

IPCC SRCL Second Order Draft Review Comments and Responses - Chapter 5

Comment No	From Page	From Line	To Page	To Line	Comment	Response
1651	0	0	0	0	Food security should focus on the adaptation solution to secure the production, stock, sale, consumption of food. The adaptation solution should include policy, technology and investment. [Chao WEI, China]	Accepted, adaptation section rewritten to include these topics
40719	0		0		Each subsection / section should end with a summary of the key finding with confidence level, to provide traceability with ES. [Valerie Masson-Delmotte, France]	Accepted, added summary of key findings in each section
40727	0		0		Nutrient deficiency (zinc etc) relevant for SPM [Valerie Masson-Delmotte, France]	Accepted, Zinc has been added to ES
40789	0		0		Please see my general remarks on the report and those on the SPM. I appreciate the developments of chapter 5 from the FOD. Chapter 3 is addressing all the elements identified during scoping. The narrative works well. [Valerie Masson-Delmotte, France]	Noted. Thank you
25811	0	0			General comment on Chapter 5 Additional studies should be used on insect based diets, and cellular agriculture. For example: - Megido, Rudy Caparros, et al. "Consumer acceptance of insect-based alternative meat products in Western countries." Food quality and preference 52 (2016): 237-243. - Rumpold, Birgit A., and Oliver Schlüter. "Insect-based protein sources and their potential for human consumption: Nutritional composition and processing." Animal Frontiers 5.2 (2015): 20-24. - Van Huis, Arnold. "Potential of insects as food and feed in assuring food security." Annual review of entomology 58 (2013): 563-583. - Smetana, Sergiy, et al. "Sustainability of insect use for feed and food: life cycle assessment perspective." Journal of cleaner production 137 (2016): 741-751. - Post, Mark J. "Cultured meat from stem cells: Challenges and prospects." Meat science 92.3 (2012): 297-301. - Kadim, Isam T., et al. "Cultured meat from muscle stem cells: A review of challenges and prospects." Journal of Integrative Agriculture 14.2 (2015): 222-233. [., France]	Accepted, added section on insect-based diets. Cellular agriculture was already included, added Kadim reference
13779	0	0			Thanks for the opportunity to review this very important and timely chapter. The chapter contains pertinent information about the linkages between climate change and food security and with some improvement could be a go-to resource for decision makers focusing on solving the problem of climate change and food security. [Sunday Leonard, United States of America]	Noted. Thank you, we have worked to improve the chapter to be even more relevant for decision makers.
13781	0	0			While I believe significant efforts has been made to review relevant literature; overall, the current chapter looks like a poorly done literature review with findings from various research and publications brought together in a disjointed manner without effectively or rigorously distilling overall conclusions from them. Several sections of the document require to be made more succinct for the readers to understand the conclusions. The logic of several arguments in the chapter need to be tightened and presented in a more succinct way that will not leave the readers confused. I have provided some specific examples as part of my specific comments but not all identified. [Sunday Leonard, United States of America]	Accepted, the new draft provides more robust assessments, it is more succinct and the arguments have been tightened

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13783	0	0			The flow and structure of text and readability of the chapter need to be significantly improved. There are repetitions; sometimes, arguments on the same issue is presented in several paragraphs- that is after a topic has been discussed in a paragraph, the author moves to another topic and then go back to the already discussed topic in later paragraph(s). This has significantly reduces the readability and the logic of the document. Hopefully the copyeditors will be able to help with this but I think this will be best addressed by the authors by making the presentation of arguments and discussions more logical, succinct and concise. I have provided some specific examples in my review but not all. It will be useful to thoroughly review the chapter and resolve these issues. [Sunday Leonard, United States of America]	Accepted, improved flow, structure, and readability. Deleted repetitions. Made chapter more succinct.
13785	0	0			Some discussions and conclusions are based on just a single study. For a more rigorous assessment, it will be useful to find studies that corroborate or contradict the findings. See some specific examples in my detailed review [Sunday Leonard, United States of America]	Accepted, added more studies so that assessments are more robust and also described areas of disagreement
13787	0	0			For some of the discussions, I really feels that the large body of knowledge and research on the topics have not been taken into consideration. Instead the discussions have been mainly based on a few publications. Ideally, an IPCC report should review the latest set of literature and synthesis the knowledge from them in a balance manner. [Sunday Leonard, United States of America]	Accepted, expanded literature base for assessment
13789	0	0			It is good that cellular agriculture was discussed in the chapter, however some other emerging topics/issues that are becoming very important or will soon become very important are not (or not adequately) addressed in the chapter. Examples include (1) role of gene editing especially CRISPR in improving agriculture ( <a href="https://scholar.google.com/scholar?as_ylo=2015&amp;q=crispr+and+agriculture&amp;hl=en&amp;as_sdt=0,21&amp;as_vis=1">https://scholar.google.com/scholar?as_ylo=2015&amp;q=crispr+and+agriculture&amp;hl=en&amp;as_sdt=0,21&amp;as_vis=1</a> ); (2) the role of blockchain for improving the efficiency of supply chains and smallholders financial support and consequently mitigation and adaptation to climate change (see for example the following example publications: <a href="https://www.ictsd.org/sites/default/files/research/emerging_opportunities_for_the_application_of_blockchain_in_the_agri-food_industry_final_0.pdf">https://www.ictsd.org/sites/default/files/research/emerging_opportunities_for_the_application_of_blockchain_in_the_agri-food_industry_final_0.pdf</a> ; <a href="https://www.researchgate.net/publication/328345129_Blockchain_technology_and_its_relationships_to_sustainable_supply_chain_management">https://www.researchgate.net/publication/328345129_Blockchain_technology_and_its_relationships_to_sustainable_supply_chain_management</a> ; <a href="https://ac.els-cdn.com/S187705091831158X/1-s2.0-S187705091831158X-main.pdf?_tid=036fafa7-7bda-484b-8411-541a846df746&amp;acdnat=1547403549_19daf4b7e1d72a2a983e9d4d1731426d">https://ac.els-cdn.com/S187705091831158X/1-s2.0-S187705091831158X-main.pdf?_tid=036fafa7-7bda-484b-8411-541a846df746&amp;acdnat=1547403549_19daf4b7e1d72a2a983e9d4d1731426d</a> ; <a href="https://ieeexplore.ieee.org/abstract/document/8290114">https://ieeexplore.ieee.org/abstract/document/8290114</a> ; <a href="https://www.sciencedirect.com/science/article/pii/S0167739X18304527">https://www.sciencedirect.com/science/article/pii/S0167739X18304527</a> ; <a href="https://www.mdpi.com/1660-4601/15/8/1627">https://www.mdpi.com/1660-4601/15/8/1627</a> [Sunday Leonard, United States of America]	Accepted, added gene editing and block chain and references
13791	0	0			This is a continuation of above comment. Other emerging topics not addressed in the chapter include: the role of nanotechnology in improving agricultural productivity, reducing fertilizer usage, food safety and managing crop diseases. [Sunday Leonard, United States of America]	Partly accepted. Expended on reduction of fertilizer use, food safety and pests and diseases. Nanotechnology beyond scope
13793	0	0			I feel the chapter is very weak on impacts of climate change on fisheries and the mitigation options (freshwater and wild fisheries not aquaculture). There is more emphasis on aquaculture. Fresh and wild fisheries is a major food in many parts of the world so discussion on food security is incomplete if fisheries is not adequately addressed [Sunday Leonard, United States of America]	Rejected, fisheries beyind scope of chapter

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13795	0	0			<p>While there is a mention of the role of short-lived climate pollutants in the chapter, their important role especially impact on crop yield and extreme weather events as well as contribution to climate change has not be adequately recognised in the chapter. Significant literature on this topic has been ignored even though the topic has been widely researched and was significantly recognised in the IPCC 1.5 report. . Example literature include: UNEP/WMO 2011: <a href="https://library.wmo.int/pmb_ged/wmo_1073.pdf">https://library.wmo.int/pmb_ged/wmo_1073.pdf</a>; UNEP, 2011: <a href="http://wedocs.unep.org/handle/20.500.11822/8048">http://wedocs.unep.org/handle/20.500.11822/8048</a>; Shindell et al. 2012. <a href="http://science.sciencemag.org/content/335/6065/183">http://science.sciencemag.org/content/335/6065/183</a>; Haines et al. 2017: <a href="https://www.nature.com/articles/s41558-017-0012-x">https://www.nature.com/articles/s41558-017-0012-x</a>; Shindell et al. 2017: <a href="https://www.cfa.harvard.edu/~wsoon/myownPapers-d/Ronan-2018withBob-d/ShindellRamanathaneta17-May5-ClimatePolicyPathway.pdf">https://www.cfa.harvard.edu/~wsoon/myownPapers-d/Ronan-2018withBob-d/ShindellRamanathaneta17-May5-ClimatePolicyPathway.pdf</a>; Burney et al 2014. <a href="https://www.pnas.org/content/pnas/early/2014/10/29/1317275111.full.pdf">https://www.pnas.org/content/pnas/early/2014/10/29/1317275111.full.pdf</a>; Fan et al. 2015: <a href="https://pdfs.semanticscholar.org/7d5f/0fc17ca0cf609f012d09666554f688390c82.pdf">https://pdfs.semanticscholar.org/7d5f/0fc17ca0cf609f012d09666554f688390c82.pdf</a>; Shindell 2016. <a href="https://agupubs.onlinelibrary.wiley.com/doi/epdf/10.1002/2016EF000377">https://agupubs.onlinelibrary.wiley.com/doi/epdf/10.1002/2016EF000377</a>; [Sunday Leonard, United States of America]</p>	Accepted. Burney et al 2014 already cited. Added additional references for SLCP
22625	0				<p>Overall, Chapter 5 takes a very wide perspective by addressing the entire food system. This partially explains the length of the chapter, which could be significantly reduced. While there is a certain justification for taking a food systems approach, the content of the chapter appears to be missing important elements of food security. Food security aspects are briefly addressed, but the chapter swiftly switches to areas the authors are more comfortable with, ie mitigation and adaptation in the land sector.</p> <p>The underlying weakness of the chapter is its lack of a consistent framework that will help the reader understand what is 'in' and what is 'out'. This should be considered together with the approach to covering related material in Chapters 6 &amp; 7. It is not necessary to repeat the same response options multiple times with slight moderation. This may be due to the structure of the report, but it can certainly be addressed in a way that avoids unnecessary redundancy. This would provide space for elements that are missing entirely: wood fuels as a source of energy for cooking and the impacts on forest and landscape degradation, GHG emissions, and health.</p> <p>In this Chapter (5), there is very little information on expected future trends in food security and how they could be overcome in a sustainable way. There is also very little reflection on possible climate shocks leading to multiple food basket failures. (This is mentioned in Chapter 1 briefly.) The chapter should also cover relevant aspects of energy security, which is essential in the context of cooking food to improve aspects of the utility component of food security. [Anastasios Kentarchos, Belgium]</p>	Accepted, components of food security have been expanded. Revised framing diagram to clarify framework for chapter. Focus on chapter is on future trends in food security as they relate to climate change. We added more on climate shocks.

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21357	0				The chapter presents a comprehensive literature review, but in many instances does not actually do an assessment of the literature, in that it does not reach conclusions about where the (often diverse, cited) evidence base leaves us. I point out a number of those instances in my more detailed comments, but in general, the authors should spend considerable effort to check, at the end of each sub-section, whether there is a clear enough summary assessment provided. In many instances, authors cite a range of studies but make no obvious effort to bring those diverse studies into a clear assessed conclusion. A good example of a successful effort at reaching a conclusion is page 76 lines 9-11. I have given specific examples of where such assessment conclusions are sorely lacking in section 5.2.4, but the same goes for many other sections - I just didn't want to repeat the same comment for too many individual sections. Ask yourself at the end of each subsection - what message do I want a policymaker to take away from the preceding literature review? How confident am I in that message? Then make sure this does form the end of each subsection. [Andy Reisinger, New Zealand]	Accepted, assessment statements added
21359	0				there are many instances in this chapter where uncertainty terms are used without proper assessment (do a word search for "likely" and check whether there has been a quantitative, statistical or otherwise probabilistic assessment done). At the same time, language in the executive summary is often too confident (e.g. stating that something "will" happen) without clear reflection of uncertainty and confidence. [Andy Reisinger, New Zealand]	Accepted, improved uncertainty language
21361	0				the chapter badly lacks a coherent and concise presentation of future scenarios of food security, GHG emissions, mitigation needs to be consistent with 1.5 and 2 degree pathways, and vulnerabilities. Section 5.1 stops at current status and historical trends, but fails to then take this forward into future scenarios based on SSPs and related scenarios, or to put such scenarios into the context of 1.5 and 2 degree pathways. As a result, much of the subsequent discussion seems somewhat disconnected from the reality of what the Paris Agreement sets out to achieve and what the real pressure points for food security are. Please ensure that you provide such a clear overview (building e.g. on the very brief summary provided in chapter 6, page 19 lines 20-26). [Andy Reisinger, New Zealand]	Accepted, added RCPs/SSPs scenario framework in 5.1. Added scenario analysis to sections 5.2 and 5.5. Highlighted assessment of implications to food security
21363	0				I feel this chapter takes insufficient recognition of the pressure provided by the need for biomass for BECCS and the implications for food security. Yes some of this discussion occurs in chapter 6, but there is a lot of detail that really belongs within the chapter on food security, such as: what are critical issues and thresholds of BECCS scale and implementation that would raise serious food security issues, but also, how could/should approaches to food security and climate change be changed once the potential demand for land for BECCS is recognised - what are the solutions to manage such trade-offs and ensure that food security is NOT threatened (other than engaging in wishful thinking that we should not have or need to have a lot of BECCS)? For me, a significantly greater emphasis on how to generate land sparing, and how to place sustainable intensification alongside likely demand for bioenergy crops would be very useful in this chapter. Chapter 6 can then pick this up more briefly and alongside issues other than food security. It just doesn't seem to make sense to leave any and all interactions between land-based mitigation (afforestation, BECCS) to chapter 6 and not deal with this core issue here in chapter 5. (Chapter 6 necessarily deals with this far too briefly, e.g. chapter 6 page 33 lines 12ff). [Andy Reisinger, New Zealand]	Accepted, added discussion on BECCS and pressure on food security in section 5.5

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21543	0				Please cross-check all the numbers given in Tables 6.4ff in chapter 6, and reconcile with your chapter. If numbers are different, can they be rconciled? If Chapter 6 gives numbers that your chapter doesn't, why? Could you provide those numbers? Ideally, chapter 6 should be able to grab all numbers it needs for those tables from your chapter, not from the primary literature. [Andy Reisinger, New Zealand]	Accepted, emissions numbers have been coordinated with Chapters 2 and 6
7323	0				The solutions focus of this chapter would be greatly enhanced if there was a greater focus on the financial mechanisms and incentives available to achieve food security. [Debra Roberts, South Africa]	Accepted, financial mechanisms covered in Enabling Conditions
7325	0				The strong solutions focused narrative of this chapter is highly commended. But is there any reason that improved "climate services" are not specifically called out as a response option? [Debra Roberts, South Africa]	Accepted, climate services covered in Enabling Conditions
7327	0				Given the strong focus on gender in the chapter it seems appropriate to have a point in the ES addressing gender issues. [Debra Roberts, South Africa]	Accepted, added main point on gender to ES
3453	0				Food security focuses on how to take effective adaptation measures to keep secure the processes of grain production, storage, marketing and consumption. Adaptation measures should include policy measures, technical measures, financial mechanisms, etc. However, this chapter devotes a lot of words to the impact and mitigation, and few ones to the adaptation. So it is suggested that further supplements be made in this connection. [, China]	Accepted, adaptation section rewritten to include these topics
6367	0				Thanks to the authors for this very useful chapter. [, Gambia]	Noted. Thank you
27155	0				We kindly request to display a more differentiated assessment of mitigating emissions from ruminants by replacing them with monogastrics. While ruminants produce overproportionally higher GHG emissions than monogastrics, the negative side effects of replacing ruminants with monogastrics need to be addressed as well. Please consider for example that a certain amount of ruminants is needed to respond to the dietary recommendations regarding the consumption of milk and dairy products. Please see our other comments on specific mentions of ruminants. [, Germany]	Accepted, statement removed from ES
23807	0				Could the authors provide a more detailed framework specifically for developing countries with large undernourished populations to achieve food security under a changing climate while also contributing to climate mitigation and achieving climate resilience. [, India]	Accepted, added 'just transitions' section
23919	0				Data related to emissions due to crop and livestock for a country should be sourced from their respective National Communications submitted to UNFCCC to ensure authentic representation of facts. [, India]	Repeat. Beyond scope to give national level emissions
33753	0				General comment: The food security chapter is well explained and it's comprehensive. [, Norway]	Noted. Thank you
33755	0				General comment: How is the trend of land area for agriculture and biofuels explained parallel to the dynamic of world population? Consider associating with the IPCC SR15 report assumptions of land area for agriculture and biofuels. [, Norway]	Accepted, added figures showing land area for a range of scenarios
33757	0				This report should consider how climate mitigation and adaptation measures help stabilize food production and reduce loss situations due to crop failure. Suggestion: "Agri-environmental mitigation and adaptation measures such as buffer zones, minimum till and hydrological measures (drainage, remeandering etc), are being implemented to reduce the risk of both crop failure and environmental impacts due to climatic instability. In the mid- to longer term, such measures can increase resilience against extreme weather events and improve average productivity". [, Norway]	Accepted, added text

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12123	0				The link of food security to climate change is much clearer than in the FOD - however, in some sections it is still rather marginal. [Hans Poertner and WGII TSU, Germany]	Accepted, the linkage between FS and CC has been strengthened
12125	0				The format of uncertainty/confidence statements is partly wrong and missing in many section. Also, uncertainty/confidence statements lack line-of-sight. They are often placed in introductory statements, but rather disconnected to the sections where the assessment lies. [Hans Poertner and WGII TSU, Germany]	Accepted, improved uncertainty language
12127	0				Some general comments: The assessment of 'observations' is quite limited, and should be extended. Consider including explicit reference to "Sustainable Land Management" (SLM), for consistency with the report title and other chapters. References to SR1.5 should be more explicit. And more cross-references to interlinked sections would be helpful. [Hans Poertner and WGII TSU, Germany]	Accepted, observation section expanded, added more links to SR1.5. Added explicit reference to SLM in Adaptation section
17975	0				Data related to emissions due to crop and livestock for a country should be sourced from their respective National Communications submitted to UNFCCC to ensure authentic representation of facts. [Nayanika Singh, India]	Rejected, beyond scope. We do not go down to country level for emissions numbers
17873	0				"The chapter would benefit from inclusion of the concept of telecoupling. E.g. see Easter, T. S., A. K. Killion, and N. H. Carter. 2018. Climate change, cattle, and the challenge of sustainability in a telecoupled system in Africa. Ecology and Society 23(1):10. <a href="https://doi.org/10.5751/ES-09872-230110">https://doi.org/10.5751/ES-09872-230110</a> Fris et al. 2015: From teleconnection to telecoupling: taking stock of an emerging framework in land system science, <a href="https://doi.org/10.1080/1747423X.2015.1096423">https://doi.org/10.1080/1747423X.2015.1096423</a> " [Quentin Lejeune, Germany]	Accepted, added telecoupling to Enabling Conditions
34031	1	1	1	1	The title of this chapter is "food security" but it also covers the contribution of the food system to GHG emission, and the possible contribution of the food to mitigation via demand changes. Choose a better title. [Elke Stehfest, Netherlands]	Rejected. Original title is approved by IPCC plenary
34053	1	1	1	1	Identical comment to chapters 1, 5 and 6: As mentioned above, there is large overlap between chapters without cross-referencing. The potential contribution of dietary change to mitigation is shown in 6.4.1.2, and in 5.5.2.1 and in 1.4.2.2, without referencing the other section, and apparently written completely independently. It is not even clear what the "main" location for the diet potential is in the report. [Elke Stehfest, Netherlands]	Accepted, we have added cross-chapter references
7371	1	1	1	1	Water hungry plant production should be limited and shifting to low water demanding plant production subsidies will be increased by governments [Erhan Akca, Turkey]	Accepted, added
25569	1	1	1	1	See GENERAL COMMENT ON CHAPTER 5. [France]	Noted.
17223	1	1	103	15	The Chapter is well written and extensive in its review of literature. The chapter, however, need more integration of the different parts to be clearer and more coherent (what is discussed in other parts are contextualized in other parts). Specifically, the Chapter is about Food Security and discusses the relationship of food security, food systems and climate change. The chapter, however, fails to account for globalization of food supply, cross country competitiveness in food production and free trade challenges among others that also affect local, national and regional food systems and food security. Globalization of food supply, cross country competitiveness in food production and free trade challenges in turn are also affected by climate change. In short, the food system and food security should have several interacting levels. May I suggest that you also consider this in your framework (e.g. Figure 5.1, 5.8 and others). [Hoang Anh Le, Vietnam]	Accepted, added globalisation of food supply in ES. Added global and regional scales to Framing figure caption. Added more on trade in Enabling Conditions section

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4097	1		103		Good chapter, balanced. Excellent Ex. Summary. [Turi Filecchia, Italy]	Noted. Thank you.
1303	1		164		Chapter is nicely written and I am happy to see that authors have included discussion on crop disease and food security in this version. So I feel no more amendments are required. [Pushp Raj Tiwari, United Kingdom (of Great Britain and Northern Ireland)]	Noted. Thank you.
2483	1	1			Recycling/ Recovery of nutrients (from waste water, sewage sludge, wastes, manures) has significant potential to reduce artificial fertiliser use, one key element of GHG emissions linked to food systems. This could be better integrated/ highlighted in the chapter. [Sigrid Kusch-Brandt, Germany]	Accepted, added to Mitigation section
28421	2	35	3	3	Consider inverting the order in the structure/table of contents (i.e. 5.3 and 5.4 to be inverted); so "5.2 Impacts of climate change on food systems [...]" comes first followed by "5.4 Impacts of food systems on climate change", if deemed appropriate (while for an external review this might seem plausible, for an author this does not - so kindly proceed according to your judgement). [Barron Joseph Orr, Germany]	Noted. Structure of SOD retained in FGD.
11619	4	1	4	38	The summary is well written, but key messages or recommendations don't seem expressed strong enough. [Nazimi Acikgoz, Turkey]	Accepted, we have rewritten the ES and strengthened the statements
6369	4	2	4	5	This introductory paragraph should mention that climate change impacts food production and food security. Currently it highlights the interlinkages between climate and food but then only mentions greenhouse gases from food production and the role of changes in the food system for mitigation and adaptation. [ , Gambia]	Accepted, added CC impacts on food security to first bullet
30723	4	2	4	5	This introductory paragraph should mention that climate change impacts food production and food security. Currently it highlights the interlinkages between climate and food but then only mentions greenhouse gases from food production and the role of changes in the food system for mitigation and adaptation. [ , United Republic of Tanzania]	Repeat of comment 6369
14727	4	2	4	5	It is an overreach to state that climate change leads to food insecurity. In many parts of the world, climate change may IMPROVE food security because there are more planting seasons, or crop plants or animals can be produced in areas that previously were not amenable to agriculture. How was the determination of "robust evidence, high agreement" reached? I don't think even the USEPA would agree with this statement. When EPA's climate page was available, it had stated that food security might be one of the items that improve from climate change because of the aforementioned points. [Wu Felicia, United States of America]	Reject. Disagree, the chapter documents that climate change will exacerbate food insecurity across all pillars: availability (negative impacts on production), access (increase in prices), utilisation (decline in nutritional quality), and stability (increasing volatility due to increasing extreme events). Earlier work was more positive due to CO2 fertilization effects, but understanding of these has now been tempered by role of N fertilization and effects on nutrition
11621	4	2	4	10	"Climate change has complex interactions with food systems, leading to food insecurity through impacts on food availability, access, utilization and stability...". I think, "safety" and "quality" should also be added to those three items. Neglected quality has been revered in the text inevitably (see line 30: "Protein content of plants is affected negatively by higher CO2 concentrations") [Nazimi Acikgoz, Turkey]	Rejected. These are the four pillars of food security. Safety and quality are included in utilization
6451	4	2	4	10	the mention to the increase of food insecurity that has been occurring for the past 3 years - mentioned later in the core of the chapter- should be reminded in the exec summary as well. [Sara Lickel, France]	Accepted, food insecurity trends clarified
25497	4	5	4	6	Could it be more explicit. for example : food is essential/an integral part of ... [ , France]	Noted. ES has been rewritten
17875	4	5	4	7	The two sentences (dealing with mal- & undernourishment) do not make a clear connection to "climate change[']s complex interactions with food systems." These two sentences are distracting and could be better connected to climate change impacts on availability (where the majority of the research focuses) and then ensuingly nutrition (through access and utilisation). [Quentin Lejeune, Germany]	Accepted, first paragraph has been rewritten

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2943	4	5	4	10	It ' is important to add a little explanation about impact of climate change to food borne diseases incidence in this part . We can use reference Kendrovski V. , Gjorgjev D, Climate change : Implication for foodborne diseases (Salmonella and food poisoning among Humans in R. Macedonia). The sentences we can add to that part are : - It has been estimated that climate change in the year 2000 contributed to about 2,4 % of all diarrhea outbreaks in the world (reference: World Health Organization (2002). World Health Report. Geneva ). -Roughly one-third of the transmission of Salmonellosis in England, Wales, Poland, the Netherlands, The Czech Republic, Switzerland and Spain can be attributed to temperature influences. [Sulistiawati Sulistiawati, Indonesia]	Food safety is addressed later in the ES
30915	4	6	4	6	In Chapter 5, will perhaps be a good idea to put a comma after the word 'currently' under Executive Summary' [Christopher Ilori, Canada]	Accepted
5115	4	6	4	7	This sentence states that "1.3 billion adults are overweight," while in Chapter 5, P5-13, Line 25, "In 2016, around two billion adults are overweight"; and therefore, request consistency between Executive Summary and cited sentences. [, Japan]	Accepted, sentences rewritten to "2 billion are overweight or obese"
12131	4	6	4	7	Are there definitions of "undernourished" and "overweight" and can they be referred to or explained? [Hans Poertner and WGII TSU, Germany]	Noted. Malnutrition is defined in the glossary
17979	4	7	4	10	All activities of the food system (from production to consumption to waste management) emit greenhouse gasses and are also each impacted by a changing climate system. Impacts on the food system are not explicitly mentioned, although impacts to the food systems are the logical link to food insecurity (rather than GHG emissions). [Quentin Lejeune, Germany]	Accepted, CC impacts on the food system now included in first bullet
3363	4	9	4	9	I would suggest to use "high confidence" to replace (robust evidence, high agreement) and hereafter to follow the judgement and expression of «Guidance Note for Lead Authors of the IPCC Fifth Assessment Report on Consistent Treatment of Uncertainties IPCC Fifth Assessment Report on Consistent Treatment of Uncertainties» . [Rongshuo Cai, China]	Accepted, we are using confidence statements as appropriate
17707	4	13	4	13	Bit unclear whether the "responses" refer to climate change impacts or human responses (such as management, adaptation). Could be clarified. [, Sweden]	Accepted, text rewritten
3365	4	14	4	14	The comment is the same as the above mentioned. [Rongshuo Cai, China]	Repeat
17879	4	14	4	15	It is not yet clearly stated that the stagnation of yields "in some dryland areas (despite improvement in technology and management practices) is connected to changing climatic conditions. [Quentin Lejeune, Germany]	Accepted, text rewritten
6375	4	14	4	20	It would also be good to have an example or a line specifying that impacts occur not only to commercial or large-scale farming systems but also smallholder farms and pastoral systems. [, Gambia]	Accepted, added smallholder farmers and pastoral systems



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Comment No	From Page	From Line	To Page	To Line	Comment	Response
5117	4	14	4	20	The statement "In some dryland areas, such as Australia, increases in agricultural yields have stagnated despite improvements in technology and management practices" seems to be cited from P5-20, Line 1-5, "In Australia, declines in rainfall and rising daily maximum temperature based on simulations of 50 sites caused water-limited yield potential to decline 27% from 1990 to 2015, even though elevated atmospheric CO2 concentration had a positive effect. However, the 27% decline driven decline was not experienced in recorded national yields due to ongoing improvements in management and technology, which have allowed yields to stay stagnant rather than decline 25 kg /ha yr", but the messages that these two paragraphs imply are slightly different. Cited paragraph suggests improvements in management and technology helped avoid climate change-induced 25 kg/ha yr decline stagnant, and therefore we suggest modifying the statement in the Executive Summary to be consistent with the cited paragraph. [Japan]	Noted. Sentence has been deleted
30713	4	14	4	20	There is a need to provide some examples on the impacts of climate impacts on food (agricultural) production on most vulnerable countries in Africa, especially those that are very prone to droughts [United Republic of Tanzania]	Accepted, added examples of impacts in Africa and other vulnerable regions
30715	4	14	4	20	It would also be good to have an example or a line specifying that impacts occur not only to commercial or large-scale farming systems but also smallholder farms and pastoral systems. [United Republic of Tanzania]	Repeat of 6375
40689	4	18	4	18	worse => more negative? [Valerie Masson-Delmotte, France]	Noted. Sentence has been deleted
21367	4	18	4	20	Please offer some examples of at least the nature or direction of those impacts - are they negative or positive, significant at what scales, ? [Andy Reisinger, New Zealand]	Noted. Sentence has been deleted
17981	4	18	4	20	The wording of this sentence is unclear. It may be useful if more specific language can be used regarding the types of impacts being referred to. A number of 'studies' are referred to in Section 5.2.2.2 that incorporate a mix of data sources. It may be clearer to refer to studies or local research. It is also unclear why the term 'local knowledge' is used and what is being communicated through the use of this term. There is a risk it may be construed as synonymous with 'Indigenous and Local Knowledge', which is discussed at length later in the Chapter. [Beau Damen, Thailand]	Noted. Sentence has been deleted
6161	4	19	4	19	You can find examples of autonomous adaptation of rural populations in the Sahel in those two references: Sultan Benjamin (ed.), Lalou Richard (ed.), Amadou Sanni M. (ed.), Oumarou A. (ed.), Soumaré M.A. (ed.) Rural societies in the face of climatic and environmental changes in West Africa. Marseille : IRD, 2017, 432 p. (Synthèses). ISBN 978-2-7099-2424-5 Richard LALOU, Benjamin SULTAN, Bertrand MULLER, and Alphousseyni NDKY, Evidence of Autonomous Adaptation to Recent Climate change by Smallholder Farmers in the Sahel, Palgrave Communications (2019), in revision, Manuscript Number: PALCOMMS-01250 [Benjamin Sultan, France]	Partly accepted. Cited Sultan et al 2017. Lalou et al 2019 not yet published
21369	4	21	4	21	Make clear that this is related to temperature change, e.g. "to grow with every degree of warming and related climate changes" [Andy Reisinger, New Zealand]	Noted. Sentence has been deleted
5119	4	21	4	29	Suggest adding 5.2.1, 5.2.2, 5.3.2 in the reference because these sections are relevant to this paragraph. [Japan]	Noted. Paragraph has been deleted
12999	4	23	4	23	ES Table 5.1-table formatting seems truncated [Aidan Farrell, Trinidad and Tobago]	Noted, table has been deleted

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6163	4	23	4	23	Table. It is not clear what are low and high estimates. It is weird to have high estimates with lower values than low estimates (for instance for wheat) [Benjamin Sultan, France]	Noted, table has been deleted
5121	4	23	4	23	ES Table 5.1, (figures perhaps cited from Figure 5.5 in P5-25) could be enhanced for further understanding by adding average values to the low and high estimates currently included. [, Japan]	Noted, table has been deleted
17709	4	23	4	23	It might be better to leave the table into the chapter text, rather than bring this much detail into the Executive Summary. [, Sweden]	Noted, table has been deleted
12129	4	23	4	23	ES Table 5.1: It is not clear what the 'low' and 'high' estimates exactly refer to. Please be more specific. [Hans Poertner and WGII TSU, Germany]	Noted, table has been deleted
26051	4	23	4	23	ES Table 5.1 should make it clear what are the assumptions in the estimates given: e.g., is CO2 fertilization included or excluded, and which adaptation measures included. [Haroon Kheshgi, United States of America]	Noted, table has been deleted
23395	4	23	4	23	ADD mention carbon fertilisation which moderates the reductions due to temperature increases [John Dixon, Australia]	Accepted, added beneficial effects of CO2
152	4	23	4	23	Is ES Table 5.1 useful/necessary here? Could this not be summarised in words? [Tommy Wiedmann, Australia]	Noted, table has been deleted
18023	4	23	4	24	The table is unclear. The reader is unable to discern from the table or the accompanying text what constitutes a 'low estimate' or a 'high estimate.' It is recommended that if the table is retained a footnote or explanatory text accompanies the use of the table. [Beau Damen, Thailand]	Noted, table has been deleted
6823	4	23	4	24	in the executive summary ,there is no uncertainty language. [Changke Wang, China]	Uncertainty language in ES has been expanded
29779	4	24	4	25	Climate change will also affect water resources for food production via sea level rise, warming and acidification of waters; Tseil-Waututh traditional harvest of clam has been impacted accordingly already. TWN is working on restoration projects to allow the community to harvest on a regular basis again in specific locations. [Tanya Smith, Canada]	Rejected. Beyond scope of chapter
21371	4	25	4	25	"will" -> "are projected to" [Andy Reisinger, New Zealand]	Accepted, changed 'will' to 'are projected to' in several places
25499	4	27	4	29	This part is not self-understanding. It should be clarified. [, France]	Noted. Sentence has been rewritten
27159	4	30	4	30	This statement implies a direct impact of higher CO2 concentration on the nutrient content which affects food security and should therefore be given more prominence. We recommend raising it into the ES and SPM. [, Germany]	This is included in the Ch5 ES and we have raised it for inclusion in the SPM
5123	4	30	4	31	The confidence level of this sentence (medium evidence) seems not to correspond with that in P5-34, Line 6 (robust evidence). [, Japan]	Accepted, statement on CO2 impacts on protein is now identified as "high confidence"
21373	4	30	4	34	I would have put the last sentence as the first one after the bold text (and include "affecting food utilisation" in the bold text, unless there is a very good reason not to - in which case I would recommend a different sentence construction. [Andy Reisinger, New Zealand]	Noted. This paragraph has been rewritten
5125	4	30	4	34	Suggest adding 5.2.3 to the reference because these sections are relevant to this paragraph. [, Japan]	Accepted, added 5.2.4 (new section)
17711	4	30	4	34	This paragraph could be moved, so that the preceding and following paragraphs are together, as both refer to disruptions to food systems. [, Sweden]	Noted. The ES has been restructured
2937	4	30	4	34	Executive summary should focus on the important understanding of the impact of complex climate change on agricultural production. However, this paragraph only described the effects of elevated carbon dioxide concentration on protein, trace elements, and crop yield. The single effect (especially the positive effects) of elevated carbon dioxide concentrations was easily misunderstood by readers on climate change effects. In addition, it is recommended that the effects of warming described in Section 5.2.3.1 should also be described here. [Kun Cheng, China]	We have now included a statement in the ES that there are about beneficial effects on production and negative effects on nutrition due to CO2

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21375	4	31	4	31	"will" -> "are projected to" [Andy Reisinger, New Zealand]	Accepted, changed 'will' to 'are projected to' in several places
6165	4	32	4	32	Can we say something on the CO2 effect on C4 crops or is it too uncertain? It is admitted that higher CO2 concentration will increase rainfall efficiency of C4 crops in dry regions [Benjamin Sultan, France]	Noted. Sentence on C3 crops has been removed
12133	4	33	4	33	The target audience of the Executive Summaries might appreciate an explanation for "C3 photosynthetic pathways" (or a simple rephrase). [Hans Poertner and WGII TSU, Germany]	Noted. Sentence on C3 crops has been removed
25031	4	35	4	36	It is more of climate change induced extreme events/disasters disrupting the supply chain or market disruption due to decreased production. Suggested to revise for clarity [Binaya Shivakoti, Japan]	Noted, sentence has been removed
24873	4	35	4	36	change the word "manufacture" to manufacturing, and add process or system after the word "retail" [Justice Issah Musah Surugu, Germany]	Noted, sentence has been removed
21377	4	36	4	36	"will" -> "are projected to" [Andy Reisinger, New Zealand]	Accepted, changed 'will' to 'are projected to' in several places
40691	4		4		Why focus on these 4 crop types and not others (e.g. sorghum, potato, sugarcane, plantains? Is it due to the level of scientific understanding, the importance in the global food supply / markets? SR15 had a few key findings on livestock heat stress and productivity (ex Table 3.8 of chapter 3). [Valerie Masson-Delmotte, France]	Noted. Text has been removed.
40693	4		4		The ES does not convey a sense of magnitude of impact-risk / level of future warming. Why? [Valerie Masson-Delmotte, France]	Accepted, added magnitudes in ES
12467	4	35	5	2	Immediately pairing the naming of a process / impact with the magnitude of its change should be implemented to the extent possible as this will strengthen the messaging. [Hans Poertner and WGII TSU, Germany]	Repeat
21379	4	37	5	2	There must be an easier and more easily comprehensible way of saying this; "food security depends not only on production but also transport, trade, storage including stable food prices (etc etc), all of which are subject to disruption by climate change" [Andy Reisinger, New Zealand]	Noted. Text has been changed
6377	4		6		No mention in the ch 5 summary of the knowledge, & technology transfer (and in some cases, resources) that is needed for implementation of many of these mitigation and adaptation actions highlighted throughout this chapter, i.e. that needed for sustainable intensification [, Gambia]	Accepted, added technology transfer and resources
1021	4	1	7	7	The Executive Summary is excellent. [Alisher Mirzabaev, Germany]	Noted. Thank you.
21365	4	1	7	7	I'm puzzled not to find in the executive summary the basic conclusion that including agricultural GHGs in mitigation strategies, including where appropriate via price-based incentives for mitigation is essential to realise the assessed mitigation potential. To this could have been added the observation that at the time of the SOD, no country in the world had any sort of comprehensive price-based or otherwise comprehensive mitigation policy in place. Plus then a brief discussion of the key challenges in achieving mitigation outcomes in ways that don't (or are not perceived to) jeopardise food security. Without a price on emissions (or some other form of comprehensive incentive to mitigate emissions), most of the mitigation potential discussion in this chapter won't be realised - this is potentially one of the most policy relevant conclusions from this chapter in my view. It can't be all done via co-benefit - and if the price on emissions is zero, then the potential at US\$20/tonne simply won't be realised, let alone the potentials that come out of IAM studies that have (and apply!) much higher prices. [Andy Reisinger, New Zealand]	Accepted. A statement to the importance of agriculture and food systems to achieve stated global mitigation goals under Paris has been inserted at the beginning at 5.5 and repeated in the ES. At the same time, a new sentence has been inserted at the end of 5.5 to make it clear that the technical potentials synthesised in 5.5 and sub-sections cannot be achieved without the proper mechanisms in place, both governance and market-based for carbon. However please note that there are no significant carbon markets in place currently in the world that would facilitate carbon trading at scale--the EU ETS being largely now downsized under the second phase of the KP. We mention the performance based payments under the UNFCCC structure, such as the GCF.

