into account - the table has been revised
1863	54	2	54	2	I suggest authors include in the caption to Table 4.2 an explanation of the letters M, A, D, L, F, in the response section. [William Lahoz, Norway]	Taken into account - the table has been revised
27127	54	3	54	4	Table 4.2: Please consider changing the presentation of the legend of the symbols under the table to improve legibility, perhaps by giving it the title "legend" and putting the symbols first (in the format it is presented now, it is not easily distinguishable from the table itself). Also this figure is not self-explanatory. A caption is needed explaining various elements, particularly what the different sized arrows mean as well as the meaning of the categories "M", "A", "D", "L", and "F". [, Germany]	Taken into account - the table has been revised
21461	54	15	54	24	As per my comment on the overall food system section, please recognise that there are other global databases of emissions and assess how consistent they are before deciding to use FAOSTAT as reference one. Also, the comparison with the GLEAM based estimate is not helpful as it combines a change in methodology (Tier 1/Tier 2) and lifecycle approach (farm-gate, and full lifecycle). What policymakers need to know is whether Tier 1 based estimates of global emissions are consistent with more complex Tier 2 methods at the farm gate. Also it would be helpful to spell out the CH4/N2O ratio of emissions, not just report CO2-equivalent. [Andy Reisinger, New Zealand]	unclear
40249	54		54		in table 4.2, column 5, please define M, A, D, L, F [Thelma Krug, Brazil]	Taken into account - the table has been revised
40675	54		54		example of figure for which we need traceability to the underlying assessed literature and report of level of scientific understanding / evidence and agreement / confidence. [Valerie Masson-Delmotte, France]	Taken into account - references to chapter sections is provided in last column of new table

Comment No	From Page	From Line	To Page	To Line	Comment	Response
23559	54		65		The meanings of the charts in Table 4.2 and Table 4.3 should be consistent,or not? [Huai Jianjun, China]	Taken into account - the table has been revised
21139	54	Table 4.2			Why is the LD issue of degradation of peat soils limited to 'tropical' peat soils? This is an issue for all peatlands as per section 4.11.4.2, p75. Suggest deleting 'tropical'. [, United Kingdom (of Great Britain and Northern Ireland)]	Accepted
22013	54				Table 4.2.: What is the meaning of M, A, D, L, F (second line); what is the meaning of the blue/red arrows? [Vanda Acácio, Portugal]	Taken into account - the table has been revised
33373	55	1	55	1	I see no mention of the extensive material in IPBES LDRA that covers many of the topics in 4.10.1. Even without references to a report that is specifically about the topic, the material here has only marginal significance in a chapter on climate and land degradation. [Stephen Prince, United States of America]	Taken into account - the section has been revised substantially and material from LDRA has been used
30513	55	2	55	44	Again would benefit from reference to the role archaeological investigations can play in demonstrating the imapct of past human activities on the environment and land degradation. [Hannah Fluck, United Kingdom (of Great Britain and Northern Ireland)]	Rejected - outside the scope of this section
39495	55	3	55	6	Replace contour ploughing with conservation tillage, reduced or no-tillage, or other conservation practice. [, United States of America]	Accepted
39497	55	5	55	5	Define bunds. [, United States of America]	Taken into account - the term is removed
39499	55	9	55	9	Reference incorrect. [, United States of America]	Accepted
1865	55	12	55	13	(Camacho et al. …) repeated. [William Lahoz, Norway]	Accepted
39501	55	32	55	34	Excellent point to recognize knowledge co-production. Could also include co-innovation here (if this is not quite the same?). [, United States of America]	Accepted
2181	55	1	59	35	In the process of sustainable land management to address land degradation, engineering technologies such as soil conservation technology, forestry development, and afforestation play an important role. However, we should also pay attention to the methods of managing & monitoring such as land classification and grading, project review and third-party evaluation of land quality after construction [Xiangzheng Deng, China]	Noted - the section has been revised substantially
32851	55	1			Include discussion of agroecological approaches to land management [Doreen Stabinsky, United States of America]	Taken into account - Agroecological approaches have been included
30945	55	1			Despite mentions throughout other chapters ecosystem-based adaptation and/or restoration are not mentioned as actions on the ground to combate land degradation (1.4.4, 6.3.1.7) [Kelsey Perlman, France]	Taken into account - EBA has been included
15383	55				Suggest a discussion in section 4.10.1 of Fire management in the semi-arid tropics as a major lever for increasing SOC in Australia: Richards et al 2011. Optimal fire regimes for soil carbon storage in tropical savannas of northern Australia. Ecosystems 14: 503-518, doi:10.1007/s10021-011-9428. [, Australia]	Taken into account - this is treated in a later section on forest managment

Comment No	From Page	From Line	To Page	To Line	Comment	Response
33743	56	10	56	21	Effects of physical soil water conservation (SWC), in terms of maintaining fertility, moisture, increasing crop yield, etc, depend on the potential of areas. According to Mekuriaw and other co-authors (Mekuriaw et al. 2018) have reviewed that in certain high-potential areas, investment in physical SWC structures may not be profitable at the farm level due to the associated loss of farmland and water logging effects of SWC structures. Mekuriaw, A., Heinimann, A., Zeleke, G., & Hurni, H. (2018). Factors influencing the adoption of physical soil and water conservation practices in the Ethiopian highlands. International Soil and Water Conservation Research, 6(1), 23-30. The purpose of implementing conservation structures are (1) to conserve moisture, nutrient, soil, etc (moisture limited) and (2) sometimes to remove excess water (high rainfall areas). The report should be consider including (a) discussing drainage structures as part of SWC measures. (b) Beside to positive effect of soil water conservation, the negative effects have to addressed. e. g. in the dryland environment, water harvesting structures may create a conducive environment for mosquito reproduction /malaria. (c) the physical SWC can be a potential habitat for weeds and pests, e.g. rodents. Rodents have negative impact on the crop yields, and (d) the adoption of SWC are most likely to associated with short-term benefits and labour demand (Tefera and Sterk 2010). (Tefera, B., & Sterk, G. (2010). Land management, erosion problems and soil and water conservation in Fincha'a watershed, western Ethiopia. Land Use Policy, 27(4), 1027-1037. [, Norway]	Taken into account - the text is revised and this information has been incorporated
11723	56	17	56	18	.....and where rainfall is decreasing, by increasing infiltration and reducing runoff. This sentence needs revision. [Serah Kahuri, Kenya]	Accepted
40677	56		57		Why have these figures been chosen and why are they relevant to convey the outcome of the assessment of this report? Please explain. [Valerie Masson-Delmotte, France]	Taken into account - Figure removed
24963	56	18			Li, H., Shen, H., Chen, L., Liu, T., Hu, H., Zhao, X., Zhou, L., Zhang, P. and Fang, J. (2016). Effects of shrub encroachment on soil organic carbon in global grasslands. Scientific reports, 6. DOI: 10.1038/srep28974 Manjoro, M., Kakembo, V., & Rowntree, K. M. (2012). Trends in soil erosion and woody shrub encroachment in Ngqushwa District, Eastern Cape Province, South Africa. Environmental management, 49(3), 570-579. Grellier, S., Kemp J., Janeau JL, Florsch N., Ward D., Barot S, Podwojewski P, Lorentz S., Valentin C., 2012. The indirect impact of encroaching trees on gully extension: a 64 year study in a sub-humid grassland of South Africa. Catena: 98, 110-119. ISSN 0341-816 Grellier S., Ward, D., Janeau J.L., Podwojewski P., Lorentz, S., Abbadie L., Valentin C., Barot S 2013. Positive versus negative environmental impacts of tree encroachment in South Africa. Acta Oecologica, 53, 1-10. doi.org/10.1016/j.actao.2013.08.002. Podwojewski, P., Grellier S., Mthimkhulu, S. and Titshall L., 2014. How tree encroachment and soil properties affect soil aggregate stability in an eroded grassland in South Africa. Soil Sci. Soc. of Am. J. 78: 1753-1764. doi:10. 2136/sssaj2013.12.0511. Muñoz-Robles, C., Reid, N., Tighe, M., Briggs, S. V., & Wilson, B. (2011). Soil hydrological and erosional responses in areas of woody encroachment, pasture and woodland in semi-arid Australia. Journal of Arid Environments, 75(10), 936-945. [Pascal Podwojewski, France]	Noted - these references are primarily concerned about drylands. Bush/shrub encroachemnt is covered in Ch 3

Comment No	From Page	From Line	To Page	To Line	Comment	Response
24965	56	18			BE CAREFUL, ITS ABUSIVE CONCEPT FOR SOIL INFILTRATION RATE AND SLOPES. In South East Asia, erosion rate calculated of the base of 27 catchment (Valentin et al, 2008) is not controlled by the slope but generally by the soil cover at the beginning of the rainy season. Generally there is less detachment with increasing slope – clear measurements by rainfall simulation on very steep slope areas. This is due to higher infiltration rate with less surface crusting on steep slopes (Janeau et al., 2003: Ribolzi et al., 2011) and a decrease of the kinetic energy of raindrops according to the increase of the reference surface impacted by the raindrops: for the same rain intensity 1m2 on flat land receive more kinetic energy than in a slope position, the reference surface is larger). However at a larger scale, the crust factor is overruled by other factors, namely rill and gully erosion, tillage erosion and mass movements, all increasing with slope. But steeper is the slope, higher is the infiltration rate. Terraces taro systems in Pacific islands (classical example of are classical example of sustainability because they are easier to irrigate and the fallow rotation is easier to manage. [Pascal Podwojewski, France]	Rejected - this phenomenon (more infiltration on steep than gentle slopes) is not valid for terraces where the slope is zero.
24967	56	18			Janeau, J. L., Bricquet, J. P., Planchon, O., & Valentin, C. (2003). Soil crusting and infiltration on steep slopes in northern Thailand. European Journal of Soil Science, 54(3), 543-554. Ribolzi, O., Patin, J., Bresson, L. M., Latsachack, K. O., Mouche, E., Sengtaheuanghoung, O., ... & Valentin, C. (2011). Impact of slope gradient on soil surface features and infiltration on steep slopes in northern Laos. Geomorphology, 127(1-2), 53-63. Valentin C., Agus F., Alamban R., Boosaner A, Bricquet J.P. Chaplot V., de Guzman T., de Rouw A., Janeau J.L., Orange D, Do Dui Phai, Podwojewski P., Ribolzi O., Silvera N. Subagyono K., Thiébaux J.P. and Tran Duc Toan. 2008. Runoff and sediment losses from 27 upland catchments in Southeast Asia: Impact of rapid land use changes and conservation practices. Agriculture, Ecosystems and Environment 128, 225–238 [Pascal Podwojewski, France]	Rejected - this phenomenon (more infiltration on steep than gentle slopes) is not valid for terraces where the slope is zero.
12895	57	1	57	1	(E) and (F) are not specified in the caption of Figure 4.8 [Robert Treuhaft, United States of America]	Taken into account - Figure removed
28375	57	1	57	3	Fig 4.8 D appears to be a contour bank, not a terrace. What are E and F? [Barron Joseph Orr, Germany]	Taken into account - Figure removed
27129	57	1	57	3	A description of the final two parts of the figure (e. and f.) is missing and should be added for clarity. [, Germany]	Taken into account - Figure removed
39503	57	1	57	3	E and F not defined in Figure 4.8 caption. [, United States of America]	Taken into account - Figure removed
4291	57	2	57	2	The explaination for Figure 4.8 E) and F) was missing. [Lee-Sim Lim, Malaysia]	Taken into account - Figure removed
8695	57	2	57	3	what is subfigure E and F this is not explained [Louise Andresen, Sweden]	Taken into account - Figure removed
26165	57	2	57	3	Only four descriptors are shown for six examples [Reid Detchon, United States of America]	Taken into account - Figure removed
11725	57	2	57	3	Figure 4.8 : Terraces E and F are not in the explanatory text [Serah Kahuri, Kenya]	Taken into account - Figure removed
27131	57	6	57	6	Figure 4.9: Please consider changing the colour of the map (in a black and white printout only the dots are visible and not the map). Also, it would improve the legibility, if you could extend the map, as, by now, in Europe and Africa it is quite difficult to relate the dots to single countries. [, Germany]	Taken into account - Figure removed
4293	57	13	57	13	Typo: "(Young, 1995, p.11)" should be (Young, 1995), page number can be showed in the References Section. [Lee-Sim Lim, Malaysia]	Accepted
2393	57		61		These pages are desciptive - there is little assessment of the literature with no confidence limits stated. Could more assessment be undertaken? [Nina Hunter, South Africa]	Taken into account - text is revised to be more analytical

Comment No	From Page	From Line	To Page	To Line	Comment	Response
11705	57	2			What are panels e and f? The are not labeled in the caption. [Paul Dirmeyer, United States of America]	Taken into account - Figure removed
2375	57	3			Notes for "E" and "F" are not provided in the figure notes [Nina Hunter, South Africa]	Taken into account - Figure removed
7007	57				Figure 4.8 E and F are not explained. [Debra Roberts, South Africa]	Taken into account - figure removed
26199	58	3	38	21	Add reference: Sonwa, D.J., Walker, S., Nasi, R., Kanninen, M. 2011. Potential synergies of the main current forestry efforts and climate change mitigation in Central Africa. Sustainability Science 6, 59-67. Doi: 10.1007/s11625-010-0119-8 [Markku Kanninen, Finland]	Accepted
26201	58	3	38	21	Add reference: Chia, E.L., Kalame, F., Kanninen, M. 2016. Exploring Opportunities for Promoting Synergies between Climate Change Adaptation and Mitigation in Forest Carbon Initiatives. Forests 7, 24. doi:10.3390/f7010024 [Markku Kanninen, Finland]	Accepted
2377	58	15	58	16	"has the potential … deforestation" - meaning unclear [Nina Hunter, South Africa]	Accepted - clarified
11727	58	17	58	18	…..and co-benefits such….: The use of and in this sentence should be changed to but [Serah Kahuri, Kenya]	Accepted
33745	58	34	58	34	The effect of crop-livestock interaction depends on the population of livestock, management and resources. In some countries, like e.g. in Ethiopia free grazing is a commonly practiced and overgrazing is a serious ecological problem. Parallel to expansion of restoration and protected areas, the size of grazing lands are declined. Moreover, the entire crop residues are collected as a sources of animal feed which have an indirect implication on soil fertility and land productivity. Land fertility/productivity are affected by the net amount of input added and removed. Besides to erosion and grazing, crop residues are removed for energy sources in some tropical lands. Thus, the report should address the implication on ecosystem resilience and sustainable land management in general. It's suggestible to consider the "input-output model" under degraded and sustainable ecosystem. [, Norway]	Noted - some of the issues raised are covered, but it is beyond the scope to expand the text
40679	58		58		Why solutions to accelerate the deployment of agroforestery and overcome barreers? [Valerie Masson-Delmotte, France]	unclear
28377	58	34	59	16	Discuss also the potential benefits of re-introduction and expansion of mixed farming in industrial scale ag, to increase SOC, manage herbicide-resistant weeds, make use of failed crops (more likely under climate change) in addition to benefits of nutrient cycling and diversification. [Barron Joseph Orr, Germany]	Noted - beyond the scope of this section. To some extent the section on perennial grains touches upon this. We also refer to Ch 5
17199	58	10			Replace "crops" with "perennial crops" [José Alfonso Domínguez-Núñez, Spain]	Accepted
2379	58	24			Is it possible to restate this sentence? "Reasons … are many, but many reasons are related to …" - as a reader I was left wondering why the authors did not state what the many reasons are. [Nina Hunter, South Africa]	Accepted - text revised
2381	58	28			"18% … South India" - incomplete sentence [Nina Hunter, South Africa]	Accepted - text revised
2383	58	33			"the difficulties" - can you illustrate some of these? [Nina Hunter, South Africa]	Accepted - text added
2385	58	44			Please define "animal traction" [Nina Hunter, South Africa]	Accepted
28379	59	1	59	1	How is this more recent - it refers to the same literature cited above plus some older papers. [Barron Joseph Orr, Germany]	Section has been restructured to clarify distinction between the early proponents and the later more critical Scoones/Wolmer view
28381	59	7	59	8	Clarify the issues of mixed farming with respect to land degradation. [Barron Joseph Orr, Germany]	Last sentence of 2nd paragraph clarifies this issue.
4295	59	10	59	13	both of these sentences need to be re-write to avoid confusion and ensure accurate message pass to the readers. [Lee-Sim Lim, Malaysia]	Accepted - Fixed