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30729	4	1	7	7	Please reorganized the content of the summary following the order in the full chapter. It is a bite confusing when the summary provide more information on mitigation than adaptation. Please make a balance . It is alike the chapter is more talking about food systems mitigation than adaptation. Moreover less info is on food security!!! Take this seriously [Constant Labintan, Benin]	Accepted, the ES follows the same order as the chapter.
30631	4	1	7	7	The executive summary frequently reports statements of medium evidence and/or medium agreement. If it is not possible to refrain completely from such statements, please rephrase using a conditional tense and include the conditions that surround such statements . [Lorenzo Giovanni Bellù, Italy]	Accepted, removed some statements of medium confidence. Added caveats and conditional tense to some other statements
30633	4	1	7	7	None of the tables in the executive summary is cross-cited inside the text. Do you need them? If yes, please give a cross-reference inside the text and name the references [Lorenzo Giovanni Bellù, Italy]	Accepted, tables removed
21693	4	1	7	7	Negative impacts of development of bioenergy as means of emissions mitigation on food security should be emphasized [Mustafa Babiker, Saudi Arabia]	Accepted, negative impacts and competition for land from mitigation strategies included
13811	4	1	7	7	Overall, I think the executive summary is not affirmative enough on the key findings and conclusions from the assessment and synthesis of the full chapter. This is partly because the full chapter itself is mainly an inadequate review of literature instead of an assessment and synthesis of reviewed literature that distills out important messages and conclusions. To improve the executive summary, the main body of text will need to be improved too. Please previous comments on the whole report above [Sunday Leonard, United States of America]	Accepted, we have rewritten the ES and strengthened the statements
21149	4		7		The Executive Summary does not mention competition for agricultural land between food crops and crops to provide biomass for fuel, biochar, timber for construction or afforestation. This is very important; it is explicitly called for in the scope: "The influence of land based mitigation options on food and nutritional security". Suggest a new paragraph eg on page 5 after row 12, with this summary sentence "Increased demand for biomass, either to replace fossil fuel or for CDR technologies, could have strong adverse impacts on food prices and food security". (Based on page 78, rows 15-17). (Figure SPM 3b in the SPM is helpful and appears to illustarte this point, although in an unquantified way). [., United Kingdom (of Great Britain and Northern Ireland)]	Accepted, competition for land between food and bioenergy now explicitly mentioned in ES
40687	4		7		I suggest to use levels of confidence as much as possible in ES and SPM, rather than evidence and agreement. [Valerie Masson-Delmotte, France]	Accepted, confidence language used appropriately
11469	4	1	164	26	The UNCCD SPI welcomes the significant progress made on Chapter 5. This SOD has been completely re-organized compared to FOD Chapter 5. Although the total length is very similar to the FOD version, one section of the FOD has disappeared, while some have been extended. Some sections have been put in a unique section. On the whole, the UNCCD SPI reviewers consider that this reorganization benefits the entire document. We encourage efforts to ensure consistency among the chapters resulting from these improvements. [Jean-Luc Chotte, France]	Noted. Thank you
11471	4	1	164	26	General: This chapter of the SOD has been completely re-organized. Although the total length is very similar to the FOD version, one section of the FOD has dispeared, while some have been extended. Some sections have been put in a unique section. On the whole,this re-organized benefits to the document [Jean-Luc Chotte, France]	Noted. Thank you.
17877	4	12			Climate change is affecting food production through changes in CO2 concentrations as well as other atmospheric pollutants such as ozone and black carbon (5.2.1. p 17, line 14-26). [Quentin Lejeune, Germany]	Accepted, added other GHGs and SLCPs to ES

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23233	4	20			replace such as the Hindu- Kush Himalayas with like the Hindu-Kush Himalayas [Elizabeth Diego, Kenya]	Noted. Setence has been deleted
27157	4	23			ES Table 5.1 gives the impression that impacts on crop yields will change linearly with temperature on a global scale, so that a +1°C change from today to a 2°C world would have the same effect as a change between 2.5 und 3.5 or 5 and 6°C GMT rise - which surely can't be the intention of the authors. Please revise this table and paragraph. [, Germany]	Noted, table has been deleted
12465	4	24		29	Immediately pairing the naming of a process / impact with the magnitude of its change should be implemented to the extent possible as this will strengthen the messaging. [Hans Poertner and WGII TSU, Germany]	Accepted, added magnitudes in ES
23235	4	25			in water resources as there should be a mention of effects on surface water as there is a mention of ground water levels [Elizabeth Diego, Kenya]	Accepted, added both surface and ground water
12463	4	34			Not clear what "nutrient status" refers to in term of environment, availability of nutients? [Hans Poertner and WGII TSU, Germany]	Noted, sentence has been removed
21151	5	7	4	8	Some of the examples in brackets don't appear to be examples of diversity; can this sentence be made clearer? Is the argument in fact for systems more tailored to local circumstances? [, United Kingdom (of Great Britain and Northern Ireland)]	Accepted, text changed
15255	5	1	5	11	Saleemul Huq (2019) articulated an aspect of transformational approach for addressing the adaptation in Bangladesh [Md Hossain, Australia]	Rejected. This article is about coastal adaptation not about food systems
15267	5	1	5	11	Saleemul Huq (2019) articulated an aspect of transformational approach for addressing the adaptation in Bangladesh for addressing food security issues which is well and truly relevant globally. He says, 'in order to anticipate and prepare for the inevitable displacement of millions of citizens in the low-lying coastal districts, we will need to invest in a dozen towns away from the coast to make them both climate resilient and migrant-friendly towns that are able to absorb up to a million migrants each so that young girls and boys from coastal areas can be educated and skilled up to get better paying jobs in towns rather than becoming farmers and fishers like their parents. This strategy will also relieve the pressure on Dhaka which would not be able to absorb another 10 million climate migrants over the next decade. It also speaks to the most important part of making Bangladesh an example of transformational adaptation, namely building the adaptive capacity of all our young and future citizens'. Certainly, with education and creating jobs away from agriculture and fisheries sectors for new generation would one way to coastal regions' food security from the demand side point of view. For more see www.Dailystar/oped/ Dhaka, 1 January 2019 [Md Hossain, Australia]	Rejected. This article is about coastal adaptation not about food systems
5127	5	2	5	2	We were unable to trace which parts of 5.2.4 were cited and request clarification or modification of reference. [, Japan]	Noted. ES has been rewritten and sections updated
21381	5	3	5	4	Simpler: "Effective adaptation strategies could reduce or even avoid...". [Andy Reisinger, New Zealand]	Accepted, text changed
6379	5	3	5	12	This is the only point in the ch. 5 summary that explicitly deals with adaptation. It is comparatively weak compared to the next 5 points on mitigation. Another point should be added on specific best practices for adaptation such as ecosystem-based adaptation, community-based adapatation, and transformational adaptation. In addition, there should be greater elaboration on limits to adaptation (e.g. limits are already being experienced, and will increase with warming) and risk management. [, Gambia]	Accepted, Adaptation discussion has been expanded in ES

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Comment No	From Page	From Line	To Page	To Line	Comment	Response
6381	5	3	5	12	It would also be good to already allude to integrated climate agricultural practices as adaptation measures that also have mitigation potential [5.6.3] [ Gambia]	Accepted, integrated agricultural practices are explicitly mentioned in ES
11623	5	3	5	12	“By formulating effective adaptation strategies, it is possible to reduce or even avoid some of the negative impacts of climate change on food systems”. In this paragraph, already developed drought, stress, salt and heat tolerance varieties should be addressed firstly. They have been improved by not only national plant breeding institution, but also by international an agricultural research organization like CGIAR, with its 15 center like IRRI, CIP, ICRISAT, ICARDA, IITA etc. (A HIDDEN HERO OF WORLD AGRICULTURE ECONOMY: CGIAR; <a href="http://nacikgoz.blogactiv.eu/index.php?s=cgiar">http://nacikgoz.blogactiv.eu/index.php?s=cgiar</a> ), Their genetic improvement activities for nitrogen use efficiency, abiotic stress tolerance, disease and pest reduction and yield and yield stability etc. are the main subject for reducing of the negative impact of climate change food systems. Actually these themes should be put forward by SPCCCL. In case, keeping them outside of the report, it would be not left too much to recommend to the decision makers. [Nazimi Acikgoz, Turkey]	Accepted, added
14811	5	5	5	8	This is the exact same sentence as in section 5.3.1.2. 'Diversification', just that somehow the evidence is now robust and the agreement high whereas in the respective chapter it was only medium evidence and medium agreement. As explained in my comment below, I think the sentence needs to be changed to: Diversification of many components of the food system is a key element for increasing performance and efficiency that may translate into resilience and reduced risks...(medium evidence, medium agreement). [Katharina Waha, Australia]	Accepted, sentence rewritten. Confidence level is medium
13569	5	5	5	8	It is recommended that gender and equity be integrated here as the main theme of these statements is to increaseresilience and reduce risks. Women, especially in the developing countries most often play a greater role in attaining food productivity and security. [Lourdes Tibig, Philippines]	Accepted, bullet on gender and equity now included in ES
33039	5	5	5	8	The report has to acknowledge the ‘many’ alternative pathways that can increase resilience, suggested here –‘increasing agrobiodiversity, using indigenous knowledge and local knowledge, and developing local food systems’ are intertwined pathways reflecting agroecological practices and community based resource use knowledge which co-evolves with agricultural and climatic conditions. It is essential that these ‘pathways’ are identified for their commonalities, their differences and rightly acknowledged with the terms. Agroecology encompasses use of agrobiodiversity, community based knowledge and developing appropriate food system based on local needs and resources. The report should acknowledge agroecology for what it encompasses, and others such as indigenous knowledge and local knowledge for their roles. [Neeraja Havaligi, United States of America]	Accepted, agroecology is now included in two ES statements
17881	5	5	5	8	The examples listed in parenthesis for "diversification of many components of the food system" do not necessarily detail "diversification" activities or at least, the diversification aspect is not clear. Specifically "indigenous knowledge and local knowledge" and "local food systems." [Quentin Lejeune, Germany]	Accepted, text changed
17885	5	5	5	12	"diversification" (of intensively managed systems and production systems) are explored in Cross-Chapter Box 5, which should also be referenced here. Especially as links to section 5.3 (on adaptation) and 5.6.3. (on integrated agricultural practices) are weak. [Quentin Lejeune, Germany]	Accepted, added reference to Cross-Chapter Box 5

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6453	5	6	5	8	in the list contained between brackets, agroecology should be added, on the basis of the HLPE report on agroecology for example. [Sara Lickel, France]	Accepted, agroecology is now included in two ES statements
28423	5	7	5	7	Not necessary to include the word "knowledge" in the first place, as it would be a repetition in conflict with the established term Indigenous and Local Knowledge (ILK). [Barron Joseph Orr, Germany]	Accepted, text changed
5129	5	8	5	8	The confidence level and agreement level of this sentence (robust evidence, high agreement) seem not to correspond with that in P5-45, Line 2 (medium evidence, medium agreement). [Japan]	Accepted, updated to medium confidence
23397	5	8	5	11	Differences between regions is a crude approach. The best approach to such differences to capture different land types, climate types, agro-ecologies and socioeconomic conditions, and farming patterns and livelihoods would be to recognise and incorporate the FAO/World Bank Farming Systems and Poverty classification and map of 72 farming systems in the 6 developing regions (Dixon, Gulliver, Gibbon 2001 Farming Systems and Poverty, also on FAO website in multiple languages. This recommendation applies to other parts of the report. [John Dixon, Australia]	Accepted, sentence removed
13063	5	10	5	10	For a review on the evidence of cash transfers and impacts on nutrition, see Fenn (2018): <a href="http://www.cashlearning.org/downloads/user-submitted-resources/2018/06/1529400438.WFP-0000071735.pdf">http://www.cashlearning.org/downloads/user-submitted-resources/2018/06/1529400438.WFP-0000071735.pdf</a> . The Cash Learning Partnership (CaLP) also has a number of resources: <a href="http://www.cashlearning.org">www.cashlearning.org</a> [Kristi Tabaj, United States of America]	Accepted, this reference now cited in Enabling Conditions section
21383	5	10	5	11	The last clause is both clumsy and frankly not far away from trivial - see if you can turn the whole sentence around to offer something of value that has not been said several times in previous IPCC reports. [Andy Reisinger, New Zealand]	Accepted, sentence removed
17713	5	13	5	13	As the food system related emissions cut across sectorial emission inventories (e.g. AFOLU, transport, industry), it would be good to provide a footnote or suchlike, to avoid misunderstandings. [Sweden]	Accepted, this is now clarified
13065	5	13	5	13	Although Section 5.1.2.2 is titled "Status of food insecurity," this section is really about nutritional status. The title should be modified to reflect this or the title retained and the discussion expanded to include a summary of the evidence in Table 5.1. [Kristi Tabaj, United States of America]	This comment is misplaced for the ES. Status of food security and linkage to malnutrition is discussed in Section 5.1.2.2
21385	5	13	5	17	"is estimated to account for ...". Also make clear whether this is up to retail stage, or all the way to consumption (i.e. consumer transport, storage, cooking). Please express the table in Gt rather than (or perhaps in addition to) percentages. [Andy Reisinger, New Zealand]	Accepted, clarified that it includes all the way to consumption. Table removed from ES but included numbers in Gt and % in table in section 5.4
27161	5	13	5	18	It is surprising to see how large the "supply chain" emissions are compared to the LULUCF and crop/livestock emissions in Table 5.2. To avoid misunderstandings, please spell out exactly what is included in which category in the table itself. Currently it is not clear at first sight whether, e.g., fertilizer production is counted as "other supply chain" or "crop system". Please also specify in which category "food loss" is incorporated. It may also be helpful to separate "crop" and "livestock", given the emphasis on dietary change in other parts of the chapter. If this table is kept, it would help to expand the categories to give some more detail that allows the reader to understand the individual contributions. [Germany]	Accepted. We added some clarification on what is included in each category of the Table in object. Note however that the AR5 indicated emissions from food systems outside of the farm gate as 18%. The current chapter has done nothing but put together this estimate with current estimates from AFOLU (about 20%), i.e., that emissions outside of the farm gate are of the same order of magnitude as those within the farm gate. Indeed, emissions for manufacturing of fertilizers are NOT considered to be within the farm gate-- following the practice in national ghg inventories. Note also that it is not easy to separate crop and livestock for the sake of reconstructing the analysis to diets, as a good 50% of crops overall are grown to feed livestock.

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Comment No	From Page	From Line	To Page	To Line	Comment	Response
11625	5	13	5	25	Crop and livestock activities should be separated in this paragraph and Table 5.2. Emissions from crop and livestock activities differ quite a lot. In Figure 5.16 you expose their different impact in mitigation and adaptation. We have to emphasize the share of livestock. It would be helpful to support attempts for rapid improvements on cultured meat in vitro, which have lower environmental impact than livestock. It seems to be quite promising and in FAQ 5.2 has been mentioned "In high-income industrial countries, there is scope for reducing meat consumption with tangible environmental benefits". [Nazimi Acikgoz, Turkey]	Rejected. They are already treated separately in the two subsections 5.4.2 and 5.4.3, where the relevant information linking to diets can be obtained. Here we intend emissions from crops and livestock as those corresponding to the category "agriculture" as an economic sector as well as a category of the national ghg inventory. Note that 2/3 of these emissions are in fact emissions from livestock already, without considering that about half of crop production is used as feed for livestock.
11627	5	13	5	25	Actually SPCCCL should advise to governments to develop new strategies and policies for food security. For example EU has already started to support "Modelling Adaptation to climate change in agricultural systems". The scope of this theme includes determining adaptation options to climate change and increased climatic variability throughout the whole food chain, including market repercussions; adapting seeds and breeds through conventional and modern breeding and biotechnology; improved management practices for land use; water in agriculture; soil management; and adapting markets, institutions and insurance mechanisms. Alternative meat sources like cell-cultured meat global demand for animal protein consumption is increasing. Cell-cultured meat in vitro will have lower environmental impact than livestock. Considering animal health and welfare and to address climate change this potential must be put in the research agenda of every nation. SRCCCL should also recommend to governments to reorganize their manpower and infrastructure for an effective agricultural research and food systems like Brazil did. Brazil has already established its EMPRAPA (Brazilian Enterprise for Agricultural Research) for all future national research activities by bringing together their federal and state experiment stations, including universities. Genetic engineering has steadily advanced, resulting in new scientific opportunities. 'Traditional' methods, using heavily criticized antibiotic or herbicide resistance markers have been replaced by new methods which result in marker-free GMOs. Studies have demonstrated that genetically modified plants are as safe as plants grown by conventional methods (EASAC, 2013). It has been suggested that transgenic plants (carrying genes from other species) should be distinguished from cisgenic ones (which do not carry an alien gene) in regulatory terms. But they are numbers of transgenic crop species grown 15% of world's cultivated land. Genome editing, also called new breeding techniques are new methods of genetic engineering that give scientists the ability to more precisely, lower costs and more flexibility in their use, genetically modify crops and animals. With this method, researchers can enhance or silence or insert or remove desired traits. So breeding a new variety/genotype takes quite short time compared to the conventional breeding. Genome editing has the potential to replace mutagenesis by irradiation or chemical treatment, which has been frequently used in breeding for 70 years. In these methods, there is no transfer of any gene from outside like there is in GMOs. On the contrary, new genotypes are created by changing the target gene with the help of transient DNA-cutting enzymes. This application can increase or decrease the effect of gene. We can call this process artificial micro-mutation. If SRCCCL won't emphasize their necessities for breeding new genotype to mitigate impact of	Accepted. The Chapter considers adaptation in the whole food change, improved breeding and biotechnology, SLM, and markets, institutions and insurance. Also includes alternative meat sources, new genetic techniques, and the food system approach for research.
6167	5	18	5	18	In the table, the sum of the columns "crop & livestock", "land-use and LU change" and "supply chain" is not equal to the column "entire food system" [Benjamin Sultan, France]	Noted. Table deleted
5131	5	18	5	18	We were not sure how these values in Table 5.2 and Table 5.5 in P5-53 were estimated. Request further description of the sources of these values. [, Japan]	Noted. Table removed in ES. Emissions section revised
17715	5	18	5	18	It might be better to leave the table into the chapter text, rather than bring this much detail into the Executive Summary. [, Sweden]	Accepted. Table deleted.
12135	5	18	5	18	Can numbers for crop and livestock be listed separately? [Hans Poertner and WGII TSU, Germany]	Repeat of 11625



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Comment No	From Page	From Line	To Page	To Line	Comment	Response
14701	5	18	5	19	I suggest modifying Figure 5.1 in such a way that the words 'Adaptation' and 'Mitigation' are read in a single line. Do not use: Adapt- ation Mitig- ation [Adalberto Benavides-Mendoza, Mexico]	Comment appears to be misplaced. Figure 5.1 has been updated. Adaptation and Mitigation now in single line
13797	5	18	5	19	Why doesnt the low estimate of ES Table 5.2 add up to 30 and the high estimate add up to 50. The reason for this should be provided so that the reader is not left confused. [Sunday Leonard, United States of America]	Noted. Table deleted
30635	5	18	5	20	Regarding table ES 5.2: 1) what is the source?; 2) the activities of the three last rows are presumably sub activities of the "entire food system", correct? If yes please specify. Also if yes, why the numbers of these activities do not add up to those under "entire food systems"? 3) as we speak there are no official statistics on how high food losses and waste are. So how do you know how high their GHG emissions are? and to what exactly do these emissions refer to? to producing what is lost and wasted? to use land? to transport it? please specify [Lorenzo Giovanni Bellù, Italy]	Noted. Table removed in ES. Emissions section revised
8175	5	19	5	20	In the sentence «Contributions from food loss and waste are included in these estimates and may account for 8-10% of total GHG emissions from all sectors.» it seems a bit unclear. I suggest to use the phrasing at p.73 line 12 ; «8-10% of total anthropogenic greenhouse gas emissions». [Harold Leffertstra, Norway]	Noted, sentence and table have been removed in ES. FLW emission revised and clarified in Chapter
13799	5	19	5	20	This is unclear. How are contributions from food loss and waste included in the estimates? In which of the activity were they included? Why cant they be included separately? If difficult to include separately, please explain why [Sunday Leonard, United States of America]	Noted, sentence and table have been removed in ES. FLW emission revised and clarified in Chapter
21153	5	21	5	21	What are the relative contributions of population growth v diet change towards greater consumption of animal-based foods etc towards increasing GHG emissions? [, United Kingdom (of Great Britain and Northern Ireland)]	Rejected. If we take the Tillman and Clarke projection of 100% more production (food and feed) between 2010-2050, and population growth projected at that time (7-9.3bn; ~33%) then it suggests about 3x more growth due to increasing wealth than population alone. But this is highly uncertain so not included in the Chapter.
24875	5	21	5	24	The claim that food system emission are growing globally due to increasing population and demand for food appears to be weakly grounded in literature. Complex web of factors account for food system emission increases. As a result it is better to conclude that inefficiencies within the food system account for increasing emission in the sector rather than singling out population increase as the major cause. [Justice Issah Musah Surugu, Germany]	Accepted, deleted population
5387	5	21	5	25	Wouldn't it be good to mention the adverse health effects of some of these food trends? There is good evidence that too high consumption of red meat, saturated fats and sugar have strongly negative health consequences (and climate-change mitigation benefits, if healthier eating is adopted). I have noted that these potential synergies are mentioned below, but this key message could be alluded to also here. [Helmut Haberl, Austria]	Noted. Health is included in later statement
6455	5	27	5	27	on carbon sequestration, some limits should also be added, such as the question of non permanence, the potential risk of shifting food production to cultures that are targeted towards carbon sequestration, compromising food security in such ways (for reference, see Dooley et al, 2018, Missing pathways for 1,5°C: <a href="https://www.climatelandambitionrightsalliance.org/report/">https://www.climatelandambitionrightsalliance.org/report/</a> [Sara Lickel, France]	Accepted, added limits on carbon sequestration.

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5133	5	28	5	29	Suggest revision from "applied by farmers, processors, and retailers, etc.)" to "applied by food system actors (farmers, processors, and retailers, etc.)" in order to maintain consistency between Executive Summary and cited phrase. [, Japan]	Noted. Sentence deleted
21387	5	28	5	30	The "can" is rather a cop-out here since they "can" also do the opposite. Split the sentence into two, one saying "Supply side options can be directly applied... and lead to a reduction of total emissions. Under appropriate policy interventions, they can also contribute to (rural?) livelihoods and help countries move towards sustainable land management (or should this be "meet sustainable development objectives?)." [Andy Reisinger, New Zealand]	Noted. Sentence deleted
28425	5	29	5	29	Remove the parenthesis [Barron Joseph Orr, Germany]	Noted. Sentence rewritten
21389	5	30	5	35	Why give two different years for cropping and livestock systems? Also, how do those numbers compare with (and potentially depend on) projected baseline emissions in those years? And are cropping and livestock mitigation potentials additive? What is the carbon price at which those mitigation potentials can be realised? The AR5 found a mitigation potential of up to 4.6 Gt at a cost of USD100, so is this assessment now saying that in fact the agricultural mitigation potential is significantly greater than assessed in the AR5? A lot more work and clarity is needed here, since this is a key conclusion. Also, it is notable that there is no mention of novel technologies (methane and nitrification inhibitors, vaccine, targeted breeding of low-emissions animals etc) - looking out to 2050 it seems strange to not even mention the potential for such technologies here as they could make a major difference in the long term. [Andy Reisinger, New Zealand]	Accepted. Sentence edited for improved clarity. No additional info with respect to the AR5, in fact this is a summary of AR5 findings., Carbon prices stated in the text. Novel technologies are mentioned in the specific sub-section, with edits to include those specified by this reviewer.
32863	5	30	5	35	List other types of options beyond high-tech ones like breeding for root systems or biochar. See Dooley et al (2018) and agroecology literature for examples of mitigation options that are practices. [Doreen Stabinsky, United States of America]	Variety of options listed, cited Dooley
13801	5	30	5	39	It is important that the options listed here reflects all of the options in the main text. Brief explanation of the options will also be useful in the executive summary, if we want the executive summary to be standalone [Sunday Leonard, United States of America]	Rejected, we list the options with the largest mitigation potentials
23793	5	31	5	31	water and irrigation management may also be included as one of the GHG mitigation contributor [, India]	Accepted, added
25273	5	31	5	31	water and irrigation management may also be included as one of the GHG mitigation contributor [Naresh Kumar Soora, India]	Repeat of comment 23793
2939	5	31	5	32	There are inter-relationships between options for GHG mitigation in cropping systems including improved land and fertiliser management, biochar applications, breeding for larger root systems, and bridging yield gaps. For example, the first two measures (improved land and fertiliser management, biochar applications) can directly be "breeding for larger root systems, and bridging yield gaps." Therefore, it is recommended to reconsider the options in these sentences. [Kun Cheng, China]	Accepted, specific options removed. Broad categories provided
23399	5	31	5	33	ADD conservation agriculture [John Dixon, Australia]	Noted. Conservation agriculture included in later ES statement
8177	5	33	5	35	The use of 2 different years – 2030 and 2050 – makes comparison difficult. And are the reductions compared with today's emissions or emissions in 2030 resp 2050 according to baseline? Please clarify. [Harold Lefferstra, Norway]	Accepted. Text has been edited to more closely adhere to the original AR5 findings. There is now no need to talk about crops and livestock separately in this sentence

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Comment No	From Page	From Line	To Page	To Line	Comment	Response
21391	5	36	5	38	Isn't the simple key constraint that reductions in emissions intensity only reduce absolute emissions if total production is constrained? I can easily envisage a system that moves to fewer animals at constant pasture area, but animals are bigger and receive supplementary feed so that total emissions increase; also with a reduction in pasture area, it depends on the livestock system and the balance between pasture and supplementary feeds. In the end it comes down to whether total production can go up as emissions intensity comes down (in which case absolute emissions may not reduce and could even increase), or whether total production is constrained so that any gains in emissions intensity translate into reduced absolute emissions. [Andy Reisinger, New Zealand]	Accepted, changed sentence to include "as long as total production is constrained"
21393	5	38	5	39	The numbers 4.27-21.5 Gt seem out of whack. If Agroforestry sequesters 20 Gt per year every year this would have major implications for the way food is (or rather, isn't) produced - this must be mentioned otherwise the numbers are extremely misleading. [Andy Reisinger, New Zealand]	Accepted, units were incorrect. Agroforestry now included in AFOLU.
30083	5	38	5	39	Agroforestry mitigation potential is 4.27 to 21.5 GtCO <sub>2</sub> per year? This is a huge number, without any reference to literature in section 5.5.1. We do not know of any study that shows such a big number. Also it is inconsistent with other parts of the report (see other comments). [., Netherlands]	Repeat of 21393
8179	5	39	5	39	The interval of the mitigation potential, 4.27–21.5 GtCO <sub>2</sub> -eq yr <sup>-1</sup> seems quite wide and lacks information about which year [Harold Leffertstra, Norway]	Repeat of 21393
40695	5		5		Is it possible to separate plant based crops and livestock here? And is there an equivalent of a Kaya equation for food (= population x wealth/ capita x food / wealth unit x emissions / food unit)? This could be interesting to deconstruct drivers of trends as done for GHG emissions (population, growth and consumption, carbon intensity of energy, energy per unit of growth). [Valerie Masson-Delmotte, France]	Rejected, data are not available to separate crops and livestock. Kaya equation great idea but beyond the scope of chapter
12937	5	32	6	19	There is no agreed conversion to generate GtCO <sub>2</sub> -eq per year (note elsewhere in the report this is written as "GtCO <sub>2</sub> eq yr <sup>-1</sup> " or "GtCO <sub>2</sub> e per year"). For instance the methane metrics in IPCC AR5 WG 1table 8.7 vary by a factor of 20. It would be more scientifically accurate if CO <sub>2</sub> , methane and N <sub>2</sub> O mitigation were quoted separately, rather than aggregating them in the controversial (and undefined in the report) CO <sub>2</sub> eq. [William Collins, United Kingdom (of Great Britain and Northern Ireland)]	Accepted, gases are now disaggregated

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Comment No	From Page	From Line	To Page	To Line	Comment	Response
5333	5	1	11	46	<p>This chapter is very well written and analysed various dimensions of food security as well as causes of food insecurity.</p> <p>I have ,however, few observations:</p> <p>5-5: Emphasis should also be on the impact of productivity decrease on food prices.For instance high production of a food item; wheat, potatoes, onions etc. Causing decline in market price of commodity, input costs more than the price farmers receive, causing farming distress, particularly in some parts of India, leading farmers into debt trap, and in some cases farmers commits suicides.</p> <p>Food insecurity is also associated with farmers behaviour. In Indian context if a farmer feels that the price of onion is high this year, next year the whole cultivable land will be devoted for opium( or any other crop) leading to glut in the market causing decline in the market price leading to distress. In such scenario it is just not possible to understand actual production of food items.</p> <p>Another aspect is related with cultivation of certain crops like COTTON in areas not suitable geographically ,but since farmers feel the cotton production pays more money, they borrow loan from banks and cultivate cotton in geographically unsuitable regions,with slight fluctuation in weather conditions, crop is lost, causing terrible mental distress.There are also important health related issues. In some parts of Punjab state ignorant farmers use chemicals and pesticides in high quantity for high productivity, this has caused the incidence of cancer in the state , and Cancer Train comes every month from Mumbai, tours this region and treat cancer patients.This is a various situation.</p> <p>While discussing malnutrition,the chapter must also incorporate undernutrition due to lack of QUANTITY OF FOOD , as the lack of quality of food causes malnutrition.</p> <p>From many areas in India particularly mountainous regions , for instance Kumaon and Garhwal Himalaya, farmers are migrating to towns as agriculture is not viable.</p> <p>Figure 1. should also depict food insecurity.</p> <p>IT WAS BECAUSE OF SUCH FARMING DISTRESS IN INDIA THAT SEVERAL STATE GOVERNMENTS HAVE RECENTLY ANNOUNCED WAVING OF FARMING LOANS.</p> <p>I hope the chapter 5 on Food Security may take note of the above comments.</p> <p>1.Green revolution and the cancer train in Punjab - World News Report</p> <p><a href="http://worldnewsreport.in/green-revolution-and-the-cancer-train-in-punjab/">worldnewsreport.in/green-revolution-and-the-cancer-train-in-punjab/</a></p>	Partly accepted, food prices are now included. Farming distress in India is included. Social and cultural behavior taken into account in socioeconomic sections. Chapter documents effects in mountain regions in India. See glossary for comprehensive definition of malnutrition. Some other comments beyond scope of chapter.
29677	5	3		12	<p>There are no explicit mentions of good examples to adaptation. One could add the SIDS-specific example given in Box 5.5 (p. 48) on community-based adaptation strategy for food security on Yap Island in the Federated States of Micronesia. This would also help to address the extreme lack of information relevant to small island states in terms of food security. [, Saint Lucia]</p>	Accepted, added SIDS to ES
12469	5	3		12	<p>Can limits to adaptation be quantified / qualified for different food systems, regions, examples, also in relation to the degree of climate change? Pairing this with an assessment of risk, e.g. burning ember approach and a narrative quantifying / quantifying the risk transitions would be most useful. [Hans Poertner and WGII TSU, Germany]</p>	Accepted. Food security pillars now represented in burning embers figure
23303	5	4			<p>The header statement is only partly supported by the following text.. In particular there is no support text on how climate change impacts on food systems. [Mark Howden, Australia]</p>	Accepted, discussion on Adaptation has been expanded
29679	5	5			<p>The losses ensuing from reaching limits to adaptation are not mentioned. Limits to adaptation will be reached, resulting in losses (in terms of yields, income). [, Saint Lucia]</p>	Accepted, sentence removed

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Comment No	From Page	From Line	To Page	To Line	Comment	Response
23307	5	5			There are also (albeit limited) prospects of productivity increases. So rather than frame this as only negative impacts, perhaps change to a more neutral framing. [Mark Howden, Australia]	Accepted, sentence removed
23309	5	6			perhaps change to 'is a key adaptation strategy to reduce risks' [Mark Howden, Australia]	Accepted, text changed
12471	5	13		20	This is a very useful assessment as it includes the supply chain in a quantitative picture. This is then providing a good underpinning for capturing the messages from the next bullet points. [Hans Poertner and WGII TSU, Germany]	Noted. Thank you
23311	5	21			Perhaps mention that the increase in demand has been enabled by increase in supply - the two are linked. [Mark Howden, Australia]	Accepted, linked supply and demand
23237	5	34			illustration of better feeding practices should be enumerated [Elizabeth Diego, Kenya]	Accepted, added better quality feed
12473	5	37			The term "reduction in pasture area" calls for specification and context as it makes sense only with a concomitant over-proportional reduction on herd size? Can a number / magnitude be given for sustainable land use for animal herds, e.g on natural grass land and the consequences for global food supply and use, e.g. % reduction in meat consumption? [Hans Poertner and WGII TSU, Germany]	Accepted, see above
32865	5				Be judicious with the use of the word "efficient." It becomes meaningless rather easily. If you can't attach units to the efficiency, you probably either shouldn't use the word or add the units to the description. [Doreen Stabinsky, United States of America]	Accepted, deleted "efficiently"
12571	6	12	5	12	Addition at the end of the paragraph: Given the pace and scale of the dietary changes required in high-income industrialised countries to support a low-carbon budget, harder-measures to support a change in diets, such as regulation and taxation, will also be required. (Chatham House, 2015) (Chatham House (2015) Changing Climate, changing diets: Pathways to Lower Meat Consumption) [Carina Millstone, United Kingdom (of Great Britain and Northern Ireland)]	Rejected, this is policy prescriptive.
12567	6	1	6	2	Replace 'Demand-side measures, for example in food choices and consumption can help to achieve global GHG mitigation targets and improve human health' with: Demand-side measure, for example through changes in diets, will be essential to achieve global GHG mitigation targets and improve human health. [Carina Millstone, United Kingdom (of Great Britain and Northern Ireland)]	Noted. Sentence has been rewritten
27163	6	1	6	7	This paragraph does not reflect the entire discussion of chapter 5.2.2. There is clear evidence from various studies referenced in subchapter 5.2.2.1 that diets without any animal products (vegan) lead to the highest GHG reduction compared to any other diets. Does the GHG-reduction potential solely depend on the meat share of the diet? Which other aspects have to be considered? Please provide a more comprehensive discussion of this issue. Furthermore it would be helpful to clearly state the differences of the diet categories (e.g. the reader might be confused why a flexitarian (normally meat/fish at some occasions) diet is less GHG-intensive than a vegetarian diet (normally without any meat)). Please see also our comment on SPM-22-10. [, Germany]	Accepted, removed specific names of diets

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Comment No	From Page	From Line	To Page	To Line	Comment	Response
13803	6	1	6	7	Several publications were reviewed on this topic in Section 5.5.2.1 but the final main finding that makes it here to the executive summary does not seem to reflect the aggregated findings from the many reviewed literature. What is the reason for this? I would have thought that the findings of the reviewed publications will be synthesized and a conclusion drawn for the executive summary based on the agreement and otherwise between the reviewed publications. [Sunday Leonard, United States of America]	Accepted, ES statement rewritten
30449	6	1	6	12	Assessments of various diets and their impact on GHG emissions are based on the assumption that one can choose their diet, or in other words they're seen from the point of view of wealthy consumers in industrialized countries. It is important to highlight that choosing one's diet is not an option for a large part of the population and that in many countries and agroecosystems, a nutritious enough diet does include animal source food. In addition, the analysis of various diets and their GHG emissions are all based on kcal and protein intake. They don't look at the whole nutritional balance of the various diets, in particular iron, calcium, zinc, vitamin A and vitamin B12. This statement should be rated as moderate evidence as 1) there is so far only one study looking at at range of micronutrient and 2) no "feasibility" aspect of changing diets has been studied, in particular when it comes to costs of products, incomes and access to markets. In addition, no mention is made of the low carbon livestock initiatives already implemented by the producers and the processors with support of research and academia. See France, Ireland, Italy, UK, and the regional initiative with governments in Latin America (last intergovernmental meeting of CODEGALAC) [Anne Mottet, Italy]	Accepted, added caveat
28427	6	1	6	12	Justify all text in this paragraph. [Barron Joseph Orr, Germany]	Accepted, fixed justification
6457	6	1	6	19	Those parts are extremely important and must be kept in the final version. [Sara Lickel, France]	Noted. Importance of dietary change and reduction of food loss and waste is included in ES
12569	6	2	6	2	Add after the introductory sentence to the paragraph: The most effective dietary change mitigation scenario consists of adopting a largely plant-based diets, limiting animal-source foods to non-ruminant meat and eggs from livestock produced solely from feed that does not compete directly for arable land with human edible crops: unavoidable food waste and by-products (Van Zanten et al. 2018) (Van Zanten, Hannah H. E., Mario Herrero, Ollie Van Hal, Elin Rööfs, Adrian Muller, Tara Garnett, Pierre J. Gerber, Christian Schader, and Imke J. M. De Boer. 2018. 'Defining a Land Boundary for Sustainable Livestock Consumption'. Global Change Biology 24 (9): 4185–94. <a href="https://doi.org/10.1111/gcb.14321">https://doi.org/10.1111/gcb.14321</a> .) [Carina Millstone, United Kingdom (of Great Britain and Northern Ireland)]	Accepted, ES statement describing dietary change rewritten. Van Zanten et al is cited
154	6	3	6	6	it would be useful if the GtCO2-eq yr-1 could also be expressed as estimated % of total global GHG by 2050. [Tommy Wiedmann, Australia]	Rejected, beyond scope. Not available in current literature.
21395	6	4	6	4	"ranging from" -> "is estimated to range from" [Andy Reisinger, New Zealand]	Noted, sentence has been deleted
23313	6	4	6	6	The use of 'healthy' here and elsewhere implies that the alternative diets listed are 'unhealthy' (and there is good evidence to the contrary in relation to the Mediterranean diet). This needs either a new name or at the least placed into inverted commas. The terminology etc of the different categories also is confusing – following the logic of the text, why should a diet with 'limited meat and dairy' be more mitigation-friendly than a vegetarian one? [Mark Howden, Australia]	Accepted, removed specific names of diets
12137	6	4	6	10	As some readers might only have a vague idea of the diets mentioned in this paragraph, explanations might be helpful. [Hans Poertner and WGII TSU, Germany]	Accepted, removed specific names of diets

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Comment No	From Page	From Line	To Page	To Line	Comment	Response
13805	6	5	6	5	I am struggle with the use of "healthy diet" in the sentence. what is the definition of healthy diet and what food make an healthy diet and is there scientific consensus on this? Does it mean that other diet such as mediterranean and vegetarian and flexitarian are not healthy? I suggest changing this to a neutral name that doesnt bring in the debate about healthiness of other options. [Sunday Leonard, United States of America]	Accepted, removed specific names of diets. Healthy and sustainable diets defined
21397	6	9	6	10	I feel the clause about developing countries it too general and too timid. Meat consumption in many officially developing countries is rising significantly, with all the familiar health problems of the upper middle class. The authors should seek to provide more policy-relevant nuance here, while fully recognising that the issue and the potential is different from developed countries where meat overconsumption is much more prevalent. [Andy Reisinger, New Zealand]	Accepted, added clearer statement about issues in developing countries
120	6	9	6	10	and due to high levels of protein deficiency in developing countries any reductions in meat-based diets need to be replaced with viable alternatives. [Sharelle Polack (nee Hart), Switzerland]	Accepted, added caveat
13807	6	10	6	10	not sure if the word "may" should be in this sentence. I think overall, it is known and agreed that there is a limited scope for reducing consumption of high-meat based diets in developing countries. Instead, efforts are needed to provide sustainable protein to many who lack this in this part of the world [Sunday Leonard, United States of America]	Noted, sentence has been rewritten
13809	6	11	6	11	I do not think awareness raising campaigns can be called a policy in itself. Suggest that the sentence be rephrased as follows: To encourage low-carbon diets, effective policies in public procurement and health insurance incentives as well as awareness-raising campaigns have been tested in differing contexts. [Sunday Leonard, United States of America]	Accepted, added sentence to ES
27165	6	13	6	19	It would be very interesting for policy makers to be informed about options to reduce food waste (technology- and policy-wise). We therefore suggest raising some approaches to reduce food waste across countries from 5.5.2.4 to the executive summary and also to the SPM, and to discuss this issue in more detail (see our comment on 5.5.2.4). [Germany]	Accepted, added
28467	6	13	6	19	It would be worth noting that the causes of food waste differ substantially between developed and developing countries [Valerie Kapos, United Kingdom (of Great Britain and Northern Ireland)]	Accepted, added
21155	6	18	6	18	should this say 'help compensate'? Can it fully compensate (now and in future)? [United Kingdom (of Great Britain and Northern Ireland)]	Accepted, added
21399	6	18	6	19	Suggest you focus on reducing rather than avoiding, since not all food loss and waste can be avoided. It would be useful to offer a realistic estimate of how much food loss and waste could be reduced realistically and how, rather than focus on an unachievable outcome. Also the figure of 4.4 Gt seems rather precise and in contrast to the figure offered in chapter 6. [Andy Reisinger, New Zealand]	Accepted. Exact figure was deleted, with reference rather to a percentage figure representing an absolute maximum. Edited text refers now to reduction actions as suggested.
8181	6	18	6	19	Wouldn't avoiding of loss and waste also reduce emissions from animal production? This in addition to the emission reduction from less agricultural expansion? If so add; «and emissions from animal production» [Harold Leffertstra, Norway]	Accepted, added animal production
17891	6	20	6	26	Figure 5.16 on p. 76 could fit nicely in the summary to elaborate the above point. [Quentin Lejeune, Germany]	Rejected, there are no figures in ES
17983	6	22	6	22	In the corresponding section (5.6.3) the practices being referred to here are labelled 'Integrated agricultural practices' rather than 'best agricultural practices'. The reason for this change is unclear. Given the balanced account of trade-offs detailed in the main body, it may be more accurate to use 'integrated'. [Beau Damen, Thailand]	Accepted, changed to "integrated agricultural systems and practices"

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Comment No	From Page	From Line	To Page	To Line	Comment	Response
28469	6	22	6	22	Sentence implies that 'best agricultural practices' is a defined term. Is that correct? [Valerie Kapos, United Kingdom (of Great Britain and Northern Ireland)]	Accepted, changed to 'integrated agricultural systems and practices'
32869	6	24	6	25	It is not at all clear what "efficient production, trade and processing" refers to. Use more concrete examples. Avoid use of the word "efficient" here. [Doreen Stabinsky, United States of America]	Noted, text has been changed
21401	6	24	6	26	For me, this sentence deserves a paragraph on its own - the key point is that if (and perhaps only if!?) we combine supply and demand side interventions can we achieve food systems that are resilient, offer food security, and reduce emissions consistent with Paris Agreement compliant pathways. This would be a major and significant finding (given the near absence of targeted mitigation supply side policies, complete absence of mitigation demand side policies, and fractured effort at adaptation at present). [Andy Reisinger, New Zealand]	Accepted, added as major finding.
31727	6	27	6	34	Consider mention of the threat of increasing surface seal, with expanding urbanization, into actual and potential agricultural land and the impact of food security as well as reduction in carbon sequestration potential. Literature exmples: 1. Reducing the loss of agricultural productivity due to compact urban development in municipalities of Switzerland J Schwaab, K Deb, E Goodman, S Lautenbach... - ... Environment and Urban ..., 2017 - Elsevier. Globally urban growth destroys fertile soils and gers food security. Fertile soils are often located in the vicinity of existing urban areas. Thus, preserving high-quality soils can conflict with the objective of developing compact urban patterns. 2.(PDF) Rapid Urbanization and Food Security: Using Food Density ... <a href="https://www.researchgate.net/.../237477479_Rapid_Urbanization_and_Food_Security_U...">https://www.researchgate.net/.../237477479_Rapid_Urbanization_and_Food_Security_U...</a> Aug 22, 2016 - threat to all dimensions of food security, because the majority of ... In fact, in 2005, 51 percent of Africa's urban population lived in slums; ... As cities expand, prime agricultural land is converted into residential or industrial areas. For ... higher urbanization rates, countries have draw ground water and surface ..... more refs for citations are there [Elizabeth Migongo-Bake, Kenya]	Taken into account, Urban and peri-urban removed from ES. Added in Urban section
23315	6	27	6	34	The evidence in the text provides strong evidence that urban agriculture can assist (but not solve) urban food issues wth the bulk of the text dealing with this. There is very little on how GHG footprints can be lessened and essentially only two references by teh same author for the adaptation benefits of urban agriculture. Is this enough to rate a 'robust evidence, medium agreement' confidence rating ? [Mark Howden, Australia]	Taken into account, Urban and peri-urban removed from ES. Added in Urban section
13813	6	27	6	34	Please add that urban and peri-urban agriculture can also contribute to biodiversity conservation and maintenance of ecosystem services. This should also be reflected in the main body of the chapter. See further comment and suggestion of references in the main body [Sunday Leonard, United States of America]	Taken into account, Urban and peri-urban removed from ES. Added in Urban section
17893	6	30	6	31	specify that urban agriculture has benefits generally at the household level, as the greater potential for contributing to food security for large populations in cities actually lies in peri-urban agriculture, and then even, it is only as supplemental. [Quentin Lejeune, Germany]	Taken into account, Urban and peri-urban removed from ES. Added in Urban section
32871	6	31	6	32	Delete "if practiced efficiently." It is not at all clear what that might mean. See comment above on the use of the word "efficient." [Doreen Stabinsky, United States of America]	Taken into account, Urban and peri-urban removed from ES. Added in Urban section



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Comment No	From Page	From Line	To Page	To Line	Comment	Response
21403	6	31	6	33	The "if practiced efficiently" is a rather big if. In many cases, inefficiencies on the production side could far outweigh any benefits of reduced transport emissions. I urge the authors to be clearer and more careful on this to avoid misleading conclusions. [Andy Reisinger, New Zealand]	Taken into account, Urban and peri-urban removed from ES. Added in Urban section
13001	6	33	6	34	It is not clear here, or in the cited section, how urban agriculture results in evaporative cooling. [Aidan Farrell, Trinidad and Tobago]	Taken into account, Urban and peri-urban removed from ES. Added in Urban section
21987	6	35	6	48	I do not understand how emission can be higher for locally produced food in some instances? [Petra Minnerop, United Kingdom (of Great Britain and Northern Ireland)]	Noted. It depends on production system (e.g., greenhouse production can be very energy intensive)
28429	6	39	6	39	Not necessary to include the word "knowledge" in the first place, as it would be a repetition in conflict with the established term Indigenous and Local Knowledge (ILK). [Barron Joseph Orr, Germany]	Noted, text has been deleted. We use ILK
6459	6	39	6	41	Those parts are extremely important and must be kept in the final version. [Sara Lickel, France]	Accepted, ES includes ILK and agro-biodiversity
17225	6	39	6	43	Globalized food system threaten local livelihood and not just biodiversity, indigenous/local knowledge. The challenge is how do you address this challenge of globalization considering that is also a free trade issue and competitiveness. [Hoang Anh Le, Vietnam]	Noted, text has been deleted
28431	6	40	6	40	Specify what is meant with agro-biodiversity, so as to add in parenthesis immediately after agro-biodiversity (e.g. concerning large-scale monoculture of commodities) [Barron Joseph Orr, Germany]	Noted, text has been deleted
21405	6	41	6	43	add "products" before "regions and seasons". For some products, differences in production efficiency far outweigh any reductions that can be achieved by avoided transport emissions. It would be useful to elaborate on this a little since there is a lot of advocacy out there without a clear and robust evidence basis, so it would be useful for the IPCC to clarify the circumstances under which consumption of local foods is potentially a mitigation option. [Andy Reisinger, New Zealand]	Accepted, added text
21883	6	41	6	44	Avoiding long-distance food transport can reduce emissions in both urban agriculture and locally produced food, but the potentially increasing emissions (assumedly e.g. by differences in climate) are now only attributed to local food production. Is there a need to raise this issue also in regard to urban agriculture? [, Finland]	Noted, urban and peri-urban removed from ES
5135	6	43	6	44	Suggest modification of reference: {5.2.5, 5.3.3, 5.6.4} to {5.5.2, 5.7} [, Japan]	Noted, section references changed throughout chapter
17895	6	45	6	46	Enabling conditions are created not only through the markets, policies, etc. operating alone, but also the productive communication and cooperation between these channels (especially vertical or transdisciplinary cooperation). This could mean, for example, farmer participation in government structures. {5.7.3} This key cooperation is not addressed in this summary point. [Quentin Lejeune, Germany]	Accepted, added local coordination
5137	6	47	6	47	The agreement level of this sentence (medium agreement) seems not to correspond with that in P5-93, Line 7 (high agreement). [, Japan]	Accepted, changed to high confidence
17985	6	48	6	48	"...women's role in food systems..." [Beau Damen, Thailand]	Noted, text has been deleted
13055	6	48	6	48	Instead of "acknowledging women's role on food systems" state "identifying gender roles and dynamics within food systems to strengthen climate change mitigation and resilience." [Kristi Tabaj, United States of America]	Noted, text has been deleted
40697	6		6		is SLM relevant for this chapter? How to better link to SR15 (land transition, supply / demand, CRDP, conditions for ambitious mitigation etc)? There is no link with ch 3 and 4, would that make sense to touch this here or only in ch 6 - 7? [Valerie Masson-Delmotte, France]	Noted, SLM included in ES

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Comment No	From Page	From Line	To Page	To Line	Comment	Response
12485	6	45	7	7	Expanding on and differentiating the list of items outlined in this bullet point would improve the contribution of this chapter to a perspective on solution pathways. Adding more bullet points in that sense to the extent possible would be warranted. [Hans Poertner and WGII TSU, Germany]	Noted, revised Enabling Conditions ES message focuses on governance, policies, and finance
6461	6	45	7	7	add to the list of conditions: the importance played by local markets and short circuits, as well as how public policies have the power to shape those; the importance of transforming the governance in order to develop food systems linked to territories by favouring a rights-based approach, empowering local communities for the management of common natural resources. For more, see : Secours catholique - Caritas France, Supporting the agroecological transition, 2018 [Sara Lickel, France]	Accepted, added
39613	6	48	7	1	It is unclear what the effect of "acknowledging women's role on food systems in regards to climate change mitigation and resilience" would be, more specifically, with regards to earlier sections. Would it lead to better practices on the supply or demand side? Where and how specifically? [, United States of America]	Noted, text has been deleted
12475	6	4		6	The definition of diets is clearly insufficient as e.g. a Mediterranean diet is seen to be a healthy diet? [Hans Poertner and WGII TSU, Germany]	Accepted, removed specific names of diets
32867	6	13			delete the first part of the sentence. Start with "Reducing food loss and waste..." [Doreen Stabinsky, United States of America]	Accepted, text changed
12477	6	19			"Lowering GHG emissions by reducing the need for agricultural land expansion", yes, but this only means lowering the increase (!) in GHG emissions by reducing the need for agricultural land expansion, right? Isn't giving back agricultural land to natural ecosystems what is really meant to support the lowering of emissions? [Hans Poertner and WGII TSU, Germany]	Accepted, text deleted
12479	6	21		26	The term "ecosystem health" should be better explained, e.g. in a way that brings sustainable food production and natural biodiversity conservation together, in line with the SDGs. The following bullet text does not meet expectations generated in the bold sentence which is unfortunate. [Hans Poertner and WGII TSU, Germany]	Noted, text has been changed. Ecosystem health not included in ES
12481	6	31		34	This is an important perspective but lacks a statement on the capacity of urban and peri-urban food production to meet food requirements or which fraction thereof? [Hans Poertner and WGII TSU, Germany]	Taken into account, Urban and peri-urban removed from ES. Added in Urban section
23239	6	31			replace "is" with "was" in *population was nourished by food* [Elizabeth Diego, Kenya]	Taken into account, Urban and peri-urban removed from ES. Added in Urban section
12483	6	37		39	This mixture and its optimization need to be clearly identified in the ES, best supported by quantification, e.g. by giving the % contribution of the different sectors. [Hans Poertner and WGII TSU, Germany]	Noted, text has been deleted
13571	6	39			Explain how does globalized food systems threaten indigenous knowledge and local knowledge? [Lourdes Tibig, Philippines]	Noted, text has been deleted
17987	7	3	7	3	Use of the word 'incentives' may be preferable instead of 'subsidies' as it can imply a wider range of financial interventions aiming for changes in the uptake of climate-friendly production practices. [Beau Damen, Thailand]	Noted, we use both incentives and subsidies
28433	7	4	7	4	Add the word inclusive before trade networks. [Barron Joseph Orr, Germany]	Noted, text has been removed
28435	7	6	7	6	Add the words 'school feeding and' before programs. [Barron Joseph Orr, Germany]	Noted, text has been removed
23317	7	1			replace 'resilience' with 'adaptation' [Mark Howden, Australia]	Noted, text has been removed
31081	8	1	8	2	An important aspect of the food system - processing/value addition - should be specified [Robert Onyeneke, Nigeria]	it is encompassed in the terms production...manufacturing. Space precludes identifying every element of the supply chain (packaging, cooking at home, hospitality, waste disposal etc) and so production, manufacturing, transport, retail encompasses the issues.

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Comment No	From Page	From Line	To Page	To Line	Comment	Response
13815	8	7	8	7	I think Figure 5.1 should be placed in this line after "(robust evidence, high agreement) not in Line 4 because the preceding sentence between line 4 and 7 more appropriately reflect the content of the figure. [Sunday Leonard, United States of America]	The text has changed, but the exact placement of the figures is related to page-layout concerns at design
122	8	10	8	11	Caron, P. et al (2018) Food systems for sustainable development: proposals for a profound four-part transformation. Agronomy for Sustainable development 38:41 <a href="https://link.springer.com/article/10.1007/s13593-018-0519-1">https://link.springer.com/article/10.1007/s13593-018-0519-1</a> [Sharelle Polack (nee Hart), Switzerland]	Text has been deleted
13817	8	11	8	11	Not sure how figure 5.1 reflects the sentence between line 7 and 11. Suggest deleting Figure 5.1 from the sentence [Sunday Leonard, United States of America]	The text has changed, but the exact placement of the figures is related to page-layout concerns at design
124	8	12	8	13	Include governance in the list as transformative change is required for better integration between and within government departments and between levels of government, across all parts of the food system...governance, social aspects [Sharelle Polack (nee Hart), Switzerland]	Text has been changed , sentence no longer exists
11473	8	15	8	15	add Land in "the food-energy-water-LAND nexus" [Jean-Luc Chotte, France]	The term in the TOR for the chapter is the FEW Nexus. This reflects the fact that food water and energy are provisioning services arising from the landscape. So land is an enabler not a service.
13819	8	16	8	22	This diagram is very simplistic and does not seem to adequately reflect the definition, complexity and interactions of the food system as describe on this page as some elements of the food system are missing including the ecological and planetary health aspects such as biodiversity, water, soil, air. [Sunday Leonard, United States of America]	diagram has been redesigned, now incorporates these elements
14051	8	18	8	19	Comment: it is not clear the relation among the components of elements described in figure 5.1. It is suggested redesign the figure to explain better from a system perspective which are the levels, components in each level and its interactions. [Ana Felicien, Venezuela]	figure has been redesigned. Sense of comment taken in the redesign process.
14053	8	18	8	19	Comment: Is food security a emergent property of food systems? make more clear this relation in the graphic. [Ana Felicien, Venezuela]	figure redesigned to make clearer (and the term "outcomes" inserted)
39615	8	18	8	21	The figure provides a general description of food system and food security dimensions, but does not provide an adequate description of the more nuanced interplay between the food system-food security dependencies affected by climate change. Further development of the figure so that it can serve as roadmap for the chapter sections and to guide readers to what components are being dealt with in the section could be designed into the figure and within the various components. [, United States of America]	figure has been redesigned, so comments no longer apply, but sense of comment fed into the redesign. We're also now using Table 5.1 as roadmap to orientate readers.
39617	8	18	8	21	The figure does not provide explicit effects of climate change on food security. [, United States of America]	figure redesigned to make clearer (and the term "outcomes" inserted)
39619	8	18	8	21	Figure does not include social-economic aspects affecting food security and climate change impacts. [, United States of America]	added to new figure
23401	8	18	8	21	Figure is fundamentally sound, but I would add Equity in the center of the lower right Food Security circle because it is such a fundamental issue and desirable outcome. Consider shifting Sustainability to the lower left Food System circle -- that is what has to be sustainable -- as highlighted in Figure 5.8 [John Dixon, Australia]	figure has been redesigned, so comments no longer apply, but sense of comment fed into the redesign
13573	8	18	8	21	Figure 5.1, though simple, adequately shows the interactions that affect the planetary food system. [Lourdes Tibig, Philippines]	comment - no response needed
13059	8	25	8	25	Given how much has occurred since this definition's introduction in 2001, the interpretation is probably different than it was then. If you revisit this paragraph, I recommend thinking about what this definition meant then versus how it might be interpreted now. [Kristi Tabaj, United States of America]	extra material added to cover this

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Comment No	From Page	From Line	To Page	To Line	Comment	Response
13057	8	27	8	27	Is it possible that "All people at all times" also refers to those in conflict and crisis situations, given the degree of people displaced by conflict and natural disasters often linked to climate change? [Kristi Tabaj, United States of America]	yes, agreed, added
2945	8	28	8	29	We can add sentences ....also insecurity food because of contaminated food as impact of climate changes. There are different ways in which weather conditions can affect the incidence of foodborne diseases : - The prevalence of specific pathogenic organism in animals may increase with higher temperatures. - The food cooling chain is harder to maintain in higher temperatures and prolonged warm weather increase the risk of mistakes in food handling. Higher air temperatures may speed up the replication cycles of foodborne pathogenic organism which leads to higher degree of contamination. Higher temperatures in interaction with inadequate hygiene conditions, improper food handling and lack of hand-washing, may lead to an increased number of epidemic resulting from consumption of unsafe food. [Sulistiawati Sulistiawati, Indonesia]	these specific points are covered in the food safety and quality section in 5.3. This definitional section is at the level of defining "food safety" as part of "food security"
40699	8		8		Fig 5.1 could refer to glacier melt and sea level rise [Valerie Masson-Delmotte, France]	"Oceans" added to encompass the notion
39621	8	23	9	38	Definitions only deal with food security, and neither define aspects of food systems nor the climate change considerations. Further development of the definitions and the relationships would enhance aspects of what will be dealt with later in the chapter. [, United States of America]	section re-written; additional material added to re-orient food systems stuff to climate change
39623	8	27	9	3	This interpretation of "at all times" implying inter-generational equity may be held by the author(s), but is not explicit or straightforward. Other interpretations would be that in this present moment, food security is assured throughout the near term (month, year, etc.), not through future generations. Suggest removing this interpretation or providing other interpretations such as the one mentioned in this comment. [, United States of America]	reworded to incorporate this point
1353	8	28	9	1	his period explains when food can be considered "nutritious" but not when it can be considered safe. I suggest to modify as follow : "Safe and nutritious food for a healthy life implies that food insecurity can occur if the diet is not nutritious, including when there is consumption of an excess of calories, or if food is not safe, meaning free from adverse substances". [Francesca Spagnuolo, Italy]	This addition made to text
30731	8	2	10	17	In 5.1.1 Food security and insecurity, the food system, and climate change, given that the definition of food systems has been given in introduction of this section, it is recommended to firstly provided the full picture ( with detail concret scientific references) of climate impact on food systems using the food systems impact chaine. This will clearly help the reader to really understood the link between climate and food systems as define in the Fig 5.1. Then in the chapter on 5.1.1.2 Effects of climate change on the four pillars of food security, the summary table could group the information per food systems impact chaine and per food security pattern!!!! The ways it is actually written is a bite confusing the reader and quiet a lot of things are missing [Constant Labintan, Benin]	There is a confusion that using a food systems approach means every part of (the set of) supply chains should be described. We use the food system's approach rather to indicate that the demand side shapes the supply side, and the two are intimately linked. We therefore clarigfy this in the new text, and add details into table 5.1 that will help orientate readers.
15135	8	1			What is the source of Figure 5.1? [Ibouraïma Yabi, Benin]	the authors of this chapter
11475	8	18			figure 5.1 clearer than that in FOD [Jean-Luc Chotte, France]	comment - no response needed
21407	8	20			The figure is missing the critical element of carbon sequestration (directly e.g. via soil carbon, or indirectly via land sparing allowing afforestation or BECCS). [Andy Reisinger, New Zealand]	The term "carbon storage" added to figure

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Comment No	From Page	From Line	To Page	To Line	Comment	Response
13821	9	1	9	1	please change excess of calories line 1 to "excess and unhealthy calories" [Sunday Leonard, United States of America]	An unhealthy calorie vs a healthy calorie is not definable, whereas an excess of calories is explicit about the excess being unhealthy. Suggestion rejected.
28471	9	1	9	3	Suggest moving this sentence before prior one to improve flow of paragraph [Valerie Kapos, United Kingdom (of Great Britain and Northern Ireland)]	change made as suggested
1355	9	6	9	7	no reference is made to law, I would suggest "but also comprise the diverse set of institutions, laws, regulations, technologies and practices that govern (...)" [Francesca Spagnuolo, Italy]	change made as suggested
13823	9	8	9	12	Please provide reference for the FAO definition of undernourishment [Sunday Leonard, United States of America]	done - SOFI 2018 glossary
21157	9	13	9	13	this suggests that where undernourishment exists, hidden hunger is not necessarily the case. However, the bits in brackets suggest what you mean is that hidden hunger can occur where levels of undernourishment are not necessarily high. maybe say 'Hidden hunger tends to be present in countries with high levels of undernourishment, however it isn't exclusive to them (for example...)' [, United Kingdom (of Great Britain and Northern Ireland)]	reworded to incorporate this point
1877	9	13	9	15	Check correct use of parentheses. [William Lahoz, Norway]	corrected
13825	9	16	9	17	What is malnourishment? Please first provide the definition of malnourishment before mentioning one of its concepts -overconsumption. Since over-consumption is one of the aspects of the malnourishment, what is the full definition of the malnourishment? This will help your readers [Sunday Leonard, United States of America]	section re-ordered to incorporate this point
21159	9	16	9	21	these messages should be lifted to the SPM, which in turn should cover health impacts in greater detail [, United Kingdom (of Great Britain and Northern Ireland)]	The SPM draft now refers to ill health costs associated with malnutrition
39625	9	16	9	21	The definition of malnutrition should reference the international standard definition as stated by WHO. This definition is misleading and not all encompassing. [, United States of America]	modified to use WHO definition
31083	9	22	9	23	Repetition - "the relationship between food security and nutrition is the same as the association between food insecurity and malnutrition". Authors may consider one [Robert Onyeneke, Nigeria]	This is not repetition it is describing the "other side of the coin" for emphasis
1357	9	26	9	26	if I have correctly understood lines 24-26, I suggest to write "This may be through lack of resources to produce or access healthy food" instead of "This may be through lack of resources to produce or access food, lack of resources to access healthy food" [Francesca Spagnuolo, Italy]	Reworded for clarity
40701	9	27	9	27	about cost of diets : only supported by one ref, could be context dependent. I just typed in "cost and healthy and diet" in scholar google and found tens of recent papers in various contexts (sociology and country) showing marginally higher cost for many of them (/ avoided cost of processed food). Please check and provide an assessment. [Valerie Masson-Delmotte, France]	the paper referred to is not "one study, context dependent" but a recent meta-analysis of the last ~20 year's literature. confidence statement inserted.
28473	9	28	9	28	not clear what 'it' refers to in 'it may be' [Valerie Kapos, United Kingdom (of Great Britain and Northern Ireland)]	Reworded for clarity
13827	9	28	9	29	Please simplify this sentence starting for "or". It is difficult to understand what is meant by "the availability of food in the "food environment". And what does it mean that "retail outlets provide availability of poor diets?" [Sunday Leonard, United States of America]	Reworded for clarity
13061	9	32	9	32	More useful than discussing one example of a food security measure would be the discussion of the various shortcomings of these measurement tools. In the FAO scale example, shortcomings appear to be discrepancies in perception versus reality and assessing only one aspect of food security (access). Other shortcomings may include inaccurate recall and gender blind methods. [Kristi Tabaj, United States of America]	Adding a discussion of the FAO was requested by other reviewers, but point broadened out to include recal and gender bias.