Comment No	From Page	From Line	To Page	To Line	Comment	Response
4297	59	10	59	13	Typo: "Howden and coauthors (Howden et al. 2007)" should be "Howden et al. (2007)"; "Rivera-Ferre and coauthors (Rivera-Ferre et al. 2016)" should be "Rivera-Ferre et al. (2016)". [Lee-Sim Lim, Malaysia]	Accepted
11729	59	12	59	12	Rivera-Ferre and coauthors (Rivera-Ferre et al. 2016) : Remove the double reference [Serah Kahuri, Kenya]	Accepted
39505	59	17	59	35	Section 4.10.1.5 is poorly developed. [, United States of America]	Taken into account - the section has been substantially revised
25481	59	18	59	18	This section should not begin by highlighting a particular case, but staying first at a global level. Furthermore, the presentation or even the mention of China afforestation policies should be based on scientific references. Side-effects should also be presented, including the decline of soil moisture and the alteration of hydrological regimes. Some references for China : - Piao, Shilong, et al. "Detection and attribution of vegetation greening trend in China over the last 30 years." Global Change Biology 21.4 (2015): 1601-1609. - Zhang, Yao, et al. "Multiple afforestation programs accelerate the greenness in the 'Three North'region of China from 1982 to 2013." Ecological indicators 61 (2016): 404-412. - Jia, Xiaoxu, et al. "Soil moisture decline due to afforestation across the Loess Plateau, China." Journal of hydrology 546 (2017): 113-122. - Li, Yue, et al. "Divergent hydrological response to large-scale afforestation and vegetation greening in China." Science advances 4.5 (2018): eaar4182. [, France]	Taken into account - the section has been substantially revised
39507	59	18	59	20	Define afforestation initially. Why start with China having largest afforested area? Seems out of context. Consider deleting. [, United States of America]	Taken into account - the section has been substantially revised
24709	59	18	59	23	"China has the largest afforested area in the world." Absolute orc relative measures? Please specify in relation to what. On afforestation; is this natural or planted forest? decidious or evergreen? please specify. [gunnar austrheim, Norway]	Taken into account - the section has been substantially revised
4299	59	27	59	27	Typo: "Bacena and co-authors (2014)" should be "Bacena et al (2014)" [Lee-Sim Lim, Malaysia]	Taken into account - the section has been substantially revised
39509	59	36	59	36	What is a "higher-level" response? [, United States of America]	Taken into account - changed to policy responses
28385	59	39	59	41	this is an inaccurate description of GEF objectives with respect to LD. see for example Henry et al Section 6 http://stapgef.org/sites/default/files/publications/SLM-Henry_Murphy_Cowie.pdf [Barron Joseph Orr, Germany]	Accepted - text revised
28383	59	36	60	12	This section would flow better and more logically if it started by considering the development of the UNCCD. [Barron Joseph Orr, Germany]	Noted - but UNCCD is primarily relevant for Ch 3
27133	59	36	61	20	Citation and discussion of the very important IPBES-Report on Land Degradation and Restoration in this passage is missing (see https://www.ipbes.net/assessment-reports/ldr). Please add. [, Germany]	Accepted - IPBES report added
8725	59	36	61	20	Please include a reference to High-Level Political Forum 2018. Among the targets that were subject to discussions and VNR was also SDG15. More information:https://sustainabledevelopment.un.org/hlpf/2018 [Mihaela Stefanescu, Romania]	Noted - the SDGS are discussed
174	59	18			substantiate with literature. [Chukwuma Anoruo, Nigeria]	Taken into account - the section has been substantially revised
7137	60	1	60	2	This sounds prescriptive. Consider rephrasing the sentence. [Debra Roberts, South Africa]	Accepted - sentence removed
12899	60	5	60	5	UNFCCC is not defined. [Robert Treuhaft, United States of America]	Accepted - reference made to Glossary
28387	60	7	60	8	this sentence is difficult to follow and apparently incorrect. The UNCCD mandate covers only the drylands. [Barron Joseph Orr, Germany]	Accepted - text is revised

Comment No	From Page	From Line	To Page	To Line	Comment	Response
26167	60	7	60	8	Some word(s) appear to be missing here [Reid Detchon, United States of America]	Accepted - text is revised
28389	60	9	60	9	What UNCCD debates does this refer to? [Barron Joseph Orr, Germany]	Noted - UNCCD debates on LDN
33375	60	13	60	37	Net Degradation Neutrality/Zero Net Degradation etc.: LDN discussion should include biodiversity. Following is a discussion between Steve Prince and Ben ten Brink. "... Land Degradation Neutrality approach... related terms, e.g. "No net loss", "Zero Net Land Degradation", and "No Net Gain".[It is not true that a] loss can be so easily be compensated by creation of the state or process elsewhere. Certainly something like NPP or forest biomass could be replaced, but what about ecosystems? For example, there remain measurable differences between the biodiversity of old growth forest (supposedly never cleared) and 100yr old regrowth along side it, at least here in the mid-Atlantic of USA. This seems to me to be rather fundamental, although it appears to have been adopted widely." "….you are certainly right, npp and biomass can be quite easily replaced/compensated else, but biodiversity is another story, taking sometimes many hundreds of years, and similar conditions. There is some literature on habitat banking and nature off setting although I have no titles at this moment. It has been applied as compensation for nature loss due to road building and other human interventions. Although it will be not easy to achieve a neutral balance for each of a representative set of LD components (say biodiv, biomass/ vegetation cover, SOC,soil depth, NPP, WHC, wood/fiber stock, yields, ..), it would be interesting to speculate how this could be achieved. The spatial and temporal scaling is an interesting issue too for this investigation; Neutral at what space/time unit? 1 Km2, province, country, continent,.. That would have major different consequences. And can gains in one LD component compensate for loss in another (hard or soft LDN?). Probably application of LDN it would result in a virtual halt to all conversion of natural land, whether sustainably converted into cropland (big losses of B and most ES) or degradation in de badly managed sense. How could a future socioeconomic development look like within these LDN limits? And how would that change current economic rules, redefine value creation, income, status, consumption and global wealth distribution? If these difficult and reshaping questions are ignored, what is well understandable, env crises will take over". [Stephen Prince, United States of America]	Noted - there are many interesting thougths, but it is beyond the scope of this chapter to discuss the concept of no-net-loss further
28391	60	20	60	21	wrong references. Should be Cowie et al 2018. Land in balance: The scientific conceptual framework for Land Degradation Neutrality. Environmental Science & Policy, 79, pp.25-35. [Barron Joseph Orr, Germany]	Accepted
39511	60	21	60	21	Correct reference and add period. [, United States of America]	Accepted
28393	60	26	60	26	Inappropriate reference for this point: cite Cowie et al 2018 (above) and Sims et al 2018. Developing good practice guidance for estimating land degradation in the context of the United Nations Sustainable Development Goals. Environmental Science & Policy. [Barron Joseph Orr, Germany]	Accepted

Comment No	From Page	From Line	To Page	To Line	Comment	Response
13293	60	28	60	32	This admirable principle would be most effective if enhancement was linked to better protection and re-establishment of key ecological processes. Buffering and reconnecting areas of natural biodiversity is particularly relevant on farms and agricultural land where an increasing number of connectivity conservation initiatives involving ecologically based forest and woodland restoration along riparian zones and other important stepping stones (initially aimed at improving the outlook for wildlife) are delivering robust improvements to water retention, farm productivity and livelihoods as well as long term carbon sequestration and storage benefits (IUCN "Nature Based Solutions to Address Global Societal Challenges"). As noted earlier forest restoration can deliver multiple goals of great benefit to climate mitigation and adaption, biodiversity, ecosystem integrity, ecosystem services and sustainable development (Cohen-Shacham 2016). These points are made well on Page 29 lines 29-32 where the benefits of integration begin to be acknowledged. • Cohen-Shacham, Emmanuelle & Walters, Gretchen & Maginnis, Stewart & Janzen, Christine. (2016). Nature-based Solutions to address global societal challenges. 10.2305/IUCN.CH.2016.13.en. [Aila Keto, Australia]	accepted - reference added
39513	60	36	60	36	SDG not defined. [, United States of America]	Accepted - SDG spelled out
27135	60	38	60	39	NAPs do not "enable adaptation needs", but rather "enables Parties to formulate and implement national adaptation plans (NAPs) as a means of identifying medium- and long-term adaptation needs and developing and implementing strategies and programmes to address those needs", please see https://unfccc.int/topics/adaptation-and-resilience/workstreams/national-adaptation-plans and revise this statement. [, Germany]	Accepted - text revised
28395	60	38	60	45	Needs rewording [Barron Joseph Orr, Germany]	Accepted - text revised
28397	60	46	60	48	Provide some information about how the initiative will achieve this. [Barron Joseph Orr, Germany]	Accepted - more information on the initiative is included
40681	60		60		www. => use literature not web site (not accepted for IPCC). [Valerie Masson-Delmotte, France]	Accepted
30327	60	32	61	2	This is a key figure for LD and CC policies. The (annual) sequestration potential of soil and vegetation restoration is highly debated, and progress is slow. What are the sources of these figures and other estimates should be added. Please give a confidence level to all. Next to the annual sequestration potential it is important to know what is the total potential of both and how annual sequestration will change over time to finally zero. [, Netherlands]	Taken into account - the text is revised, and referenced
32853	60	46	61	2	I would delete this paragraph unless you have the ability to look at the large literature critiquing the 4/1000 initiative and provide a balanced assessment of this rather problematic claim. [Doreen Stabinsky, United States of America]	Taken into account - references to the critique has been added
25483	60	46	61	2	We suggest to recall the importance of a deep reduction of emissions in other sectors. See GENERAL COMMENT ON CDR AND SUSTAINABILITY. [, France]	Noted - but not relevant in this section
39515	61	9	61	9	Describe these goals in the context of land degradation. [, United States of America]	Noted - the goals are mentioned very briefly. There is not enough space to elaborate
2387	61	11	61	12	Is it possible to state the goals in brief words in parentheses after each number? As a reader I was wondering what these goals are. [Nina Hunter, South Africa]	Accepted

Comment No	From Page	From Line	To Page	To Line	Comment	Response
22605	61	13	61	14	It could be noted that under CDM, only afforestation and reforestation activities are eligible. "voluntary carbon markets" are a colloquial term and should not be capitalised. If it refers to one particular scheme/company, it should be properly referenced. [Anastasios Kentarchos, Belgium]	Accepted
28399	61	13	61	14	The voluntary carbon market is not a specific scheme as implied here, esp by juxtaposition with CDM. [Barron Joseph Orr, Germany]	Noted
17503	61	13	61	20	The writing here is confusing, as it implies that the UNFCCC and potentially its CDM recognize REDD+ projects. This is NOT the case. It would be important to be very clear that these concerns apply to what voluntary carbon markets call "REDD+ project", but not to the implementation of REDD+ at national level in accordance with the UNFCCC Warsaw Framework. [Dirk Nemitz, Germany]	Accepted - clarification added
14483	61	13	61	20	The above management options for mitigating land degradation target mainly local drivers of land degradation. In a globalized world, the issue of teleconnections and how distant markets affect land degradation have also been a major focus of research attention and it may be useful to have a paragraph in this section to highlight the distal socio-political and economic) drivers that lead to land degradation and the mechanisms to mitigate them (e.g., governance of global agro-commodity supply chains). See Lambin et al. (2018) Nature Climate Change for a great review. [Janice Ser Huay Lee, Singapore]	Accepted - a paragraph was added
40251	61	16	61	16	as previously explained, there are no REDD+ projects. Need to clarify the difference between the national REDD+ under the Conventin and other self nominated REDD+ projects [Thelma Krug, Brazil]	Accepted - the text is clarified
28401	61	23	61	23	Provide some explanation of these limits to adaptation. Eg Building SOM can enhance resilience of croplands to drought stress but drought may become too frequent/severe for this impact to adequately support continued cropping. [Barron Joseph Orr, Germany]	Taken into account - examples are provided later in the section
2391	61	25	61	26	"How limits .... contested" - needs to be stated earlier on in the paragraph [Nina Hunter, South Africa]	Rejected - but the text has been revised and extended
28403	61	30	61	30	… if climate changes beyond the adaptation capacity of the system [Barron Joseph Orr, Germany]	unclear what this means
28405	61	32	61	32	Thawing permafrost has negative climate impacts but how is it a severe land degradation issue? [Barron Joseph Orr, Germany]	Accepted - clarification added
4301	61	33	61	33	Typo: "(Poesen et al. 2003))." should be "(Poesen et al. 2003)." [Lee-Sim Lim, Malaysia]	Accepted
5827	61	35	61	37	Resilience has different meanings, good to mention it and add reference! [Sanaz Moghim, Iran]	Noted - there are several references further down relating to different meanings of resilience
13295	61	34	62	41	This analysis adds weight to the need to prioritise increased protection and improved management of our most resilient ecosystems – those with natural patterns of distribution and abundance of biodiversity and high ecosystem integrity such as primary forests and other relatively undisturbed natural ecosystems. [Aila Keto, Australia]	Noted
30515	61	34	62	41	Archaeology can provide infomration regarding past tipping points. [Hannah Fluck, United Kingdom (of Great Britain and Northern Ireland)]	Noted

Comment No	From Page	From Line	To Page	To Line	Comment	Response
33377	61	34	62	41	It would be appropriate to cite IPBES LDRA Chapter 4.1.2 which presents the issue of thresholds in the context of degradation, as does a report prepared for the Science and Technology Advisory Panel of the GEF. - Prince, S., Von Maltitz, G., Zhang, F., Byrne, K., Driscoll, C., Eshel, G., Kust, G., Martínez-Garza, C., Metzger, J. P., Midgley, G., Moreno-Mateos, D., Sghaier, M., & Thwin, S. (2018). Status and trends of land degradation and restoration and associated changes in biodiversity and ecosystem fundtions. In L. Montanarella, R. Scholes, & A. Brainich (Eds.), The IPBES assessment report on land degradation and restoration. Bonn, Germany: Secretariat of the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem services. - Yengoh, G. T., Dent, D. L., Olsson, L., Tengberg, A., & Tucker, C. (2016). The use of the Normalized Difference Vegetation Index (NDVI) to assess land degradation at multiple scales: a review of the current status, future trends and practical considerations. SpringerBriefs in Environmental Science. Lund University Centre for Sustainability Studies/ Scientific Technical Advisory Panel of the Global Environment Facility. Retrieved from https://www.researchgate.net/publication/275768719_A_longer_closer_look_at_land_degradation [Stephen Prince, United States of America]	Accepted
40683	61		62		resilience has an IPCC definition (SR15 for CRDP for instance). I could not find an assessment of tipping poiints in this section. [Valerie Masson-Delmotte, France]	Accepted - reference to the glossary is made
2389	61	23			"Expanding adaptation limits" - what does this mean? Could it be expanded on? [Nina Hunter, South Africa]	misunderstanding - it says exceeding, not expanding
17489	62	28	62	32	The attempt to restore secondary forests, especially those in a state of monoculture tree crops (often consiting of non-native species) to a more natural state and structure (e.g. through more natural regrowth or by planting a diversity of climate change and biome shift prone species that best support the ecosystem services in the region now and in the future), should be integrated here as key example for good SFM measures that enhance the resilience of a managed forest ecosystem. [Taehyun Park, Republic of Korea]	This comment is out of context
25485	62	32	62	34	We suggest to add organic farming in this list. See also GENERAL COMMENT ON AGROECOLOGY. [, France]	Rejected - organic farming is subject to different defintions as it is primarily a marketing label
39517	62	34	62	34	Describe what is in these references. [, United States of America]	Rejected - in the interest of space
4303	62	36	62	36	Typo: "by (O'Connell et al. 2016; Simonsen et al. 2014)." should be "by O'Connell et al. (2016) and Simonsen et al. (2014)." [Lee-Sim Lim, Malaysia]	Accepted
27137	62	42	65	11	Section 4.10.4 addresses barriers to implementation. We would however expect such information in chapter 7, which contains a comprehensive discussion of these issues. We suggest shortening this section and moving it to chapter 7. [, Germany]	Taken into account - Ch 4 and Ch 7 have been better coordinated
25495	63	24	63	24	Some emphasis is put in the SPM on insurances. If they can be very useful, we would like the SPM to explicit that as a priority, prevention actions need has to be taken, and in parallel of them, to face residual risks, it's important to have a global strategy that can mix, depending from the local situation and choices, some private risk management (like precautionary savings, agricultural mutual funds, insurance) and direct public intervention, depending on the risk/loss intensity. Concerning their costs, further explanations should be provided, including the relevant stakeholders. Could you confirm that the idea is if insurances are provided by private companies then this will cost less for States? [, France]	Insurance as an innovative source of funding to SLM has been added to the last paragraph in the section instead of at this place. A new reference (Shames et al. 2013) has also been added for further reading of the important aspects raised by the reviewer.