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Comment No	From Page	From Line	To Page	To Line	Comment	Response
13831	9	32	9	32	Suggest to be consistent in the use of FAO or UN FAO, either say FAO as has been done previously or say UN FAO all through the document. [Sunday Leonard, United States of America]	OK, FAO makes more sense.
13829	9	32	9	33	It will be useful to highlight other methods for assessing food insecurity in the literature or justify why only the FAO methods is mentioned as an example here [Sunday Leonard, United States of America]	we do not have space to assess the breadth of methodologies, but previous comments from referees emphasised the need to comment on the FAO methodology as the primary custodian of, and mouthpiece for, "food insecurity"
21409	9	32	9	38	I find this rather hard to read/understand, please focus on what your key issue is here. [Andy Reisinger, New Zealand]	The key issue was that FAO reviewers asked us to use their figures or justify why others should be cited. Hence this paragraph is a response to previous reviews.
1359	9	33	9	33	correct typo "questionnaire" instead of questionnanire [Francesca Spagnuolo, Italy]	corrected
1879	9	33	9	33	questionnaire. [William Lahoz, Norway]	corrected
13833	9	34	9	34	This is a new term not used since the start of the chapter. What is food insufficiency? [Sunday Leonard, United States of America]	"food insufficiency" is English for an insufficiency of food (i.e. not having enough - whether through availability or access).
6463	9	40	9	44	a better introduction to the 4 pillars of Food security could be provided by reminding where they come from. In addition, this part must stay in the final version and appear in the executive summary of the chapter. [Sara Lickel, France]	No sure we understand reference to "where they come from". However, Table 5.1 strengthens the point about food security being impacted...
21411	9	41	9	41	Should this not say "on average" since climate change can have beneficial effects on all pillars in some contexts? [Andy Reisinger, New Zealand]	On average added
21161	9	41	9	42	This statement seems overly simplistic. For example, Co2 fertilisation effects could result in some positive impacts for agriculture. Please consider rephrasing to reflect greater complexity [, United Kingdom (of Great Britain and Northern Ireland)]	"On average" added
28475	9	41	9	42	the four pillars could be usefully defined in the previous section [Valerie Kapos, United Kingdom (of Great Britain and Northern Ireland)]	they are now defined in table 5.1
6465	9	45	10	2	There could be an explanation of why availability of food is not enough, and that insecurity is firstly a matter of access. [Sara Lickel, France]	This is now made more implicit by the explanations of the pillars in T5.1
39627	9	40	11	1	This section asserts that "climate change is projected to negatively impact all aspects of food security" (page 9, line 41), yet Figure 5.1 does not explicitly reflect this assertion. Aspects highlighted in this section (page 10, lines 12-15) are not represented in Figure 5.1. How can these impacts on food security be better represented in Figure 5.1 so that there is greater clarity in the various ways climate change can impact food security-food system components, and how other social-economic aspects are incorporated in the manifestation of climate change impacts and responses by various communities around the globe? [, United States of America]	Figure has been redesigned to show the relationships between the food system and climate change. The essence of this comment has been adopted by adding table 5.1 in detail.
30637	9	40	11	1	Reference you missed studying and citing in this section is FAO. 2017. The future of food and agriculture – Trends and challenges. Rome. <a href="http://www.fao.org/3/a-i6583e.pdf">http://www.fao.org/3/a-i6583e.pdf</a> . Please look at pages 41 and 42 of this reference (chapter 4) for the findings of a meta analysis of 1090 studies on climate change impacts on yields in low-, middle- and high-income countries as well as on research gaps (p. 42). [Lorenzo Giovanni Bellù, Italy]	The FAO report's citations on p42 are of the meta-analysis in AR5 (Porter et al), not any new work. As we already cite AR5, FAO report not added.
14729	9	16			The commonly accepted term in nutrition science is "malnutrition," not "malnourishment." Indeed, in the paragraph right below, this document uses "malnutrition". [Wu Felicia, United States of America]	Indeed. Malnourishment leads to malnutrition, they are not synonyms and the text uses them in English usage.
23241	9	27			calorie dense diets poor in nutrition this is not clear [Elizabeth Diego, Kenya]	That means diets rich in calories and poor in nutrition. Reworded.
23243	9	41			impact instead of impacting [Elizabeth Diego, Kenya]	changed

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Comment No	From Page	From Line	To Page	To Line	Comment	Response
28477	10	3	10	3	Food aid plays an important role in providing food security and saving lives after climate disasters.' Food aid provides short-term assistance to the food-insecure, but does it provide food security? The text that follows in the paragraph suggests not. [Valerie Kapos, United Kingdom (of Great Britain and Northern Ireland)]	text now removed
12139	10	3	10	11	Why is food aid discussed here in a section that deals with impacts? [Hans Poertner and WGII TSU, Germany]	agreed. This section now moved
6467	10	3	10	15	Regarding the evolution of thinking in the past 10 years in the reflections regarding food security made by the HLPE and the Committee on Food Security, it is disappointing that the first elements reminded in this chapter is food aid, adding to the fact that this part does not even properly address the limits of food aid, especially regarding how some practices disturb local food systems: food aid cannot be considered as the first element for reaching food security; this part should therefore start by expounding the 4 pillars and the conditions for reaching them/ how they are affected by climate change. A part on food aid should come with limitations of those practices more explicitly stated as they are now, even though we welcome the mention of health and nutrition aspects of food aid. [Sara Lickel, France]	agreed, food aid moved; more efforts have been made to link food security and its pillars to climate change in reworked section
21163	10	5	10	6	How to 'best use'? Do you mean food aid has drawbacks? If so this should be stated first, e.g. 'however food aid has disadvantages and there is a lack of agreement on the best use (administer?handle?) of food aid'. [United Kingdom (of Great Britain and Northern Ireland)]	agree- text now removed
13837	10	5	10	11	Line 5 - 11. Not sure how the discussions here contributes to the main thrust of this section: Effects of climate change on the four pillars of food security.  The connection seems blur by the way the discussion is presented. It be useful to clearly discuss that climate change is linked to disasters and that disasters affects food security (availability, assessibility and stability. Then discussion on food aid can then come in as well as how such food support administered during such disaster which could consequently influence some of the pillars of food security: availability, accessibility, and stability [Sunday Leonard, United States of America]	agreee - food aid text removed
17989	10	6	10	6	".....and this can come with unintended consequences at different levels (micro,...." [Beau Damen, Thailand]	text now removed
13835	10	6	10	6	Please clarify do you mean "at different levels" or "and different levels"? And different levels is confusing here [Sunday Leonard, United States of America]	text now removed
11477	10	7	10	7	Lentz et al 2005 not in the list [Jean-Luc Chotte, France]	text now removed
21165	10	8	10	10	could you explain 'tied' and 'untied'? [United Kingdom (of Great Britain and Northern Ireland)]	text now removed
23403	10	8	10	15	CONSIDER DELETING these sentences in order NOT to overplay food aid (only 14M cf 821M hungry and a much greater population at risk of transient poverty and hunger [John Dixon, Australia]	text now removed
17991	10	12	10	14	This sentence is unclear and could be reworded. [Beau Damen, Thailand]	text now removed
6169	10	16	10	16	In the table, the assertion "effect of on food supplies due to disruption of transportation infrastructure by increased extreme events" is more relevant in the "availability" section than in "access" [Benjamin Sultan, France]	I think this depends on the scale at which availability is defined. The usual scale is "country" (is there enough food in the country?) but transport may make it impossible to get to rural markets. It could therefore go in either, we think.
11479	10	16	10	16	tabe 5.1 Availability; add reference Sultan and Gaetan 2016 (already in the reference list [Jean-Luc Chotte, France]	there are now no references in T5.1 as it has been rewritten to act as roadmap to chapter

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Comment No	From Page	From Line	To Page	To Line	Comment	Response
30639	10	16	10	16	Regarding table 5.1, under all bullet points of "access" please cite FAO. 2018. The future of food and agriculture - Alternative pathways to 2050. Rome. <a href="http://www.fao.org/publications/fofa/en/">http://www.fao.org/publications/fofa/en/</a> [Lorenzo Giovanni Bellù, Italy]	there are now no references in T5.1 as it has been rewritten to act as roadmap to chapter
40703	10		10		Table 5.1 : projected impacts or risks? (potential impacts?) [Valerie Masson-Delmotte, France]	reworded now to "existing or projected impacts"
39629	10	16	11	1	Link Table 5.1 to food system aspects depicted in Figure 5.1. [, United States of America]	Table 5.1 now linked to Fig 5.1 by note in F5.1 legend.
31085	10	16	11	16	Table 1 (Examples of projected climate change impacts): Are there no studies/examples of inability to adapt food availability to climate change? What about destruction of post-harvest handling infrastructure and disruption of value-chains? [Robert Onyeneke, Nigeria]	T5.1 reworked to make explicit the way food security can be disrupted.
15137	10	16			Table 5.1 : Availability. There is also : - lower yields and production due to seasonal instability of rains, especially in sub-Saharan African countries; - Production and crop losses due to floods ; - the rarefaction (or disappearance) of varieties and / or local crop species due to climate changes [Ibouraïma Yabi, Benin]	Table 5.1 now rewritten as road map to chapter
30641	11	4	11	17	The causality and correlation statements in this section should not be attributed to FAO 2018b, which according to your list of references is FAOSTAT. These are your views and analysis; FAOSTAT only reports data. Please rephrase accordingly. [Lorenzo Giovanni Bellù, Italy]	Point accepted. we now make it clear it is our analysis using FAOSTAT data by citing FAOSTAT directly.
30643	11	4	11	17	Reference you missed studying and citing in section 5.1.2.1. "Trends in the global food system" is: FAO. 2017. The future of food and agriculture – Trends and challenges. Rome. <a href="http://www.fao.org/3/a-i6583e.pdf">http://www.fao.org/3/a-i6583e.pdf</a> . Please start the section (line 5) with the sentence "The current status of the food system and food insecurity, trends that will determine its future and challenges to achieve food security are analysed and reported in FAO, 2017 (see also Figure 5.2 and Table 5.2)." [Lorenzo Giovanni Bellù, Italy]	This is a nice report, but there have been a very large number of reports published in the last couple of years covering the same ground. As we show data from FAOSTAT in the figure, we do not need to reference another report in this section
13839	11	5	11	5	Please change this sentence to adequately reflect figure and table. Figure 5.2 and Table 5.2 do not present information on current status of food system and food insecurity but basically present informing on selected crop production and some aspects of food security. Giving the definition of food system and food security in this chapter, the figure and table cannot be said to adequately represent the global status of both unless we are saying that food security is define by production, trade and prevalence of overweight, obesity and underweight. [Sunday Leonard, United States of America]	Accepted. Figure 5.2 extensively changed; and sentence replaced by new text.
1881	11	5	11	7	Perhaps authors could add references to back this specific statement. [William Lahoz, Norway]	Section re-written so comment now moot.
23405	11	8	11	9	Still global trade remains only a low proportion of produced and consumed food grains (total energy traded approx 20%, wheat 15%, less for rice and food maize) [John Dixon, Australia]	Agreed, but doesn't alter the point that global trade has increased, and whilst it might be traded thinly for some crops (like rice) on a value basis the trade is ~60% of total value (due to the added value of processed foods) (see <a href="https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0037810">https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0037810</a> )
13841	11	11	11	12	This is ambiguous. How does availability reflects shift towards more-affluent diet? Are we saying that demand for more-affluent diet directly results in availability? The sentence does not seem to add up well. Please clarify [Sunday Leonard, United States of America]	yes, that is what we're saying: demand creates supply (as well as vice versa in some instances)



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30687	11	14	11	14	Before the sentence starting "During the same period,..." please include the following: Obesity in particular, can be attributed to increased consumption of foods that are high in energy, added sugars or salt and an inadequate intake of fruits, vegetables and fibres, reflecting rapid urbanisation and the increased consumption of processed food, as FAO 2017 and 2018a report. [Lorenzo Giovanni Bellù, Italy]	We make this point in several locations, and, in the interests of space, prefer to avoid digressing at this point.
31087	11	14	11	16	The statistics on increase in greenhouse gas emission needs be supported with reference [Robert Onyeneke, Nigeria]	The reference is given as FAOSTAT (see next sentence and Fig 5.2)
12939	11	15	11	16	There is no agreed conversion to generate GtCO <sub>2</sub> -e yr <sup>-1</sup> (note elsewhere in the report this is written as "GtCO <sub>2</sub> eq yr <sup>-1</sup> " or "GtCO <sub>2</sub> e per year"). For instance the methane metrics in IPCC AR5 WG 1 table 8.7 vary by a factor of 20. It would be more scientifically accurate if CO <sub>2</sub> , methane and N <sub>2</sub> O mitigation were quoted separately, rather than aggregating them in the controversial (and undefined in the report) CO <sub>2</sub> -e. This is especially important for methane because its mitigation potential is so dependent on the metric and timescale. Collins et al. 2018 <a href="https://doi.org/10.1088/1748-9326/aab89c">https://doi.org/10.1088/1748-9326/aab89c</a> in fact show that a mitigation potential in GtCH <sub>4</sub> /yr is best equated to a one-off pulse of CO <sub>2</sub> emissions. [William Collins, United Kingdom (of Great Britain and Northern Ireland)]	Accepted, disaggregation into different gases has been done. For conversation we have used those recognized in most of the literature
11481	11	16	11	16	it is not clear if the number given (GHG from agriculture production) are related to the FAO 2018b reference, cited in the following sentence [Jean-Luc Chotte, France]	Reference changed to FAOSTAT so it should be more explicit.
30733	11	5	14	21	In 5.1.2.1 Trends in the global food system ,why the information is only limited to food production and consumption and other aspect of food systems are not presented ? Does global food system patterns only limited to these aspect??? Again the terminology of food systems should strictly be covered. If these is limitation then please specify. Moreover informations on detail impact cropping systems are missing. Indeed, only presented detail impact of wheat, rice and maize yield is limiting the comprehension. The listed should be completed by primary crops consumed both in developed and developing countries included indigenous crops!!!! [Constant Labintan, Benin]	Point rejected. We explain in opening section what a food systems lens implies (and it is not examining equally every part of the food system, rather treating it as a system). Similarly, this section is about providing a high level overview of trends in the food system, not a detailed description of every crop and every country.
21413	11	3	16	4	I'm critically missing in sections 5.1.2 and 5.1.3 a discussion of future trends in food security and GHG emissions, building on the SSP literature and related work (e.g. RAPs). Include the amount of emissions reductions needed from agriculture in Paris compliant pathways, compared with baseline scenarios. This would help set the scene for subsequent discussions of impacts, adaptation needs and limits, mitigation potentials, and also clarify the amount of land that could be subtracted from food production for the generation of biomass for afforestation, bioenergy and BECCS. At present the chapter seems to float in empty space here, which gives no sense of the scale, urgency, and limits to action. If this assessment is provided in another chapter (I could not find it), please recap this here as it is critical to provide context for subsequent sections. [Andy Reisinger, New Zealand]	Point accepted. New text drafted.
12141	11	3			Since this section with a relatively high-level heading is not directly climate change-related and largely based on FAO data, it could be shortened and placed in a box instead. [Hans Poertner and WGII TSU, Germany]	We disagree. Having shortened it in response to FOD comments, we have expanded in response to SOD comments, and the need to provide context for the chapter, and particularly comments raised to Exec Summary and SPM
23795	12	1	5	1	Fig 5.2 graphs may be updated with data upto at least 2015 in all panels [, India]	Data, where available has been updated
25275	12	1	5	1	Fig 5.2 graphs may be updated with data upto at least 2015 in all panels [Naresh Kumar Soora, India]	Data, where available has been updated

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30917	12	1	12	9	Use of another color in lieu of green is suggested as the green labels (words) for the green lines are not very clear [Christopher Ilori, Canada]	Colour changed as suggested
23407	12	5	12	5	Figure 1 f GHG emissions. Correct rice cultivation to puddled rice cultivation (if this is correct) [John Dixon, Australia]	The used database for this plot names it as rice cultivation. We apply the same terminology.
40705	12		12		Important figure, could be proposed for consideration / SPM. Providing assessment of uncertainty would be relevant. Explain choice of crops. [Valerie Masson-Delmotte, France]	Choice of crops now explained in legend
13843	13	1	13	6	The discussion in this section is so focus on malnutrition, under-nutrition and micro-nutrient deficiency that it suggest that the authors have concluded that they are the only measure or definition of food security. It will be useful if this discussion brings in other aspects contributing to food insecurity based on the definition used at the begining of this chapter. The FAO provided several indicators for identifying each of the pillars of food security (see: <a href="http://www.fao.org/economic/ess/ess-fs/ess-fadata/en/#.XDjDH1VKjDc">http://www.fao.org/economic/ess/ess-fs/ess-fadata/en/#.XDjDH1VKjDc</a> ). This discussion will only be robust if the status of each of the pillars of food security are discussed using relevant indicators in available literature. Overall, the current text is a poor job of describing the current status of food insecurity with the text extremely skewed toward discussion on nutrition, possibly due to the expertise or interest of the authors. [Sunday Leonard, United States of America]	Space precludes detailed discussions of how the four pillars of food insecurity translates through to map onto issues beyond malnutrition. In response to other comments we have added extra panels to the figure, but we cannot add any more. Our feeling is not that the indicators highlighted in the comment (like density of rail lines, import dependence, access to sanitation) are not important, but that the outcome of food insecurity is in chronic malnourishment - and given this is a high-level overview, highlighting some of the indicators (like food availability) and some of the outcomes (like malnourishment) is most suitable to the terms of reference for the chapter.
13845	13	4	13	4	UN agenyies? There are many of them. Do you mean FAO here? Please correct accordingly [Sunday Leonard, United States of America]	No, we don't. SOFI is produced by a set of UN agencies (including FAO, WHO, IFAD, etc). Which is why the refernce is "The UN agencies' report SOFI"
30645	13	6	13	6	Please specify which reference is FAO 2018 (in the list of references you have FAO 2018a and b). [Lorenzo Giovanni Bellù, Italy]	clarified
13847	13	6	13	7	the 821 million is estimate for what year? This is needed to understand this sentence fully [Sunday Leonard, United States of America]	rewritten to make clear
14055	13	6	13	10	Comments: improve the wording. Is not well understood the comparison between the contrasting tendencies: on one hand "the global undernourished population on a global basis is 821 million, up from 815 million the previous year", on the other hand " the prevalence of hunger had been declining over the last three decades" [Ana Felicien, Venezuela]	The sentence meant that the trend has been downwards for ~3 decades, but has increased recently. It has been reworded for clarity
13003	13	10	13	10	children under 5 were wasted '- ther term 'wasted' rather than 'wasting' is not clear. [Aidan Farrell, Trinidad and Tobago]	Rejected: A child who expressed the condition of wasting is wasted. A stunted child suffers from stunting.
13849	13	10	13	10	some might not understand what it mean for a child to be wasted. Useful to explain [Sunday Leonard, United States of America]	Accepted; added definitions
28479	13	10	13	10	50.5 million (7.5%) of children under 5 were wasted'. When is this referring to? Define 'wasting' (i.e. low weight for height) [Valerie Kapos, United Kingdom (of Great Britain and Northern Ireland)]	Accepted Date added; definitions added.
13851	13	14	13	15	But is everyone suffering from micronutrient deficiencies strictly due to food insecurity? Some may be due to ill health. Useful to delineate this. [Sunday Leonard, United States of America]	Yes, agreed. This sentence is in section 5.1. above and covers this point "Not all malnourishment arises from food insecurity, as households may have access to healthy diets but choose to eat unhealthily, or it may arise from illness, but in many parts of the world poverty is linked to poor diets"
14731	13	14	13	36	The nutrition-disease challenges mentioned in these paragraphs do not relate to climate change, so it is somewhat misleading to include them as if climate directly affected them: overweight and obesity, micronutrient deficiencies, and their associated diseases. The reality is far more complex than that, and climate plays a tiny (if any) role. [Wu Felicia, United States of America]	The section is about context and framing, and the heading is "Staus and Trends in...". There is no meaning to link the status of the food system to climate change - but we cannot discuss the future role of climate on malnutrition without describing the baseline. Comment rejected

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39631	13	19	13	36	There is an overemphasis on obesity and over consumption. This section does not discuss the significant impact climate change has on under nutrition and under consumption. Though over consumption may have impacts on increase in GHG emissions, those that are most vulnerable to the impacts of climate change are those in impoverished areas already struggling to meet food production demands and in particular areas that are prone to famine. [, United States of America]	This section describes the status and trends of food insecurity. This sub-section on malnutrition gives the same space (16 lines) to under-nutrition as to over-consumption (17 lines). Vulnerability to climate change is an important issue, more for the global poor, but poverty-related ill-health-through-diets is a food security issue and needs coverage.
21167	13	23	13	24	Can you please uplift this to the SPM. Also 33-36 and page 14/line 13 [, United Kingdom (of Great Britain and Northern Ireland)]	Suggested this to be lifted to SPM
31089	13	33	13	34	Authors please provide studies that observed associations between obesity and cardiovascular disease and some cancers. Can we the know the cancers? [Robert Onyeneke, Nigeria]	Many thanks. We included the study and name the cancers.
14057	13	37	13	37	Comment: This is the first appearance of SOFI and FIES, include a footnote with the complete names. [Ana Felicien, Venezuela]	Many thanks now described as a foot note in table.
30647	13	37	13	37	Please specify which reference is SOFI (2018). [Lorenzo Giovanni Bellù, Italy]	Refrence added.
13575	13	39	13	41	A review of the Uncertainty Guidance does not give any guidance on using the term "weak evidence", but I m guessing it is alright to say (multiple studies, but low agreement)". [Lourdes Tibig, Philippines]	Many thanks. We change it to limited evidence as suggested in the guidance.
25501	13	41	13	46	This finding should be futher explained and illustrated with concrete figures or case studies, from North and South countries. [, France]	We love to do this. But do to page limitation, we are not able to do this.
6471	13	37	14	12	add the link of food insecurity to poverty. [Sara Lickel, France]	The link to poverty is added.
23525	13	30			The Sustainable Development Goals aims to eradicate hunger and all forms of malnutrition by 2030, which is crucial for the lives of people in developing countries. The report should analyze more more specific realities of developing countries. [Huai Jianjun, China]	We agree and we include all forms of malnutrition in the section,
13577	13	40			What is meant by "childhood wasting"? [Lourdes Tibig, Philippines]	We added an explanation.
39633	14	1	14	12	There is no reference to under developed countries. The examples stem solely out of the UK which has little added value in the larger discussion of food insecurity. Either replace examples with a more relevant country or provide additional examples. [, United States of America]	We included reference to developing counties/ Asia, Africa and Latian America.
39635	14	15	14	16	The statement about more compromised impacts need further elaboration and associated citations for substantiation. [, United States of America]	Reference to upcoming section on climate change impact provided.
14703	14	16	14	16	Missing the Table number. [Adalberto Benavides-Mendoza, Mexico]	Table number included
39637	14	16	14	16	Refer to Table 5.2. [, United States of America]	Table number included
40333	14	16	14	16	... as shown in table 5.2. [Thelma Krug, Brazil]	Table number included
30649	14	17	14	17	Regarding table 5.2: 1) Please specify the time period the figures refer to. 2) When you give percentages please specify what is the total, namely 33.3% of what? (see column HLPE 2017); 3) please harmonise the units inside the table - either report everything in million people or in percentages [Lorenzo Giovanni Bellù, Italy]	The table has been changed
28483	14	17	14	17	In table caption make clear that it is global prevalence [Valerie Kapos, United Kingdom (of Great Britain and Northern Ireland)]	"global" added
28481	14	16	16	16	which table? [Valerie Kapos, United Kingdom (of Great Britain and Northern Ireland)]	Table number included
21415	15	8	15	33	Please expand on the AR5 findings, either here or in more detail in relevant sections. For example, there is no mention of the mitigation potential found in the AR5 anywhere in this chapter, which is very odd and unhelpful. Either give a more comprehensive summary here, or ensure a mini-summary of relevant parts is provided at the beginning of each sub-section. [Andy Reisinger, New Zealand]	Accepted, done

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12143	15	26	15	29	The AR5 reference is missing here: Revi, A. et al., 2014: Urban areas. In: Climate Change 2014: Impacts, Adaptation, and Vulnerability. Part A: Global and Sectoral Aspects. Contribution of Working Group II to the Fifth Assessment Report of the Intergovernmental Panel of Climate Change [Field, C. B., V. R. Barros, D. J. Dokken, K. J. Mach, M. D. Mastrandrea, T. E. Bilir, M. Chatterjee, K. L. Ebi, Y. O. Estrada, R. C. Genova, B. Girma, E. S. Kissel, A. N. Levy, S. MacCracken, P. R. Mastrandrea and L. L. White (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA, 535-612. [Hans Poertner and WGII TSU, Germany]	Ref added
12145	15	36	15	42	This sentence can be cut, because it is too generic. [Hans Poertner and WGII TSU, Germany]	Accepted: half the referenced section cut
21417	15	37	15	37	A lot of countries are keen to see the Paris Agreement as a whole, not as a key aim and secondary aims. Suggest you replace "The central aim" with "A key aim". [Andy Reisinger, New Zealand]	Accepted: text changed
39639	15	40	15	42	In paraphrasing Article 3 of the Paris Agreement, this sentence mischaracterizes it. The sentence should be rephrased to read: "UNDER The Paris Agreement [DELETE: requires all] Parties ARE EXPECTED to put forward their best efforts through nationally determined contributions (NDCs) and to strengthen these efforts in the years ahead." [, United States of America]	Accepted: text changed
21171	15	42	15	45	Could you please clarify how agriculture is included in NDCs. It's my understanding (see Richards et al 2018 <a href="https://www.tandfonline.com/doi/abs/10.1080/14693062.2018.1430018">https://www.tandfonline.com/doi/abs/10.1080/14693062.2018.1430018</a> ) that the largest agricultural emitters do not include sector specific contributions from agriculture (but most include it in economy wide targets). Being more precise here would be welcomed. [, United Kingdom (of Great Britain and Northern Ireland)]	Accepted, added reference
40707	15		15		Link to Paris Agreement : what needs to be introduced in ch 1, what belongs to this chapter? Avoid overlaps / repetitions. [Valerie Masson-Delmotte, France]	Comment noted, and section now streamlined - but it focusses on how food has been treated in Paris, so is important here.
21169	15	35	16	4	Section 5.1.3.2 is missing important information about how the Paris Agreement relates to the issues being discussed in this chapter. In particular, Article 2 of the PA places the agreement "in the context of sustainable development" and states "in a manner that does not threaten food production." This is important to mention as the PA recognises the challenges posed by mitigation actions that are not consistent with wider sustainability concerns. It is important not to contribute to the perception that it is Paris per se that may challenge sustainability, rather such challenges would arise from inappropriate implementation of Paris. Please ensure that this important additional context is added. [, United Kingdom (of Great Britain and Northern Ireland)]	Accepted: text change added
6473	15	35	16	4	This part would benefit from a reminder of the evolution from the Convention that mentioned food production in 1992 to the Paris Agreement that includes food security in its preamble. [Sara Lickel, France]	Accepted: text change added
25503	15	46	16	1	To cover agroecology as well as climate-smart agriculture, couldn't we refer to "sustainable agriculture practices"? Cf. GENERAL COMMENT ON AGROECOLOGY [, France]	Accepted: text changed and "sustainable" added
17993	16	2	16	2	"...least developed countries...." [Beau Damen, Thailand]	Accepted: text changed
39641	16	2	16	2	The term "lesser" developing countries is not standard nomenclature and the countries intended to be captured by this designation could be unclear to readers. Provide better clarity on which developing countries are included in this assessment. [, United States of America]	Accepted: text changed
39643	16	6	16	24	Road map needs to be closer to the introduction and build off the conceptual framing of the chapter. [, United States of America]	accepted: section rewritten and roadmap now moved to T5.1

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39645	16	6	16	24	The roadmap does not reflect the consideration of multiple food system collapse, the role of conflict zones, multiple climate calamities affecting food system dynamics, emerging refugee situation and food security challenges, etc. It does not provide a linkage to SDG considerations, and does not utilize advances in conceptual thinking associated with nexus framing. [, United States of America]	accepted: section rewritten and roadmap now moved to T5.1
28485	16	8	16	9	Is the impact of climate change on supply chains and food demand included in section 5.2? This is not clear from the contents list. [Valerie Kapos, United Kingdom (of Great Britain and Northern Ireland)]	yes it is in 5.2; clarity added by T5.1 being a clearer list of contents
17995	16	14	16	14	This sentence may overstate the extent to which the preceding content is related to the food-water-energy nexus given the light treatment it receives at the very end of the chapter. [Beau Damen, Thailand]	comment accepted; text removed.
11485	16	15	16	18	this exemple is a bit odd without a specific reference ? [Jean-Luc Chotte, France]	accepted: paragraph re-written
39651	16	29	16	34	This collection of variables -- climate and some not climate -- needs to be cast in a more synthetic fashion to reflect modal climate changes (e.g., shift in climate envelope causing shift in cropping varieties planted), seasonal changes (e.g., warming trends in shoulder seasons extending growing season for certain crops), extreme events (e.g., extreme temperatures affecting critical periods of phenological importance, flooding/droughts), and associated atmospheric conditions (e.g., CO2 concentrations, UV radiation, dust, ozone, etc.). [, United States of America]	Accepted, added categorization to Table
14813	16	32	16	33	Replace with "Extreme climate events resulting in inland and coastal flooding, ..." [Katharina Waha, Australia]	Accepted, changed text
2873	16	32	16	33	I would write: 'Consequences of extreme climate events, such as inland and coastal flooding .....' [Luca Castrucci, United States of America]	Noted, repeat of comment 14813
23877	16	34	16	34	Consider adding the reference 'Rama Rao C.A., Raju B.M.K., Subba Rao, A.V.M., Rao, K.V., Rao, V.U.M., Kausalya Ramachandran, Venkateswarlu, B., Sikka, A.K., Srinivasa Rao, M., Maheswari, M. and Ch Srinivasa Rao (2016), A District Level Assessment of Vulnerability of Indian Agriculture to Climate Change, Current Science, 110:1939-1946' [, India]	Accepted, added reference
14815	16	42	16	42	Replace CO2 with atmospheric CO2 concentrations [Katharina Waha, Australia]	Accepted, changed text
39653	16	29	17	29	This section needs more systematic coverage of food system considerations related to how climate impacts directly affect system elements and also potentially cause indirect or cascading effects across the food system. [, United States of America]	Accepted, added systematic coverage of food system and food security pillars
39647	16	26	18	4	The section on impacts of climate change on food systems needs to be more directly linked to food security considerations. The overall extent of the material is a good food system literature review, but it is not integrated relative to linkages to food security considerations as alluded in the title of the chapter. [, United States of America]	Accepted, explained linkages to food security in each subsection. Reorganized section.
39649	16	28	18	4	Section 5.2.1 is entitled "Climate variables important to food systems" but mainly discusses food production. Authors should note that food production is only one element of food security or retitle the section to "food production" rather than systems. [, United States of America]	Accepted, changed to "important for food security" and referenced other elements besides food production.
30651	16	28	18	5	Reference you missed studying and citing in section 5.2.1 is: FAO. 2017. The future of food and agriculture – Trends and challenges. Rome. <a href="http://www.fao.org/3/a-i6583e.pdf">http://www.fao.org/3/a-i6583e.pdf</a> , pp. 41-43. Please include as very first sentence when starting the section (line 29) the following: "Climate change will affect every aspect of food production (FAO, 2017)." [Lorenzo Giovanni Bellù, Italy]	Accepted, added sentence and reference

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Comment No	From Page	From Line	To Page	To Line	Comment	Response
30689	16	28	18	5	In this section you did not discuss at all long-term environmental problems such as groundwater depletion and soil degradation due to climate change. These should be named as well as variables important to food systems. [Lorenzo Giovanni Bellù, Italy]	Accepted, added text
13579	16	35	18	4	The entire discussion is highly informative, but it is looking like a literature review. It can be improved to transform into an asynthesis [Lourdes Tibig, Philippines]	Accepted, synthesized discussion in a Table
1653	16	26	41	34	5.2 part of the report focuses too much on the impacts on production, and there is problems with connection of 5.3, which should first analyze vulnerability, future risks, challenge, obstacle and demand of adaptation. [Chao WEI, China]	Accepted, reduced focus on impacts on production. Added call-outs to section 5.3.
12147	16	6			Is a new sub-heading really needed here? Suggest to merge the section with 5.1.3. Otherwise, if it should be a roadmap, clearly introduce what is discussed in which section of this chapter. And potentially also add cross-references to aspects discussed in other chapters of SRCCL. [Hans Poertner and WGII TSU, Germany]	Accepted: section rewritten and roadmap now removed
11483	16	14			add Land in "the food-energy-water-LAND nexus" [Jean-Luc Chotte, France]	Text removed as "roadmap section" now gone
14817	17	3	17	6	Reference missing for statement [Katharina Waha, Australia]	Accepted, added reference (Zhao et al 2015) in Table
14819	17	7	17	7	Add "the": the length of growing seasons... [Katharina Waha, Australia]	Accepted, added
11487	17	27	17	29	this paragraph is not needed here.. Transfert to section 5.4 [Jean-Luc Chotte, France]	Accepted, deleted text
28487	17	27	17	29	Does this information belong in this section? [Valerie Kapos, United Kingdom (of Great Britain and Northern Ireland)]	Accepted, deleted text
11489	17	31	17	31	Figure 5.3 not so clear ! [Jean-Luc Chotte, France]	Rejected, Figure 5.3 shows the importance of large-scale changes in precipitation to food production, especially within pastoral regions
14821	17	33	17	33	Add to caption: Figure 5.3 Precipitation anomaly and vegetation response in Eastern Africa. (a) Sep 2015-Feb 2016 ..... [Katharina Waha, Australia]	Accepted, added text
14823	17	33	17	33	What is the acronym CHIRPS? [Katharina Waha, Australia]	Accepted, spelled out acronym
40709	17		17		SLCF : how addressed in the other parts of the assessment? Link with land degradation? Represented in projections? [Valerie Masson-Delmotte, France]	Taken into account. Added call-outs to Chapters 2 and 4 (see Chapter 2, section 2.5 (in SOD). Aerosols are also mentioned in Chapter 4 (Land Degradation))
22627	17	31	18	5	Would be good if the figure also showed links to hotspots in food insecurity rather than only <u>greening or browning</u> . [Anastasios Kentarchos, Belgium]	Rejected, greening and browning do indicate hotspots of food insecurity
23855	18	8	18	9	Under extreme events in addition to heat waves, droughts, inland and coastal flooding "coldwave, frost and hailstorms" may also be considered [, India]	Rejected, focus on chapter is main climate change related extreme events
21419	18	8	18	11	I don't think this summary statement works up-front - it's not clear at this point what it is based on. I'd rather have a detailed discussion of the literature, followed by this statement as clear conclusion of this discussion. [Andy Reisinger, New Zealand]	Accepted, summary statements in chapter moved to end of sections
12149	18	11	18	12	It is not clear what this sentence is saying in addition to the previous one. [Hans Poertner and WGII TSU, Germany]	Accepted, text changed
39655	18	12	18	12	This sentence is grammatically incorrect and needs to be rewritten. [, United States of America]	Accepted, text changed
21421	18	12	18	13	Please don't just make reference to the AR5, but tell me what the AR5 found with regard to D+A - otherwise it remains entirely unclear where there is new information, strengthening of existing information, or potentially a revising of previous conclusions. It also forces you to be more focused on what is new and different (or say clearly if there isn't anything new or different). [Andy Reisinger, New Zealand]	Accepted, clarified AR5 findings for D+A

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13581	18	12	18	19	Have there been attribution done in each of the cited studies. If so, it is recommended that this is stated and uncertainty language be included to achieve coherence. [Lourdes Tibig, Philippines]	Accepted, table now includes only studies in which attribution has been done. Uncertainty language included
14825	18	17	18	17	Remove Ugockukwu 2018 reference and replace with another example, e.g. Saxena et al. 2016. Ugockukwu et al. is about adaptation of farmers only, but does not say anything about perceived climate change by local communities. [Katharina Waha, Australia]	Accepted, cited Saxena
31091	18	17	18	17	Ugockukwu 2018 should be cited as Onyeneke 2018. Onyeneke is the surname. See the full citation 5. Onyeneke, R.U. (2018). Challenges of Adaptation to Climate Change by Farmers Anambra State, Nigeria. International Journal of BioSciences, Agriculture and Technology, Vol. 9, No. 1, Pp. 1-7 [Robert Onyeneke, Nigeria]	Fixed
6073	18	18	18	19	were also carried out instead of "are being increasingly utilised for example" (remove comma and the end of sentence, preferably move "for example" to the beginning of the sentence) [, Poland]	Text changed
13583	18	18	18	19	Surveys on farmers' perception of observed impacts can not be included unless attribution is done. [Lourdes Tibig, Philippines]	Farmers' surveys now described as local knowledge
28489	18	18	18	19	Improve grammar of this sentence [Valerie Kapos, United Kingdom (of Great Britain and Northern Ireland)]	Text changed
14827	18	19	18	19	Add "Other methods are to establish a statistical relationship between past climate trends and crop yield or production trends (e.g. Kukal et al. 2018) and to use crop models to simulate crop yields with and without climate change (e.g. Meng et al. 2014)." [Katharina Waha, Australia]	Accepted, added
39657	18	20	18	23	References need to be supplied for these sentences. Authors are quoting a finding and readers need to be able to trace the origin as it has great implications for future work and understanding of implications of changes in agriculture yields. [, United States of America]	Accepted, references added
14829	18	26	18	26	Add after "such systems change over time": "...and can offset some otherwise negative effects on productivity." [Katharina Waha, Australia]	Accepted, text changed
28491	18	27	18	30	Improve grammar of this sentence. Currently unclear [Valerie Kapos, United Kingdom (of Great Britain and Northern Ireland)]	Accepted, text changed
15715	18	32	18	42	The increase in extreme temperatures can highly affect the crop yield and reduce it [, Iran]	Noted
14831	18	33	18	33	Add: more, Since AR5, there have been more studies that... [Katharina Waha, Australia]	The word "more" has been added.
14833	18	33	18	33	Add: climate-related, "...that document climate-related trends in crop production" [Katharina Waha, Australia]	The phrasing we currently have is more appropriate, as it allows us to also discuss climate variables and climate variability.
14835	18	34	18	34	Replace 'regional' with 'national and local' [Katharina Waha, Australia]	Reject. We believe regional is a more appropriate term, and find no compelling reason to change it.

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Comment No	From Page	From Line	To Page	To Line	Comment	Response
176	18	35	18	35	It would become more attracting than currently if the description of "Global scale" section starts from estimates of global total production loss associated with historical climate change which give readers a sense of the scale of observed impacts because drought is a main but specific climatic cause of crop production loss. "Estimated average annual production loss at the global scale in 1981-2010 associated with historical climate change accounts for 22.3 billion USD (B\$) for maize, 13.6 B\$ for wheat, 6.5 B\$ for soybean and 0.8 B\$ for rice (Iizumi et al., 2018)." is a proposed text to be added between just after "Global scale." and just before "A recent analysis related to global aridity change...". Citation: Iizumi, T., Shiogama, H., Imada, Y., Hanasaki, N., Takikawa, H., Nishimori, M., 2018. Crop production losses associated with anthropogenic climate change for 1981–2010 compared with preindustrial levels. Int J Climatol., 38, 5405–5417, <a href="https://doi.org/10.1002/joc.5818">https://doi.org/10.1002/joc.5818</a> . [Toshichika Iizumi, Japan]	Thank you for your suggestion. We have cited your study. However, we feel that there are several uncertainties in the work, and it is primarily model-based rather than observed
5139	18	35	18	42	We would suggest including the recent study examining the observed impacts on a global scale. Iizumi, T., Shiogama, H., Imada, Y., Hanasaki, N., Takikawa, H. and Nishimori, M. (2018) 'Crop production losses associated with anthropogenic climate change for 1981-2010 compared with preindustrial levels', International Journal of Climatology. doi: 10.1002/joc.5818. This study used a global crop model to determine the observed impacts between 1981 – 2010 and showed the crop-species dependent and region-dependent impacts. [Japan]	Thank you for your suggestion. We have included this study in your discussion and table. However, please note that the uncertainties in this study at the 90% probability interval are very high, often greater than the reported change.
14837	18	39	18	41	Remove sentence "Another recent study found...". Irrelevant here, not about observed impacts but about projections and not about crop production. [Katharina Waha, Australia]	Sentence deleted.
28493	18	39	18	41	This sentence is not specifically about crop production [Valerie Kapos, United Kingdom (of Great Britain and Northern Ireland)]	Sentence deleted.
13585	18	41	18	42	a third of global crop yield availability? [Lourdes Tibig, Philippines]	We meant global crop variability. Change made. Thanks.
178	18	41	18	42	As Ray et al. (2015) describes seasonal climate variability and its impact on crop yields in the present-day climate, additional information more relevant to changes in weather extremes and their impacts on yield variability makes this text more relevant to readers than currently. The following text is an example: "In 9–22% of the global harvested area (22% for wheat, 16% for rice, 13% for maize and 9% for soybean), significant increase in yield variability for the period 1981-2010 is detected (Iizumi and Ramankutty, 2016). Over one fifth of the detected yield variability change could be explained by change in daily temperature and precipitation extremes and the increased frequency of high temperatures exceeding the optimal temperature range for yield formation is the most important climatic factor in explaining the yield variability change (Iizumi and Ramankutty, 2016).". Citation Iizumi, T. and N. Ramankutty, 2016. Changes in yield variability of major crops for 1981–2010 explained by climate change. Environ. Res. Lett., 11, 034003, doi:10.1088/1748-9326/11/3/034003. [Toshichika Iizumi, Japan]	Suggested text has been added. Thank you.
14839	18	42	18	42	replace "crop" with "wheat, maize, rice and soybean" [Katharina Waha, Australia]	Done. Thank you.
14841	18	42	18	42	Add: to a fifth, "variation explains a third to a fifth of..." [Katharina Waha, Australia]	Thank you. Done.



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14843	18	42	18	42	Add after Ray et al. 2015: However, the relationship between climate and crop yield variability depends on the crop and country studied (Osborne & Wheeler 2013). Add reference Osborne TM, Wheeler TR (2013) Evidence for a climate signal in trends of global crop yield variability over the past 50 years. Environ Res Lett 24001(2):24001 (Accepted on 19 March 2013, after the WGI AR5 literature cut-off for accepted papers) [Katharina Waha, Australia]	Thank you. This was an important suggestion. Change made and reference added.
14845	18	42	18	42	Add to that last paragraph: National cereal production in selected countries was 9-10% below the control mean in years with drought and heat between 1964 and 2007 (Lesk et al. 2016). The same study found no significant production effects from extreme cold and flood and more damage in developed countries than in developing countries, possibly because of the different structure of farming systems. Add reference: Lesk C, Rowhani P, Ramankutty N (2016) Influence of extreme weather disasters on global crop production. Nature 529(7584):84-7. [Katharina Waha, Australia]	I am wary about adding this study. The study is NOT about climate change. It's a work that documents that extreme weather disasters impact crop production. Also, the authors do not make an attempt to tie their work with climate change impacts.
14847	18	42	18	42	Add reference: Iizumi & Ramankutty 2016: Iizumi T, Ramankutty N (2016) Changes in yield variability of major crops for 1981–2010 explained by climate change. Environ Res Lett 11(3):34003. [Katharina Waha, Australia]	Done.
14849	18	42	18	42	Ray et al. 2015 missing in reference list: Ray DK, Gerber JS, MacDonald GK, West PC (2015) Climate variation explains a third of global crop yield variability. Nat Commun 6:5989. [Katharina Waha, Australia]	Not sure why it wasn't there. It has been reformatted in Mendeley and added. Thank you.
40711	18		18		Chapter 2 needs to provide an assessment of trends in aridity in conjunction with 5.2.2.2 (to coordinate). [Valerie Masson-Delmotte, France]	Noted
14069	18	6	21	32	Comment: Include a brief analysis of observed impacts according to regions or climatic zones [Ana Felicien, Venezuela]	Accepted, done
903	18	7	21	32	South Asia and Hindukush Himalayas are likely to witness a drop in crop yield impacting the vulnerable communities more in the respective countries owing to climate change. Special focus is required in enabling these countries to face and address the spectre of reducing food grain yields in future. The enablement should comprise extending of technical, financial, capacity building and material support in addition to creating a chain of food storage and distribution centres in most vulnerable locations. Similar situation is likely to be faced by African countries, and mountainous areas of South American countries. They will also need similar kind of help and support. The aforesaid requirements of South Asian, African and South American countries should be included in the relevant section of this Chapter. [Jagdish Kishwan, India]	Accepted, vulnerable regions highlighted in chapter
29681	18	32	21	32	This section does not include anything on small islands. A separate subsection on small islands would be very useful here. This could cover challenges associated with e.g. salinisation and damage from cyclones to crops for domestic food security or for export. [, Saint Lucia]	Rejected, see box on Pacific region
11491	18	32	21	32	the country entry point of this section is one option, however addressing current Observed impact on crop production by "climatic zone" might have been pertinent.. Since this SR addressed climate change [Jean-Luc Chotte, France]	Rejected, section is organized by continent
30735	18	6	23	15	Please be consistent!!! Given that you didn't provide full picture of global food systems then the information provided in 5.2.2 Observed climate change impacts are limited. Moreover, your argument on identifying attribution to climate change are not precise and confused. I believe that the second order draft should really be digestible and concise. Moreover the detail information is needed per food systems per agro-climatic or agro-ecological zone, per countries and region if possible. This would help to test the future performance of existing adaptation measure for capitalization. [Constant Labintan, Benin]	Accepted, text rewritten

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39659	18	32	23	5	Section 5.2.2.2 on continental impacts of climate change on crop production is very uneven in regional considerations. [United States of America]	We have added more references, but please provide specific ones that you might want us to consider.
13853	18	32	23	5	There is a limited discussion of the significant role of short-lived climate pollutants (black carbon, methane and tropospheric ozone) on agricultural yield both current and future impacts. This is a well studied field and the role they will play is significant. It is suggested that authors do a detail review of this and incorporate into relevant sections of the document. See example references: UNEP/WMO 2011: <a href="https://library.wmo.int/pmb_ged/wmo_1073.pdf">https://library.wmo.int/pmb_ged/wmo_1073.pdf</a> ; UNEP, 2011: <a href="http://wedocs.unep.org/handle/20.500.11822/8048">http://wedocs.unep.org/handle/20.500.11822/8048</a> ; Shindell et al. 2012. <a href="http://science.sciencemag.org/content/335/6065/183">http://science.sciencemag.org/content/335/6065/183</a> ; Haines et al. 2017: <a href="https://www.nature.com/articles/s41558-017-0012-x">https://www.nature.com/articles/s41558-017-0012-x</a> ; Shindell et al. 2017: <a href="https://www.cfa.harvard.edu/~wsoon/myownPapers-d/Ronan-2018withBob-d/ShindellRamanathanetal17-May5-ClimatePolicyPathway.pdf">https://www.cfa.harvard.edu/~wsoon/myownPapers-d/Ronan-2018withBob-d/ShindellRamanathanetal17-May5-ClimatePolicyPathway.pdf</a> ; Burney et al 2014. <a href="https://www.pnas.org/content/pnas/early/2014/10/29/1317275111.full.pdf">https://www.pnas.org/content/pnas/early/2014/10/29/1317275111.full.pdf</a> ; Fan et al. 2015: <a href="https://pdfs.semanticscholar.org/7d5f/0fc17ca0cf609f012d09666554f688390c82.pdf">https://pdfs.semanticscholar.org/7d5f/0fc17ca0cf609f012d09666554f688390c82.pdf</a> ; Shindell 2016. <a href="https://agupubs.onlinelibrary.wiley.com/doi/epdf/10.1002/2016EF000377">https://agupubs.onlinelibrary.wiley.com/doi/epdf/10.1002/2016EF000377</a> ; [Sunday Leonard, United States of America]	Reject. These topics are beyond the scope of this section.
12151	18	32			This section should make use of uncertainty/confidence statements. [Hans Poertner and WGII TSU, Germany]	Accepted, added uncertainty/confidence statements
23917	19	0	19	0	Its "India Meterological Department" and not "Indian....." as mentioned in the table on this page. [India]	Change made. Thank you.
14857	19	0	19	0	Change column heading to "Observed / perceived impacts" [Katharina Waha, Australia]	Reject.
14859	19	0	19	0	Table 5.3. needs revision. Of the current studies 3 are not reporting any impacts on crop production and should be removed. The attribution methods used could be grouped as: 'None', 'Associate pattern' or 'Statistical relationship between past climate and production or yield trend' and 'Local farmer's knowledge and perception' and explained in the text above. There are more studies that can be included here, see the comment above with some studies. [Katharina Waha, Australia]	Reject. We are using the IPCC definition of attribution (Hegerl et al. 2010) .
14861	19	0	19	0	Remove first row in Table 5.3. Ketiern et al. does not provide any evidence for changes in crop production and should therefore be removed from the table. [Katharina Waha, Australia]	Table revised. We are keeping this study as important grey literature, though we are moving it.
14863	19	0	19	0	Second row: Correct to "Southwest" [Katharina Waha, Australia]	Change made. Thank you.
14865	19	0	19	0	Second row, impact method / source: Replace "Data were collected" with "Findings based on perceived effect of climate change on crop production..." [Katharina Waha, Australia]	Reject. We believe our current language is more appropriate.
14867	19	0	19	0	Second row, attribution method: Replace None with Local farmer's knowledge and perception [Katharina Waha, Australia]	Reject. We are using the IPCC definition of attribution (Hegerl et al. 2010) .
14869	19	0	19	0	Third row, impact method: Correct Key to key and Agricultural to agricultural [Katharina Waha, Australia]	Change made. Thank you.
14871	19	0	19	0	Third row, attribution method: replace None with Local farmer's knowledge and perception [Katharina Waha, Australia]	Reject. We are using the IPCC definition of attribution (Hegerl et al. 2010) .
14873	19	0	19	0	Remove fourth row. Ugochukwu 2017 does not provide any evidence for impacts of climate change on crop production but describes adaptation measures and constraints to adaptation without establishing in the paper that climate change is a problem at all. Should therefore be removed from the table. [Katharina Waha, Australia]	Reject. An observed adaptation is in itself a response to climate change. This paper was also requested to be included by another reviewer in the second order draft.

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14875	19	0	19	0	Fifth row, attribution method: Replace None with Local farmer's knowledge and perception [Katharina Waha, Australia]	Reject. We are using the IPCC definition of attribution (Hegerl et al. 2010) .
14877	19	0	19	0	Remove sixth row from table. The maize yield decline in this study is attributed to different plant densities and cultivars / growing period from experimental data for just one year. Any long-term climate impact on maize yield is modeled only. [Katharina Waha, Australia]	Agreed. Study removed. Thank you.
14879	19	0	19	0	Hussain et al. row, climate data: Remove everything from "used in the study..." to keep only "No climate data included" to be consistent with the information given for the other studies [Katharina Waha, Australia]	Reject. The clarification is necessary and important.
14881	19	0	19	0	Meng et al. row, region, correct to Heilongjiang [Katharina Waha, Australia]	Change made. Thank you.
14883	19	0	19	0	Meng et al. row, impact method: Add "Modeling with process-based crop model based on long-term climate and yield data/... [Katharina Waha, Australia]	Reject. We are using the IPCC definition of attribution (Hegerl et al. 2010) .
14885	19	0	19	0	Meng et al., Attribution method, Replace Single Step with Modeling crop yields with and without increases in temperature. [Katharina Waha, Australia]	Reject. We are using the IPCC definition of attribution (Hegerl et al. 2010) .
14887	19	0	19	0	Meng et al. row, observed impacts, add "in high-latitudes > 45 degrees and a shift of northward limits of maize area" at the end [Katharina Waha, Australia]	Change made. Thank you.
14889	19	0	19	0	Meng et al. row, region, Add Northeast to Northeast China [Katharina Waha, Australia]	Change made. Thank you.
14891	19	0	19	0	Hussain et al. row, add - between Hindu and Kush [Katharina Waha, Australia]	Change made. Thank you.
14893	19	0	19	0	Hussain et al. row, correct to "households" [Katharina Waha, Australia]	Change made. Thank you.
14895	19	0	19	0	Hussain et al. row, observed impacts: Replace with "Declines in crop production over the last 10 years. Increase in production of summer crops in some parts." [Katharina Waha, Australia]	Change made. Thank you.
14897	19	0	19	0	Hussain et al. row, attribution method: Replace with "Local farmer's knowledge and perception" [Katharina Waha, Australia]	Reject. We are using the IPCC definition of attribution (Hegerl et al. 2010) .
14899	19	0	19	0	Gupta row, observed impacts: Change to Reduce wheat yields by about... [Katharina Waha, Australia]	Change made. Thank you.
14901	19	0	19	0	Gupta row, observed impacts, Add: "1 °C increase in average daily maximum and minimum temperatures lowers yields by 2-4%." [Katharina Waha, Australia]	Change made. Thank you.
14903	19	0	19	0	Gupta row, attribution method: Replace with "Associative pattern" [Katharina Waha, Australia]	Reject. We are using the IPCC definition of attribution (Hegerl et al. 2010) .
14905	19	0	19	0	Carleton row, observed impacts: Replace by "Crop yield decline with rising growing season temperatures. Positive relationship between growing season precipitation and crop yield." The focus in the table should be on change in crop production. [Katharina Waha, Australia]	Excellent suggestion. Change made.
14907	19	0	19	0	Carleton row, attribution method: Change to "Associative pattern" [Katharina Waha, Australia]	Reject. We are using the IPCC definition of attribution (Hegerl et al. 2010) .
14909	19	0	19	0	Abbas row, observed impact: correct to "phenology" and "maize" and add: "Sowing dates for spring maize 3.5-5.5 days per decade earlier. Sowing dates for autumn maize 1.5-4.2 days per decade later." [Katharina Waha, Australia]	Change made. Thank you.
14911	19	0	19	0	Abbas row, attribution method. Change Single step to Associative pattern [Katharina Waha, Australia]	Reject. We are using the IPCC definition of attribution (Hegerl et al. 2010) .
14913	19	0	19	0	Tariq row, observed impacts: Add "Sowing dates for spring sunflower 3.4-9.3 days per decade earlier. Sowing dates for autumn sunflower delayed by 2.7-8.4 days per decade." [Katharina Waha, Australia]	Change made. Thank you.
14915	19	0	19	0	Tariq row, attribution method: Associative pattern [Katharina Waha, Australia]	Reject. We are using the IPCC definition of attribution (Hegerl et al. 2010) .

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14917	19	0	19	0	Hochman row, Attribution method change to: None [Katharina Waha, Australia]	Reject. We are using the IPCC definition of attribution (Hegerl et al. 2010) .
14919	19	0	19	0	Hochman row, observed impacts: Add "Decline in water-limited yield potential" [Katharina Waha, Australia]	Change made.
14921	19	0	19	0	Potopova row, observed impact, correct to: "impacts on fruiting vegetables (+ 4.9 to 12.2% °C-1) [Katharina Waha, Australia]	Change made. Thank you.
14923	19	0	19	0	Potopova row, add: "(location and crop-specific effects)" at the end [Katharina Waha, Australia]	Rejected
14925	19	0	19	0	Moore row, reference change to Moore & Lobell [Katharina Waha, Australia]	Noted
14927	19	0	19	0	Moore row, add "due to temperature and precipitation changes" at the end [Katharina Waha, Australia]	Change made.
14929	19	0	19	0	Kukal reference missing in reference list: <a href="https://www.nature.com/articles/s41598-018-21848-2">https://www.nature.com/articles/s41598-018-21848-2</a> [Katharina Waha, Australia]	Noted
14931	19	0	19	0	Kukal row, observed impacts: change to "variability in maize, sorghum, and soybean yield explained by climate variability (but site-, management- and crop-specific effects)" [Katharina Waha, Australia]	Rejected
14933	19	0	19	0	Kukal row, references, change from None to Associative pattern [Katharina Waha, Australia]	Reject. We are using the IPCC definition of attribution (Hegerl et al. 2010) .
14935	19	0	19	0	Last row, climate data: remove everything from ", though the article states..." to be consistent with information given for the other studies [Katharina Waha, Australia]	Reject. We are using the IPCC definition of attribution (Hegerl et al. 2010) .
14937	19	0	19	0	Last row, attribution method, change from None to Local farmer's knowledge and perception [Katharina Waha, Australia]	Reject. We are using the IPCC definition of attribution (Hegerl et al. 2010) .
14939	19	0	19	0	Last row, region, change to: Colomi, Bolivian Andes [Katharina Waha, Australia]	Reject. We are using the IPCC definition of attribution (Hegerl et al. 2010) .
17973	19	0	19	0	Its "India Meterological Department" and not "Indian....." as mentioned in the table on this page. [Nayanika Singh, India]	Change made. Thank you.
14851	19	1	19	1	Add "phenology and" and replace "regional" with "local to national" to "local to national crop phenology and production" [Katharina Waha, Australia]	Rejected
14853	19	1	19	1	Content of Table 5.3. There are much more studies that are missing. ScienceDirect gives 689 results when searching for observed changes AND crop production AND climate change and the time period 2013-2018. For example, about local farmer's knowledge and perception (abstracts indicate findings about impacts on crop production, not just changes in climate or weather) - Tea plantations in Sri Lanka: <a href="https://www.sciencedirect.com/science/article/pii/S1462901117309346">https://www.sciencedirect.com/science/article/pii/S1462901117309346</a> - Horticulture in Ghana: <a href="https://www.sciencedirect.com/science/article/pii/S2212096318301633">https://www.sciencedirect.com/science/article/pii/S2212096318301633</a> - Cocoa in Ghana: <a href="https://www.sciencedirect.com/science/article/pii/S0264837716313230">https://www.sciencedirect.com/science/article/pii/S0264837716313230</a> - Nigeria: <a href="https://www.sciencedirect.com/science/article/pii/S2212094716300755">https://www.sciencedirect.com/science/article/pii/S2212094716300755</a> . Could add more studies developing associative pattern between climate and production (abstracts indicate findings about impacts on crop production, not just changes in climate or weather): - Corn in Midwest Corn Belt, US: <a href="https://www.sciencedirect.com/science/article/pii/S0048969717317205">https://www.sciencedirect.com/science/article/pii/S0048969717317205</a> [Katharina Waha, Australia]	Accepted, added suggested studies

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Comment No	From Page	From Line	To Page	To Line	Comment	Response
31093	19	1	19	1	Ugochukwu 2018 should be cited as Onyeneke 2018. Onyeneke is the surname. See the full citation 5. Onyeneke, R.U. (2018). Challenges of Adaptation to Climate Change by Farmers Anambra State, Nigeria. International Journal of BioSciences, Agriculture and Technology, Vol. 9, No. 1, Pp. 1-7 [Robert Onyeneke, Nigeria]	Change made.
23409	19	1	19	2	Table 5.3. Sound buy Observed Impacts column needs to be expanded substantially with due concern for attribution. [John Dixon, Australia]	Unclear
22629	19	1	19	3	Potentially move table to annex [Anastasios Kentarchos, Belgium]	Table now only has documented D+A studies. Local knowledge table moved to Supp Material
13587	19	1	19	3	Table 5.3 includes entries that are not observed impacts , and also, not reflecting the title of this table. For instance, if no climate data is used in the study, how can one call it observed climate change impacts It is also being suggested that inferred climate change impacts be removed from the table and perhaps could be dealt with in a subsection on indigenous knowledge and local knowledge. Moreover, statistical relationship between variables and outcomes do not constitute formal attribution [Lourdes Tibig, Philippines]	Accepted, Table has been revised
39661	19	1	19	4	Table needs to reformatted to be readable. [ , United States of America]	Accepted, table has been reformatted to be readable
17227	19	1	19	4	Table 5.3 -This table does not provide good examples of the observed climate change impact on crop production. Many of studies cited are not good studies. [Hoang Anh Le, Vietnam]	Accepted, Table has been revised
14855	19	2	19	2	Add: "from selected studies" to "methods from selected studies" [Katharina Waha, Australia]	Rejected
14705	19	2	19	3	In Table 5.3. Reference Carleton 2017. 'is responsible' is a causal statement that can not be extracted from a statistical relationship. Better to use 'associates.' [Adalberto Benavides-Mendoza, Mexico]	Agreed. The cell has been revised.
14059	19	2	19	3	Comment: in the table 5.3, observed impact cell, file 10. The relation between suicide rates and increase in temperature is an oversimplification. Suicide is a very complex phenomenon un rural communities which can not related with just one climatic variable [Ana Felicien, Venezuela]	This cell has been revised to omit the suicides.
14061	19	2	19	3	Comment: in the table 5.3, observed impact cell, file 10. It is needed a brief description of suicide as a complex phenomenon in rural communities. It is recomended start the explanation with the second part of the argument: ..."but the suicides may also be related to lack of crop insurance and inability to repay loans taken for high-yield, high-input crops", and clarify better the relation between suicide and temperature as an indirect effect [Ana Felicien, Venezuela]	The cell has been revised to focus more on effects on crops.
17997	19	2	19	3	The reference here to Meng et al 2014 omits that the increases in maize yields were achieved because of farmer adjustments to crop varieties and planting dates. As presented in the table, the reference here may infer that climate change resulted in increased yield alone. As noted, this is only part of the story here. [Beau Damen, Thailand]	Change made. Thank you.
23851	19	2	19	3	The reference of Carleton 2017 attributing increase in temperature to suicides in India is neither scientifically nor technically proved. More so farmers deaths is more of socio-economic problem rather than a climate change problem. Hence, this reference alongwith the content may be deleted. [ , India]	The reference to suicides has been deleted, but the study still has interesting crop and temperature data.
2161	19	2	19	3	Table 5.3, line 8 Heilongjiang Province, China . There were some errors in the estimation of 7-17% yield increase of heilongjiang maize. The original meaning of the literature is that if the 1980 variety is still adopted, the yield of maize in heilongjiang may stagnate or decrease, but due to the adoption of adaptive measures, the application of maize varieties with a long growth period increases by 7-17% every decade. [Hui Ju, Comoros]	Thanks. Change made.

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Comment No	From Page	From Line	To Page	To Line	Comment	Response
2163	19	2	19	3	What the means of Single step? Give clear definition. [Hui Ju, Comoros]	Definition given.
23911	19	17	19	17	The farmer death is attributed to lack of crop insurance, whereas in chapter 7 (Page 46, line 20), it is mentioned that crop insurance is heavily subsidized by Indian taxpayers. Linking farmers' deaths to insurance regime and correlating with global climate change is incorrect, misplaced, misleading and out of context. Both the statements are selective, contradictory, intrusive and are not based on robust, scientific, technical literature. These should be deleted. [, India]	The line now simply reads "A recent study has shown that there are crop-damaging temperatures in India (Carleton 2017). "
40713	19		19		Table 5.3 : choice of examples? Exhaustive? Confidence associated with studies? What does "associative pattern" mean? Are there situations of double attribution (impact to climate characteristic, and climate characteristic to human induced climate change)? [Valerie Masson-Delmotte, France]	The attribution methods have been described in further detail.
28667	19	1		2	Climate Change impacts on regional crop production, data sources and attribution methods. I recommend weather data for south-west Nigeria ,Abia state,Anambra state and Ebonyi state Nigeria should be highlighted. Climatic data must be collected from the Nigerian Meteorological office in Nigeria to be integrated along with the sample collected from various farmers across the listed state above. The impacts of Climate change is based on the Climate data collected and factors. Also the Table highlighted is inconclusive, analysis from Nigeria state listed above is not complete Climatic factors data sets for the areas sampled in Nigeria. Integrated climatic data sets process should be implemented along with data sources in relation to the regional crop production and food security. [Abiodun Adegoke, Nigeria]	Unclear
21423	19	1			Where are the attribution methods defined? Also, while I applaud the authors efforts to include examples where the literature is not strong, I do find it problematic to include in a table on observed climate change impacts studies that did not include any climate data and made no attribution effort. The authors should try to come up with a way that more clearly demonstrates that there are trends and issues going on in regions where literature is sparse, but we cannot pretend that this are studies of observed climate change impacts. [Andy Reisinger, New Zealand]	In the cited reference. But a summary of these attribution methods has also been included.
15139	19	1			Table 5.3 : It would be interesting to present also the situation of a Sahelian country in Africa where the problem of food security related to climate change arises much more. [Ibouraima Yabi, Benin]	Please provide a reference.
8737	19	2			In Table 5-3, "Heilengjiang" should be "Heilongjiang". "a 7-17% percent" should take off either % or percent. [Changxiao Li, China]	Change made. Thanks.
13855	20	1	20	3	Are there other studies that corroborate this? And I think there are more studies on Australia that should be reflected in a robust IPCC report. See: <a href="https://scholar.google.com/scholar?as_ylo=2015&amp;q=climate+change+impact+on+agriculture+i+n+Australia&amp;hl=en&amp;as_sdt=0,21">https://scholar.google.com/scholar?as_ylo=2015&amp;q=climate+change+impact+on+agriculture+i+n+Australia&amp;hl=en&amp;as_sdt=0,21</a>  This is same for other regions or countries discussed below. I think a more robust review of the literature should be included in the discussion [Sunday Leonard, United States of America]	Please provide specific references.
23411	20	1	20	6	Substantively correct. Add comment on punctuated equilibria in climate changes (1974, 1988, 1998, 2004, etc). Add comment that major management change has been conservation agriculture (no or minimum till). Refer also to livestock changes. [John Dixon, Australia]	Added suggestion on no till.
13591	20	1	20	6	Has there been only one study? [Lourdes Tibig, Philippines]	Another study has been added.

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Comment No	From Page	From Line	To Page	To Line	Comment	Response
13857	20	3	20	6	Kindly provide reference(s) for this [Sunday Leonard, United States of America]	Provided.
17999	20	8	20	10	Meng et al 2014 is focused on maize production, but in the context of this sentence it appears to imply that it refers to an expansion of rice area. [Beau Damen, Thailand]	Change to sentence made.
2165	20	8	20	10	This statement is misleading. Suggestion as: The observed warming has increased the thermal resources in Northeast China, combining with the adjustment of regional planting structure, improvement of varieties and progress of field management technology, the area of rice has been expanded and the yield has been increased. [Hui Ju, Comoros]	Ok. The suggestion was followed with only a slight adjustment. "The observed warming has increased the thermal resources in Northeast China. Combined with adjustments in regional planting structure, improvements in varieties, and progress in field management technology, the area of rice cultivation has been expanded and yield has increased."
23413	20	9	20	10	northern Central Asia (including Siberia) is expected to become moister and warmer so the wheat belt will expand north just as in China (but I am not aware of any impact studies yet). [John Dixon, Australia]	Noted.
14941	20	10	20	10	Add at the end: ",increased wheat yield (Tao et al. 2014) and changes in wheat phenology (He et al. 2015, Liu et al. 2018)", References are: -Tao et al. <a href="https://www.sciencedirect.com/science/article/pii/S0168192314000227">https://www.sciencedirect.com/science/article/pii/S0168192314000227</a> , -He et al. <a href="https://www.sciencedirect.com/science/article/pii/S0168192314002226">https://www.sciencedirect.com/science/article/pii/S0168192314002226</a> , -Liu et al. <a href="https://www.sciencedirect.com/science/article/pii/S0168192317303039">https://www.sciencedirect.com/science/article/pii/S0168192317303039</a> [Katharina Waha, Australia]	Accepted, added references
23845	20	11	20	13	Lal et al. (2017) Loss of crop yields in India due to surface ozone: an estimation based on network of observations, Environ Sci Pollut Res Int. 24(26): 20972-20981. doi: 10.1007/s11356-017-9729-3. Garibaldi et al 2016. Science Vol. 351, Issue 6271, pp. 388-391: Mutually beneficial pollinator diversity and crop yield outcomes in small and large farms. These references in Indian context may further strenghten these satementes. [, India]	Accepted, added references in relevant sections
39663	20	13	20	14	Unclear what climate impact would "increase by half". [, United States of America]	Accepted, added Rice production.
14943	20	13	20	14	Unclear language: "; and that if India continues to deplete its groundwater impacts of increased climate variability are likely to increase by half" [Katharina Waha, Australia]	Sentence revised to increase clarity. Thank you.
23853	20	15	20	17	The statement that crop damaging temeputeres have led to increase in deaths among small holders in India is factually incorrect and prejudicial. This statement and the underlying study need to be deleted. [, India]	Sentence now just reads, "A recent study has shown that there are crop-damaging temperatures in India (Carleton 2017). "
14945	20	15	20	17	Not relevant in this section on observed impacts on crop production. Move to section about socio-economic impacts. [Katharina Waha, Australia]	Sentence now just reads "A recent study has shown that there are crop-damaging temperatures in India (Carleton 2017). "

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Comment No	From Page	From Line	To Page	To Line	Comment	Response
24365	20	18	20	24	Wheat and rice are major food security determinant crops in Pakistan. The para 18-24 does not mention of these crops where as significant scientific literature is available on the impacts of climate change on these crops. A review of the following studies may help in phrasing the South Asian in general and Pakistani context in particular. <a href="#">Tingju Zhu, Claudia Ringler, M. Mohsin Iqbal, Timothy B. Sulser and M. Arif Goheer. 2013. Climate change impacts and adaptation options for water and food in Pakistan: scenario analysis using an integrated global water and food projections model. Water International, Vol. 38, No. 5, 651–669, <a href="http://dx.doi.org/10.1080/02508060.2013.830682">http://dx.doi.org/10.1080/02508060.2013.830682</a>; Iqbal, M. M., Goheer, M. A. and Khan, A. M. 2009. Climate Change Aspersions on Food Security of Pakistan. Science Vision. 15(1): 15-23. Iqbal, M.M., M.A. Goheer, B.V.R. Punyawardena, A. De Silva and A. Hassan (2014). Final Report of APN Project "Assessment of Food and Water Security in South Asia under Changing Climate using Crop Simulation and Water Management models and Identification of Appropriate strategies for Adaptation to Meet the Future Demand (ARCP2008-20NMY-Iqbal)", Global Change Impact Studies Centre (GCISC), Islamabad, Pakistan. [Muhammad Goheer, Pakistan]</a>	I looked at the first study, and it was not an observed impact study. I can't locate the other studies.
14063	20	32	20	33	Comment: conclude this idea with some brief results of the surveys, the idea appears incomplete. [Ana Felicien, Venezuela]	Accepted, sentence has been clarified
14065	20	34	20	40	Comment: Include evidences of other regions of south america related with key crops as soybean, corn, etc. E.g: Rose, G., Osborne, T., Greatrex, H., & Wheeler, T. (2016). Impact of progressive global warming on the global-scale yield of maize and soybean. Climatic change, 134(3), 417-428 [Ana Felicien, Venezuela]	I have downloaded this study and read much of it, and am baffled as to why it was suggested by the reviewer. It does not deal with observed impacts, and is clearly a model based study.
14067	20	34	20	40	Comment: Include evidences of other regions of south america related with key crops as soybean, corn, etc. E.g: Pires, G. F., Abrahão, G. M., Brumatti, L. M., Oliveira, L. J., Costa, M. H., Liddicoat, S., ... & Ladle, R. J. (2016). Increased climate risk in Brazilian double cropping agriculture systems: Implications for land use in Northern Brazil. Agricultural and forest meteorology, 228, 286-298. [Ana Felicien, Venezuela]	I have downloaded this study as well, and it also appears to be not an observed impacts study. It is all modeled.
13859	20	37	20	40	Provide reference [Sunday Leonard, United States of America]	Done.
1015	20	41	20	45	Current discussion about drylands in this section gives the impression that they are restricted to Africa, which is incorrect. [Alisher Mirzabaev, Germany]	Accepted, fixed
13005	20	46	20	47	Inconsistent formatting and use of latin names here compared to elsewhere in chapter. [Aidan Farrell, Trinidad and Tobago]	Accepted, latin names removed
13861	20	41	21	14	The discussion here focuses on sub-saharan Africa and not the whole of Africa. For completeness, studies related to the northern Africa should be included. [Sunday Leonard, United States of America]	Please provide suitable references.
13589	20	1	23	4	This discussion on regional crop production could be transformed into a synthesis for each of the regions. [Lourdes Tibig, Philippines]	Unclear.
23527	20	1			The construction and implementation of the food supply chain faces the challenges of internationalization and is subject to the heterogeneous environment and technology of each country. Therefore, the global construction and implementation of the supply chain is quite difficult, and international trade will promote the risk of price volatility of the food chains, so it may be more valuable to discuss the implementation of different supply chain construction schemes by certain strong countries, such as America and China. [Huai Jianjun, China]	Beyond scope of chapter.