Comment No	From Page	From Line	To Page	To Line	Comment	Response
22607	63	43	63	45	Additional barriers to adoption of the SLM in Kenya Highllands are gender issues (women farmers do not have the same opportunities as men) as well as lack of tenure. [Anastasios Kentarchos, Belgium]	The issues of gender and lack of tenure have been added to the discussion about adoption of SLM in the Kenyan highlands.
29777	63	3	64	6	Is culture considered an ecosystem service? If so - how could compensation work? [Tanya Smith, Canada]	Noted. Cultural services are an ecosystem service. Some landholders are compensated to maintain cultural landscapes eg meadows in Switzerland. Specific discussion of this point is not warranted due to space restrictions.
2413	63		77		These pages are desciptive - there is little assessment of the literature with no confidence limits stated. Could more assessment be undertaken? [Nina Hunter, South Africa]	Existing literature on barriers to implementation of SLM has been reviewed, especially existing synthesis reports. Barriers to implementation have often been identified in development projects and the analysis by e.g. Uitto and Tengberg & Valencia are based on large portfolios of projects of multilateral donors, such as the GEF, UN agencies, World Bank, etc. Although generic barriers to scaling up of SLM in developing countries have been identified from these large portfolio analyses, the particular mix of barriers is often context specific. So **we can say with high confidence that these barriers exist and are widespread, but there are large variations between and within countries as well as regions of the world**. Further assessments and discussion of barriers to SLM is required to put countries on a pathway to sustainable development, but would merit a report in its own right.
2395	63	15			"have been identified" - by whom? where is the reference for the bulleted points? [Nina Hunter, South Africa]	A number of references are provided in the paragraph above the bullet points, which have identified these barriers. An additional reference (Shames et al. 2014) has been added to further strengthen these conclusions.
39519	64	2	64	2	Consider changing the word "situated". It is not the right word. [, United States of America]	The sentence has been changed to: Tengberg and Valencia (2018) **analysed** the findings from a review of the GEF integrated natural resources management portfolio of projects **using** the transition theory framework.
39521	64	14	64	14	It is clear that the dots connect the bubbles, but what are the top 5? Half an arrow? [, United States of America]	See answer to comment above.
21953	64	14	64	15	Figure 4.10 is incorrectly depicted. In the original figure it follows an S-shape (Tengberg & Valencia 2018). A corrected figure is sent to the lead author. [Anna Tengberg, Sweden]	A sentence about the landscape approach as a way to scale up SLM has been added and two of the suggested references have been included (Sayer et al. 2013; Burgi et al. 2017) for further reading.
39523	64	14	64	17	The figure should be cited in the text before it occurs in the manuscript. [, United States of America]	The reference to the figure was in the wrong place and has now been moved to th paragraph before the figure where it is discussed.
8697	64	16	64	17	you need to write out the full lenght of LDN and PES what it means or we can not understand it from the figure alone [Louise Andresen, Sweden]	LDN and PES are now written out in the text in the sections before and after the figure.
4305	64	23	64	24	Typo: "(Kelly (Letcher) et al. 2013)." should be "Letcher et al. 2013"?? Please double check. [Lee-Sim Lim, Malaysia]	Accepted, corrected
1867	64	23	64	24	Is there a typo in the reference provided? [William Lahoz, Norway]	Yes and it has been corrected to Kelly et al. 2013.

Comment No	From Page	From Line	To Page	To Line	Comment	Response
1439	64	8	65	11	For scaling up to landscape scale, suggest mention of landscape approaches as a means to mediate competing demands on the land and implement SLM. Relevent references: --Sayer, Jeffrey, Terry Sunderland, Jaboury Ghazoul, Jean-Laurent Pfund, Douglas Sheil, Erik Meijaard, Michelle Venter, et al. 2013. "Ten Principles for a Landscape Approach to Reconciling Agriculture, Conservation, and Other Competing Land Uses." Proceedings of the National Academy of Sciences of the United States of America 110 (21): 8349–56. doi:10.1073/pnas.1210595110. --Scheyvens, H., R. Shaw, I. Endo, J. Kawasaki, P. Ngoc Bao, B.R. Shivakoti, H. Samejima, B.K. Mitra, and Y. Takahashi. 2017. "Promoting the Landscape Approach in Asia-Pacific Developing Countries: Key Concepts and Ways Forward." 37. Policy Brief. Hayama. doi:10.1177/0022146513479002. --Deneir, L., S. Scherr, P. Chatterton, L. Hovani, and N. Stam. 2015. "The Little Landscapes Book." Oxford. doi:10.1017/CBO9781107415324.004. --Matthias Bürgi, Panna Ali, Afroza Chowdhury, Andreas Heinimann, Cornelia Hett, Felix Kienast, Manoranjan Kumar Mondal, Bishnu Raj Upreti and Peter H. Verburg. 2017. Integrated Landscape Approach: Closing the Gap between Theory and Application. Sustainability 2017, 9, 1371; doi:10.3390/su9081371 [Henry Scheyvens, Japan]	A sentence about the landscape approach as a way to scale up SLM has been added and two of the suggested references have been included (Sayer et al. 2013; Burgi et al. 2017) for further reading.
39525	65	1	65	1	Urbanization needs to be discussed throughout, not just as a case study. [, United States of America]	Urbanisation is mentioned as a long-term economic effect that can lead to change and affect upscaling of SLM. In-depth discussion of urbanisation is provided elsewhere in the report.
27139	65	7	65	11	It would be very helpful if you could expand briefly on the innovative funding schemes LDN finance and carbon finance, as it is not clear what exactly is understood by these terms. For instance, do you understand "carbon pricing" by your expression carbon finance? [, Germany]	More information has been provided on the LDN Fund as well as other innovative funding schemes and two references have been added for further reading (Baumber et al. 2019; Shames et al. 2013).
39527	65	9	65	9	Spell out LDN. [, United States of America]	This has been done.
12905	65	13	65	18	Define what is a hot spot and a case study. [Robert Treuhaft, United States of America]	Taken into account - the term hot-spot is removed
39531	65	16	65	16	Reference incorrect. [, United States of America]	unclear
39533	65	19	65	21	Table 4.3 incomplete? [, United States of America]	Taken into account - the table has been revised
24209	65	19	65	21	In table 4.3. a co-benefit of biochar that might be inlcuded is the recycling of organic residues. [Maria Luz Cayuela, Spain]	Noted - not in the table, but in the text
28407	65	19	65	22	Table 4.3 Include drought resistance as a benefit of biochar [Barron Joseph Orr, Germany]	Noted - not in the table, but in the text
12901	65	20	65	20	Meaning of arrow thickness is not described for Table 4.3. [Robert Treuhaft, United States of America]	Accepted - explanation added
39529	65	13	88	5	Would be nice to have some forest-related examples, from North America (agroforestry, reforestry, etc.). [, United States of America]	Noted - much of the literature on forests emanate from North America, and this is reflected in the earlier parts of the chapter. But we wanted to highlight some particular good examples of forest managment from other parts of the world.
24839	65	13	88	5	The chapter has nine case studies in section 4.11. These provide very nice evidence for the reader. However, I would suggest the case studies be reduced to three, based on SLM principles which is avoid, reduce, reverse (bundle the 9 under those three headings which will allow some synergies and cross-regional learning). This would also help reduce the volume and increase the analytical value (comparing, contrasting, showing what the cases have in common or where they differ, what has worked or not worked in SLM). [Justice Issah Musah Surugu, Germany]	Rejected - Land degradation is such a wide field which is also highly context specific that it would be be hard to justify just three case studies. The nine case studies have been selected to reflect the width of land degradation.

Comment No	From Page	From Line	To Page	To Line	Comment	Response
23557	65				The social ecosystem in Figure 4.3 is the result of internal and external interactions. The social impact here should also have an impact on the system dynamics, but only affect the strength and weakness. [Huai Jianjun, China]	unclear
31725	66	1	66	34	This section could mention the impactof reduction of mitigationg effects of vegetation through clearing and sealing of surfaces (concrete jungle) by increasing urbanization globally, especially in the 3rd world. In many case, it is likely that the sealed surfaces are high potential agricultural land that also has impact on food security which will be exercabated by changing climate [Elizabeth Migongo-Bake, Kenya]	Rejected - beyond the scope of this section
25093	66	1	66	47	The definition of green infrastructure and its role should be further clarified. Below is description of green infrastructure from Palmer et al., (2015). “Green infrastructure is a network of natural or seminatural features that has the same objectives as gray infrastructure. Gray infrastructure may always be needed to pipe and store water, but careful planning can limit its magnitude and extent. Green infrastructure—wetlands, healthy soils and forest ecosystems, as well as snowpack and its contributions to runoff—supplies clean drinking water, regulates flooding, controls erosion, and “stores” water for hydropower and irrigation.” – from Palmer et al. (2015) “Green approaches to crop and soil management can reduce evaporative losses of water from fields (Rockström et al., 2014). Rainwater harvesting and small, farm-scale reservoirs allow more efficient use of water in agriculture (Rockström et al., 2014). Smallholders can access these methods, whereas large-scale irrigation projects benefit fewer local people. Such approaches can enhance farmers’ resilience and long-term adaptation to climate change.” – from Palmer et al. (2015) Palmer M.A., Liu J., Mattews J.H., Mumba M., D’Odorlco P., 2015. Manage water in a green way. Science 349 (6248): 584-585. Rockström J. et al., Water Resilience for Human Prosperity (Cambridge Univ. Press, Cambridge, 2014). [Junguo Liu, China]	Rejected - Not in scope for this contribution, which specifically focusses on urban green infrastructure, not green infrastructure in non-urban areas.
30517	66	17	66	24	many of these green and blue urban featuers are historical cultural assets. [Hannah Fluck, United Kingdom (of Great Britain and Northern Ireland)]	Noted
1649	66	28	66	29	I suggest the additional references for this line. ①Kochi Tonosaki,Shiro Kawai and Koji Tokoro,2014: Editors N. NAKAGOSHI/J. A. MABUHAY,Cooling Potential of Urban Green Sapces in Summer.Designing Low Carbon Societies in Landscaps,15-34,Springer,DOI 10.1007/978-4-431-54819-5 ② 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) [Kochi Tonosaki, Japan]	Accepted
39535	66	39	66	39	Period needed. [, United States of America]	Accepted
1647	66	39	66	40	I suggest the additional reference for this line. Kochi Tonosaki,Shiro Kawai and Koji Tokoro,2014: Editors N. NAKAGOSHI/J. A. MABUHAY,Cooling Potential of Urban Green Sapces in Summer.Designing Low Carbon Societies in Landscaps,15-34,Springer,DOI 10.1007/978-4-431-54819-5 [Kochi Tonosaki, Japan]	Accepted
25487	66	43	66	43	Shouldn’t it be « permeable » instead of « impermeable » ? [, France]	Accepted

Comment No	From Page	From Line	To Page	To Line	Comment	Response
11731	66	46	66	46	.....important adaption mechanism.....should read .....adaptation [Serah Kahuri, Kenya]	Accepted
24711	66	1	67	21	A reference to nature-based solutions and the re-naturing cities could be relevant to mention in this section, as these have demonstarted to be powerful concepts with policy impact. https://publications.europa.eu/en/publication-detail/-/publication/fb117980-d5aa-46df-8edc-af367cddc202 [gunnar austrheim, Norway]	Accepted - text added
7139	67	15	67	16	Replace the full stop after the reference with a comma. [Debra Roberts, South Africa]	Accepted
33747	67	19	67	21	Parallel to expected population growth and urbanization, the demands for domestic and agriculture water are expected to increase in the future, mostly in developing countries. The water supplies are also influenced by climate change and ecological modifications. Considering "roof-water harvesting" can therefore have multi advantage on domestic water supply, urban greening and partly compensate groundwater recharge. [, Norway]	Noted - in the interest of space we have not been able to cover all aspects.
33749	67	27	67	30	Is conservation tillage or conventionally plowed (tillage) vulnerable to erosion? I think conservation tillage is a strategy for minimizing disturbance of agricultural soils. Further information please refer this link. https://conservationist.wordpress.com/2006/12/03/conventional-vs-conservation-tillage/ [, Norway]	Taken into account--the reviewer's comment is correct, and the original language was actually in agreement with the reviewer but needed clarification. Factor of four was changed to four fold.
4099	67	27	67	30	unclear, suggest reviewing: should be the other way around! [Turi Fileccia, Italy]	Accepted - text revised
14265	67	41	67	41	OM is around 58% C- there is some variation depending on SOM quality and type [Lukas Van Zwieten, Australia]	Accepted--58% was changed to ~58%
689	67	42	67	44	The sentence states that 20 to 70% of original SOC is lost. This is too great of an estimate and needs to be harmonized with the value for SOC loss used on p. 31 and 32 as discussed in the previous comment [Daniel Pennock, Canada]	Accepted--The ranges given on p. 32 are 40-60% in cooler climates and 75% for tropical areas. The text has been changed to harmonize with this range.
17055	67	44	67	44	The magnitude of losses of SOM are from land use change from natural, forest or grassland to arable land, not agricultural practices. Managed grasslands are also subject to agricultural practices and organic C stocks of grasslands may remain stable or even increase under management when compared to their natural state. [Roland Hiederer, Italy]	Rejected--this section is not about managed grasslands, but specifically tilled agriculture. "agricultural practices" as detailed in the subsequent paragraph includes land use change (quantity and quallity of C inputs) as well losses from enhanced mcirobial respiration. Citations are listed to support these from 68: 1-16.
14267	68	11	68	14	This section could utilize more recent literature on aggregate protection and stabilization of new and mineral protected organic C. The term “attack” referencing the microbial consumption of C previously protected in aggregates is not appropriate. Indeed, some of the newer theories on SOM stabilization , formation and degradation need to be considered to balance this section. Please see as an example: The contentious nature of soil organic matter J Lehmann, M Kleber Nature, doi:10.1038/nature16069 [Lukas Van Zwieten, Australia]	Taken into account--the concepts presentated and existing references by Grandy, Robertson and Neff were very consistent with the evolving contemporary view of SOM. Nowhere is there mention of recalcitrant OM or chemically protected OM. But language was added to underscore mineral-protection, and recent references were added.
14269	68	20	68	20	I am not sure that the process of reducing microbial activity is directly sought- rather, processes that stabilize aggregates (ie min till) can result in lower flushes of microbial activity which lead to a positive priming effect. [Lukas Van Zwieten, Australia]	Rejected--I am afraid this is a bit too nuanced for this short piece, but the discussion is welcome..... If aggregates reduce flushes of microbial activity that lead to a positive priming effect then isn't one ultimate effect of improving aggregate structure reduced microbial activity?