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Comment No	From Page	From Line	To Page	To Line	Comment	Response
25073	20	44			Liu J., Fritz S., van Wesenbeeck C.F.A., Fuchs M., Obersteiner M., Yang H., 2008. A spatially explicit assessment of current and future hotspots of hunger in Sub-Saharan Africa in the context of global change. <i>Global and Planetary Change</i> 64(3-4): 222-235. [Junguo Liu, China]	Rejected, reference is too old
31095	21	4	21	4	Ugochukwu 2018 should be cited as Onyeneke 2018. Onyeneke is the surname. See the full citation 5. Onyeneke, R.U. (2018). Challenges of Adaptation to Climate Change by Farmers Anambra State, Nigeria. <i>International Journal of BioSciences, Agriculture and Technology</i> , Vol. 9, No. 1, Pp. 1-7 [Robert Onyeneke, Nigeria]	Noted
13863	21	8	21	9	Why "another" here? This is same study referenced earlier. Please revised accordingly [Sunday Leonard, United States of America]	Changed "Another," to "The."
31097	21	12	21	12	Ugochukwu 2018 should be cited as Onyeneke 2018. Onyeneke is the surname. See the full citation 5. Onyeneke, R.U. (2018). Challenges of Adaptation to Climate Change by Farmers Anambra State, Nigeria. <i>International Journal of BioSciences, Agriculture and Technology</i> , Vol. 9, No. 1, Pp. 1-7 [Robert Onyeneke, Nigeria]	Noted
31729	21	13	21	13	delete "that" as redundant in the sentence [Elizabeth Migongo-Bake, Kenya]	Done.
13865	21	15	21	15	The impacts of climate change are varied across the continent. This is the case for other regions too, even though the current text does seem to reflect that [Sunday Leonard, United States of America]	Unclear comment.
39665	21	29	21	32	North American section seems highly truncated. Box may have been overlaid on this section...? [, United States of America]	Please provide specific references.
13867	21	29	21	32	The text here is extremely light compared to the numerous studies available on North America [Sunday Leonard, United States of America]	Please provide specific references. There does not appear to be that many.
2169	21	41	21	43	Temperature of 1.43°C misquoted the past 50 years, and is the second-hand reference, the original documents is raising temperature of 1.43°C/100a one hundred (Sun F.H et al, 2006) [Hui Ju, Comoros]	Accepted, changed text
2171	21	44	21	46	To indicate the research period and the exact citation of the contribution rate of climate change of 0.59% of the production increase in northeast China. [Hui Ju, Comoros]	Accepted, changed text
23415	21	45	21	46	Take great care with attribution. I suspect the improved cultivars and management have contributed to the steady yield increase. [John Dixon, Australia]	Accepted, emphasized multiple factors with respect to attribution
2167	21	34	22	39	BOX5.1 details Chinese studies too much and exaggerates the effect of climate warming on rice yield and area in northeast China. It is recommended to delete BOX5.1 and use the same format as India and Pakistan (see p5-20 line11-17 India, line18-24 Pakistan). [Hui Ju, Comoros]	Accepted, deleted box and used same format as India and Pakistan
1655	21	34	23	4	The example of expansion of rice planting in China should be analyzed here. [Chao WEI, China]	Accepted, added more information from Liu et al 2014 and Wang et al 2014
3455	21	34	23	4	The present BOX 5.1, which is too long, exaggerates the role of climate warming in contributing to rice yield in Northeast China. The changes in rice acreage and yield there result all the more from structural adjustment, scientific and technological progress and government policies. So it is suggested to modify and shorten the box. Figure 5.4, which does not support the description in BOX 5.1, is suggested to be deleted. [, China]	Accepted, text revised. Figure deleted.
2173	22	1	22	1	'the three river basin'should be better to translate as Sanjiang river basin. [Hui Ju, Comoros]	Noted, text deleted with previous comment

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Comment No	From Page	From Line	To Page	To Line	Comment	Response
2175	22	3	22	4	The quotation here is not accurate, it is a secondary quotation, and it deviates from the original meaning of the original literature. It is misinterpreted and easy to mislead decision makers, and misunderstand the relationship between climate change and land reclamation in northeast China. It is suggested to apply the research results of (Shi, 2013) as 'the relevant researches indicate that there is close correlation between the significant climate change and the more and more large-scale cultivated land reclamation in Northeast China in recent decades' [Hui Ju, Comoros]	Accepted, text deleted
2177	22	5	22	6	Over-affirming the degree of coincidence between rice expansion and climate change, while the original sentence has a turning point, indicating that it is not an ideal correspondence, and the use of determiners in the elaboration. 'indicating that the shifts in the extent and location of the rice cropping area partly matched the climate change pattern'. [Hui Ju, Comoros]	Accepted, text deleted
5141	22	17	22	20	The authors argued that area for japonica rice is growing in the northern limit and seems to treat it as if it is an opportunity to increase in production and nutritional quality, but this seems confusing as we are not aware of scientific evidence that japonica rice is any better than in indica in nutritional quality. The cited literature does not touch upon nutritional quality either. If the authors insist that japonica rice is more nutritious, please indicate the references, or otherwise, provide elaboration on "increase in the nutritional quality". Li et al (2017) [, Japan]	Accepted, text deleted
5143	22	20	22	20	Suggest modifying "Li et al (2016)" to "Li et al (2017)". [, Japan]	Noted, text deleted with previous comment
2179	22	24	22	33	Environmental risk is a potential global problem, not an exception in Northeast China. [Hui Ju, Comoros]	Accepted, text deleted
2941	22	29	22	33	Box 5.1 talked about climate change effects in Northeast China. There are some problems with the literature cited in the sentence. Accordong to You et al. (2011), the risks Northeast China faced, especially the risk of water shortage, are not the highest over China. Piao et al. (2010) did not seem to discuss the groundwater level in Northeast China. Ju et al. (2004) is a country level study, which indicated that the nitrogen application rate in Northeast China (especially Heilongjiang and Jilin) was not high compared to other regions of China. The environmental risk caused by nitrogen loss in paddy fields emphasized here is exaggerated. The research object in Yao et al. (2017) study is the paddy rice field in Hubei province, but not Northeast China. Given these, please recheck if all the references are suitable for the report. [Kun Cheng, China]	Accepted, text deleted
3483	22	32	22	33	Beside of the discussion about greenhouse gas increasing caused by expansion of rice land over Northeast China, the discussion about the reduction effect resulted from changes of planting pattern discussed in Yao et al. (2017) should be included in this part. [Jianqi Sun, China]	Noted, text removed with previous comment
6825	22	38	22	39	"However, institutional efforts and policy initiatives are needed for GHG emissions reduction and environmental protection at the same time (Liang et al. 2015)." The cited literature does not support this BOX . The cited literature is about Shanghai, China, which is not in Northeast China. The author team verified and revised. Liang, Z., T. Gu, Z. Tian, H. Zhong, and Y. Liang, 2015: Agro-climatic adaptation of cropping systems under climate change in Shanghai. Front. Earth Sci., 9, 487–496, [Changke Wang, China]	Accepted, box removed
22189	23	1	23	1	Legend in figure (UR, LSR, MSR, HSR) was not explained [Junhwan KIM, Republic of Korea]	Accepted, figure deleted
23417	23	1	23	2	Figure. CONTRDICTS text (possibly). Why has MSR area in NE China reduced 1990-2000, and why has HSR area in southern China reduced 2000-2010? [John Dixon, Australia]	Accepted, figure deleted

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Comment No	From Page	From Line	To Page	To Line	Comment	Response
3457	23	1	23	3	It is suggested to supplement the specific meanings of UR, LSR, MSR and HSR in the legend. [, China]	Accepted, figure deleted
22631	23	6	23	15	This section is very brief. Are issues pastoral systems dealt with in more depth elsewhere? Or is there insufficient evidence to say any more? [Anastasios Kentarchos, Belgium]	Text expanded
23419	23	6	23	15	EXPAND massively because range land is an important potential source of carbon sequestration, differentiate by region, and include impacts on livestock productivity [John Dixon, Australia]	Text expanded
28495	23	7	23	15	This section on pastoral systems is much briefer than that on crop production. If this is because there is less research in the area it would be helpful to say this (cf section 5.2.3.2 [Valerie Kapos, United Kingdom (of Great Britain and Northern Ireland)])	Text expanded
1017	23	10	23	13	What is the likelihood that the listed impacts were caused by climate change ? Crop production was extensively covered, but is it possible to expand the discussion on climate change and food security in pastoral systems, now extremely brief. [Alisher Mirzabaev, Germany]	Text expanded
14947	23	15	23	15	Add: "Past climate variability has been linked to animal numbers in Africa (Lunde and Lindtjorn 2013). Drought occurrence influenced cattle herd sizes and calving rates with slow recovery rates in a savanna rangeland grazing system in Ethiopia (Angassa & Oba 2013)." References are: <a href="https://peerj.com/articles/55/">https://peerj.com/articles/55/</a> and <a href="https://link.springer.com/article/10.1007%2Fs11250-012-0279-x">https://link.springer.com/article/10.1007%2Fs11250-012-0279-x</a> [Katharina Waha, Australia]	Text added
31099	23	16	23	16	I expected to see observed impacts of climate change on fish farming/aquaculture. There are empirical/scholarly papers in this area. Aquaculture is an important component of the food system. Please, let the authors create a section and report observed impacts of climate change on fish farming/aquaculture as they did in reporting the future impacts of climate change on aquaculture. We should move from "past/today" to "future" [Robert Onyeneke, Nigeria]	We have included a short section on land-based aquaculture. Natural and farmed fisheries will be covered in the SROCC
25505	23	17	23	17	We strongly suggest to illustrate some of the main findings on global maps. As an example, it would be very useful for identifying adaptation options to insert a map showing the future areas suitable for the main types of crops and farming under different climate scenarios and time horizons. Fig 5.4 is an illustration of the kind of maps to be produced at global scale. [, France]	Rejected, global map is included in Figure 5.4 (from Rosenzweig et al 2014)
14949	23	26	23	27	Change "for food system implications" to "to analyse implications for food systems" [Katharina Waha, Australia]	Accepted, changed text
40715	23		23		Fig 5.4 : explain acronyms, confidence? Method? [Valerie Masson-Delmotte, France]	Accepted, figure deleted
30653	23	17	31	38	The entire section 5.2.3 deals only with biophysical impacts of climate change and misses that production is an economic activity and so not only biophysical aspects have to be named but also the effects on the behaviour of producers need to be mentioned. There are several studies carried out with economic models that report future impacts of climate change on supply. For example: Several papers carried out by AgMIP's global economics team listed in <a href="http://www.agmip.org/global-economics-team">http://www.agmip.org/global-economics-team</a> ; FAO. 2018. The future of food and agriculture - Alternative pathways to 2050. Rome. <a href="http://www.fao.org/publications/fofa/en/">http://www.fao.org/publications/fofa/en/</a> . Please extend the section and cite the suggested references. [Lorenzo Giovanni Bellù, Italy]	Section has been restructured to includes impacts to all pillars of food security. AgMIP Economic studies cited.

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Comment No	From Page	From Line	To Page	To Line	Comment	Response
12153	23	6			This very short section gives the impression that there are hardly any observations, although lines 10-13 state that there are such observations. Please specify them and provide according references. Also a statement with uncertainty/confidence level would be helpful. [Hans Poertner and WGII TSU, Germany]	Text expanded, uncertainty level added
5145	23	8			Preferable to add 'heat wave' between 'drought' and 'flood' for heat also causes considerable damage. [, Japan]	Added to the text
5147	23	10			Preferable to add 'area of' between 'decreasing' and 'rangeland' to make it clearer. [, Japan]	Added to the text
5149	23	10			The meaning of "decreasing mobility" is unclear. Please specify. [, Japan]	"of herd" added for clarity
23543	23	38			The content of greenhouse gas emissions should be more analyzed in light of the specific conditions of the country. For example, developing countries rely more on industries with large greenhouse gas emissions to increase national income. [Huai Jianjun, China]	Rejected, comment appears to be misplaced. Page 23 does not have line 38.
7009	23				Figure 5.4 Please spell out abbreviations - only one legend required for figure. [Debra Roberts, South Africa]	Accepted, figure deleted
14733	23				Figure 5.4 is unhelpful because there is no description of what the four acronyms stand for: neither here nor in the text. [Wu Felicia, United States of America]	Accepted, figure deleted
14951	24	1	24	1	Change from "CO2 direct" to "direct CO2" [Katharina Waha, Australia]	Accepted, changed text
27745	24	2	24	2	re "depends on nutrient status":presumably you mean soil nutrient status ie nutrient availability? Water availability is also important eg , though elevated CO2 often enhances WUE. eg Uddin, et al. 2018. Yield of canola (Brassica napus L.) benefits more from elevated CO2 when access to deeper soil water is improved. Environmental and Experimental Botany, 155, pp.518-528. [Annette Cowie, Australia]	Accepted, changed text and added reference
15717	24	13	24	41	Crop production and farming system are highly influenced by extreme events. Due to the severe changes in the climate extreme indices, owing to climate change, evaluating the impact of climate change indicators on the crop production and farming system is necessary [, Iran]	Accepted, expanded literature on extreme events
23885	24	14	24	20	Consider adding the reference: "Liu, B., Asseng, S., Müller, C., Ewert, F., Elliott, J., Lobell, D. B., ... Zhu, Y. (2016). Similar estimates of temperature impacts on global wheat yield by three independent methods. Nature Climate Change, 6(12), 1130-1136. <a href="https://doi.org/10.1038/nclimate3115">https://doi.org/10.1038/nclimate3115</a> " [, India]	Noted, paper is already cited in that paragraph
23887	24	14	24	20	Consider adding the reference: "Cammarano , D., Rotter, R.P., Assenga, S., Ewert, F., et al., (2016) Uncertainty of wheat water use: Simulated patterns and sensitivity to temperature and CO2. Field Crops Research. 198: 80-92" [, India]	Accepted, added reference
23889	24	14	24	20	Consider adding the reference: "Wang, E., Martre, P., Zhao, Z., Ewert, F., Maiorano, A., Rötter, R. P., ... Asseng, S. (2017). The uncertainty of crop yield projections is reduced by improved temperature response functions. Nature Plants, 3, [17102]. <a href="https://doi.org/10.1038/nplants.2017.102">https://doi.org/10.1038/nplants.2017.102</a> " [, India]	Accepted, added reference
1387	24	15	24	18	Term "meta-analysis" is used incorrectly. Müller et al. 2017; Asseng et al. 2015; Liu et al. 2016 used simulation models, and Shiferaw et al. 2013 used FAOSTAT. [Elena Valkama, Finland]	Accepted, deleted meta-analysis
14953	24	16	24	16	Add references at the end of the sentence: "(Liu et al. 2016, Zhao et al. 2017a, Lobell & Asseng 2017)". References are Lobell & Asseng 2017:\rhttp://iopscience.iop.org/article/10.1088/1748-9326/aa518a/meta [Katharina Waha, Australia]	Accepted, added references

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Comment No	From Page	From Line	To Page	To Line	Comment	Response
14955	24	16	24	18	Change sentence to: "The approaches to study global and local changes are global gridded crop model simulations (e.g. Deryng et al. 2014, for an evaluation of model skills see Mueller et al. 2017), point-based crop model simulations (e.g. Asseng et al. 2015), analysis of point-based observations in the field (e.g. Zhao et al. 2016), and temperature-yield regression models (e.g. Auffhammer & Schlenker 2014)." References are Zhao et al. 2016: <a href="https://www.nature.com/articles/ncomms13530">https://www.nature.com/articles/ncomms13530</a> , Auffhammer & Schlenker: <a href="https://www.sciencedirect.com/science/article/pii/S0140988314002205?via%3Dihub">https://www.sciencedirect.com/science/article/pii/S0140988314002205?via%3Dihub</a> [Katharina Waha, Australia]	Accepted, added text and references
22633	24	19	24	20	Add 'soybean', if appropriate. [Anastasios Kentarchos, Belgium]	Noted, text removed with previous comment
21175	24	22	24	23	Can Fig5.5 be considered robust if it does not take into account CO2 effects? CO2 fertilisation effects can result in positive impacts for agriculture in some models and in some scenarios. For example, see Levis et al 2018 ( <a href="https://link.springer.com/article/10.1007/s10584-016-1654-9">https://link.springer.com/article/10.1007/s10584-016-1654-9</a> ) and Ren et al 2018 ( <a href="https://link.springer.com/article/10.1007/s10584-016-1791-1">https://link.springer.com/article/10.1007/s10584-016-1791-1</a> ). Please include in section 5.2.3.1 an expanded discussion about the consequences of CO2 fertilisation effects, incorporating Levis et al and Ren et al. Without it, the text will be unbalanced. [United Kingdom (of Great Britain and Northern Ireland)]	Accepted, figure deleted. Added references and discussion of CO2 fertilization effects
1389	24	29	24	29	Zhao et al. (2017) used no meta-analysis, but Global Gridded Crop Model Simulations; Point-Based Ensemble Simulations; Statistical Regressions. [Elena Valkama, Finland]	Accepted, removed 'meta-analysis'
15069	24	36	24	36	Alimitation? Should be A limitation - -. The para may be combined with previous paragraph. [Muhammad Mohsin Iqbal, Pakistan]	Accepted, fixed
13871	24	36	24	36	put space between A and Limitation at the beginning of the line [Sunday Leonard, United States of America]	Accepted, fixed
1883	24	36	24	36	A limitation... [William Lahoz, Norway]	Accepted, fixed
15071	24	39	24	39	The word 'in' is suggested to be changed to 'at'. [Muhammad Mohsin Iqbal, Pakistan]	Accepted, changed to at
23421	24	41	24	42	Contrdicts Exec Summary [John Dixon, Australia]	Accepted, table of yield response removed from Executive Summary
13595	24	13	27	25	Again, a synthesis on future impacts in crop production is preferred, not a literature review. [Lourdes Tibig, Philippines]	Accepted, the text is now an assessment rather than literature review
15719	24	19	27	35	Investigate the impact of extreme climate events on these crop products [Iran]	Accepted, expanded extreme events section
21173	24	13	28	9	This section is missing a number of significant recent papers, in particular Betts et al 2018 ( <a href="http://rsta.royalsocietypublishing.org/content/376/2119/20160452">http://rsta.royalsocietypublishing.org/content/376/2119/20160452</a> ), Ren et al 2018 ( <a href="http://iopscience.iop.org/article/10.1088/1748-9326/aae6a9">http://iopscience.iop.org/article/10.1088/1748-9326/aae6a9</a> ), Levis et al 2018 ( <a href="https://link.springer.com/article/10.1007/s10584-016-1654-9">https://link.springer.com/article/10.1007/s10584-016-1654-9</a> ) and Ren et al 2018 ( <a href="https://link.springer.com/article/10.1007/s10584-016-1791-1">https://link.springer.com/article/10.1007/s10584-016-1791-1</a> ). Please incorporate these recent findings. [United Kingdom (of Great Britain and Northern Ireland)]	Accepted, added references

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Comment No	From Page	From Line	To Page	To Line	Comment	Response
6641	24	13	28	27	For México the subsistence agriculture is expected to be the most vulnerable with climate change scenarios (Monterrosso-Rivas, Conde, Gay, Gómez-Díaz & López, 2014), due to being temporary and having maize as a crops mainly for self-consumption, usually supplemented with bean; In addition, only 50% of the municipalities that practise this agriculture use fertilizers, less than the fifth part uses pesticides and the modernization is very low in most cases (Arce, 2017). By depending México almost entirely on the temporary crop production, drastic changes and extreme climatic events can affect crops of teporal comparatively more than those irrigations crops. In addition, according the study developed by (Gabriel Morales, 2003), the level of socioeconomic development of the population living in the 1232 municipalities with subsistence agriculture is very low. It is estimated that 70% of the population of these municipalities is directly related to the primary activities. Thus, in the last National Agricultural Survey according to the INEGI (2015), it was documented that the loss of crops due to climatic causes, pests and disease took the second place in the perception by the producers with a 78% of them, only slightly behind the high costs of inputs and services with 82%. [Mexico]	Accepted, added to impacts on smallholder farming
13869	24	14	28	9	See previous comment: There is a limited discussion of the significant role of short-lived climate pollutants (black carbon, methane and tropospheric ozone) on agricultural yield both current and future impacts. This is a well studied field and the role they will play is significant. It is suggested that authors do a detail review of this and incorporate into relevant sections of the document. See example references: UNEP/WMO 2011: <a href="https://library.wmo.int/pmb_ged/wmo_1073.pdf">https://library.wmo.int/pmb_ged/wmo_1073.pdf</a> ; UNEP, 2011: <a href="http://wedocs.unep.org/handle/20.500.11822/8048">http://wedocs.unep.org/handle/20.500.11822/8048</a> ; Shindell et al. 2012: <a href="http://science.sciencemag.org/content/335/6065/183">http://science.sciencemag.org/content/335/6065/183</a> ; Haines et al. 2017: <a href="https://www.nature.com/articles/s41558-017-0012-x">https://www.nature.com/articles/s41558-017-0012-x</a> ; Shindell et al. 2017: <a href="https://www.cfa.harvard.edu/~wsoon/myownPapers-d/Ronan-2018withBob-d/ShindellRamanathanetal17-May5-ClimatePolicyPathway.pdf">https://www.cfa.harvard.edu/~wsoon/myownPapers-d/Ronan-2018withBob-d/ShindellRamanathanetal17-May5-ClimatePolicyPathway.pdf</a> ; Burney et al 2014. <a href="https://www.pnas.org/content/pnas/early/2014/10/29/1317275111.full.pdf">https://www.pnas.org/content/pnas/early/2014/10/29/1317275111.full.pdf</a> ; Fan et al. 2015: <a href="https://pdfs.semanticscholar.org/7d5f/0fc17ca0cf609f012d09666554f688390c82.pdf">https://pdfs.semanticscholar.org/7d5f/0fc17ca0cf609f012d09666554f688390c82.pdf</a> ; Shindell 2016. <a href="https://agupubs.onlinelibrary.wiley.com/doi/epdf/10.1002/2016EF000377">https://agupubs.onlinelibrary.wiley.com/doi/epdf/10.1002/2016EF000377</a> ; [Sunday Leonard, United States of America]	Rejected, out of scope
13593	24	14			"to grow"?Please use a better word. [Lourdes Tibig, Philippines]	Accepted, changed to 'increase'
23423	25	8	25	8	Killer assumption. The Chapter should present yield changes which incorporate temperature and CO2 fertilisation, but for the basic tables remove the effects of germplasm and management which will be massive responses to climate change. MAKE all time horizons explicit and where feasible standardize on 2050 or 2080. ESSENTIAL to recognize BAU yield increases in major food crops without climate changes for purposes of comparison [John Dixon, Australia]	Noted, figure removed
23167	25	10	25	15	Conclusion: Evidences that indicate that developed countries are closing the yield gaps (reached adaptation limits (potential or yield plateau and therefore, global average yields can only be increased significantly if the differences in crop yields are narrowed down in developing countries (evidences related to this conclusion can be added) [Girma Diga, Ethiopia]	Taken into account, yield gaps covered in sections 5.3 and 5.6

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Comment No	From Page	From Line	To Page	To Line	Comment	Response
14957	25	10	25	15	This paragraph is not directly about crop production but rather about changes in suitable areas for crop production. I have moved to adaptation section to highlight that large scale shifts in cropland and crop choices may be necessary. Also, I understand from the article that total land area climatically suitable for high attainable yields in 2050 are not increasing but stay constant so corrected that later as well. [Katharina Waha, Australia]	Accepted, text revised
14959	25	16	25	16	Change "both maize and wheat systems" to "different cropping systems" [Katharina Waha, Australia]	Accepted, text changed
14961	25	17	25	18	Unclear language. Statistical models coupled to global climate models found? [Katharina Waha, Australia]	Accepted, text changed
14963	25	17	25	22	Remove "(Tebaldi and Lobell 2018a)" here and move to end of the paragraph, line 22 [Katharina Waha, Australia]	Accepted, text moved
40717	25		25		Fig 5.5 : why results of assessment have changed since AR5 ? Other types of crops? [Valerie Masson-Delmotte, France]	Accepted, figure removed
40721	25		27		Is the response of crop yields etc to climate change expected to be linear? Please explain linearity / thresholds. [Valerie Masson-Delmotte, France]	Accepted, added caveat explaining non-linearity
21425	25	1			It would be useful if those results could be broken down into impacts on tropical/subtropical and mid-latitude regions. More importantly, some additional explanation and critical assessment of the various coloured results bars would be useful. E.g. the points simulations and observations, how representative are they and how many? How is the average derived (average of the various bars, or average based on area weighting?) Otherwise the different results are difficult to interpret and there is no discussion in the text either. There is a curious issue in the text that page 24 line 36-41 says that wheat and rice yields increase up to 3 degrees, but this figure is showing a consistent decline with every degree of warming. Both cannot be true. Where is the critical assessment of the literature? And is the figure correct or is it misleading in what it shows because Zhao et al simply make an unjustifiable assumption (is it unjustifiable? What are policymakers meant to take away from this discussion - is wheat yield expected to decline or increase for warming of, say, 2 degrees?) [Andy Reisinger, New Zealand]	Noted, figure removed
14735	25				Figure 5.5 is hard to believe, since there is only ONE study taken into account (Zhao et al. 2017a) and no other studies that may show increases due to two seasons per year of a cereal crop, or the availability of new lands for planting. At the very least, this seems like a careless compilation of available data. [Wu Felicia, United States of America]	Accepted, figure removed
14967	26	19	19		Add before Schlessner et al. (2018): "A special feature published in 2017 examined biophysical impacts in five world regions under different warming scenarios - 1, 1.5, 2, and 4 °C warming (Reyer et al. 2017). The number of available studies in two regions permitted a meta-analysis of impacts on food production. For the Middle East and Northern Africa region a significant correlation between crop yield decrease and temperature increase was found, regardless of whether the effects of CO2 fertilization or adaptation measures are taken into account (Waha et al. 2017). For Latin America and the Caribbean the relationship between temperature and crop yield changes was only significant when the effect of CO2 fertilization is considered (Reyer et al. 2017b). References are Reyer et al. 2017b: <a href="https://link.springer.com/article/10.1007%2Fs10113-015-0854-6">https://link.springer.com/article/10.1007%2Fs10113-015-0854-6</a> , Waha et al. 2017: <a href="https://link.springer.com/article/10.1007%2Fs10113-017-1144-2">https://link.springer.com/article/10.1007%2Fs10113-017-1144-2</a> , Reyer et al. 2017: <a href="https://link.springer.com/article/10.1007/s10113-017-1187-4">https://link.springer.com/article/10.1007/s10113-017-1187-4</a> " [Katharina Waha, Australia]	Accepted, added text and references

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Comment No	From Page	From Line	To Page	To Line	Comment	Response
14965	26	18	26	18	Add source to figure caption: (Rosenzweig et al. 2017) [Katharina Waha, Australia]	Accepted, added reference (Rosenzweig et al 2014)
14969	26	19	26	19	Change: "in 1.5 to 2 worlds" to "with different global warming levels" [Katharina Waha, Australia]	Accepted, text changed
18001	26	22	26	23	Unclear what is meant by: "...using climate forcing data from the Half a degree Additional warming, Prognosis and Projected Impacts project." [Beau Damen, Thailand]	Accepted, clarified that this is the HAPPI project
14971	26	22	26	23	Change "using climate forcing data from the Half a degree Additional warming, Prognosis and Projected Impacts project" to "using HAPPI climate forcing data (Mitchell et al. 2017)". Reference is <a href="https://www.geosci-model-dev.net/10/571/2017/">https://www.geosci-model-dev.net/10/571/2017/</a> [Katharina Waha, Australia]	Partly accepted. Added reference. This is the first use of HAPPI so it needs to be spelled out
14973	26	25	26	26	Unclear language. Stronger effects than what? Unclear use of stronger...than... [Katharina Waha, Australia]	Accepted, changed text
21177	26	19	27	25	Please incorporate into your discussions the recent findings from Ren et al 2018, which highlight the challenges of distinguishing agricultural impacts between 1.5 and 2C <a href="http://iopscience.iop.org/article/10.1088/1748-9326/aae6a9">http://iopscience.iop.org/article/10.1088/1748-9326/aae6a9</a> [, United Kingdom (of Great Britain and Northern Ireland)]	Accepted, added references
14975	26	26	27	1	Unclear language. Extremely low yields? Increased probability of low yields? [Katharina Waha, Australia]	Accepted, text changed
27747	26				Figure 5.6 It seems odd and misleading to show yield changes - either positive or negative - for crops in the arid lands of central Australia, where no cropping occurs. How should this be interpreted? [Annette Cowie, Australia]	Accepted, clarified in figure caption
14977	27	1	27	2	Unclear language. Not just temperature change but also CO2 forcing is important to consider? [Katharina Waha, Australia]	Accepted, text changed
21179	27	3	27	3	Tebaldi and Lobell is now published and the reference is <a href="http://iopscience.iop.org/article/10.1088/1748-9326/aaba48/meta">http://iopscience.iop.org/article/10.1088/1748-9326/aaba48/meta</a> . Please correct the citation in the references section. [, United Kingdom (of Great Britain and Northern Ireland)]	Accepted, reference updated
14979	27	3	27	3	Start next sentence then with "The [inclusion of CO2 effects]..." [Katharina Waha, Australia]	Rejected, comment unclear
14981	27	3	27	3	Add after Tebaldi and Lobell (2018b) showed that: "the impacts of a 1.5°C warming on wheat and maize yields when averaged globally does not differ substantially from a 2.0°C warming." [Katharina Waha, Australia]	Accepted, text changed
13007	27	3	27	6	This paragraph is not clear. The role of the CO2 effect v the temperature effect and the extreme temperature effect needs to be explained better. The last sentence is also unclear and does not seem to reflect the scenarios used in Tebaldi and Lobell (2018b), where RCP4.5 and RCP8.5 are used not 1.5 and 2.0°C. [Aidan Farrell, Trinidad and Tobago]	Partly accepted, text revised. Tebaldi and Lobell 2018b does use 1.5 and 2.0 scenarios (it is Tebaldi and Lobell 2018a that uses RCP4.5 and 8.5, that paper is cited earlier in the text)
14983	27	4	27	6	Remove everything from "They found that for globally...." Have moved to beginning of that paragraph. [Katharina Waha, Australia]	Noted, text changed with previous comment
14985	27	7	27	7	"show" to "confirm" [Katharina Waha, Australia]	Accepted, text changed
14987	27	8	27	8	"areas" to "results" [Katharina Waha, Australia]	Accepted, text changed
14989	27	8	27	8	changes in simulated wheat and maize yields instead of "simulated wheat and maize yield changes" [Katharina Waha, Australia]	Accepted, text changed
14991	27	17	27	17	declined instead of "were shown to fall" [Katharina Waha, Australia]	Accepted, text changed
14993	27	20	27	21	Remove everything from: "that were calibrated with common varieties from...". Irrelevant information here. [Katharina Waha, Australia]	Partly accepted, text rewritten
27749	27	23	27	23	Briefly explain the intensification case (eg x% higher N fertiliser) [Annette Cowie, Australia]	Accepted, added explanation
14995	27	26	27	26	Replace "Extreme events and production shocks" to "Heat stress, yield variability and production shocks" [Katharina Waha, Australia]	Partly accepted. Added "yield variability". Text has been expanded to include other extremes



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Comment No	From Page	From Line	To Page	To Line	Comment	Response
21427	27	26	27	35	I expected a lot more discussion of the impact of extremes than this very scant reference in a single para. [Andy Reisinger, New Zealand]	Accepted, text expanded
15073	27	33	27	33	What is the baseline year? May be specified. [Muhammad Mohsin Iqbal, Pakistan]	Accepted, added baseline (1950-2000)
40723	27	39	27	41	relevant for SPM [Valerie Masson-Delmotte, France]	Accepted, included in Chapter Executive Summary
14997	27	40	27	40	Add (Scheelbeck et al. 2018) Reference was missing. [Katharina Waha, Australia]	Accepted, added reference
15075	27	41	27	41	The word 'that' after 'that may be deleted. [Muhammad Mohsin Iqbal, Pakistan]	Accepted, text changed
15077	27	46	27	46	The word 'cultivated' is suggested to be replaced with 'done'. [Muhammad Mohsin Iqbal, Pakistan]	Accepted, text deleted
14999	28	3	28	3	Replace "these crops" with "different root and leafy vegetables, tomatoes and legumes" [Katharina Waha, Australia]	Accepted, text changed
27751	28	5	28	7	Sentence is hard to follow [Annette Cowie, Australia]	Accepted, sentence rewritten
21429	28	24	28	27	Clarify what assumption was made when impacts on forage production were translated into livestock numbers - no change in performance per animal to 2050? No change in production systems and feeding regimes? Also, the sentence in lines 25-28 seems a tautology - Boone et al model impacts on forage production, so I'm not clear where the "these results suggests" comes from - these ARE the results, are they not? [Andy Reisinger, New Zealand]	Noted, sentence deleted
15079	28	26	28	26	The word 'the' at the end of the line may be deleted. [Muhammad Mohsin Iqbal, Pakistan]	Rejected, "the" is needed
251	28		29		The results of research work of Jaberansar et al (2017) ( <a href="https://link.springer.com/article/10.1007%2Fs40333-017-0058-7">https://link.springer.com/article/10.1007%2Fs40333-017-0058-7</a> ) in Isfahan province of Iran is useful to add in page 28 that was titled: 5.2.3.2 Future impacts on rangelands and livestock. The other research work has done by Saki et al (2017) (Saki, M., Tarkesh Esfahani, M. & Soltani, S. Environ Earth Sci (2018) 77: 670. <a href="https://doi.org/10.1007/s12665-018-7864-x">https://doi.org/10.1007/s12665-018-7864-x</a> ) in central of Iran. They observed that the rangelands have great significance in carbon cycle due to their contribution for a large part of regional net primary production (NPP). The rangeland ANPP was estimated using a support vector machine (SVM) model with RMSE of 23.78 g C m <sup>-2</sup> year <sup>-1</sup> and R2 of 0.92. The mean annual ANPP showed different trends between bioclimatic zones. It decreased about 25.9% in the sub-humid and cold zone and increased over 120% in the hyper-arid and warm zone by 2070s. Generally, rangelands in western and southwestern parts of the Isfahan province in Iran are found to be more vulnerable to future drying-warming condition. [Hamidreza Solaymani Osbooei, Iran]	Accepted, added references

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Comment No	From Page	From Line	To Page	To Line	Comment	Response
16189	28		29		The results of research work of Jaberalnsar et al (2017) ( <a href="https://link.springer.com/article/10.1007%2Fs40333-017-0058-7">https://link.springer.com/article/10.1007%2Fs40333-017-0058-7</a> ) in Isfahan province of Iran is useful to add in page 28 that was titled: 5.2.3.2 Future impacts on rangelands and livestock. The other research work has done by Saki et al (2017) (Saki, M., Tarkesh Esfahani, M. & Soltani, S. Environ Earth Sci (2018) 77: 670. <a href="https://doi.org/10.1007/s12665-018-7864-x">https://doi.org/10.1007/s12665-018-7864-x</a> ) in central of Iran. They observed that the rangelands have great significance in carbon cycle due to their contribution for a large part of regional net primary production (NPP). The rangeland ANPP was estimated using a support vector machine (SVM) model with RMSE of 23.78 g C m <sup>-2</sup> year <sup>-1</sup> and R2 of 0.92. The mean annual ANPP showed different trends between bioclimatic zones. It decreased about 25.9% in the sub-humid and cold zone and increased over 120% in the hyper-arid and warm zone by 2070s. Generally, rangelands in western and southwestern parts of the Isfahan province in Iran are found to be more vulnerable to future drying-warming condition. [Hamidreza Solaymani Osbooei, Iran]	Repeat
21439	28	10			I'm missing a conclusion here that turns the literature review into an assessment. In summary, what are policy- and decision-makers meant to take away from this discussion, and how confident are you in that conclusion? [Andy Reisinger, New Zealand]	Accepted, conclusion statements added with confidence levels
12155	28	11			Please specify also impacts in South America. [Hans Poertner and WGII TSU, Germany]	Accepted, impacts in South America included
5151	28	20			Please specify 'annual productivity' is about 'rangeland' or 'livestock products'. [Japan]	Accepted, added "in rangelands"
5153	28	24			We would suggest adding description about the impact on forage quality because quality is also affected. [Japan]	Accepted, forage quality now included
21431	29	9	25	9	I don't think "likely" here is a quantified uncertainty assessment. Replacement with another appropriate expression. [Andy Reisinger, New Zealand]	Accepted, changed to "projected"
21433	29	13	29	13	I don't think "likely" here is a quantified uncertainty assessment. Replacement with another appropriate expression. [Andy Reisinger, New Zealand]	Accepted, changed to "projected"
21435	29	16	29	16	shrub and tree cover ARE PROJECTED TO increase [Andy Reisinger, New Zealand]	Accepted, changed to "projected"
40725	29				Fig 5.7 :relative importance of land use scenario / RCP8.5 climate impacts? [Valerie Masson-Delmotte, France]	Decomposition analysis not available
17899	30	33	5	33	"Another relevant publication would be Easter, T. S., A. K. Killion, and N. H. Carter. 2018. Climate change, cattle, and the challenge of sustainability in a telecoupled system in Africa. Ecology and Society 23(1):10. <a href="https://doi.org/10.5751/ES-09872-230110">https://doi.org/10.5751/ES-09872-230110</a> ." [Quentin Lejeune, Germany]	Included Easter in section on telecoupling
13873	30	4	30	5	What do goats and camels consume that makes this shift favorable for them? [Sunday Leonard, United States of America]	They consume shrubs
21437	30	12	30	21	Is there anything to help quantify the impact of heat stress on production and reproductive rates? Without quantifications these statements are not very useful to inform any decision-making [Andy Reisinger, New Zealand]	Accepted, text rewritten
15081	30	18	30	18	The word 'to' in ' - - directly to' may be deleted. [Muhammad Mohsin Iqbal, Pakistan]	Accepted, text changed
5155	30	27	30	28	distress sales' requires explanation like "Drought conditions can force producers to market cattle early, as they frequently have limited feed reserves." (Drouillard, 2018, Asian Australan J Anim Sci, p1010) (MAFF) [Japan]	Added