Comment No	From Page	From Line	To Page	To Line	Comment	Response
28409	68	21	68	21	This section can start here. All the text above, though well-expressed, is peripheral and repeats points made elsewhere. Delete or move the introductory text. Are you proposing perennial cereals as an alternative to annual cereals? How do the yields compare? This is the key issue determining whether perennial crops can substitute for annual crops. If yields are lower, then more cropland is required to produce the same quantity of food, which could increase land degradation and/or lead to loss of biodiversity. [Barron Joseph Orr, Germany]	Rejected--The segments of text identified by Dr. Orr are not the least bit peripheral to this section. They explicitly frame the rationale for perennial grains. Language has been added to acknowledge that in most cases (except rice) the perennial grains under development yield less than highly bred annual counterparts. It is important to be vigilent in guarding against undesirable consequences, like expanding the footprint of agriculture. However, the argument that there is no place for lower yielding grains because more land would need to be put into production is too simplistic. There are plenty of circumstances specific to particular regions with multiple factors at play (changing % of grain fed to livestock, levels of meat consumption, areas with large yield gaps) that could benefit from the planting of perennial proto-crops on a segment of the landscape.
39537	68	23	68	23	This is not novel or new, but not widely adopted. Check out publications from The Land Institute in Salina Kansas, or Wes Jackson publications since the 1980s. [, United States of America]	Noted--the author of this section is the Director of Research at The Land Institute.
39539	68	23	68	25	Could be mentioned that every major annual crop used for food production has a perennial counterpart. [, United States of America]	Rejected--not a bad suggestion but "counterpart" is too tricky to define in a short piece like this.
28411	68	34	68	36	pigeonpea is a legume not a grain crop; rewrite the sentence [Barron Joseph Orr, Germany]	Rejected--it is not uncommon for people to suggest that "grains" only refer to seed producing grasses. However we (along with most of our colleages) adhere to "cereals" as seed producing grasses. Grains is inclusive of pulses and many oilseed crops. One of the most famous legume breeding books written is in fact called "Grain Legumes" by J. Smartt
40685	68		88		case studies : why have those been selected? What are the conclusions? Are they reflected in the ES ? Avoid prescriptive statements in case studies. [Valerie Masson-Delmotte, France]	Noted--the section on perennial grains has been included because of the potential far-reacing effects these crop species would have reducing and even reversing soil degradation associated with annual grain production.
14271	69	4	69	5	Typographical errors- spaces [Lukas Van Zwieten, Australia]	Accepted--corection made
28413	69	8	69	10	Clarify that SOC stock will increase only until a new equilibrium is reached. [Barron Joseph Orr, Germany]	Accepted--text adjusted.
33751	69	19	69	28	How is the issue of food demand and other ecosystem services interrelated? Perennial crops might be preferable to annual crops in terms of ecological services. Since selection of crops, perennial or annual depend on moisture availability for example, it's challenging to adopt perennial crops in moisture limited environment (e. g. only short rainfall period). [, Norway]	Noted--The ideas raised by Dr. Christophersen are valid and important, but they require more nuanced discussion than space allows in this short piece. All perennial grains are works in progress and with few exceptions will require many years of breeding before they match annual grains (with the exception of rice which has already achieved this). However, during the period of "proto-crops" there are many circumstances where a perennial grain may fit well in a cropping system (see Ryan et al. 2018 in Bioscience). New language was included in this revision along thses lines. Perennials do require more water, but they also capture more water in many agroecosystems (less runoff and evaporation, greater infiltration, and greater soil water appropriation).

Comment No	From Page	From Line	To Page	To Line	Comment	Response
39541	69	28	69	28	Somewhere in this section Schulte et al., 2017 should be discussed: Schulte, L.A., J.B. Niemi, M.J. Helmers, M. Liebman, J.G. Arbuckle, D.E. James, R.K. Kolka, M.E. O'Neal, M.D. Tomer, J.C. Tyndall, H. Asbjornsen, P. Drobney, J. Neal, G. Van Ryswyk, and C. Witte. 2017. Prairie strips improve biodiversity and the delivery of multiple ecosystem services from corn?soybean croplands. Proceedings of the National Academy of Sciences, 114(42): 11,247-11,252. doi:10.1073/pnas.1620229114/-/DCSupplemental. [, United States of America]	Noted--the work reported in Schulte is extremely valuable, and adds to a growing literature on how the inclusion of carefully placed buffer strips (herbacious and/or woody) can improve landscape level ecosystem functioning. However, this is a very different proposition than perennializing the major grain crops themselves. In an exhaustive review of how integration of perennials in general can reduce environmental degradation, this and related articles would be essential. However, in a short piece specifically on perennial grains, it does not introduce a missing concept.
3449	69	16	83	3	The present chapter is too long. So it is suggested to delete some figures lacking substance, such as Figure 4.11 on page 69, Figure 4.12 on page 71, Figure 4.14 on page 75, Figure 4.15 on page 78, Figure 4.17 on page 81 and Figure 4.18 on page 83. [, China]	noted--Figure 4.11 is quite valuable in helping readers conceptualize the difference in belowground root allocation of annual and perennial grains. However, the decision to include or remove this and other figures remains with the editors of the chapter.
14273	70	13	70	13	Need to be specific here for N, not the more generic term “nutrient” [Lukas Van Zwieten, Australia]	Accepted
39543	70	17	70	17	In all places note that it is "South" Korea. [, United States of America]	Accepted - Text revised
25095	70	29	70	36	Too many numbers are shown here. It's advised the key messages are delivered by using 3-5 numbers. Don't list all numbers here. [Junguo Liu, China]	Rejected - this is a scientific report and it is appropriate to included numerical values.
2399	70	17	71	22	It is important to state "South Korea" instead of "Korea" as it should be clear that "North Korea" is not being referred to. [Nina Hunter, South Africa]	Accepted - Text revised
27141	70	15	73	8	A general statement at the beginning of this section on the limits to reversing land degradation would be helpful as this suggests general reversibility. [, Germany]	Rejected - the main text speaks about this - this section represents examples of two success stories.
2397	70	11			Perhaps state "after this initial period of high CO2 and N20 emissions" as an introduction to this paragraph? [Nina Hunter, South Africa]	Taken into account--The next to last paragraph was re-worded to better represent the concern of crop conversion from a perennial to a perennial. To avoid confusion, sentences and a citation were removed that focused on the conversion of a perennial ecosystem to an annual grain system.
4307	71	1	71	1	If possible, the four pictures of Figure 4.12 should be labelled with the year which the picture is taken, to show the reforestation progess and process. [Lee-Sim Lim, Malaysia]	Accepted - best available information about approximate years of the photos is added.
12111	71	1	71	3	Provide years in which the photographs were taken for a clear timeline [Hans Poertner and WGII TSU, Germany]	Accepted - best available information about approximate years of the photos is added.
39547	71	2	71	3	Incorporate dates in these images. [, United States of America]	Accepted - approximate years of the photos are added.
8699	71	2	71	3	please add to each subfigure what year the picture was taken [Louise Andresen, Sweden]	Accepted - approximate years of the photos are added.
39549	71	19	71	19	Do those dollar values reflect the negative effect of switching to fossil fuels? [, United States of America]	Noted - No - the cited publication makes no reference to inclusion of fuel switching in the economic assessment, but they do state in the discussion that "the shift to other energy sources was subsidized to decrease in demand on forest wood resource".
39545	71	1	89	1	There is not a single reference to the rapid and extensive loss of wetlands and the extreme damage to urban centers like New Orleans and Houston and all along the southern United States Gulf Coast. These areas have been repeatedly impacted by hurricanes that have recently altered the social and economic structure of this entire region. The following reference should be included in this section of the report: USGS, 2017, Land area change in coastal Louisiana (1932 to 2016). [, United States of America]	Note that the line numbers for this comment are incorrect

Comment No	From Page	From Line	To Page	To Line	Comment	Response
16519	71	15			Please add "Furthermore, reforestation enhanced the capacity of disaster risk reduction significantly (UNDP 2017)" UNDP (2017) Valuation of reforestation in terms of disaster risk reduction: A technical study from the Republic of Korea. Sustainable Development Goals Policy Brief Series No. 1. [, Republic of Korea]	Accepted - text added
39551	72	20	72	20	Check a reference: Liqian and Changjin 2007. It is not in the reference list, either add this reference or delete it in the text. [, United States of America]	Accepted - Reference deleted
39553	72	34	72	34	Change to "runoff", also somewhere in this section consider citing this paper and the potential for reforestation failure in China (Chen et al. 2018): http://iopscience.iop.org/article/10.1088/1748-9326/aaf27b/meta [, United States of America]	Accepted - typo fixed and reference to the issues around plantations requiring irrigation to be sustained has been added.
39555	72	46	72	46	Elsewhere authors use US dollars. [, United States of America]	Accepted - add a conversion estimate to USD
15385	72	1	73	10	Suggest consistency in 4.11.3.2 with acronyms, including Fig. 4.13. - GFGP or GTGP? NFPP or NFCP? [, Australia]	Accepted - acronymns made consistent
25097	72	1	73	10	The Loess Plateau is located in the upper and middle reaches of the Yellow River in Northwest China. It has an area of 640,000 km2 and is home to < 100 million people. After thousands of years of intensive land use and overgrazing, it's soil has eroded at one of the highest rates ever recorded in the world, causing widespread poverty. In 1994, a watershed rehabilitation project was launched to mitigate desertification. This effort was incorporated into China's Grain to Green Program (GTGP) in 1999. The GTGP was the largest ecological rehabilitation program in the developing world with an ambitious goal to restore China's degraded ecosystems by converting cultivated land on steep slopes (≥25°) to perennial vegetation. The GTGP sharply decreased soil erosion and increased farm income and food security in the Loess Plateau (Fig. 23.1). [Junguo Liu, China]	Noted
33177	72	1	73	10	How does this relate to the State Forest Administration Three-North Shelterbelt ("Green Wall")? [Stephen Prince, United States of America]	Taken into account - the text is revised

Comment No	From Page	From Line	To Page	To Line	Comment	Response
33379	72	1	73	10	How does this relate to the State Forest Administration Three-North Shelterbelt ("Green Wall")?This does not review the large literature on the China Green Wall and its relationship to degradation. The concept is now largely considered to have been ill-conceived (see Wang et al. 2010, below). Most of the problem is caused by natural sand movement, not human activities. It is therefore not desertification in the sense of this Report. An organizational account is given by Jiang 2016. - Wang, X. M., Zhang, C. X., Hasi, E., & Dong, Z. B. (2010). Has the Three Norths Forest Shelterbelt Program solved the desertification and dust storm problems in arid and semiarid China? Journal of Arid Environments, 74(1), 13–22. https://doi.org/10.1016/j.jaridenv.2009.08.001 - Jiang, H. (2016). Taking Down the “Great Green Wall”: The Science and Policy Discourse of Desertification and its Control in China. In R. Behnke & M. Mortimore (Eds.), The End of Desertification? Disputing Environmental Change in the Drylands (pp. 513–536). Berlin: Springer. https://doi.org/10.1007/978-3-642-16014-1_19 [Stephen Prince, United States of America]	Taken into account - the text is revised
14485	72	46	73	7	While the GFGP in China has restored forest areas, its use of monocultures in the restoration process has led to missed opportunities for biodiversity gains should a mixed-forest restoration approach had been adopted. A recent paper by Hua et al. (2017) Nature Communications provide more details on the biodiversity results. [Janice Ser Huay Lee, Singapore]	Accepted - reference to potential for greater biodiversity gains has been added.
2401	72	3			"floods, droughts" - the decline in the natural forest resulted in a drought and flood? Please check. [Nina Hunter, South Africa]	Noted - and yes - loss of vegetation land cover can affect water flow rates resulting in both floods (high run-off) and droughts, uneven flow.
2403	72	24			Are there 25 provinces in China? The reader is not sure if "finally" means all provinces were included. If it is, then perhaps state "all 25 provinces". [Nina Hunter, South Africa]	Accepted - text revised
3451	73	7	73	8	In Figure 4.13, there is an error in the mapping of China. So it is suggested to delete the figure. [, China]	Accepted - for reasons of length of the overall chapter the figure was deleted.
39557	73	11	73	11	Similar to urbanization, wetlands (peatlands in this example) should be discussed throughout the chapter. [, United States of America]	this doesn't pertain to the peatland section but to the entire chapter it seems
12903	73	11	73	11	The reader should be reminded that this broad section 4.11 is about hospots and case studies. Is degradation and management of peat soils a hot spot or a case study? Mention at the beginning of this subsection 4.11.4. [Robert Treuhaft, United States of America]	This is a case study and the text was amended inserting 'this is a notable case study since...'
21141	73	16	73	19	The critical role of peatlands in the carbon cycle needs to be said more explicitly in the ES, and reflected in the SPM. The implications of peat degradation also needs to framed more explicitly in the ES and SPM. [, United Kingdom (of Great Britain and Northern Ireland)]	Accepted - included in KM 5
28415	73	11	79	25	Peat sesction is disproportionately long; cut back this section to a couple of pages at most. [Barron Joseph Orr, Germany]	This section has been edited to reduce text
2405	73	12			Please define "peatland ecosystems" [Nina Hunter, South Africa]	A footnote was added: "Definitions of peatland and peat soil differ between countries in relation to the thickness of the peat layer required to be determined as a peatland or a peat soil. Peatlands are defined in the IPCC Wetland Supplement as ‘land with organic soils’ "

Comment No	From Page	From Line	To Page	To Line	Comment	Response
18357	74	19	74	19	"In Colombia, peatland located at altitudes higher than 3000 m.a.s.l. (called Páramos) could increase their CO2 emissions due to soil organic matter decomposition under expected climate change escenarios, altering their capacity to sequester carbon." Curiel-Yuste J, Hereş A-M, Ojeda G, Paz P, Pizano C, Garcia-Angulo D, Lasso E, 2017. Soil heterotrophic CO2 emissions from tropical high-elevation ecosystems (Páramos) and their sensitivity to temperature and moisture fluctuations. Soil Biology and Biochemistry 110, 8–11. [Gerardo Ojeda, Colombia]	Norted - the section has been substantially revised
39559	74	22	74	22	Change to Mg. [, United States of America]	edited to Mg
26169	74	34	74	38	It would be helpful to express these numbers also in CO2e, as the changes in CH4 go a long way to offsetting the changes in CO2, depending on the forcing factor used. [Reid Detchon, United States of America]	Rejected - we think it is important to keep the GHGs separate
2407	74	15			"around 44% for both" - this is confusing; if the area for South America is larger then how can both be 44%? [Nina Hunter, South Africa]	Taken into account - the section has been substantially revised
11733	75	6	75	8	I suggest to add this explanation "Despite the existence of viable sustainable harvesting techniques, the collection of M. flexuosa fruits is extensively performed by cutting the entire palm" to explain why the harvesting of non-timber products contribute to degradadtion and loss of SC. [Serah Kahuri, Kenya]	Rejected - the section has been shortened, no place for this information
1869	75	7	75	7	Perhaps authors could provide the common name of M. flexuosa. [William Lahoz, Norway]	Accepted
21955	75	9	75	19	The effects of peatland conversion of inland fisheries should also be considered. This has been studied in Indonesia and have impacts both on livehoods and biodiversity. For more info see e.g. FAO, SEAFDEC publications. [Anna Tengberg, Sweden]	Rejected - even if interesting and relevant, the whole section had to shrink
27143	75	12	75	12	Please add clarification whether "USD 3,835 and 9,630" is per plantation or per area, or some other relation. [, Germany]	accepted (per ha)
12113	75	27	75	30	Consider placing labels for hag top, bog, etc on the photograph for clarity [Hans Poertner and WGII TSU, Germany]	Noted - but illustration has been taken out
2409	75	5			"changing rainfall regimes" - what does this do to the peatlands? Perhaps elaborate? [Nina Hunter, South Africa]	Taken into account - the section has been substantially revised
2411	75	9			"peatland conversion" - conversion to what? Please elaborate. [Nina Hunter, South Africa]	Taken into account - the section has been revised
6153	76	15	76	16	Please add drainage of forests into text also. According to Ojanen et al. 2010, 2014 and Minkkinen et al. 2018, some of the organic forests soils still accumulate C into soils although those have been drained. This was espeacilly pronounced on nutrient poor sites (based on Ojanen). Please modify text in a way that this fact is taken into account. Soils may sitll accumualte C depending on their fertility and water levels. See also Minkkinen et al. 2018 which also resports soil sinks for drained boreal peat soils (https://www.biogeosciences.net/15/3603/2018/bg-15-3603-2018.html). For Ojanen: https://doi.org/10.1016/j.foreco.2010.04.036 and https://doi.org/10.1016/j.foreco.2014.03.049 [Aleksi Lehtonen, Finland]	Drainage for forestry is now mentioned under the main drivers of the accelaration of peatland degradataion. Emissions depend on nutirent content as stated in Line 26 (p76). The case of lower GHG emissions and even C sink in nutrient poor peatland ecosystem (forestry and grassland) is indeed known and a sentence has been added to this effect (if space allows).
5829	76	24	76	26	just always increased impact! "Lowering of the water table leads to direct and indirect increased CO2 and N2O ….", indicator, reference! [Sanaz Moghim, Iran]	Added reference. CO2 and N2O emissions are always increased due to higher respiration but may still be a C sink
14693	76	31	76	33	"This leads to a colouration in drinking water and negative socio-economic impacts that include health-related issues associated with the cleaning of the water (O'Driscoll et al. 2018)." This text is vague. Suggest specifying the health-related issues or risks. [, Canada]	rephrased: DOC concentrations are high in degraded peatland catchment leading to a colouration in drinking water, the cleaning of which has negative health impact due to halogenated disinfection by-products such as trihalomethanes (THMs) which have carcinogenic effects (O'Driscoll et al. 2018)

Comment No	From Page	From Line	To Page	To Line	Comment	Response
8701	76	47	76	47	what does 'climatic envelope' mean ? It this well defined ? [Louise Andresen, Sweden]	Could be defined as 'ecological niche modelling and is widely used to study the current distribution of species and to project potential changes under future climate scenarios. Suggest footnote is text space allows
39561	77	2	77	2	Early results from the SPRUCE experiment should be included here. See publications tab under the project tab on this website: https://mnspruce.ornl.gov/ [, United States of America]	A reference to Richardson et al was added in the sentence above as an example of shift of vegetation phenology. Richardson, A.D., Hufkens, K., Milliman, T., Aubrecht, D.M., Furze, M.E., Seyednasrollah, B., Krassovski, M.B., Latimer, J.M., Nettles, W.R., Heiderman, R.R., Warren, J.M., Hanson, P.J., 2018. Ecosystem warming extends vegetation activity but heightens vulnerability to cold temperatures. Nature. 560, 368-371. 10.1038/s41586-018-0399-1.
1871	77	7	77	12	Check that there is correct use of parentheses. Same for P. 4-86, L. 5. [William Lahoz, Norway]	Parantheses have been removed for the most part and checked
1873	77	10	77	11	Turetsky et al… repeated. [William Lahoz, Norway]	removed
6389	77	29	77	30	Please could you include the ranges of bioenergy cropland expansion? It is interesting to have the rates, but not so informative to only have an upper level. It would also be helpful to have more specific information about low overshoot scenarios [, Gambia]	Comments not related to this section
25099	77	29	77	48	Xu et al. (2018) found peatlands are potentially sensitive to land-use change, and once degradation is initiated these systems can rapidly denude and degrade. The authors used land use as an indicator of degradation in water supply peatlands around the world by interrogating the Ecosystem-Land Use System. They estimate that only 651.7 km2, or 28.17%, of water-supply peatlands globally were pristine or protected as of 2010. Anthropogenic pressures on peatlands may therefore threaten their water supply function. The most common land-use activity on water-supply peatlands is arable and livestock hill farming, particularly in the United Kingdom. Overgrazing often leads to peatland erosion and degradation, while arable cropping on peatlands has resulted in peat mass loss and nutrient loading of water courses39,40. Both activities have been shown to increase fluvial aquatic carbon loss from peatlands, which will enhance water treatment costs downstream. Restoration and protection of potable water supply peatlands in order to improve water quality may therefore deliver enhanced sustainability of water supply as well as a reduced cost burden on society. Xu J., Morris P. J., Liu J., Holden J., 2018. Hotspots of peatland-derived potable water use identified by global analysis. Nature Sustainability 1, 246-253. [Junguo Liu, China]	This reference was added to 'improvement of ater storate and quality (Xu et al 2018)
21957	77	30	77	37	Another co-benefit to explore is inland fisheries (see above). Systems such as "beje" fisheries in Kalimantan leads to rewetting of peatswamps and certification of inland fisheries could be a better incentive than certification of palm oil. [Anna Tengberg, Sweden]	Rejected - the section has been shortened, no place for this information
39563	77	36	77	36	Consider mentioning that Indonesia has a Peatland Restoration Agency (https://www.climatescorecard.org/2018/02/peatland-restoration-agency-activities/) [, United States of America]	Rejected - the section has been shortened, no place for this information
6159	77	45	77	48	Most of the references are pretty old. Please add more recent reference for this piece of text: Regina, K., Sheehy, J. & Myllys, M. Mitigating greenhouse gas fluxes from cultivated organic soils with raised water table. Mitigation and Adaptation Strategies for Global Change (2015) 20: 1529. https://doi.org/10.1007/s11027-014-9559-2 [Aleksi Lehtonen, Finland]	Replaced with Regina et al 2015.

Comment No	From Page	From Line	To Page	To Line	Comment	Response
15387	77	29	78	25	Suggest including in section 4.11.4.3 a discussion of the marshes of the Euphrates-Tigris rivers in Iraq, which are a leading example of ecological restoration: Al-Ansari et al 2012. Restoring the Garden of Eden, Iraq. Journal of Earth Sciences and Geotechnical Engineering, 2(1), 53-88. Albarakat et al 2018. Using Satellite Remote Sensing to Study the Impact of Climate and Anthropogenic Changes in the Mesopotamian Marshlands, Iraq. Remote Sensing, 10(10), 1524. Richardson et al 2005. The restoration potential of the Mesopotamian marshes of Iraq. Science, 307(5713), 1307-1311. [, Australia]	This would be another specific case study of wetlands: marshes and is out of the scope of this section
21879	77	45	78	25	The conclusions on rewetting peatlands are valid in most cases and particularly in the tropics, where the high temperature maintains active organic decay, and where peatland fires on drained sites are common. However, we would encourage the authors to consider the variability between soil types and vegetation covers particularly in the Northern latitudes. The current conclusions that "this makes peatland conservation and restoration as key priority for climate policy (very high confidence)" may not hold universally when it comes to restoration. Related to this, on lines 13-14, it would be helpful to briefly characterize measures for preventing higher methane emissions in restoration efforts. A possible amendment could read on the lines of: Since rewetting will often lead to increased CH4 emissions (e.g., Hahn-Schöfl et al. 2011, Zak et al. 2015, Koskinen et al. 2016) and the sequestration of CO2 often increases with a time lag (e.g., Tuittila et al. 1999, Zerbe et al. 2013), the climate benefits of restoration may not be immediate. Also, restoration may in many cases lead to severe loading of DOC and nutrients to watercourses during several years (e.g., Zak & Gelbrecht 2007, Koskinen et al. 2017), and thus, water protection needs to be carefully considered. Economic benefits may be maintained with, e.g., production of biomass on wet peat also known as paludiculture (Barthelmes, 2016), or continuous-cover forest management (Nieminen et al. 2018), which may yield realising critical synergies (Günther et al., 2015, Nieminen et al, 2018). Hahn-Schöfl, M., Zak, D., Minke, M., Gelbrecht, J., Augustin, J., & Freibauer, A. (2011). Organic sediment formed during inundation of a degraded fen grassland emits large fluxes of CH4 and CO2. Biogeosciences, 8(6), 1539-1550. doi:10.5194/bg-8-1539-2011. Koskinen M, Maanavilja L, Nieminen M, Minkkinen K & Tuittila E-S. 2016. High methane emissions from restored Norway spruce swamps in southern Finland over one growing season. Mires and Peat 17: 02: 1-13. doi: 10.19189/MaP.2015.OMB.202 Markku Koskinen, Teemu Tahvanainen, Sakari Sarkkola, Meseret Walle Menberu, Ari Laurén, Tapani Sallantaus, Hannu Marttila, Anna-Kaisa Ronkanen, Miia Parviainen, Anne Tolvanen, Harri Koivusalo, Mika Nieminen, Restoration of nutrient-rich forestry-drained peatlands poses a risk for high exports of dissolved organic carbon, nitrogen, and phosphorus, Science of The Total Environment, Volume 586, 2017, Pages 858-869, https://doi.org/10.1016/j.scitotenv.2017.02.065. Tuittila, ES., Komulainen, VM., Vasander, H. & Laine, J. Restored cut-away peatland as a sink for atmospheric CO2. Oecologia (1999) 120: 563. https://doi.org/10.1007/s004420050891	These suggestions are correct and have been incorporated
8703	78	14	78	14	double references in the text [Louise Andresen, Sweden]	yes, removed
12115	78	15	78	17	This image does not provide much information without allowing a comparison with a photograph of the previously drained state [Hans Poertner and WGII TSU, Germany]	This photo may be removed; no room to show photo of prior state
39565	78	18	78	18	Stay consistent with what was stated earlier: 26-44 percent. [, United States of America]	Edited for consistency
21143	78	18	78	20	This sentence needs to be brought forward to both the ES and SPM. A very key point. [, United Kingdom (of Great Britain and Northern Ireland)]	Noted and raised for condsideration by the SPM writing team

Comment No	From Page	From Line	To Page	To Line	Comment	Response
39567	78	20	78	20	"meager" misspelled. [, United States of America]	This is the British spelling; check with editors overall spelling
12907	79	1	79	48	Is "hurricane" a hot spot? Or a case study? [Robert Treuhaft, United States of America]	Taken into account - we have removed "hot spots"
22609	79	2	79	4	This sentence needs restructuring - hard to understand. [Anastasios Kentarchos, Belgium]	Accepted - we have reviewed the whole section to clarify
39571	79	9	79	9	Add a period. [, United States of America]	Accepted - text has been corrected
22611	79	9	79	11	This sentence is out of place. It seems to belong to 4.11.6 [Anastasios Kentarchos, Belgium]	Rejected - The text makes reference to tropical cyclones not to only to sea level rise.
22613	79	13	79	13	It is not only rainfall amounts that cause the damage but also high windspeeds in its circular motion [Anastasios Kentarchos, Belgium]	Accepted - text has been corrected
22615	79	14	79	16	"Additionally, the sea level rise can negatively affect the capacity of the wetlands to prevent salinisation of freshwater aquifer and flooding in coastal areas, by negatively impacting the peat accretion in coastal wetlands " Please explain relevance to tropical cyclones, or move to 4,11,6. [Anastasios Kentarchos, Belgium]	Accepted - text has been moved out
22617	79	21	79	42	This whole section does not belong to this paragraph. It does not talk about hurricanes. [Anastasios Kentarchos, Belgium]	Accepted - text has been arranged in a different subsection
22619	79	30	79	31	This sentence needs revisiting. It does not read right. [Anastasios Kentarchos, Belgium]	Accepted - text has been corrected
7141	79	30	79	31	The sentence seems to be missing something and does not carry a meaningful message. [Debra Roberts, South Africa]	Accepted - text has been corrected
7143	79	33	79	36	You might want to check chapter 5 of SROCC for the assessment of coastal blue carbon. [Debra Roberts, South Africa]	Accepted
23909	79	41	79	42	It is unlcear as to on what basis conclusion " More than half of the population is impoverished on the Indian side and depend heavily on the goods and services that the forests provide" has been drawn? It should be dropped. [, India]	Accepted - text has been corrected
39569	79	1	80	22	Wetlands, mangroves, etc., need to be discussed throughout chapter, not just case studies. Also, this section would benefit from some English editing. [, United States of America]	Taken into account - text of Ch 4 has been reviewed to include information of coastal areas
28417	79	1	81	5	Although the title is hurricanes, parts of this section focus on wetlands, and the relevance to hurricanes is not clear. [Barron Joseph Orr, Germany]	Accepted - we have rewritten the title and indicate subsections in order to clarify
27145	79	1			The title does not seem to match the content of this subsection - maybe add „and coastland restoration? [, Germany]	Accepted - we have rewritten the title and indicate subsections in order to clarify
22621	80	5	80	21	This whole section does not belong to this paragraph. It does not talk about hurricanes. [Anastasios Kentarchos, Belgium]	Accepted - text has been arranged in a different subsection
23743	80	7	80	11	Sentence (line 7) says mangove cover is slightly increasing. Line 9 mangrove decreased by 1.2%. This sentence referes to Sundarbans, how come Mumbai figures in. [, India]	Accepted - text has been corrected and figure deleted
39573	80	8	80	11	Sentence is difficult to understand; consider re-writing for clarity. This entire section would benefit from good editing for clariy in English. [, United States of America]	Accepted - text has been corrected
39575	80	16	80	16	Is the term "probe" correct? Do authors mean proven? [, United States of America]	Accepted - text has been corrected
7145	80	18	80	19	Figure 4.16 conveys an important message. However, it seems to suggest that monitoring and the provision of recommendations only take place at a very late stage of the process. In practice, this is very problematic since it implies that improvement can only be effected at a later stage of the project. [Debra Roberts, South Africa]	Accepted - We have now included a line from step 6 to step 9
4309	80	19	80	19	the resolution of Figure 4.16 needs to be improved. [Lee-Sim Lim, Malaysia]	Accepted - new figure is provided

Comment No	From Page	From Line	To Page	To Line	Comment	Response
12909	80	19	80	19	In Figure 4.16, step 6, there is a failed aided natural regeneration path, but no "successful" path.There should be aline from stop 6 to step 9 or to Restored Mangrove Site. How much of the rest of this figure is in error? [Robert Treuhaft, United States of America]	Accepted - We have now included a line from step 6 to step 9
8705	80	1	83	30	there are two seperate introductions and discussions of Mangrove problems, can these be joined and better coordinated ? [Louise Andresen, Sweden]	Accepted - text has been corrected
23561	80				Figure 4.16 is not very clear [Huai Jianjun, China]	Rejected - not arguments are presented by the reviewer
4311	81	1	81	1	This Figure 4.17 clearly showed the progress of restoration by labelling the date of the picture taken, and should be apply for Figure 4.12. [Lee-Sim Lim, Malaysia]	Accepted - the figure has been taken out
12911	81	2	81	5	What wavelength are we looking at? What is the take-home message? That greener is better, is wetter? The take-home should be in the caption to Figurei 4.17. [Robert Treuhaft, United States of America]	Accepted - the figure has been taken out
5831	81	7	81	8	"sea level to rise particularly in the tropical and subtropical regions"! Is it right! Indicator or reference, it should be in high latitude mainly due to ice/snow melting [Sanaz Moghim, Iran]	rejected. Reference added to support assertation
2871	81	13	81	15	Storm surges, hurricanes, sea storms are not phenomena related to tidal activity, thus the sentence should be changed in something like: ' i) increased tidal activity, storm surges, hurricanes and sea storms .....' [Luca Castrucci, United States of America]	accepted - text edited accordingly
26171	81	6	82	1	This list should also include sea level rise contaminating nearby freshwater aquifers through subsurface intrusion. See, for example, https://www.researchgate.net/publication/258462280_Impacts_of_Sea_Level_Rise_caused_by_Climate_Change_on_Saltwater_Intrusion_into_the_Gulf_Coast_Aquifer_of_South_Texas [Reid Detchon, United States of America]	accepted. Reference added
22623	82	6	82	6	The word "from" should be deleted from the sentence. [Anastasios Kentarchos, Belgium]	accepted - done
5833	82	25	82	29	"human disruption and years of dam building have affected .." agriculture is the main reason, good to mention [Sanaz Moghim, Iran]	accepted- text edited accordingly
39577	82	30	82	30	Ocean salinity is about 35 g/L, which is an order of magnitude greater than ocean water. Is that possible? [, United States of America]	Rejected. The salinity of Urmia Lake water is that high
12913	83	1	83	3	Figure 4.18 is not explained at all. What is the sensor? Lat lon of the site? Wavelength of the sensor? A figure like this which just seems to visually say "dried up" presumably due to salty intrusion (which you learn only if you read the text) hurts the credibility of the presentation. Just a visual, of an unknown (lat lon) location, at an unknown wavelength is confusing and misleading. [Robert Treuhaft, United States of America]	accepted. Fig 4.18 has been removed.
39579	83	2	83	2	Put the country name in the figure legend. [, United States of America]	rejected- figure removed in response to other comments
5835	83	5	83	7	"About three fifths of this change was caused by climate change and two fifths by water resource development" it cannot be right, mostly is due to agriculture [Sanaz Moghim, Iran]	accepted- text edited so agriculture is specified alongside water resource development
39581	83	17	83	17	Mangroves are extremely important, but they are discussed in many of the case studies with repetitive information. Suggest a single case study on mangroves or include in a blue carbon case study. 4.11.8 could be included as well. [, United States of America]	Noted - no place for another case study, even if relevant
24211	84	32	84	35	The evidence on this matter is still too low. No citations are included to support this statement. Results from meta-analyses must be taken with caution, since when the number of case studies is low, there could be confounding factors. As an example: it could be concluded that biochar has a positive priming effect in sandy soils and this is related to the fact that low temperature biochars were used in those studies. [Maria Luz Cayuela, Spain]	Taken into consideration. The specific text referred to has been deleted to reduce repetition.