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Comment No	From Page	From Line	To Page	To Line	Comment	Response
5157	30	28	30	29	Comfort zone is very important background for livestock and might be better to use percentages in narrow range for each livestock types with appropriate references. [Japan]	Included reference for percentages
5159	30	28	30	29	In addition to this information, it might be good to add the fact that rising ambient temperatures may affect the milk production because Holstein cattle are quite sensitive to higher temperature. Ref: Journal of Dairy Science, 92(8), 3781-3790. Feng, J., Zhang, M., Zheng, S., Xie, P., Ma, A. 2008: Effects of high temperature on multiple parameters of broilers in vitro and in vivo. Poultry Science, 87, 2133-2139. Barati, F., Agung, B., Wongsrikeao, P., Taniguchi, M., Nagai, T., Otoi, T. 2008: Meiotic competence and DNA damage of porcine oocytes exposed to an elevated temperature. Theriogenology, 69, 767-772. De Rensis, F., Scaramuzzi, R. J. 2003: Heat stress and seasonal effects on reproduction in the dairy cow—a review, Theriogenology, 60(6), 1139-1151. West, J.W. 2003: Effects of heat-stress on production in dairy cattle, Journal of Dairy Science, 86(1), 2231-2244 [Japan]	References are old
15083	30	41	30	42	The phrase '---and for other crops, livestock, and non-farm strategies to be examined.' is not clear. Please check. [Muhammad Mohsin Iqbal, Pakistan]	Accepted, clarified statement
23873	30	43	30	43	May consider adding this statement 'Climate change impacts on dryland agriculture especially in small holder and integrated farming systems are to be analyzed in greater depth and crop diversification is a major contributing factor for enhancing resilience in these systems' [India]	Rejected, this belongs in adaptation
23425	30	35	31	20	FARMING SYSTEM should be expanded and fixed, or removed. This current sub-section is very limited, especially for a chapter and a report that emphasises integration and systems. It should integrate the implications of major crop changes and livestock (still missing) reported in previous sections plus aquaculture and agroforestry from the following section where relevant to mixed farming systems differentiated by major types of farming systems. AgMIP provides some limited insight which is not reported in this chapter, likewise the useful RAPs. This future farming system sub-section should recognise and incorporate the FAO/World Bank Farming Systems and Poverty classification and map of 72 farming systems in the 6 developing regions (Dixon, Gulliver, Gibbon 2001 Farming Systems and Poverty) and the followups, including Dixon Garrity et al 2019 on African Farming Systems. This recommendation applies to other parts of the report [John Dixon, Australia]	Partly accepted, expanded section on farming systems. 2001 paper is too old. We could not find the 2019 paper, please share a link if available.
21441	30	34			I'm missing a conclusion here that turns the literature review into an assessment. In summary, what are policy- and decision-makers meant to take away from this discussion, and how confident are you in that conclusion? [Andy Reisinger, New Zealand]	Accepted, added summary/conclusions in every section
12157	30	35			The title is implying to be more generically about farming systems, while the section is basically only about smallholder farmers. If this is the intention, it should be reflected also in the title. [Hans Poertner and WGII TSU, Germany]	Accepted, added 'smallholder'

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Comment No	From Page	From Line	To Page	To Line	Comment	Response
26175	31	21	31	27	This chapter makes one passing reference to shell quality (p. 33, line 40) but especially in this section neglects any discussion of the effect of ocean acidification (caused by excess carbon) on shell formation. In the US Pacific Northwest oyster production has been severely affected (see for example <a href="https://agupubs.onlinelibrary.wiley.com/doi/full/10.1002/grl.50449">https://agupubs.onlinelibrary.wiley.com/doi/full/10.1002/grl.50449</a> or <a href="https://www.int-res.com/articles/meps2010/419/m419p095.pdf">https://www.int-res.com/articles/meps2010/419/m419p095.pdf</a> ), and the implications for the marine food chain may be even more ominous (see for example <a href="https://www.nature.com/articles/srep01769">https://www.nature.com/articles/srep01769</a> or <a href="https://www.nature.com/articles/ngeo1635">https://www.nature.com/articles/ngeo1635</a> ). [Reid Detchon, United States of America]	Section rewritten, further discussion on aquaculture and fisheries will be covered in SROCC
13597	31	21	31	31	References? [Lourdes Tibig, Philippines]	Section rewritten, references provided
22635	31	21	31	37	References missing [Anastasios Kentarchos, Belgium]	Section rewritten, references provided
18003	31	21	31	37	This section should refer to 'fisheries and aquaculture'. The reference stated, Barange et al (2018) covers both subsectors. The addition of discussion on climate change impacts on fisheries, both inland and marine, would enrich the section and the chapter. [Beau Damen, Thailand]	Section rewritten, further discussion on aquaculture and fisheries will be covered in SROCC. The chapter only focuses on land-based aquaculture
39667	31	21	31	37	Aquaculture seems to under represented. If this is all the material available, maybe put in a box. Though with the growing development of aquaculture around the world, it seems that issues related to increases in sea surface temperatures, storm surges, storm intensity, sea-level rise, and ocean acidification are aspects that could be included for consideration. [, United States of America]	Section rewritten, further discussion on aquaculture and fisheries will be covered in SROCC. The chapter only focuses on land-based aquaculture
26671	31	22	31	37	This section needs more references. I have not assessed these, which are outputs of DFID's CIRCLE programme, but they may be helpful: Asiedu, B., Adetola, J. O., & Kissi, I. O. (2017). Aquaculture in troubled climate: Farmers' perception of climate change and their adaptation. Cogent Food & Agriculture, 3(1), 1296400. <a href="https://www.cogentoa.com/article/10.1080/23311932.2017.1296400">https://www.cogentoa.com/article/10.1080/23311932.2017.1296400</a> Asiedu, B., Nunoo, F. K. E., & Iddrisu, S. (2017). Prospects and sustainability of aquaculture development in Ghana, West Africa. Cogent Food & Agriculture, 3(1), 1349531. <a href="http://www.tandfonline.com/doi/abs/10.1080/23311932.2017.1349531">http://www.tandfonline.com/doi/abs/10.1080/23311932.2017.1349531</a> Asiedu, B., Malcolm, D., & Iddrisu, S. (2018). Assessing the economic impact of climate change in the small-scale aquaculture industry of Ghana, West Africa. AAS Open Research, 1. Elum, Z.A. & Mjimba, V. (2016). Green economy transition and the sustainability of the Nigerian aquaculture industry: Policy perspectives and the way forward. African Journal of Science, Technology, Innovation and Development, 8(3), 309 – 319. <a href="http://www.tandfonline.com/doi/full/10.1080/20421338.2016.1163479">http://www.tandfonline.com/doi/full/10.1080/20421338.2016.1163479</a> [John Morton, United Kingdom (of Great Britain and Northern Ireland)]	Section rewritten, further discussion on aquaculture and fisheries will be covered in SROCC. The chapter only focuses on land-based aquaculture
15085	31	40	31	40	The word 'upon' seems to be redundant. Suggested to be deleted. [Muhammad Mohsin Iqbal, Pakistan]	Accepted, text revised
28497	31	40	31	45	These two sentences are not easy to follow. Check punctuation [Valerie Kapos, United Kingdom (of Great Britain and Northern Ireland)]	Accepted, text revised
15087	31	41	31	43	In one sentence, the word 'via' has been used thrice which looks odd. The sentence may be reshaped in a better way. [Muhammad Mohsin Iqbal, Pakistan]	Accepted, text revised

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Comment No	From Page	From Line	To Page	To Line	Comment	Response
126	31	43	31	45	Fanzo, Jessica; McLaren, Rebecca; Davis, Claire; and Choufani, Jowel. 2017. Climate change and variability: What are the risks for nutrition, diets, and food systems? <a href="http://ebrary.ifpri.org/cdm/ref/collection/p15738coll2/id/131228">http://ebrary.ifpri.org/cdm/ref/collection/p15738coll2/id/131228</a> [Sharelle Polack (nee Hart), Switzerland]	Reference added
15089	31	46	31	46	The phrase '- - exposure to extreme temperatures for the agricultural workforce' is suggested to be changed to '- - exposure of agricultural workforce to extreme temperatures.' [Muhammad Mohsin Iqbal, Pakistan]	Accepted, text revised
29781	31	39	34	42	No where in this section on human health, are the cultural health implications of compromised food safety, food quality, and nutritional quality discussed; this section would be more comprehensive and sensitive to Indigenous food systems if the inherent linkages between food and cultural health were acknowledged. [Tanya Smith, Canada]	Brief comment now added to signposting opening paragraph
21443	31	20			I'm missing a conclusion here that turns the literature review into an assessment. In summary, what are policy- and decision-makers meant to take away from this discussion, and how confident are you in that conclusion? [Andy Reisinger, New Zealand]	Accepted, added assessment statement
21447	31	21			This entire section has a lot of statements but only one citation. Is this cited study in itself a super-review of existing literature (how confident are you in its conclusions), or are some of your statements based on other studies (in which case, please cite them), and make clear what the take-home findings are. [Andy Reisinger, New Zealand]	Section rewritten, references provided
12159	31	21			The section is missing references. Also, new knowledge since AR5 should be specified. [Hans Poertner and WGII TSU, Germany]	Section rewritten, references provided
15091	32	6	32	7	Humidity is also an important factor in population dynamics of contaminating organisms. [Muhammad Mohsin Iqbal, Pakistan]	Accepted - humidity is noted
28499	32	6	32	11	This sentence is too long [Valerie Kapos, United Kingdom (of Great Britain and Northern Ireland)]	Accepted, text revised
15093	32	9	32	9	The words 'among others' seems to be redundant in the presence of 'as well' as -', hence suggested to be deleted. [Muhammad Mohsin Iqbal, Pakistan]	Accepted, text revised
28501	32	11	32	11	These changes' refer to which changes? [Valerie Kapos, United Kingdom (of Great Britain and Northern Ireland)]	Accepted, text revised
15095	32	19	32	19	The word 'its' is suggested to be replaced with 'their'. [Muhammad Mohsin Iqbal, Pakistan]	Accepted, text revised
28503	32	19	32	19	it's range' should be 'their range' [Valerie Kapos, United Kingdom (of Great Britain and Northern Ireland)]	Accepted, text revised
28505	32	26	32	26	suggest 'at fine scales' instead of 'on the small scale' [Valerie Kapos, United Kingdom (of Great Britain and Northern Ireland)]	Rejected - experiments are by their nature conducted at small scales not large scales. "Fine scale" is ambiguous
22637	32	30	32	36	Where is the limit of the this assessment? Sounds like it refers to marine aquatic environments. [Anastasios Kentarchos, Belgium]	The opening sentence says "aquatic environments"
15097	32	34	32	35	The sentence 'The dinoflagellate Dinophysis was modelled by (van der Fels-Klerx et al.2012b) which indicated - -' is suggested to be re-written as 'The dinoflagellate Dinophysis (van derFels-Klerx et al., 2012b) indicated - -'. [Muhammad Mohsin Iqbal, Pakistan]	Rejected - experiments are by their nature conducted at small scales not large scales. "Fine scale" is ambiguous
1361	32	39	32	39	there is evidence (well documented in several IPCC reports/documents) that the incidence of flooding is likely to increase with climate change not just to 'change' [Francesca Spagnuolo, Italy]	Accepted, text revised
13599	32	5	33	17	Please synthesize the findings here on impacts on food safety and human health, and when possible, indicate confidence levels. [Lourdes Tibig, Philippines]	Accepted, text revised

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Comment No	From Page	From Line	To Page	To Line	Comment	Response
3319	32	6	33	17	Really good to see the improvements here for the FOD - does an excellent job of summarising knowledge and limitations [Dave Reay, United Kingdom (of Great Britain and Northern Ireland)]	Thank you!
1333	33	3	33	10	Relevant impacts from food additives, pesticides, fertilizers were not addressed [Oswaldo Lucon, Brazil]	This comment is insufficiently detailed to address; furthermore, it is noted (SOD33:6) that pesticides in foods will change with changing pest pressure
128	33	11	33	17	Effects of climate change on human health/nutrition are exacerbated in urban environments by the Urban Heat Island Effect. (see possible reference in row below). With rates of urbanisation increasing, this requires greater effort to determine appropriate adaptation strategies [Sharelle Polack (nee Hart), Switzerland]	Space precludes a discussion of the climate-health-nutrition-urban links; it is implicit in new text about how climate change interacts with nutritional status to affect health and well-being in last sentence of this section.
130	33	11	33	17	Heaviside, C., Macintyre, H. & Vardoulakis, S. Curr Envir Health Rpt (2017) 4: 296. <a href="https://doi.org/10.1007/s40572-017-0150-3">https://doi.org/10.1007/s40572-017-0150-3</a> [Sharelle Polack (nee Hart), Switzerland]	Paper not relevant as about UHI impacts on health, so out of scope for chapter which focusses on food supply
25571	33	19	33	20	If possible, could you please explain a bit more on the CO2 dependent nutritional quality here and in the 5.2.4.3? [, France]	Sections combined and text revised. Comment accepted and more details added
21181	33	19	33	45	I notice here that all the stated impacts (nutrient composition, feed quality etc.) are negative. My understanding is that in reality there will be some gains and some losses which may be time dependent (e.g. short term gains versus longer term disbenefits) – particularly across the range of regions and commodities. Feels to me like the text should reflect that balance. [, United Kingdom (of Great Britain and Northern Ireland)]	Gains in yields are covered elsewhere in 5.2. This section on changes in food quality, and there is little indication it will increase (other than through any yield increases increasing availability). We think our analysis, based on a comprehensive literature search ("climate change and food quality"), reflects the literature, so comment rejected.
13601	33	19	33	45	Tighten the synthesis of the findings. Please be brief and concise. [Lourdes Tibig, Philippines]	Accepted, text revised
15099	33	23	33	23	The phrase 'have been exposed to higher temperatures and shown - ' is suggested to be rewritten as 'exposed to higher temperatures have shown [Muhammad Mohsin Iqbal, Pakistan]	Accepted, text revised
23427	33	34	33	36	ADD. Statement of lack of evidence is improbable. As the livestock scientists such as Mario [John Dixon, Australia]	Incomplete comment: cannot respond.
15101	33	35	33	35	The word 'produce' is suggested to be changed to 'products'. [Muhammad Mohsin Iqbal, Pakistan]	Accepted, text revised
15103	33	39	33	41	Please see if the sentence can be better written as 'For example, changing heat stress in poultry can affect yield as well as meat quality (by altering fat deposition and chemical constituents), shell quality of egg (and hence its function)and their immune system (Lara and Rostagno, 2013). [Muhammad Mohsin Iqbal, Pakistan]	Accepted, text revised
21445	33	18			I'm missing a conclusion here that turns the literature review into an assessment. In summary, what are policy- and decision-makers meant to take away from this discussion, and how confident are you in that conclusion? [Andy Reisinger, New Zealand]	Accepted, text revised
15105	34	2	34	3	The phrase '- - all things being equal' is suggested to be written as '- - other variables remaining constant'. [Muhammad Mohsin Iqbal, Pakistan]	Rejected - standard usage of English
21889	34	7	34	7	Which plants does this refer to? [, Finland]	All plants, hence the inclusive use of the term (i.e. not just crops)
1391	34	14	34	16	No meta-analysis was used by Zhu et al (2018), but conventional statistics such as ANOVA and correlation analysis. [Elena Valkama, Finland]	Comment rejected. Meta-analysis is defined as "examination of data from a number of independent studies of the same subject, in order to determine overall trends" and Zhu analysed data from 7 FACE trials
15107	34	17	34	17	'They show that - ' is suggested to be changed to 'They reported that - '. [Muhammad Mohsin Iqbal, Pakistan]	Comment rejected.

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Comment No	From Page	From Line	To Page	To Line	Comment	Response
13031	34	24	34	24	'photorespiration providing most of the energy'- I don't think we can be confident of this (yet). Perhaps the wording should be '...inhibition of photorespiration which can provide much of the energy used for assimilating nitrate' [Aidan Farrell, Trinidad and Tobago]	Accepted, text revised
23883	34	27	34	31	Consider adding the reference: 'Byjesh, K., Kumar, S.N. & Aggarwal, P.K. (2010) Simulating impacts, potential adaptation and vulnerability of maize to climate change in India. Mitigation and Adaptation Strategies for Global change Change 15: 413-431. <a href="https://doi.org/10.1007/s11027-010-9224-3">https://doi.org/10.1007/s11027-010-9224-3</a> ' [, India]	Rejected. Reference is about climate's impacts on maize yields, not about nutritional quality - so reference not relevant here.
15109	34	28	34	28	The words 'was found' in 'no impact was found' are suggested to be deleted. [Muhammad Mohsin Iqbal, Pakistan]	Accepted, text revised
15111	34	37	34	37	The word 'also' after 'zinc deficiency' is suggested to be deleted. [Muhammad Mohsin Iqbal, Pakistan]	Accepted, text revised
21451	34	45	34	47	I don't think "likely" here (used three times) is a quantified uncertainty assessment. Replacement with another appropriate expression (several more "likely" expressions in the following paragraphs, which I have not called out as well - please purge all that do not constitute a quantified uncertainty assessment). Also, please give at least some indication of the direction and magnitude of change - is it relevant compared to other drivers and trends in pest and diseases? Is it locally isolated or a broad issue? I'm missing a conclusion at the end of this section that turns the literature review into an assessment. In summary, what are policy- and decision-makers meant to take away from this discussion, and how confident are you in that conclusion? [Andy Reisinger, New Zealand]	Accepted, text revised
23429	34	44	35	33	Consider also bird and animal ranges which cause substantial yield losses in some continents [John Dixon, Australia]	Accepted, text revised - and "vertebrate pests" added
13603	34	44	35	33	More references, please, to support the confidence level.. Thesynthesis should be improved to support the confidence levels of the finding. [Lourdes Tibig, Philippines]	These statements summarise all the above refernces, so comment rejected
21449	34	43			I'm missing a conclusion here that turns the literature review into an assessment. In summary, what are policy- and decision-makers meant to take away from this discussion, and how confident are you in that conclusion? [Andy Reisinger, New Zealand]	Accepted, text revised
23875	35	13	35	14	Consider editing this statement ' More focus is essential on nutritional quality and pest & disease dynamics in view of the climate change impacts on food systems' [, India]	Space precludes adding this as a knowledge gap, though we admit it is one. Added to knowledge gaps section in 5.7.
23881	35	13	35	14	Consider adding the reference 'Srinivasa Rao, M., Swathi, P., Rama Rao, C. A., Rao, K.V., Raju, B.M.K., Srinivas, K., Manimanjari, D. and Maheswari, M. 2015. Model and scenario variations in predicted number of generation of Sponoptera litura Fab.on peanut during future climate change scenario. PLoS One. 10(2): DOI:10.1371/journal.pone.0116762' [, India]	Reference added
39669	35	15	35	23	All true; however, the focus here is on disease. Would suggest adding work related to insects. Deutsch, C.A., Tewksbury, J.J., Tigchelaar, M., Battisti, D.S., Merrill, S.C., Huey, R.B. and Naylor, R.L., 2018. Increase in crop losses to insect pests in a warming climate. Science, 361(6405), pp.916-919. Or weeds: Ziska, L., Bradley, B., Wallace, R., Barger, C., LaForest, J., Choudhury, R., Garrett, K. and Vega, F., 2018. Climate Change, Carbon Dioxide, and Pest Biology, Managing the Future: Coffee as a Case Study. Agronomy, 8(8), p.152. And chemical management: Waryszak, P., Lenz, T.I., Leishman, M.R. and Downey, P.O., 2018. Herbicide effectiveness in controlling invasive plants under elevated CO2: Sufficient evidence to rethink weeds management. Journal of environmental management, 226, pp.4. [, United States of America]	Comment responded to by adding "pests and disease" to encompass the sense of the comment, reference also added

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Comment No	From Page	From Line	To Page	To Line	Comment	Response
26673	35	28	35	33	Research appears to be limited, but Tsetse fly/trypanosomiasis seems to be an important case of an insect disease vector whose range is likely to be limited by climate change. References include a) Terblanche, J. S., Clusella-Trullas, S., Deere, J. A., & Chown, S. L. (2008). Thermal tolerance in a south-east African population of the tsetse fly <i>Glossina pallidipes</i> (Diptera, Glossinidae): implications for forecasting climate change impacts. <i>Journal of Insect Physiology</i> , 54(1), 114-127 b) McDermott, J. J., Kristjanson, P. M., Kruska, R. L., Reid, R. S., Robinson, T. P., Coleman, P. G., ... & Thornton, P. K. (2002). Effects of climate, human population and socio-economic changes on tsetse-transmitted trypanosomiasis to 2050. In <i>The African Trypanosomes</i> (pp. 25-38). Springer, Boston, MA. (which shows issues of attribution to CC, other environmental changes and disease control actions) and c) Thornton, P. K., van de Steeg, J., Notenbaert, A., & Herrero, M. (2009). The impacts of climate change on livestock and livestock systems in developing countries: A review of what we know and what we need to know. <i>Agricultural systems</i> , 101(3), 113-127 (which also mentions other vector-borne diseases of livestock). [John Morton, United Kingdom (of Great Britain and Northern Ireland)]	Reference added and text modified
6075	35	31	35	31	use weaken, not mitigate [, Poland]	Accepted, text revised
6077	35	32	35	32	use reduce, not mitigate (sentence unclear, further clarification is needed) [, Poland]	Accepted, text revised
40729	35		35		Are there any studies showing no climate impact on some pests, or benefits? Please sharpen this part of the assessment [Valerie Masson-Delmotte, France]	Lines 28-29 of SOD emphasis that pests and disease may go up or down. Additionally, other examples have now been given
6633	35	1	36	16	Morphological differences between pollinator species may be substantial to withstand the adverse condition of temperature changes. Bumblebees are highly efficient pollinators when performing a conical pollination, along with the abundant and branched hairs that cover their bodies easily put in contact the pollen collected with the stigmata (Mallinger and Gratton, 2015; Pires et al., 2014; Rader et al., 2013). The body size of the bumblebee is relatively large and presents the body covered with abundant, long and dense fuzz, which allows them to retain heat during foraging in cold conditions, being able to be active in a wider range of temperatures (Mallinger & Gratton, 2015; Rader et al., 2013) [, Mexico]	Rejected. Whilst the comment is true, there are many reasons why different species may respond to climate in different ways, and due to space we cannot discuss them all. It is implicit in the context-dependency comment (where guilds of pollinators are part of the context in any given ecosystem).
13605	35	35	36	16	It is reading like a literature review. A synthesis is recommended [Lourdes Tibig, Philippines]	Comment accepted, and text changed to enhance synthesis.
32539	36	3	36	5	It is also important to specify the security risks women face when women need to travel long distances and spend more time in collecting food and water. Hence the following modification on line 5 is proposed: "... risk of diarrheal diseases (Parikh, 2009) and of physical and sexual violence (Sommer et al., 2015)." Full citation: Sommer M, Ferron S, Cavill S, House S (2015) Violence, gender and WASH: spurring action on a complex, under-documented and sensitive topic. <i>Environment and Urbanization</i> 27: 105–116." Link: <a href="https://journals.sagepub.com/doi/10.1177/0956247814564528">https://journals.sagepub.com/doi/10.1177/0956247814564528</a> [Hanna Paulose, United States of America]	Reference added
39671	36	12	36	13	It has been. See: Ziska, L.H., Pettis, J.S., Edwards, J., Hancock, J.E., Tomecek, M.B., Clark, A., Dukes, J.S., Lohdz, I. and Polley, H.W., 2016. Rising atmospheric CO2 is reducing the protein concentration of a floral pollen source essential for North American bees. <i>Proceedings of the Royal Society B: Biological Sciences</i> , 283(1828), p.20160414. [, United States of America]	Accepted, added reference



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Comment No	From Page	From Line	To Page	To Line	Comment	Response
33759	36	14	36	16	We appreciate that the effect of pollinator and insects are addressed here. However, it should be supported with relevant scientific sources. Moreover, the negative effect of biological invasions on e. g., ecosystem functioning should explain. [., Norway]	Section rewritten, many references provided
12161	36	14	36	16	This statement lacks references (and potentially also confidence level) [Hans Poertner and WGII TSU, Germany]	Accepted, sentence deleted. Added summary statement
23431	36	24	36	30	See recent book on climate change and Asian women by Paris, Rola-Rubzen et al (2018). Sub-section on gender should be expanded. [John Dixon, Australia]	The reference has been added
13069	36	31	36	35	Please refer to Myth #2 within Doss, Meinzen-Dick, Quisumbing, and Thies, 2018: <a href="https://www.sciencedirect.com/science/article/pii/S2211912417300779?via%3Dihub">https://www.sciencedirect.com/science/article/pii/S2211912417300779?via%3Dihub</a> [Kristi Tabaj, United States of America]	We were aware of that paper, which is very interesting, but in the section we do not mention any of the myths neither provide any of the numbers they analyse. We were aware of the vagueness of the numbers and assumptions they analyse and for that reason we did not use them in the chapter
31731	36	31	36	36	There still exists a lot disparity in equality on access to technology and financial resources for women in the food-value-chain process in rural areas and this needed to be considered for inclusion in this section. Citations include, among others that abound, 1. Gender and food loss in sustainable food value chains - FAO <a href="http://www.fao.org/3/i8620en/i8620en.pdf">www.fao.org/3/i8620en/i8620en.pdf</a>  Gender equality: an underlying reason to value chain efficiency. 9. 2 » Analysing ... Dissemination of improved post-harvest technologies. 35. FIGURES ... sibilities, and create disparities in access to and control over resources, services, .... In addition, despite their important role in food value chains, rural women often face ...2. [PDF]Download - Europa EU <a href="https://europa.eu/capacity4dev/file/62351/download?token=-zXg8abw">https://europa.eu/capacity4dev/file/62351/download?token=-zXg8abw</a>  issues relating to gender, agriculture and rural development. This Brief is ... work in agriculture brings food to the table of families and the poorest in the .... levels women's access to training, extension programmes and technology is still limited. ... has also a direct influence in how they participate in agricultural value chains. [Elizabeth Migongo-Bake, Kenya]	Mention to differential access to financial resources and technology has been added- FAO reference added, but to the food loss and waste section
13071	36	35	36	35	Recommend summarizing the table to reduce pages. Two other observations: (1) "urban livestock holders" makes no mention of gender implications and (2) no mention is made about the impacts to boys and girls. [Kristi Tabaj, United States of America]	The urban livestock holders file has been deleted. Mention to boys and/or girls added. Children were already in the table
13073	36	35	36	35	More specific information on impacts to men, women, boys, and girls: Impact of climate change and gender roles in community adaptation: A case study of pastoralists in Samburu East District, Kenya. <a href="https://academicjournals.org/journal/IJBC/article-full-text-pdf/C89AF532892">https://academicjournals.org/journal/IJBC/article-full-text-pdf/C89AF532892</a> Sustaining learner participation and progression through networked schooling: A systemic approach for Mobile Out of School Children <a href="https://ac-els-cdn-com.proxy.lib.miamioh.edu/S0738059318304541/1-s2.0-S0738059318304541-main.pdf?_tid=94193592-2306-4fbb-b7bc-9e99405797ea&amp;acdnt=1547159765_baa4248f0b2dce8674e4a778416142e">https://ac-els-cdn-com.proxy.lib.miamioh.edu/S0738059318304541/1-s2.0-S0738059318304541-main.pdf?_tid=94193592-2306-4fbb-b7bc-9e99405797ea&amp;acdnt=1547159765_baa4248f0b2dce8674e4a778416142e</a> [Kristi Tabaj, United States of America]	Reference on gendered impact on pastoralism has been added. The second on mobile schools for pastoralist not because it is out of the scope of the section

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Comment No	From Page	From Line	To Page	To Line	Comment	Response
32537	36	35	36	36	The sentence "Climate change impacts on livestock keeping are differentiated between the food security of men and women" is unclear. Upon reading the reference associated with it, McKune et al. 2015, the article seems to suggest that "climate change has differentiated impact on the food security of women and men among livestock holders" [Hanna Paulose, United States of America]	Sentence has been changed
40731	36		36		Need to integrate issues / gender and equity x chapters and provide elements in ES to build upon for SPM. [Valerie Masson-Delmotte, France]	Gender aspects covered in section 5.1.3 and Box 5.1, also provided to the ES and SPM
13075	36	37	37	2	This paragraph would be more gender inclusive if examples for access, availability, utilization, and stability had gender examples for men, women, boys, and girls. The comment on food availability for women is linked to agricultural production. The lack of availability usually impacts a household rather than individuals in the household. The exception to this is how food is divided at meals. Women may end up with a smaller portion compared to men, children, and in-laws. Regarding food access, limitations include lack of women's mobility impacting trips to the market and lack of decision-making in the household which may be highly influenced by mothers-in-law in addition to husbands. In some contexts, men and boys may have access to different foods as the result of the freedom to move. This may impact their dietary choices as they eat more processed foods. Additionally, the availability and access of food by adolescent girls and boys may also be different. Girls pulled from school to perform household chores miss meals provided by the school. Boys who leave school to work will also miss these same meals. Nutritional status will influence the utilization of food and there may be underlying gender norms that impact nutritional status among children under five as well as adolescents. Finally, instability can cause families to be divided, with some members having greater access to food compared to others. This may be especially true if food assistance is provided and specific target groups identified to receive assistance (women and children). [Kristi Tabaj, United States of America]	Some of the examples provided have been added to the text where references to assert the point were found. The nutritional status example provided is not clear so was not added, as well as the instability one
25507	36	46	37	1	Could this assertion be sourced ? [, France]	The sources are the three references at the end of the paragraph
13067	36	19	38	1	While section 5.2.5.1 is titled "Gender and equity," the part on gender is really about women. Generally, gender is referred to as women, men, boys, and girls but often discussed in terms of women. Women, as well as adolescent girls, face enormous challenges compared to boys and men. However, there are challenges for all and this should be acknowledged in this section. My assumption here is the evidence is lacking for men, boys, and girls as well as men and women of advanced age. It would be much more impactful if gender and other factors around equity and social inclusion were included throughout the chapter rather than a standalone section. [Kristi Tabaj, United States of America]	Gender, equity and social inclusion is included along the chapter in different sections (see for instance in 5.6 in different subsections). However, we believe that a specific section on gender allows to make visible the differentiated impacts and responses needed of men and women which was neglected by the literature in the past but has recently got a lot attention with a growing body of literature providing of many evidences that need to be assessed. In the gender and equity section young children and elderly people are included and have been expanded to intersectionality (although intersectionality is more in-depth discussed in the cross-chapter box)
39673	36	19	38	20	This section contains many references to the vulnerabilities or other issues related to gender, but repeatedly clarifies that this varies between geography, culture, etc. It is unclear if, given the amount of variation, many of the assertions can be made beyond generalities. [, United States of America]	Since gender is a social construction, it depends on the cultural context. For that reason there are many specificities. However, this does not mean that there is a general trend that allows us to assert that there are gendered impacts and responses to climate change. How these impacts and responses are context-specific. But could not we say the same regarding impacts on yields? these impacts depend on the crop species, varieties, and will differ among geographical location. Yet, we can assess that on a global basis yields will reduce
11633	36	19	38	20	It may be appropriate to shorten some issues in the report, such as the role of urban agriculture and gender and equality. [Nazimi Acikgoz, Turkey]	We do not agree on reducing this section neither urban agriculture, that would be only covered in this chapter

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Comment No	From Page	From Line	To Page	To Line	Comment	Response
13875	36	19	38	20	This section need to be rewritten to focus on the interlinkages between the impact of climate change on food security and how this consequently relates to gender and equity. The current discussion doesnt seem to clearly present this interrelationships; instead it mixes the impact of climate change on gender and equity with impact of climate change on food security. The discussion need to clearly related climate change impact on food with the consequent effect of this impact on gender and equity. I know this is difficult to separate but it is important that this section does this. [Sunday Leonard, United States of America]	The whole chapter is about climate change and food security. Here we intend to analyse how the gendered impact of climate change affects food security, and how impacts of climate change on food security may affect vulnerable social groups. These are the two sides of the coin discussed here.
13607	36	31	38	20	There is a growing focus on considering gender in the climate change discourse (e.g., impacts, vulnerability, adaptive capacity, etc.). A synthesis of this discussion is suggested ; t is more like a literature review [Lourdes Tibig, Philippines]	Accepted, gender now a main section (5.1.3) and also discussed in Box 5.1
23153	36	18	41	35	Section 5.2..5.2 can be followed by three other relevant sections. Accordingly section 5.2.5.3 is commented to include evidences related to the impt of climate change on the sport performance (for instance impact on the known runners/athletes or football players through the change in food habit or dietary system owing to change in temerature,evapotranspiration and relative humidity. [Girma Diga, Ethiopia]	This comment is not relevant
23155	36	18	41	35	Section 5.2.5.4 can be used for the evidences of impact of the debilitating temepature on the appetite of the judge and therefore who might get temeprred and commit undue decision on the defendant (who is innocent until he or she is entenced to a given prosecution. [Girma Diga, Ethiopia]	This comment is not relevant
23157	36	18	41	35	Section 5.2.5.5 is commented to include evidences for the projected impact of climate change on evidences related to employment generation or disemployment. In relation to food security or food system assurance the poeer [Girma Diga, Ethiopia]	References on impact on labour added
30655	36	18	41	35	The entire section 5.2.5 although entitled "Socio-economic aspects" hadly includes any discussion of economic aspects such as food prices, food expenditure, output value, production costs. Please extend the section. References to consider for extending the section are for example (as mentioned in previous comments): 1) Several papers carried out by AgMIP's global economics team listed in <a href="http://www.agmip.org/global-economics-team">http://www.agmip.org/global-economics-team</a> ; 2) FAO. 2018. The future of food and agriculture - Alternative pathways to 2050. Rome. <a href="http://www.fao.org/publications/fofa/en/">http://www.fao.org/publications/fofa/en/</a> [Lorenzo Giovanni Bellù, Italy]	The introduction to the section has been expanded. The section is on observed impacts, so after revising the AgMIP and FAO papers they were not included in this section. However, FAO 2017 which was centered on current trends was added.
12163	36	19			It seems that there is high confidence regarding the gender dimension of climate change impacts in the context of food security. This should be clearly stated somewhere. [Hans Poertner and WGII TSU, Germany]	Confidence statement added
23245	36	24			generally rather than in general [Elizabeth Diego, Kenya]	Changed
28507	37	25	1	38	This table needs more explanation in the caption [Valerie Kapos, United Kingdom (of Great Britain and Northern Ireland)]	More explanation added in the caption
29783	37	1	37	2	These norms also vary according to culture. [Tanya Smith, Canada]	Culture has been added
13077	37	3	37	8	This paragraph seems to focus on the impacts of natural resource scarcity. Given this isn't a key topic within this chapter and the current length of the document, I would eliminate this paragraph. What is stated here just scratches the surface and while it is related to food security outcomes, the current paragraph does not sufficintly address gender concerns linked to scarcity (or abundance for that matter). [Kristi Tabaj, United States of America]	Noted, taken into account