Comment No	From Page	From Line	To Page	To Line	Comment	Response
5837	84	40	84	40	0% is right! "and average of 0%" [Sanaz Moghim, Iran]	Comment not clear.
39583	84	14	85	22	This section would benefit from heavy editing. There is much repetition in the two biochar sections. [, United States of America]	Taken into consideration. Some repetitive text has been deleted.
14277	84	43	85	3	There is also a weight of evidence that biochars can address constraints to biological N2 fixation, therefore lowering the requirement for synthetic N fertilisers. N fixation in a sub-tropical legume grown on acidic Ferralsol was more than doubled through the use of biochars with an acid neutralising effect. Well cited literature on this topic includes: Van Zwieten L, Rose T, Herridge D, Kimber S, Rust J, Cowie A, Morris S (2015) Enhanced biological N2 fixation and yield of faba bean (Vicia faba L.) in an acid soil following biochar addition: dissection of causal mechanisms. Plant and Soil 395, 7-20. [Lukas Van Zwieten, Australia]	Accepted. Point added.
2415	84	46	85	3	"avoided GHG … compost" - how do these sentences fit in with the previous information in the paragraph? Suggest rephrase for clarity. [Nina Hunter, South Africa]	Accepted. Reworded
14275	84	9	86	42	Chapter 4.11.7 (biochar) provides a well-considered, balanced overview of the opportunities and challenges of utilizing biochar technologies both for mitigation of land degradation and for climate change. Evidence with very high confidence has been provided for mitigation of land degradation, in particular with reference to how (mechanisms) biochar may contribute to this mitigation, and the soils and agro-climatic regions biochar is likely to be most effective. The authors did not mention that over 1000 papers dealing with the interaction between biochar and soils (bio-geochemical processes, agronomy, C, nutrients) were published in 2018, adding significant weight to the balanced argument provided in 4.11.7, and demonstrating the maturity of the science on biochar. While there are very real opportunities for mitigation of climate change using biochar, the range of uncertainly seems to be greater, and this has also been well captured and clearly explained in this Chapter. [Lukas Van Zwieten, Australia]	Noted.
32469	84	9	86	42	The findings about biochar in 4.10 do not seem to represent a balanced reflection of the literature on biochar. Especially more critical research is lacking, including Wang et al., 2016, Schmidt et al, 2011, Kamman et al., 2017 and Ameloot et al., 2014. [Simone Lovera-Bilderbeek, Paraguay]	Taken into consideration. The text refers to negative and nil results observed in some circumstances. The knowledge gaps referred to by Schmidt et al have been overcome, with respect to capacity to estimate carbon stability - indeed, there is now a method provided in the IPCC 2019 Refinement, developed by these same authors. Reference to Kamman et al and He et al. has been added.
28739	84	36		46	The repeated use of phrasing" biochar can…" should be avoided when "can" implies potential, whereas the effects of biochar on soils and climate are far too unpredictable and poorly understood. In other words "can not" is as likely as "can", hence misleading. For example - a review of biochar as a tool to reduce agricultural greenhouse gas emissions repeatedly highlights the contradictory results, the lack of understanding of mechanisms, hence inability to control effects of biochar on emissions of N2O, CH4 and its impacts as a fertilizer addition, livestock feed additive etc. The authors state"In spite of the extensive literature published during the past several years on the topic, knowing if a biochar will be effective in mitigating N2O emissions in a certain agricultural field is still highly unpredictable". REFERENCE FOLLOWING [Rachel Smolker, United States of America]	"Biochar can" is intentionally used to convey potential under specific circumstances,clarified where known. It is used precisely to avoid giving the impression that these effects are universal, that is, to convey that results vary between studies, and between different biochar type/application context.

Comment No	From Page	From Line	To Page	To Line	Comment	Response
28741	84	36		46	Kamman, C, Ippolito, J., Hagemann, N, Borchard, N.,Cayuela, M.L., Estavillo, J.M., Fuertes-Mendizabal, T., Jeffery, S., Kern, J., Novak, J., Rasse, D., Saarnio, S., Schmidt, H-P., Spokas, K., Wrage-Monnig, N. 2017. Biochar As A Tool To Reduce the Agricultural Greenhouse Gas Burden-Knowns, Unknowns, and Future Research Needs. J. Enviro Eng and Landscape Management [Rachel Smolker, United States of America]	This is not a separate comment - it is a reference cited in comment #28739
28743	84	36		46	Biochar impacts on methane emissions are similarly unknown. Authors of above reference state: "The interactions between biochar application to soil and CH4 fluxes are not well undertood, with disparate literature results". [Rachel Smolker, United States of America]	Accepted. Text on methane effects has been edited to refer to the range of results.
28731	84				:4.11.7: "Biochar could make a significant contribution….SHOULD READ: Biochar is unproven and results too variable at this point to predict whether it will make any contribution, or rather exacerbate land degradation due to both large demand for biomass feedstocks and impacts on soils that to date are poorly understood and highy erratic. [Rachel Smolker, United States of America]	Rejected. There is strong evidence that converting biomas to biochar and applying it to soil stabilises biomass carbon, delaying its release to atmosphere for decades to centuries. There is growing understanding of the benefits of biochar, when biochar is matched to the soil constraints in a specific context, and how to avoid adverse outcomes.Ensuring that feedstock supply is sustainable, inlcuding management of LUC, is a critical issue for governance.
28733	84				4.11.7.1: "Biochar is relatively resistant…." SHOULD READ: Biochar is resistant to decomposition under some circumstances, but the mechanisms are poorly understood and cannot be generalized at this stage. In a meta-analysis of biochar stability and priming effects, Wang et al [REFERENCE BELOW]report that "biochar degradation depends on the soil characteristics, but the details of these interactions still require specific mechanistic investigation". Similarly, Schmidt et al [REFERENCE BELOW] pointed out that SOM decomposition presents a "conundrum" with the best interpretation being that "persistence of soil organic carbon is primarily not a molecular property but an ecosystem property". Thus the properties of biochar are likely less relevant than the properties of the soil environment, which is highly variable even from one microsite to the next, and over time. Wang et al also report that "biochar application has a postive C balance at least within ten years". (i.e. we cannot infer over longer time frame). They also note that repeated introduction of glucose or plant residues strongly stimulates biochar degradation...our current understanding of the effects of living plants and rhizodeposition on biochar decomposition is limited. ....future studies on the mechanisms of biochar priming on soil-plant systems are required." This is indicative of the fact that few field studies under real world conditions, (i.e soil-plant systems in the field under naturally varying circumstances) have been undertaken. Other studies have shown that biochar degradation is strongly effected by moisture regimes, conditions that would occur "out in the real world". Extrapolation about biochar, from controlled laboratory incubation to the real world, is fraught with pitfalls and should be clearly avoided. Furthermore, few studies of more than a year in duration, under field conditions, using biochar produced by pyrolysis, (not wildfire charcoal or other black carbon) have been undertaken. Hence long term resistance cannot be assumed. In some cases biochar has "dissappeared" over a short time frame, and its' fate remains unclear - particles may break down and become air or waterborne, or migrate to deeper soil strata. Biochar "can" and it "can not". [Rachel Smolker, United States of America]	Rejected. No change required - the range in stability is described. There is strong evidence of biochar stability in soil, and growing understanding of the factors that control it. While research shows that soil properties and climatic conditions impact stability, these factors are less important than feedstock and pyrolysis conditions. Wang et al concluded that "only a small part of biochar is bioavailable and that the remaining 97% contribute directly to long-term C sequestration in soil". Despite identifying knowledge gaps, Schmidt et al conclude that "pyrolysis could be optimized to generate a more stable biochar", and "Biochar is likely to be a useful part of sequestration-mitigation strategies".

Comment No	From Page	From Line	To Page	To Line	Comment	Response
14279	85	23	85	40	Acidification is a key driver of land degradation. There is a weight of evidence that some biochars, particularly those produced at higher temperatures, can address soil acidity and reverse this form of land degradation. While access to lime or other pH neutralising agents may be limited by cost and availability, the production of biochar to address acidification may be viable alternative. Well cited literature on this topic includes: Van Zwieten L., Kimber S., Morris, S., Chan, YK., Downie, A., Rust, J., Joseph, S., and Cowie, A. (2010) Effects of biochar from slow pyrolysis of papermill waste on agronomic performance and soil fertility Plant and Soil 327: 235-246 Chan, YK, Van Zwieten, L., Meszaros, I., Downie, A., Joseph, S. (2008) Using poultry litter biochars as soil amendments. Soil Research, 46, 437–444. [Lukas Van Zwieten, Australia]	Accepted. Amelioration of acidification added as a land degradation benefit.
21145	85	24	86	42	This section is very unbalanced and spends more time focused on the benefits of biochar and very limited time on the negative effects and outstanding questions. A more balanced narrative is required. I suggest considering the following papers: https://doi.org/10.1111/gcbb.12037 https://doi.org/10.1016/j.envint.2015.10.018 https://doi.org/10.1111/gcbb.12007 [, United Kingdom (of Great Britain and Northern Ireland)]	Taken into consideration. A sentence on the range of imacts of biochar on methane has been added - positive and negative. Negative results for other variables are already mentioned. Of the three papers suggested: **Biederman** et al. found that "despite variability introduced by soil and climate, the addition of biochar to soils resulted, on average, in increased aboveground productivity, crop yield, soil microbial biomass, rhizobia nodulation... compared with control conditions. Soil pH also tended to increase, becoming less acidic, following the addition of biochar." and concluded that "biochar holds promise in being a win-win-win solution to energy, carbon storage, and ecosystem function". Most of these impacts of biochar are already covered. **Quilliiam** et al. raise PAH risk; A sentence has been added and this reference cited. **Kuppusamy** et al review a range of postive and negative impacts of biocar on a wide range of soil and plant attributes. This reference has now been included.
28765	85	1		22	Ameloot, N., Sleutel, S., Case, S.D.C., Alberti, G., McNamara, N.P., Zavallobi, C., Vervisch, B., delle Vedove, G., De Neve, S. 2014 C mineralization and microbial activity in four biochar field experiments several years after incorporation. Soil Bio and Biochem. 78: 195-203 [Rachel Smolker, United States of America]	This is not a separate comment - it is a reference cited in comment #28763
28745	85	9		22	Biochar as "potential negative emissions": To my knowledge, the term biochar refers specifically to the black carbon product produced using modern pyrolysis. (There are however some studies that refer to charcoal remains from wildfires etc as biochar, which adds to confusion). Charcoal manufacture is ancient practice, and is extremely polluting. Modern pyrolysis facilities - on commercial scale, with controls, on the other hand, do not appear to work well, facing ongoing technical challenges. THere are just two commercial scale pyrolysis facilities in existence - Ensyn and Fortum. Niether produces biochar and both have been plagued with technical challenges. We are not aware of ANY biochar production facilities that also produce power (with syngas or bio-oil). Hence "negative emissions" is a major overstatement [Rachel Smolker, United States of America]	Noted/Rejected: Yes,it is critical that biochar is produced in facilties that control emissions. This point has been expanded. There are facilities operating for example in USA, Australia and China that produce biochar and utilise the syngas for heat and/or electricity production. For example, the International Biochar Initiative estimates that about 45,000 dry tons of biochar are produced in US each year from processing 200,000 dry tons of wood residues for heat or power. Over 100 plants are operating in China, including at least 20 large scale pyrolysis plants that utilise crop straw each processing 3 ton straw pellets per hour, producing 2200-2500 cubic meters syngas per hour that generates steam for blending biochar compound fertilizer (Genxing Pan, pers. comm.)

Comment No	From Page	From Line	To Page	To Line	Comment	Response
28747	85	9		22	Pyrolysis is fraught with technical difficulties and commercial scale use that can both produce char and also produce power appears largely nonexistent. A thorough evaluation of real-world, not theoretical production methods is needed. (Slow pyrolysis appears to be preferred for agronomic use but is not effective in producing power simultaneously). [Rachel Smolker, United States of America]	Rejected: See response to comment 28745. LCA studies based on measurements of existing plants show benefit of biochar compared with alternative options: Ji, C., Cheng, K., Nayak, D. and Pan, G., 2018. Environmental and economic assessment of crop residue competitive utilization for biochar, briquette fuel and combined heat and power generation. Journal of Cleaner Production, 192, pp.916-923; Xu, X., Cheng, K., Wu, H., Sun, J., Yue, Q. and Pan, G., 2019. Greenhouse gas mitigation potential in crop production with biochar soil amendment—a carbon footprint assessment for cross-site field experiments from China. GCB Bioenergy, 11(4), pp.592-605.
28755	85	17		22	Reference to global potential for biochar: Woolf et al 2010 claims to control against food insecurity, loss of habitat and land degradation. This oft cited very large technical potential is however based on the assumption (hidden within supplementary materials to the article) of conversion of an area approximately 556 million hectares of “abandoned cropland” that could be converted to crops and trees to produce biochar. In addition to tropical grasslands that could be turned into short-rotation tree plantations to produce both biochar and animal fodder. This massive scale of land conversion would have very significant consequences for biodiversity and human rights. This reviewer confirmed the above figures with the authors at the time the article was published, when a press release condemning potential land grabs for biochar was put forward by 23 organizations. https://www.biofuelwatch.org.uk/2010/biochar-joint-pr/ [Rachel Smolker, United States of America]	Noted. The potential adverse impact of large scale land use change to produce biomass for biochar or bioenergy is discussed in chapter 6. The area of land assumed available for production of biomass in Woolf et al is consistent with other estimates of available land eg Woods et al, 2015. We acknowledge that the amount of "spare" land is contested, but assert that a broad portfolio of measures will be required to address climate change, and carefully placed land use change to produce biomass for bioenergy and biochar is likely to be an important part of the solution.
28757	85	17		22	Furthermore this unfounded global potential estimate (Woolf et al as per above comment) fails to account for findings that biochar effects vary across different soil types and landscapes - i.e. not all "available land" is suitable for biochar applications. [Rachel Smolker, United States of America]	Noted. There is more land that would benefit from biochar application than there is biochar available in the scenarios that Woolf proposed. Lack of suitable land is not a constraint to mitigaiton through biochar.

Comment No	From Page	From Line	To Page	To Line	Comment	Response
28759	85	17		22	Once again the very mixed and contradictory results for biochar must be highlighted. Putting biochar forward as a viable potential solution to the climate crisis because in some circumstances postive results have been found is reckless given there iare also many cases of negative results, and there is a lack of knowledge about the underlying causes of positve or negative impacts of biochar. This is once again highlighted in a meta-analysis by He et al [REFERENCE BELOW] who provide a useful overview of the many diverse proposed mechanisms underlying biochar impacts on soils, and states: "“The contradictory reports of changes in size and even direction of soil GHG emissions when biochar is applied and the diversity of mechanisms proposed suggest that biochar effects may depend on many factors including soil properties, experimental methods, artificial cultivation management, biochar application rate and biochar physicochemical properties (Hilscher & Knicker 2011; Lorenz& Lal 2014). These factors may determine to what extent biochar alters soil C and N transformation processes and consequently soil GHG emissions. However, how these factors contribute to the variable response of soil GHG emissions to biochar application across the globe still remains unclear. If these factors are not adequately addressed the effects of biochar application on mitigating global warming cannot be fully understood." [If they are not understood they cannot be predicted and controlled]. Based on their meta analysis of 91 published studies the authors concluded that biochar additions to soils “significantly increased GWP by 46.22%. (They nonetheless propose that biochar could benefit climate in nitrogen fertilized agricultural soils.). The authors further point out that results from lab incubation studies differ from field studies, and point to a “lack of field-scale studies especially those lasting at least two successive seasons.” [Rachel Smolker, United States of America]	Rejected. There is strong evidence that biochar reduces nitrous oxide in certain soil types and farming systems (e.g. Borchard et al., 2018). Indeed, based on their meta-analysis, He et al concluded: "Given that our study elicits that biochar application reduces CO2 fluxes and GWP in N-fertilized soil, biochar therefore appears to be a good strategy to mitigate global warming in fertilized agro-ecosystems."
28763	85	17		22	A key problem with many studies of biochar is that they are done over short time frame (from a few weeks to <5 years) and under artificial conditions - i.e. laboratory inubation. Ameloot et al 2014 [Reference below} reported results from longer term field studies, concluding: "Analysis of multi-year biochar field experiments in this study enabled the understanding of microbial communities after several years of biochar incorporation in the field. Biochar amendment led to a lowered or equal soil microbial activity and abundance and it seems unlikely that biochar would still function as a substrate after 1-4 years of incorporation in the field, in contrast to many short term laboraatory studies." [Rachel Smolker, United States of America]	Noted. It is true that labile carbon present at the time of application will be utilised over the short term as substrate for microbes., leading to short-term positive priming. Lower temperature chars with shorter mean residence times will break down, providing continued supply of substrate. The point being made by the reviewer is unclear.
26173	86	31	86	31	Change "Key message:" to "In summary," [Reid Detchon, United States of America]	Accepted. reworded
39585	86	31	86	42	Wouldn't there be an impact on the application of biochar amendments to the soil (erosion, disturbing soil processes such as flow paths, BGC, etc.)? Are the long-term impacts of excess biochar amendments fully understood? [, United States of America]	Noted, however the reviewer's point is not clear. Perhaps the concern is that cultivation to incoporate biochar may lead to erosion risk. Methods of application are being developed - such as mixed with fertilizer in granules - so that it can be drilled into the soil with minimum disturbance. Where biochar is selected to match soil constraints there is no indication of adverse effects of high rates of biochar.

Comment No	From Page	From Line	To Page	To Line	Comment	Response
18359	86	41	86	42	"The impact of contaminants produced during biomass pyrolysis process, required to obtain biochar such as polycyclic aromatic hydrocarbons (PAHs) and the impact of biochar once it has eroded from soil or moved through a soil profile into watercourses, must be assessed" Ojeda G, Patrício J, Mattana S, Sobral A. 2016. Effects of biochar addition to estuarine sediments. Journal of Soil and Sediments 16, 2482–2491 [Gerardo Ojeda, Colombia]	Accepted. Sentence on PAH risk has been added ad this paper cited.
28735	86	31		42	Wang, J., Xiong, Z., Kuzyakov, Y. 2016. Biochar stability in soil: meta-analysis of decomposition and priming effects. GCB Bioenergy. 8(512-523 [Rachel Smolker, United States of America]	relates to comment 28733
28737	86	31		42	Schmidt, M., W.I., Torn, M.S., Abiven, S., Dittmar, T., Guggenberger, G., Janssens, I.A., Kleber, M., Kogel-knabner, I., Lehmann, J., Manning, D.A.C., Nannipieri, P., Rasse, D.P., Weiner, S. and Trumbore, S.E., 2011. Persistence of soil organic matter as an ecosystem property. Nature, vol 478. [Rachel Smolker, United States of America]	relates to comment 28733
28749	86	31		42	Key messages re biochar: this should be phrased differenty - less "can" do this or that - and present more balance given the fact that there are widely conflicting results on almost every aspect of biochar proclaimed benefits and repeated admonitions in the literature regarding the need for more research and lack of understanding of mechanisms that result in conflicting outcomes. The knowledge base is limited and we are far from understanding biochar impacts on soils well enough to control outcomes. Furthermore, most studies to date have been done using incubation in laboratory conditions over relatively short time periods. We are far from being able to predict and control biochar impacts - in other words it is not a viable tool for addressing climate change at this time. Given the large demand for biomass (especially wood given biochars from wood are considered more stable than those from grasses, manures etc)., introducing policies to support scaling up of biochar are highly premature and could lead to seriously undermining real solutions including slowing and halting deforestation for example. [Rachel Smolker, United States of America]	Rejected. The number of published studies on biochar has grown exponentially in the last decade; there is a large volume of literature, including many meta-analyses, and some multi-year field trials. While there are gaps in process-level understanding of some aspects, there is sufficient knowledge on which to base decisions on biochar use. The summary raises the positive and negative findings. We agree that feedstocks should be sustainably sourced and deforestation must be managed.
2417	86	31			Suggest starting the sentence by integrating the words "key message" in with the other words - should be written as the rest of the chapter text is. [Nina Hunter, South Africa]	Accepted, reworded.
33381	87	7	87	24	This very brief and not an adequate guide for future activities. At least the aprropriate sections in the Report should be cited in support of the gap/uncertainty [Stephen Prince, United States of America]	unclear
15389	88	7	88	24	Suggest stating explicitly in section 4.12 that a key priority is to establish baseline measurements and on-going monitoring. [, Australia]	Taken into account - monitoring Land degradation is a key uncertainty
39587	88	7	88	24	These statements of research needs are good, but this section could be expanded with a better flushing out of particular research needs so that researchers and policymakers could specifically embark on the needed research. [, United States of America]	Accepted - the section has been revised

Comment No	From Page	From Line	To Page	To Line	Comment	Response
25101	88	7	88	24	More in-depth analysis is needed in this final section. The way how sustainable knowledge is generated is recommended to add. One shift is from a disciplinary, linear “tree” model toward an interdisciplinary “web” model that was promoted by Liu et al., (2019). A good example is the restoration of the Heihe River Basin in arid and semi-arid northwest of China. Human activities led to lake and oasis degradation downstream, but traditional “tree” model cannot generate effective knowledge to understand the degradation driving forces. Since the 1990s, scientists from different background gathered to generate knowledge on land degradation with a “web” model. It was found that overuse of water in middle stream for agriculture was a key reason for the downstream degradation. Such knowledge was communicated with decision makers in central and local government, and has resulted in a water re-allocation regime. It turned out that such a ”web” model is very valuable to generate knowledge of understanding land degradation and to find solutions for sustainability (Liu et al., 2019). Liu J., Bawa K. S., Seager T., Mao G., Ding D., Lee J. S. H., Swim J. K., 2019. On knowledge generation and use for sustainability. Nature Sustainability. Another way is advance the science, practice, and policy on ecological restoration is to develop and promote bilateral and multilateral cooperation among and within countries (Liu et al., 2017). Such a south–south cooperation has been demonstrated by the China-Brazil exchange for large-scale ecological restoration. Brazilian scientists learn how to initiate and implement large-sale restoration project from China’s experience, while Chinese scholars learn how to conserve biodiversity in restoration projects from Brazil (Liu et al., 2017) Liu J., Calmon M., Clewell A., Liu J., Denjean B., Engel V.L., Aronson J., 2017. South-south cooperation for large-scale ecological restoration. Restoration Ecology 25 (1): 27-32. [Junguo Liu, China]	Noted
5839	88	8	88	10	better not to say "well known in theory" since there are still many unknowns and uncertainties [Sanaz Moghim, Iran]	Noted
24713	88	8	88	24	More integrative knowledge on how climate change mitigation and adaptation are affecting ecosystem functions and services (and ultimately biodiversity) is very much needed and should be view within similar frameworks (e.g. DPSIR, IPBES framework) for a more holitic perspective. Also the effects of land use (e.g. forestry, agriculture etc.) on GHG, albedo, biodiversity and ecosystem services needs to understood in common framework, and dealt with in a ingrative way to reduce climate change. [gunnar austrheim, Norway]	Taken into account in the revised text

Comment No	From Page	From Line	To Page	To Line	Comment	Response
33547	88	8	88	24	I think that it would important to mention here the land degradation and climate effects on soil biodiversity and the important ecological functions and biogeochemical processes the soil communities regulate, the effects of which extend from terrestrial to aquatic ecosystems and, perhaps most importantly, to climate. The responses of fungal, bacterial and faunal communities in soils to climate change in terms of community composition and the abundances of key species are poorly known. The changes in the functions of the soil communities may have great consequences on nutrient cycle, carbon balance and erosion in soils, as well as the uptake of nutrients and water by plants through mycorrhizal symbioses. We lose saptrotrophic and mycorrhizal species from degraded lands, but we do not yet fully understand how this will affect the critical functions these species have. [Jenni Nordén, Norway]	Accepted - text is inserted
2419	88	8	88	24	The way this section is laid out, with line spacing between sentences, is different to the rest of the chapter text. Perhaps insert bullet points or change the text into a paragraph for consistency. [Nina Hunter, South Africa]	Noted
40255	88	11	88	11	change needs to need [Thelma Krug, Brazil]	Accepted
39589	88	24	88	24	Consider including another gap: climate-driven migration of human populations and their impacts on the forest landscape, through effects on fire regimes, urbanization, and recreation pressure. [, United States of America]	Rejected - this is more relevant for the links with climate change more generally, and not through land degradation
18361	88	26	88	26	"What about the role of microplastics in soils on future land degradation?" He D, Luo Y, Lu S, Liu M, Song Y, Lei L (2018) Microplastics in soils: Analytical methods, pollution characteristics and ecological risks. Trends in Analytical Chemistry 109, 163-172 [Gerardo Ojeda, Colombia]	Beyond the scope of the chapter
12119	88	27	88	27	FAQ 4.1: The question could be rephrased to include sustainable development and/or mitigation. These aspects are addressed in the answer and might attract more attention. [Hans Poertner and WGII TSU, Germany]	Rejected - the question formulation has been agreed through a process involving several authors
12117	88	27	88	38	FAQ 4.1: Suggest to integrate basic information about land degradation from FAQ 1.3 here. [Hans Poertner and WGII TSU, Germany]	Rejected - it would make the FAQ too long

Comment No	From Page	From Line	To Page	To Line	Comment	Response
15285	88	27	88	38	TITLE: Agro-forestry for Climate Change Adaptation: An option for salinity affected coastal farms of Bangladesh Agriculture with trees, referred to here as agroforestry, is a land-use option and policy strategy to address the issues of global food production per unit area; reduce the vulnerability of agricultural systems to climate change; and reduce greenhouse gas emissions from agriculture. Agroforestry, the inclusion of woody perennials within farming systems, is both a traditional land-use approach developed by subsistence farmers throughout the tropics, and a livelihood option promoted by land-use managers and international development agency such as World Agroforestry Centre/IKRAF based in Nairobi. Trees on farms help adapt to climate change by reducing vulnerability to climate impacts and enhance the resilience of farming systems. Reducing vulnerability also means the ability to generate more income and hence raise the adaptive capacity of smallholders. A preliminary analysis of the spatial distribution of existing agroforestry systems shows a wide potential for increasing tree cover on agricultural lands and rangelands. Diversification of food and livestock production is a key strategy to increase food security and socio-ecological resilience for climate vulnerable farmers and herders. Agroforestry systems, and the planting of trees, are long term land-use decisions, and their success is dependent upon a array of choices from species selection to management approaches, specific technological knowledge, agronomic practices, and a locally specific enough knowledge base to be ecologically and socio-economically relevant to the specific local conditions of farmers, communities, and other actors. The overall aims of this project are to develop and investigate a generic community-based and transferrable methodology for the generation of hybrid knowledge and adaptation options, which is applicable to coastal farmers and communities affected by salinity due to storm inundation and sea level rise in the era of global warming. And, these can be used by communities to select, evaluate, adapt, and modify agroforestry approaches and technologies to local and community conditions in coastal farms of Bangladesh. [Md Hossain, Australia]	Noted
5841	88	28	88	30	better to add extreme hydrological events due to climate change (e.g. flood and drought) [Sanaz Moghim, Iran]	Rejected - we focus on land degradation
21147	88	34	88	34	Should 'no till' be listed here as a way of increasing soil carbon given that at p45 lines 5-8 the benefit is described as uncertain. [, United Kingdom (of Great Britain and Northern Ireland)]	Noted - no-till cultivation has many advantages (reduced soil erosion for exmaple) even if the efficacy of soil carbon sequestration is disputed

Comment No	From Page	From Line	To Page	To Line	Comment	Response
7457	88	7	89	11	The Section is very synthetic. I think it would be necessary to expand it. My work experience in mountain areas of Central America makes me see that there are at least two more knowledge gaps, one of content and the other methodological. The content gap that could be included is as follows: "There is a shortage of studies evaluating soil degradation in areas especially vulnerable to degradation and climate change and, at the same time, establish action measures to mitigate degradation processes. These studies should include: (1) analysis of the state of degradation, (2) determine the factors that are causing the degradation detected, to (3) establish the degradation control measures, adapted to each case. This adaptation must include a socio-economic study to assess the possibility of implementation and the durability of the measures adopted". The methodological gap that could be included is as follows: "From the methodological point of view, it is important to develop experimental methods that are easy to apply and that allow the situation in the study areas to be assessed and to be able to establish the degradation control measures adapted to each situation (Blanco, 2018)". [Rafael Blanco-Sepulveda, Spain]	Taken into account - the section has been revised and some of these points are considered
27147	88	26	89	10	Please see our comment on FAQ3.1 and FAQ3.2 where we suggest a stand-alone FAQ on SLM. Ecosystem Services addressed in FAQ4.2 is further discussed in chapters 6 and 7, please use information from to these chapters as well. Please do not refer to the glossary in an FAQ as these should be understandable on their own. [, Germany]	Noted
39591	88	26	89	10	The FAQ section should be expanded greatly. There are only two questions listed and answered. [, United States of America]	Rejected - this is the agreed format of a FAQ
12121	88	40	89	10	FAQ 4.2: This FAQ might be too general to attract readers' attention. It also expects prior knowledge about ecosystem services or the willingness to look up this term which in the Glossary might not be ideal for the audience addressed with the FAQs (especially if FAQs are used separately from the report). FAQ 5.1. is a far better example how effects on key ecosystem services could be addressed in FAQs and in my opinion more interesting to readers of FAQs. [Hans Poertner and WGII TSU, Germany]	Noted - the FAQs have been determined in a process with representatives from several chapters
27149	88	34			In the list "(e.g., agroforestry, shifting to no-till agriculture, or perennial crops)", please add: grassland and peatland restoration. [, Germany]	Taken into account, - the text has been revised
1875	89	6	89	6	asymmetry. [William Lahoz, Norway]	noted
32473	89	12	157	36	Law, B. E. et al. (2018) Land use strategies to mitigate climate change in carbon dense temperate forests. Proceedings of the National Academy of Sciences. [Online] 115 (14), 3663–3668. [Simone Lovera-Bilderbeek, Paraguay]	NOTED - Climate change effects on all degradation processes are summarized in the table, we include now the reference by Hellman et al. 2009
32475	89	12	157	36	DellaSala, D. L. (n.d.) '"Real" vs. "Fake" Forests: Why Tree Plantations are Not Forests', in Encyclopedia of the World's Biomes. UK: Elservier. p. [Simone Lovera-Bilderbeek, Paraguay]	Unclear what section this refers to
32477	89	12	157	36	139–147. [Simone Lovera-Bilderbeek, Paraguay]	Unclear what section this refers to
32479	89	12	157	36	Mackey, B. et al. (2013) Untangling the confusion around land carbon science and climate change mitigation policy. Nature Climate Change. [Online] 3 (6), 552–557. [Simone Lovera-Bilderbeek, Paraguay]	Unclear what section this refers to
32481	89	12	157	36	Keith, H. et al. (2009) Re-evaluation of forest biomass carbon stocks and lessons from the world's most carbon-dense forests. Proceedings of the National Academy of Sciences. [Online] 106 (28), 11635–11640. [Simone Lovera-Bilderbeek, Paraguay]	Unclear what section this refers to
32483	89	12	157	36	Keith, H. et al. (2015) Under What Circumstances Do Wood Products from Native Forests Benefit Climate Change Mitigation? Paul Adam (ed.). PLOS ONE. [Online] 10 (10), e0139640. [Simone Lovera-Bilderbeek, Paraguay]	Unclear what section this refers to

Comment No	From Page	From Line	To Page	To Line	Comment	Response
32485	89	12	157	36	Wang, J., Xiong, Z. and Kuzyakov, Y., 2016. Biochat stability in soil: meta-analysis of decomposition and priming effects. GCB Bioenergy. 8 (512 - 523) [Simone Lovera-Bilderbeek, Paraguay]	relates to comment 32469
32487	89	12	157	36	Pingoud, K. et al. (2018) Trade-offs between forest carbon stocks and harvests in a steady state – A multi-criteria analysis. Journal of Environmental Management. [Online] 21096–103. [Simone Lovera-Bilderbeek, Paraguay]	Unclear what section this refers to
32489	89	12	157	36	Schmidt, M., Torn, M., Abiven, S., Dittmar, T., Guggenberger, G., Janssens, I., Kleber, M., Kogel-knabner, I., Lehmann, J., Manning, D., Nannipieri, P., Rasse, D., Weiner, S. and Trumbore, S., 2011. Persistence of soil organic matter as an ecosystem property. Nature, vol. 478. [Simone Lovera-Bilderbeek, Paraguay]	relates to comment 32469
32491	89	12	157	36	Curtis, P. G. et al. (2018) Classifying drivers of global forest loss. Science. 3611108–1111. [Simone Lovera-Bilderbeek, Paraguay]	Unclear what section this refers to
32493	89	12	157	36	Kamman, C., Ippoloto, J., Hagemann, N., Borchard, N., Cayuela, M., Estavillo, J., Fuertes-Mendizabal, T., Jeffery, S., Kern, J., Novak, J., Rasse, D., Saarnio, S., Schmidt, H-P., Spokas, K., Wrage-Moning, N., 2017. Biochar as a Tool to Reduce the Agricultural Greenhouse Gas Burden - Knowns, Unknowns and Future Research Needs. J. Environmental Engineering and Landscape Management 25:2, 114 - 139. [Simone Lovera-Bilderbeek, Paraguay]	Unclear what section this refers to
32495	89	17	157	36	Ameloot, N., Sleutel, S., Case, S., Albertu, G., McNamara, N., Zavallobi, C., Vervisch, B., delle Vedove, G., De Neve, S., 2014. Mineralization and Microbial Activity in four Biochar Field Experiments several years after Incorporation. Soil Bio and Biochem. 78: 195 - 203. [Simone Lovera-Bilderbeek, Paraguay]	Unclear what section this refers to
32507	89	17	157	36	Körner, C., 2017. A matter of tree longevity. Science 355, 130–131. https://doi.org/10.1126/science.aal2449 [Simone Lovera-Bilderbeek, Paraguay]	Unclear what section this refers to
32509	89	17	157	36	Pingoud, K., Ekholm, T., Sievänen, R., Huuskonen, S., Hynynen, J., 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 [Simone Lovera-Bilderbeek, Paraguay]	Unclear what section this refers to
32511	89	17	157	36	Böttcher, H., Hennenberg, K., Winger, C., 2018. Forest Vision Germany. Oko Institut, Berlin. Houghton, R.A., Nassikas, A.A., 2018. Negative emissions from stopping deforestation and forest degradation, globally. Global Change Biology 24, 350–359. https://doi.org/10.1111/gcb.13876 [Simone Lovera-Bilderbeek, Paraguay]	Unclear what section this refers to
32513	89	17	157	36	Luyssaert, S., Schulze, E.-D., Börner, A., Knohl, A., Hessenmöller, D., Law, B.E., Ciais, P., Grace, J., 2008. Old-growth forests as global carbon sinks. Nature 455, 213–215. https://doi.org/10.1038/nature07276 [Simone Lovera-Bilderbeek, Paraguay]	Unclear what section this refers to
32515	89	17	157	36	Martin, P.A., Newton, A.C., Pfeifer, M., Khoo, M., Bullock, J.M., 2015. Impacts of tropical selective logging on carbon storage and tree species richness: A meta-analysis. Forest Ecology and Management 356, 224–233. https://doi.org/10.1016/j.foreco.2015.07.010 [Simone Lovera-Bilderbeek, Paraguay]	Unclear what section this refers to
27151	89	2			Please give specific examples for impacted services like: pollination. [, Germany]	Acecpted
27153	89	5			Please give examples like for specific services affected such as: groundwater recharge, groundwater quality, resilience to extreme climate events. [, Germany]	Accepted - text revised
23563	89				The reference format of Chapter 4 and the non-uniformity of Chapter 1 [Huai Jianjun, China]	Noted

Comment No	From Page	From Line	To Page	To Line	Comment	Response
17057	146	42	146	45	There is some confusion about the date of the publication. The article is actually from 2004: https://onlinelibrary.wiley.com/doi/epdf/10.1111/j.1475-2743.2004.tb00362.x It was published online in 2006. [Roland Hiederer, Italy]	Noted
40253	Chapter 4: L	3	86	3	remove the first biochar reference in the paragraph [Thelma Krug, Brazil]	Unclear
28601					This chapter should go before the desertification chapter. The land degredation intro, including section 4.4, is very good, and applies to desertification as well because desertification is a subset of land degredation. It makes more sense to go from general to specific in this case, even if this chapter does not directly address desertification. [Alan Di Vittorio, United States of America]	Noted - but we have to stick to the plenary approved outline
41613					the risk of land degradation, both in terms of likelihood and consequences " ,and: [Cristobal Felix Diaz Morejon, Cuba]	Unclear what this refers to
41615					" Changes of hydrological regimes as a combined result of human land/water use and climate change will impact [Cristobal Felix Diaz Morejon, Cuba]	Unclear what this refers to
41617					floodplains and delta areas, an all habitats in the case of drought, with detrimental effects on livelihoods, [Cristobal Felix Diaz Morejon, Cuba]	Unclear what this refers to
41619					ecosystems and their services, human, animal, and plants habitats, and infrastructure " [Cristobal Felix Diaz Morejon, Cuba]	Unclear what this refers to
41621					high latitudes ". I think that isn´t part of this point. [Cristobal Felix Diaz Morejon, Cuba]	Unclear what this refers to
41623					exposure and sensitivity to land degradation, leaving livelihoods more sensitive to the impacts of climate change and [Cristobal Felix Diaz Morejon, Cuba]	Unclear what this refers to
41625					extreme climatic events and increasing the poverty and lack of resources " [Cristobal Felix Diaz Morejon, Cuba]	Unclear what this refers to
41627					of how climate change impacts land degradation, and vice versa, with a focus on non-drylands. Land degradation of [Cristobal Felix Diaz Morejon, Cuba]	Unclear what this refers to
41629					drylands is covered in Chapter 3¨. Chapter 3 talk about Desertification the final state of continued degradation of [Cristobal Felix Diaz Morejon, Cuba]	Unclear what this refers to
41631					drylands, and it is in this Chapter 4 Land Degradation where would be analyzed the degradation processes in drylands [Cristobal Felix Diaz Morejon, Cuba]	Unclear what this refers to
41633					that may not finish in desertification [Cristobal Felix Diaz Morejon, Cuba]	Unclear what this refers to
41635					degradation used in this report (see Glossary), some impacts are positive, although degradation and its management [Cristobal Felix Diaz Morejon, Cuba]	Unclear what this refers to
41637					are the focus of this chapter. You need to explain in short what do you want to express, whar kind of human impacts [Cristobal Felix Diaz Morejon, Cuba]	Unclear what this refers to
41639					are positive [Cristobal Felix Diaz Morejon, Cuba]	Unclear what this refers to
41641					destroy a big quantity of useful lands for a long time (thousands and thousands ha) [Cristobal Felix Diaz Morejon, Cuba]	Unclear what this refers to
41645					volcanoes, tsunamis (e.g. in biodiversity loss, on water, and soils) [Cristobal Felix Diaz Morejon, Cuba]	Unclear what this refers to
41647					Caribbean islands. [Cristobal Felix Diaz Morejon, Cuba]	Unclear what this refers to
41649					taking into account their size and limited quantity of lands available. [Cristobal Felix Diaz Morejon, Cuba]	Unclear what this refers to
32849					Booth, M. (2018). Not carbon neutral: assessing the net emissions impact of residues burned for bioenergy. Environmental Research Letters 13 035001 [Doreen Stabinsky, United States of America]	Unclear what this refers to

Comment No	From Page	From Line	To Page	To Line	Comment	Response
32857					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]	Unclear what this refers to
16523					ELD, 2015: The Value of Land, www.eld-initiative.org [, Republic of Korea]	Unclear comment
39593					The chapter includes a great deal of discussion about increases in erosion, but the potential for increases in mass wasting events (landslides and debris flows) with increasing precipitation intensity was not discussed. Given the potential impacts of these types of events, they are worth discussing. [, United States of America]	Noted - landslides are discussed (4.5.1) but there is limited evidence that landslides have been affected by climate change.
39595					Although the authors discuss the potential for increased forest mortality from drought and other stressors, there was no discussion of the potential for biome shifts from forests to woodland or grasslands to occur with changing climate. These shifts could result in decreased area of forests in some locations, affecting the ecosystem services provided by forests. [, United States of America]	Taken into account - this is discussed in 4.2.5, 4.3.1, 4.5.1
39597					While the chapter is a herculean task and appears to do an adequate job of surveying the literature, it does not synthesize a coherent view with strong takeaway points. The literature surveyed felt limited, and there wasn't enough coverage of all the land management science done in the USA and Europe (where much science infrastructure and momentum exist). The report may benefit from more of a regional or ecosystem focus that would allow discussion of specific issues in different types of environments (e.g., tropical forest, temperate forests, boreal forests, coastal systems, etc.). Some reorganization might also make it more accessible to the reader. In addition, the authors don't seem to take advantage of all the future projections-based work that has been published. They also don't include sufficent disscusion on the importance of climate change-based migration that could dramatically interact and alter the landscape and future land degradation. The report would benefit from a heavy edit as it does not read well as a schloarly document in some places. Suggest not using "time immemorial" and "used land" should be edited. As is stands now, this report fails to address the issue of land degradation adequately. [, United States of America]	Taken into account - the chapter has been substantially revised and to some extent restructures
39599					It is confusing that the chapter says it is not addressing dryland systems, but authors discuss dryland systems throughout, sometimes extensively. [, United States of America]	Taken into account - we have coordinated with Chapter 3, but some overlap is inevitable
39601					Very thorough chapter, but it needs to be carefully edited for English and to reduce redundancies. [, United States of America]	Noted
39603					There is little to no consideration on the importance of draining/altering terrestrial wetlands, coastal wetlands, mangroves, sea grass, etc., on land degradation (other than in the case studies). The focus of the chapter is pretty much solely on forestry and agriculture. The same can be said about the lack of discussion on land degradation from urbanization. [, United States of America]	Noted - coastal wetlands and sea grass are beyond the scope of thei report. Urbanisation is dealt with in 4.10.1
39605					There is little representation of northern (or southern) ecosystems where snow is an important part of the hydrologic cycle. Climate is changing the amount and timing of snowfall and subsequent melt which can have important connections to land degradation. Timing and amount of soil frost is also changing which is affecting both agriculture and forestry. Soil frost is not discussed. [, United States of America]	Noted - there is a special report (SROCC) which deals with the cryoshpere. It is correct we have not included soil frost - briefly mentioned in 4.10.4,
39607					Group references correctly; check throughout. [, United States of America]	unclear

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39609					Agricultural impacts on land degradation and non-GHGs should receive greater attention and review. Agree with the general emphasis on the unique, site-specific nature of agriculture and consequent relevance of various practices. Also the explicit inclusion of farmers and scientists working together on co-production/innovation to address climate change is a very promising direction/development. [, United States of America]	Noted
39611					This chapter lacks an adequate discussion on the role of land disturbances on hydrological properties. Land degradation will have massive impacts on hydrological process and flowpaths and water tables, yet this is only mention in passing. Alteration of the hydrology will dictate what remediation opportunites exist and overall resiliency. [, United States of America]	Noted - a detailed treatment of hydrological processes is beyond the scope of this report
1441					Suggest you make this case study more balanced, rather than being so promotional. Relevant reference that highlights some weak points in the GFGP: Seki, Y. and Xiang Hu. 2007. Forest management in the People's Republic of China. Part B: In the shadow of the Tuigeng Huanlin programme in China. In Scheyvens, Henry, Kimihiko Hyakumura, and Yoshiki Seki. 2007. Decentralisation and State-Sponsored Community Forestry in Asia. Hayama: Institute for Global Environmental Strategies. https://pub.iges.or.jp/pub/decentralisation-and-state-sponsored-community [Henry Scheyvens, Japan]	Unclear what the comment refers to
66					I find this chapter to be poorpy compiled and very incomlete. My majour concerns are: [Julian Dumanski, Canada]	Taken into account - the chapter has been substantially revised and to some extent restructures
68					1. Too much emphasis on methodology for assessment Section 4.3.2 and pg. 22, l 25 etc. shouild be part of the case studies [Julian Dumanski, Canada]	Noted - discussing methodology is important for explaining why our knowledge of the extent and severity of land degradation is still rather poor.
70					2. Too much emphasis on forestry and little ob developed lands in agriculture. Mitigation with improived technologies such as Conservation Agriculture are proving to be very effective in carbon sequestration. [Julian Dumanski, Canada]	Rejected - the chapter should treat both land and forest degradation. However, we have improved the treatment of adresing land degradation
72					3. The soil carbon pool is one of the highest pols of carbon in nature. Much of this carbon has been released into the atmosphere through land degradation. This can be reversed - see work of Lal, etc. This is hardly mentioned [Julian Dumanski, Canada]	Noted - we have assessed the recent scientific discussion on this
76					5. the mention of C02 stimultion has been around but is no longer being seriously considered. [Julian Dumanski, Canada]	Unclear what is meant
78					6. Precision agriculture and biochar are mentioned as possible techologies for carbon management. These two are likely to contribute only a small part of the total sequestration potentials. Conservation Agriculture is considerably more important. [Julian Dumanski, Canada]	Taken into account - conservation agriculture is discussed, yet recent research shows that the effectiveness of CA for building soil carbon is contested
80					7. A very important reference hs been missed - Journal of Soil and Water Conservation Research, March 2014, Vol 2, no 1. This is a collction of papers documenting on-farm success stories in mitigating land degradation and carbon sequestration. [Julian Dumanski, Canada]	unclear - the suggested reference is not particularly reelvant
82					8. FINALLY: The authors emphasize primarily climate controlled land degradation. This sounds OK in theory, but does not work. Land degradation is a process caused by several factors including climate change and should be disussed in tis way. To try and focus only on climate controlled land deradation does not work. [Julian Dumanski, Canada]	Noted - the assessment is explicitly land degradation in the context of climate change, but we have tried to integrate all drivers of land degradataion
84					RECOMMENDATION: This chapter must be thoroughly revised before publication. [Julian Dumanski, Canada]	Noted - the chapter is substantially revised

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23193					This chapter addresses degradation of both agricultural and forested lands. Section 4.3 (and the diagram 4.1) set the stage nicely. Thetopic of forest degradation is recognized as an important topic that had been relatively overlooked in previous IPCC reports. It is good, but some fine tuning in wording may be necessary. [Kaoru Kitajima, Japan]	Noted
32745					the rest of this chapter offers a terrific analysis of climate change and land degradation. This is a truly comprehensive chapter! [Kate Lajtha, United States of America]	Noted
31749					this chapter needs a good edit and further review. The style in places is more like a text book than a synthesis of recent research. In some places the climate change linkages are relatively week. I found it was too time consuming to edit, so apologies for not being able to make specific suggestions in most cases [Mike Morecroft, United Kingdom (of Great Britain and Northern Ireland)]	Taken into account - the chapter has been revised substantially
7479					This chapter (Chapter 4) requires a lot of scrutiny on the "Land degradation is a driver of climate change". Most introductory scribbles or sentences should be reduced; the concept of land degradation and climate change inferences should be reviewded with clear objectives cited with recent and relevant references. The tables, figures, etc labellings should be rewritten clearly and neatly worded again. Most labels from the diagrams and tables looks obscure. [Onema Adojoh, United States of America]	Taken into account - the entire chaper has been substantially revised
28751					Wang, J., Xiong, Z., Kuzyakov, Y. 2016. Biochar stability in soil: meta-analysis of decomposition and priming effects. GCB Bioenergy. 8(512-523 [Rachel Smolker, United States of America]	unclear what this refers to
28753					Schmidt, M., W.I., Torn, M.S., Abiven, S., Dittmar, T., Guggenberger, G., Janssens, I.A., Kleber, M., Kogel-knabner, I., Lehmann, J., Manning, D.A.C., Nannipieri, P., Rasse, D.P., Weiner, S. and Trumbore, S.E., 2011. Persistence of soil organic matter as an ecosystem property. Nature, vol 478. [Rachel Smolker, United States of America]	unclear what this refers to
28761					He, Y., Zhou, X., Jiang, L., Li, M., Du, Z., Zhou, G., Shao, J., Wang, X., Xu, Z., Bai, S.H., Wallace, H., and Xu, C. 2017. Effects of biochar application on soil greenhouse gas fluxes: a meta-analysis. GCB Bioenergy. 9(743-755 [Rachel Smolker, United States of America]	unclear what this refers to