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Comment No	From Page	From Line	To Page	To Line	Comment	Response
32541	37	5	37	8	The sentence seems to reinforce the stereotype that caring for infants, children and the elderly is primarily the responsibility of women. Hence the following change is suggested on line 6: ". . . gather fuelwood also impacts their capacity to appropriately care for infants and children. . . ." [Hanna Paulose, United States of America]	Sentence changed
13079	37	9	37	13	This paragraph is a better fit after the last sentence page 36 line 36. [Kristi Tabaj, United States of America]	The paragraph has been relocated
1363	37	12	37	12	correct typo "men" instead of mean [Francesca Spagnuolo, Italy]	Changed
32543	37	12	37	12	Typo in the sentence needs to be corrected: ". . . migration of young men to cities . . ." [Hanna Paulose, United States of America]	Changed
132	37	12	37	12	change to 'of young men to cities...'. [Sharelle Polack (nee Hart), Switzerland]	Changed
13877	37	12	37	12	change to mean to men [Sunday Leonard, United States of America]	Changed
13081	37	14	37	14	Recommended sentence before the first sentence. "While men, women, boys, and girls face food security challenges linked to climate change, women encounter numerous barriers in adapting to climate change." [Kristi Tabaj, United States of America]	Sentence changed
1885	37	24	37	24	I suggest the caption to Table 5.4 include an explanation of the meaning of upward and downward arrows. [William Lahoz, Norway]	Explanation added
12759	37	26	37	26	In table 5.4 at the first row under livelihoods there is a mistake (a fullstop) [Tiziana Susca, United Kingdom (of Great Britain and Northern Ireland)]	Changed
23433	37	25	38	1	EXPAND Table 5.4 to include other farming systems including mixed and crop-based. [John Dixon, Australia]	Table 5.4 has been reduced, not expanded, to include only pastoral and agro-pastoral systems
23247	37	5			water borne diseases instead of diarrheal diseases [Elizabeth Diego, Kenya]	Changed
13083	38	1	38	20	The value-add of this section on equity is unclear as it does not address many marginalized groups. Only poor and urban populations are addressed here. Age, caste, ability/disability, sexual orientation, and indigenous groups go unmentioned. Points on equity should be integrated throughout the chapter text. [Kristi Tabaj, United States of America]	Points on equity have been integrated throughout the text, but we believe an specific section is also needed to stress the importance of equity issues on impact, adaptation and vulnerability to climate change and food security. Clarification to other sources of inequality have been added
32545	38	17	38	18	References or data are not provided in the text to support the following statement: "Gender inequality is particularly pervasive in cities contributing to differential consequences of climate change." - As it is stated as a fact, it needs to be supported by relevant studies or evidence [Hanna Paulose, United States of America]	The sentence has been deleted
26675	38	23	39	41	If quoting AR5, WG2 Ch.12 (Adger et al.) is most relevant. It would be useful to compare the SRCL Chapter 3 discussions of migration, which go further in contextualising climate change among other drivers of migration [John Morton, United Kingdom (of Great Britain and Northern Ireland)]	Section rewritten and moved to new Section 5.8
39675	38	22	41	34	This section could be more clear in highlighting non-climate related factors that contributed to migration and security risks, including weak governance, lack of access to economic opportunity, labor market dynamics, etc. [, United States of America]	Section rewritten and moved to new Section 5.8
11493	38	22	41	34	This section dealing with Migration is less linked to the main topic of this Chapter. This raises two inter-related concerns. The chapter is comprehensive, but also quite long. It is not likely that this section will do justice to the migration topic, and to solve that problem would require even more text in an already lengthy chapter. Perhaps migration can be removed? [Jean-Luc Chotte, France]	Section rewritten and moved to new Section 5.8
13879	38	22	41	34	I think this section need to be tightened. The section at the moment loosely relates climate change and other factors with migration. My thought is that the focus should be the relationship between climate change impact on food security and how this impacts migration and conflict. This discussion is not succinct in the current text. [Sunday Leonard, United States of America]	Section rewritten and moved to new Section 5.8

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Comment No	From Page	From Line	To Page	To Line	Comment	Response
30657	38	22	41	35	Reference you missed studying and citing in this section is: FAO IFAD IOM WFP. 2018. The Linkages between Migration, Agriculture, Food Security and Rural Development. Rome. <a href="http://www.fao.org/3/CA0922EN/CA0922EN.pdf">http://www.fao.org/3/CA0922EN/CA0922EN.pdf</a> [Lorenzo Giovanni Bellù, Italy]	Noted
13609	39	7	39	10	Is "some agreement" a calibrated language? [Lourdes Tibig, Philippines]	Fixed
13611	39	16	39	22	Migration, as discussed here in this context in this introductory paragraph, has not been shown to be directly nor indirectly linked to climate change, even as food insecurity is being suggested as a factor. Try to indicate the link to the theme of the section. [Lourdes Tibig, Philippines]	Section rewritten and moved to new Section 5.8
13881	39	23	39	24	Please elaborate on this finding? What type of interrelationship did they find? [Sunday Leonard, United States of America]	Section rewritten and moved to new Section 5.8
13613	39	23	39	41	There remains a major challenge in attributing food insecurity-linked migration, even in poor countries. The findings discussed in here could be synthesized further to highlight this fact. [Lourdes Tibig, Philippines]	Section rewritten and moved to new Section 5.8
13883	39	37	39	41	See previous comments above. Are we talking about climate change impact on migration or climate change impact on food and the resultant effect on migration patterns? [Sunday Leonard, United States of America]	Section rewritten and moved to new Section 5.8
13615	39	42	41	2	box 5.2 shows a very good example of the various pathways through which sea level rise can severely impact on affected communities and islands in the Pacific. Yet there remains the challenge of really attributing migration to climate change as there are other confounding factors that need to be considered. [Lourdes Tibig, Philippines]	Text revised taking into consideration of the comments.
29683	39	43	41	8	Very useful box. However, there is no mention of salinisation of groundwater. [Saint Lucia]	Salinization is covered in SROCC
40733	39		41		This box needs to be articulated with elements in SR15 as well as the cross chapter box in SROCC. Several elements do not appear to be relevant to SRCL but other aspects (e.g. rising seas). I suggest to be very cautious and check for coherency across reports underway and avoid parallel assessment of literature. Statement on "increased frequency and intensity of storms" : please check robustness of statement / detection of changes in storms in various regions, esp. Pacific. Inconsistent with AR5 WGI, I think. [Valerie Masson-Delmotte, France]	Text revised taking into consideration of the comments. Western Pacific Ocean basin has been (and is) one of the dominant regions showing tropical weather phenomena (mentioned in SROCC SPM with figures).
12165	39	43			Box 5.2: While the first half of the box is now much more food security-related and much better than in the FOD, the second part of the box is still very generic about migration from small islands. But the link to food security is weaker. [Hans Poertner and WGII TSU, Germany]	Contents of the box revised
26677	40	37	40	37	Shishmaref is north of the Bering Strait and thus not technically in the Pacific, and certainly not usefully defined as in the Pacific region for present purposes [John Morton, United Kingdom (of Great Britain and Northern Ireland)]	Noted and corrected in the revised text.
134	41	6	41	6	including coral bleaching and storm damage to reef systems impacting in-shore fisheries which are so integral to the food security of Pacific coastal communities (see reference below) [Sharelle Polack (nee Hart), Switzerland]	Fisheries is not the focus of this chapter. It will be covered in SROCC
136	41	6	41	6	Hanich, Q., Wabnitz, C.C.C., Ota, Y., Amos, M., Donato-Hunt, C. and Hunt, A. (2018) Small-scale fisheries under climate change in the Pacific islands region. Marine Policy. 88:279-284 [Sharelle Polack (nee Hart), Switzerland]	Fisheries is not the focus of this chapter. It will be covered in SROCC
28625	41	10	41	16	This paragraph is unclear. A reference for the statement "increased resource competition can aggravate the potential for migration to lead to conflict" is missing. It is also unclear whether migration in the host region is meant here, if so this should be clarified. [Nina von Uexkull, Sweden]	Section rewritten and moved to new Section 5.8

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Comment No	From Page	From Line	To Page	To Line	Comment	Response
28627	41	10	41	16	The section does not clarify what is meant by conflict. It remains unclear whether violent conflicts or non-violent disputes are covered or both. This is important as general "conflicts of interest" can be seen as part of regular interactions in society, whether the use of violence is detrimental. Adding a section on conflict to the glossary and/or clarifying its use in this section is advisable for increasing clarity. [Nina von Uexkull, Sweden]	Section rewritten and moved to new Section 5.8
23169	41	10	41	34	These days, war is becoming a common place in the world and can be shaped by the climate change. Evidence on the impact of food quality provided for the fighters is a determinant factor for successful war/battling as linked to climate (whether a battling strategy can be launched during rainy or dry season or whether during night time (when the temperature is low or during day time, when the temperature is high). It is believed that the food type or quality should be linked to the fighters/troop body condition, and the interlinked packed food quality under the differential climate conditions. [Girma Diga, Ethiopia]	Section rewritten and moved to new Section 5.8
26679	41	10	41	34	The Chapter 3 discussion of conflict is more nuanced on attribution of conflict (and specifically the Syrian conflict) to climate change. In this section it would also be useful to more carefully distinguish drought from climate change. [John Morton, United Kingdom (of Great Britain and Northern Ireland)]	Section rewritten and moved to new Section 5.8
26681	41	29	41	30	The sentence has become garbled - the Maystadt and Ecker article refers to drought generically, not "a drought" as fuelling conflict, and it is their own quantitative analysis that establishes livestock markets as the channel of impact - which is a novel finding, and possibly quite specific to Somalia, as most literature on pastoral conflict assumes direct pressure on grazing sources is a more important driver [John Morton, United Kingdom (of Great Britain and Northern Ireland)]	Section rewritten and moved to new Section 5.8
26683	41	31	41	32	The ICPAC document refers to raiding as a normal way of restocking in the "Karamoja cluster", which should have been defined as a specific region encompassing the Kenya-Uganda borderlands and small areas of SW Ethiopia and SE South Sudan. It is a huge exaggeration to consider raiding as "normal" in the GHA as a whole. [John Morton, United Kingdom (of Great Britain and Northern Ireland)]	Section rewritten and moved to new Section 5.8
13617	41	36	41	46	It is suggested that references be given here in these findings with calibrated language. For instance, which studies support the confidence level of the finding that limits to adaptation will be reached if unabated climate change continues. [Lourdes Tibig, Philippines]	Sentence rewritten
13619	41	39	41	42	This statement should be deleted, section is on adaptation options, challenges and opportunities. [Lourdes Tibig, Philippines]	Sentence deleted
29685	41	42	41	43	The sentence "if unabated climate change continues, limits to adaptation will be reached" implies that under an abatement scenario limits would not be reached. However, SR1.5 concluded that limits to adaptation have already been reached. Could this be expanded here to highlight what limits have already been reached, and how more limits would be met at higher levels of warming? [, Saint Lucia]	This has been taken care of. Changes have been made in the Word Document. The limits of adaptation .... will be reached (refer page # 41).

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Comment No	From Page	From Line	To Page	To Line	Comment	Response
23871	41	43	41	43	May be modified as 'Effective implementation of adaptation strategies would definitely help in increasing the resilience and reduce or even avoid some of the adverse impacts of climate change on food systems. The continuous and increased impacts of climate change present severe challenges for the adaptation process itself. Hence, effective, timely, continuous and proactive implementation of adaptation strategies is the key for enhancing resilience to climate change. Participatory, multi-stakeholder and integrative and location specific approaches are crucial' [, India]	Summarized the idea and inserted a new sentence to support the comment.
39677	41	36	42	6	Section 5.3 provides an excellent framing for the report, though possibly consider leading with the paragraph starting on page 42, lines 1-6, followed by the first paragraph of this section. Mitigation will be crucial to keeping climate where we can still have adaptation in some places. [, United States of America]	Lines 1-6 has been shifted to the first section of the paragraph. Mitigation aspects to adaptation is covered in section 5.6
1659	41	0	52	0	The organization of 5.3 is not good. For example, in 5.3.1, there is demand-side adaptation but no supply-side adaptation. In 5.3.2, the content is not suitable to the topic. There is no content related to the function of early warning in adaptation and the different ways of adaptation, such as incremental adaptation, transformational adaptation. [Chao WEI, China]	Section 5.3 has been restructured
6383	41	36	52	11	It is a bizarre that in section 5.3 on adaptation, there is no mention of relevant integrated agricultural management (i.e. agroecology, climate-smart agriculture, conservation agriculture) as adaptation practices. Although these are mentioned later in section 5.6.3, the inclusion of or note of these specifically small-scale or farm-level adaptation practices should also be addressed in section 5.3, or at least noted. [, Gambia]	Notes on relevant integrated agricultural management have been inserted with a note to see section 5.6. for details
39679	41	36	52	37	Section 5.3 needs to map adaptation strategies to impacts noted in earlier sections. Development and use of a conceptual model of impact to food security to adaptations noted here would be helpful. [, United States of America]	A new figure will be inserted to list impacts and corresponding adaptation options.
39681	42	6	42	6	Include citation: Brown, M.E., J.M. Antle, P. Backlund, E.R. Carr, W.E. Easterling, M.K. Walsh, C. Ammann, W. Attavanich, C.B. Barrett, M.F. Bellemare, V. Dancheck, C. Funk, K. Grace, J.S.I. Ingram, H. Jiang, H. Maletta, T. Mata, A. Murray, M. Ngugi, D. Ojima, B. O'Neill, and C. Tebaldi. 2015. Climate Change, Global Food Security, and the U.S. Food System. 146 pages. Available online at <a href="http://www.usda.gov/oce/climate_change/FoodSecurity2015Assessment/FullAssessment.pdf">http://www.usda.gov/oce/climate_change/FoodSecurity2015Assessment/FullAssessment.pdf</a> . [, United States of America]	Section 5.3 has been restructured. Paragraph deleted
12167	42	7	42	8	(cross-)reference needed to support this statement. [Hans Poertner and WGII TSU, Germany]	Expanded text and added more references
21453	42	7	42	10	You refer here to adaptation to extreme events - where in section 5.2 are the projected impacts of extreme events discussed, and is that discussion of impacts sufficient to motivate this discussion of adaptation needs? (My point is that I think the treatment of the impacts of extreme events is insufficient in 5.2, which makes the discussion of adaptation needs here weaker than it could and should be.) [Andy Reisinger, New Zealand]	Section 5.2.5.1 discusses impacts of extreme events on food stability
29687	42	7	42	10	Can examples be given of adaptation responses to extreme events and options for addressing losses? [, Saint Lucia]	Reference to the adaptation options given in the text - Table SPM 1 (IPCC- SREX 2012). A new table describing incremental and transformational adaptation is added

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Comment No	From Page	From Line	To Page	To Line	Comment	Response
31733	42	26	42	27	loss of perishable farm produce at marketing level is a big contributor to food insecurity in the rural african agrosystems. Improving farming systems and markets without adequately capitalizing in food processing technologist to improve shelf life food crops will not go far in alleviating hunger and food insecurity in the long term, especially in the face of climate change and shifting seasons. important to mention this in this section. [Elizabeth Migongo-Bake, Kenya]	we add elements of improved food storage, processing, harvest and post as response to food security are added.
39683	42	31	42	35	These sentences imply that agribusiness models are bad. Perhaps limit the implication to "these" business models instead of "the business models". Or "Many agribusiness practices result in ..." [, United States of America]	The whole box have been revised and the language issues removed
27753	42	33	42	35	This statement needs to be supported by citations of studies based on objective measurement. These are potential outcomes, but are not inevitable. It would be helpful to propose working with agribusiness on ways to enhance sustainability of agribusiness farming systems. [Annette Cowie, Australia]	We have added a reference on use of pesticide and productivity of land. We reduced the text to highlight the environmental challenges to avoid being prescriptive
40735	42	40	42	40	"should therefore include" seems prescriptive. [Valerie Masson-Delmotte, France]	All prescriptive terms such as should, need are removed
13885	42	40	42	44	biodiversity conservation and natural capital and ecosystem services preservation should added to this functions [Sunday Leonard, United States of America]	We added these elemnst except "natural Capital" that is a contended concept
23435	42	45	42	46	INCLUDE types of farming system, because adaptation practices also depend on the crop-livestock-tree mixes. [John Dixon, Australia]	The corresponding sentence has been removed
13887	42	46	43	3	Please change sentence from Line 46 to 47 (sustainable food system in Africa entails multiple dimensions as shown in Figure 5.8) to reflect the content of Figure 5.8 as well as the heading of the figure because the figure does not clearly explain the multiple dimensions of sustainable food and I do not think the content of the diagram is unique to Africa. I expect a diagram showing multiple dimension of sustainable food system to reflect the interlinkages between the various factors and how to support or diminish each other. The current diagram is very simplistic and do not present any rigorous thought or information [Sunday Leonard, United States of America]	That sentence has been removed because the ifnoramtion is redundant and fully considered in previous statements
13621	42	1	44	16	This introductory part of the this section on adaptation options, challenges and opportunities is too long, yet it does not do a "proper" introduction for the very important function aimed at in this section-to provide information on the options, challenges and opportunities. Some parts could be moved somewhere (e.g., Box 5.3 ), the statement re extreme events is not needed here, etc. It is suggested that instead, a short, concise summary of what is to be presented in the section. The details should be in the subsections that follow. [Lourdes Tibig, Philippines]	We believe that having challenges and opportunities is a good bridge to the set of adaptations relevant for Africa and showed in the new figure we introduced. The figure is being updated.
13009	42	25	44	16	This box contains only two citations and very little concrete information- I am not sure that it adds to the document. [Aidan Farrell, Trinidad and Tobago]	The box has been revised and new references added
1657	42	25	44	16	The box of Africa should not be placed here, which is awkward. [Chao WEI, China]	Text of this box 5.3 has been amended with new emission data from Africa and revised figure 5.8. The box will be moved to a different location of the chapter in consultation with the Chapter team. The box is shorter
30691	42	25	44	16	Good to see focused assessment on food security challenges for Africa. It will add more valuable to include quantifiable assessment on the extent of vulnerability and sensitivity of African food security to climate change. [, United Republic of Tanzania]	Thanks we also improved the evidence in the chapter and improved the the whole box
26685	42	25	44	16	This box is severely under-referenced [John Morton, United Kingdom (of Great Britain and Northern Ireland)]	We brought new references to back up some of the statements.



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Comment No	From Page	From Line	To Page	To Line	Comment	Response
13623	42	25	44	16	Box 5.3 is too long. Additionally, it is should be policy-prescriptive. The statement "What Africa needs...should be revised. [Lourdes Tibig, Philippines]	The box is shorter. We removed policy prescriptive language
6475	42	25	44	16	this part is extremely interesting and should be conserved, especially as it addresses the crucial issues of land degradation and its impacts on the households incomes on p42, lines 31-39; of agroecological practices on p 43, lines 16-17; and of land tenure on p 43, lines 27. On p44, line 10 mentions the challenge of feeding itself, it could be improved by clarifying the link with the concept of food sovereignty. Land tenure and food sovereignty are key approaches for ensuring resilient food systems and those elements could be stressed. [Sara Lickel, France]	A new diagram is used in palce to the previous one to reflect this aspect
17887	42	22			Title change to "Vulnerability and resilience measures to increasing extremes and volatility" as the first part, section 5.3.2.1 does not actually address resilience (as a positive concept), rather the exposure and vulnerability of the global food system. [Quentin Lejeune, Germany]	Title changed
12169	42	25			Box 5.3: The box lacks references and uncertainty/confidence statements. [Hans Poertner and WGII TSU, Germany]	References added
11495	43	1	43	1	add "Sustainable Land Management technics and pratices in the (Farming pratices) [Jean-Luc Chotte, France]	Sustainable Land management is added in the graphic that has been revised
27167	43	1	43	2	In Figure 5.8 factors influencing a sustainable food system in Africa are diverse and not equally balanced regarding their influencing levels as some are more directly related and some are more indirectly related with the food system. The message of the figure could be strengthened, if the factors were categorized in e.g. direct-indirect factors. [, Germany]	Food security and climate change is about managing tension between supply and demand within a food system. The figure now reflects those elements
12171	43	1	43	2	Figure 5.8: This figure is too generic. It is not clear how it reflects the assessment, i.e., how the respective factors influence sustainable food systems specifically. Suggest to either specify or remove it. [Hans Poertner and WGII TSU, Germany]	We revised the figure to relect the production aspects and the deamnd aspects in the context of Africa.
13889	43	1	43	3	Figure 5.8. See comment above. This diagram is too simplistic for an IPCC report and does not reflect the complexity expected in the interactions between the various factors involved in achieving a sustainable food system in Africa or indeed in any world region. I hope more rigorous thoughts will go into preparing a scientific sound figure that readers will expect from an IPCC report. [Sunday Leonard, United States of America]	We added global drivers such climate change, global market and trade as modulator of food system
17229	43	1	43	20	This sustainable food system in Africa seems to assumes that the rest of the world will not have much impact on the sustainable food system in Africa. The impact of climate change affects global, regional and local food systems. [Hoang Anh Le, Vietnam]	We added global drivers such climate change, global market and trade as modulator of food system
23439	43	14	43	15	ADD, such as sustainable intensification approaches based on conservation agriculture with functioning support services and market access [John Dixon, Australia]	Accepted and added
11497	43	16	43	17	change this bullet point by "Identifying Sustainable Land Management techniques and practices (agroecology, agro-forestry, etc..) addressing different ecosystem services (food production, biodiversity, redution GHG, Soil Carbon sequestration, ;,) Sanz et al. 2017. Sustainable Land Management contribution to successful land-based climate change adaptation and mitigation. A Report of the Science-Policy Interface. United Nations Convention to Combat Desertification (UNCCD), Bonn, Germany. <a href="https://www.unccd.int/sites/default/files/documents/2017-09/UNCCD_Report_SLM_web_v2.pdf">https://www.unccd.int/sites/default/files/documents/2017-09/UNCCD_Report_SLM_web_v2.pdf</a> [Jean-Luc Chotte, France]	Rephrasing and reference added to this bullet

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Comment No	From Page	From Line	To Page	To Line	Comment	Response
32597	43	16	43	17	It is important to parse out these terms- “agroecological practices and strategies, including development of underutilised species in favour of biodiversity, conservation, and ecosystem services” and the use of terms such as “indigenous knowledge, local knowledge, and agroecology” – through out the report; identifying their intertwined roles their roles in local food systems and in being tools for climate change adaptation and mitigation. [Neeraja Havaligi, United States of America]	Some of these concepts are removed and definition of SLM agroecology and other concepts will be taken care of in the framing chapter and cross-chapter boxes
23529	43	8			Many studies have predicted the impact of climate change on food systems, such as crops, pastures, and livestock; however, in-depth analysis of the impact of food safety, food quality, pests, and diseases on the entire food system requires more evidence. [Huai Jianjun, China]	Reference to predicted impacts of climate on food systems. Section 5.2
22639	44	1	41	16	References missing [Anastasios Kentarchos, Belgium]	Box rewritten. References added
13891	44	9	44	16	The solutions presented here are very abstract. Describe what such a model looks like and provide a scientific basis for the model. [Sunday Leonard, United States of America]	We put concrete solution and reduced the text length.
11499	44	14	44	14	add "avoiding land degradation and restoring degraded land" "...and what the implications are for avoidin land degradation and restoring degraded land, for food production...." [Jean-Luc Chotte, France]	This section is deleted and the phrase adjusted
25509	44	15	44	16	This could also be achieved by a shift to agroecology. Thus we propose to add it here. Cf. GENERAL COMMENT AGROECOLOGY. [ France]	These words have been deleted
6173	44	23	44	23	A suggestion could be to add a box on autonomous adaptation of rural populations in the Sahel. There are several recent papers which show how people perceive and adapt to climate change in the Sahel. You can find examples of autonomous adaptation of rural populations in the Sahel in those two references: Sultan Benjamin (ed.), Lalou Richard (ed.), Amadou Sanni M. (ed.), Oumarou A. (ed.), Soumaré M.A. (ed.) Rural societies in the face of climatic and environmental changes in West Africa. Marseille : IRD, 2017, 432 p. (Synthèses). ISBN 978-2-7099-2424-5 Richard LALOU, Benjamin SULTAN, Bertrand MULLER, and Alphousseyni NDONKY, Evidence of Autonomous Adaptation to Recent Climate change by Smallholder Farmers in the Sahel, Palgrave Communications (2019), in revision, Manuscript Number: PALCOMMS-01250 [Benjamin Sultan, France]	We have a box on Sustainable solutions for food systems and climate change in Africa. The box is shorter with additional evidence and references
15721	44	23	44	23	Assessment of climate change and climate extremes on temporal and spatial changing of crop yield in the future periods and recognizing and determining the optimal planting pattern [, Iran]	This section is about adaptation. Cannot match the comment with the text.
22641	44	23	44	41	Missing: early warning, monitoring, breeding, insurances, etc. [Anastasios Kentarchos, Belgium]	We have compiled adaptation options suitable for various climate risks and these aspects are included
11501	44	25	44	25	".. Adaptation options are on farm Sustainable land management practices that include increase..." delete on-farm practices and biophysical measures [Jean-Luc Chotte, France]	This is deleted
11503	44	29	44	29	add Sanz et al. 2017 at the end of the sentence ..and land degradation) (Sanz et al. 2017) [Jean-Luc Chotte, France]	This references is an official document and a great synthesis of land management by UNCCD and was added

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18005	44	29	44	31	A number of other studies on the adoption of these adaptations, management practices also require enabling/complimentary factors and technologies such as access to basic climate information services in order to make adjustments to the cropping calendar and supportive extension or social support networks. See for example: Bhatta, G. D., & Aggarwal, P. K. (2015). Coping with weather adversity and adaptation to climatic variability: a cross-country study of smallholder farmers in South Asia. <i>Climate and Development</i> , 5529(May 2015), 1–13. doi:10.1080/17565529.2015.1016883; Bhatta, G. D., Ojha, H. R., Aggarwal, P. K., Sulaiman, V. R., Sultana, P., Thapa, D., ... Ghimire, L. (2017). Agricultural innovation and adaptation to climate change: empirical evidence from diverse agro-ecologies in South Asia. <i>Environment, Development and Sustainability</i> , 19(2), 497–525. doi:10.1007/s10668-015-9743-x; Burnham, M., & Ma, Z. (2016). Linking smallholder farmer climate change adaptation decisions to development. <i>Climate and Development</i> , 8(4), 289–311. doi:10.1080/17565529.2015.1067180; Shaffril, H. A. M., Krauss, S. E., & Samsuddin, S. F. (2018). A systematic review on Asian's farmers' adaptation practices towards climate change. <i>Science of the Total Environment</i> , 644, 683–695. doi:10.1016/j.scitotenv.2018.06.349; Wood, S. A., Jina, A. S., Jain, M., Kristjanson, P., & DeFries, R. S. (2014). Smallholder farmer cropping decisions related to climate variability across multiple regions. <i>Global Environmental Change</i> , 25, 163–172. doi:10.1016/j.gloenvcha.2013.12.011 [Beau Damen, Thailand]	Few of these references have been used to improve the table added where we bring examples of adaptation options
13625	44	29	44	31	Can there be a calibrated language here? [Lourdes Tibig, Philippines]	High confidence
6171	44	30	44	30	You could this reference which evaluates adaptation options for cereals in West Africa: K. Guan, B. Sultan, M. Biasutti, C. Baron, D.B. Lobell (2017): Assessing climate adaptation options and uncertainties for cereal systems in West Africa, <i>Agricultural and Forest Meteorology</i> , <a href="http://dx.doi.org/10.1016/j.agrformet.2016.07.021">http://dx.doi.org/10.1016/j.agrformet.2016.07.021</a> [Benjamin Sultan, France]	Noted
15001	44	31	44	31	Move study from section to here "Pugh et al. 2016 suggest that for more efficient and sustainable production increases under climate change a shift in the spatial distribution of cropland itself and crop choices will be crucial". Reference is <a href="https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5136618/">https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5136618/</a> [Katharina Waha, Australia]	this aspect is considered in the new table
39685	44	32	44	34	It is fine to say that more varieties with these stress-tolerant qualities are needed, but suggest adding a more nuanced statement that both availability and adoption of these varieties is a possible path of adaptation. [United States of America]	We included this nuance in a new sentence
13085	44	35	44	35	In addition to increasing availability, overabundance as well as water quality (such as salinity) should also be considered here. [Kristi Tabaj, United States of America]	The overabundance and water quality added
13627	44	35	44	41	The paragraph could be shortened and still be concise by revising these water management options [Lourdes Tibig, Philippines]	The paragraph was revised
138	44	35	44	41	include comment here re potential for further development of commercial-scale hydroponic or aquaponic systems which have extremely low water usage per output, particularly for growing vegetables (Barbosa GL, Gadelha FD, Kublik N, et al. Comparison of Land, Water, and Energy Requirements of Lettuce Grown Using Hydroponic vs. Conventional Agricultural Methods. <i>Int J Environ Res Public Health</i> . 2015;12(6):6879-91. Published 2015 Jun 16. doi:10.3390/ijerph120606879) [Sharelle Polack (nee Hart), Switzerland]	This aspect is added together with drip irrigation and the reference suggested used
28509	44	39	44	39	Suggest clarifying that AWD is specific to rice production [Valerie Kapos, United Kingdom (of Great Britain and Northern Ireland)]	We made it specific to rice cultivation

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Comment No	From Page	From Line	To Page	To Line	Comment	Response
6079	44	40	44	40	capital E in the beginning of new sentence [, Poland]	Corrected
13629	44	44	45	8	There are two statements with calibrated language based on what? [Lourdes Tibig, Philippines]	Sentence rewritten
15003	44	45	45	2	Replace: "resilience and reducing risks" to "performance and efficiency that may translate into increased resilience and reduced risks". I don't think that the evidence provided in this chapter justifies that there is medium evidence and medium agreement. I agree with this assessment regarding the general benefits of diversification but most of the studies cited in this chapter do not provide evidence for reduced risks or resilience. [Katharina Waha, Australia]	The sentence is rephrased. We do not agree with the reviewer that we do not have enough evidence to rise the uncertainty language to medium evidence medium agreement. We added a couple of refernces and tehre many more from CCAFs, and CGIAR that bring aspects of the evidence supporting the statement
17883	44	45	46	2	The examples listed in parenthesis for "diversification of many components of the food system" do not necessarily detail "diversification" activites or at least, the diversification aspect is not clear. Specifically "indigenous knowledge and local knowledge" and "local food systems." [Quentin Lejeune, Germany]	We adopted performance efficiency instead of diversification
30737	44	18	49	20	Here how could you demonstrated that identified current and future adaptation measure performance are attributed to climate change???? That why you should really documented this before. My previous comments make then sense [Constant Labintan, Benin]	We brought a new table where we show various adapation options to address extreme climate risk and long term climate change. The table is inpired from AR5 WGII, Africa SPM2, and from Vermulen paper in PNAS to bring new aspects of incremental and transformational change
13893	45	1	45	4	please provide reference for this assertion [Sunday Leonard, United States of America]	We have added two references
140	45	2	45	2	Add within the brackets: the sustainable use of wild animals and plants as a food source) See Bharucha Z, Pretty J. The roles and values of wild foods in agricultural systems. Philos Trans R Soc Lond B Biol Sci. 2010;365(1554):2913-26. [Sharelle Polack (nee Hart), Switzerland]	We added the element of indigenous fruits and sued a refernce from Africa that is new on this topic
15005	45	2	45	4	Needs one or more references. This is a hypotheses only at the moment. [Katharina Waha, Australia]	Accepted. Added the references
15007	45	4	45	4	Start sentence with "Diverse production systems..." [Katharina Waha, Australia]	Corrected
15009	45	11	45	11	Reference not in reference list (Zhu et al. 2011) [Katharina Waha, Australia]	Editorial
15011	45	13	45	13	Change from "were taken" to "can" [Katharina Waha, Australia]	Accepted
15013	45	16	45	16	Reference needed for statement "Dietary diversity does not only increases adaptation options," [Katharina Waha, Australia]	We rephrased saying "dietary diversity is not enough"
5161	45	17	45	17	Suggest to modify from "underutilised" to "underutilized" [, Japan]	Corrected
15015	45	24	45	24	Change from "as an" to "as a" [Katharina Waha, Australia]	Corrected
39687	45	31	45	31	"... commercial crops ..." Does this need defining since it implies that the local crops listed are not commercial. [, United States of America]	we replaced "commercial" to "commodity" as a common language to identify market orineted cash crops.
40737	45		45		explain why focus on this region in Box 5.4. Check coherency with SROCC (high mountain chapter). Link to climate change missing. [Valerie Masson-Delmotte, France]	We need to cross-ref to SROCC
22643	45	27	46	37	The box says very little about climate change. Also, it would be better to change the focus of the box to NUS crops more generally rather than giving only an example of a specific region. [Anastasios Kentarchos, Belgium]	NUS is a large topic, and many reports written globally. We opted highlighting its importance through this box by showing how NUS have helped adapt to climate change in a given geographic location. We added a sentence to flesh out the idea.
13011	46	10	46	11	Much of this sentence is repeated from the first paragraph of the box. [Aidan Farrell, Trinidad and Tobago]	Repetition removed
27169	46	10	46	11	As the term NUS was already explained on page 45 line 29, there is no need to explain it again in the same box. [, Germany]	Corrected
1887	46	10	46	13	The text describing NUS repeats previous text in Box 5.4. Consider removing or curtailing the text here. [William Lahoz, Norway]	Corrected

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Comment No	From Page	From Line	To Page	To Line	Comment	Response
1889	46	33	46	33	Is there a more common term for "Jammun"? [William Lahoz, Norway]	Scientific added
13895	46	42	46	42	It will be useful to give the reader an idea of what EbA is before giving an example. This will help the reader understand better. For example, the next few sentence discusses the benefit of conservation agriculture but the reader does not know whether conservation agriculture is the same as EbA of an example of EbA practices. [Sunday Leonard, United States of America]	A reference from USAID on EbA and food security was used to define what EbA is and the ref is added
6637	46	39	47	25	Silvopastoral systems combine trees and/or shrubs with grazing cattle. In the municipality of Salto de Agua, Chiapas, Mexico, some indigenous communities have developed silvopastoral systems based on their traditional knowledge regarding use of local natural resources. Besides the services to farmers already mentioned, trees contribute to cleaner agricultural production and provide services to the ecosystem, such as biodiversity conservation and climate change mitigation through carbon capture and storage in tree biomass (Ibrahim et al., 2000; Murgueitio et al., 2006; Jose, 2009) Further benefits include mitigation of effects of climate change through carbon capture and storage in tree biomass and necromass, moderation of runoff and lixiviation, watershed protection, biodiversity conservation, and landscape connectivity. [, Mexico]	We added in one sentence the examples of silvopastoral system. We also improved language of what EBA is about
28511	46	39	47	25	Description of EbA options is limited to on-farm (agroecosystem) measures (including climate smart, conservation agriculture and agroecological practices). Eba in other ecosystems within farmscapes, such as forests and rivers, can also be important, for example to improve soil conservation, water cycling and agro-biodiversity. Some important work on forests and food security has been undertaken by FAO, CIFOR amongst others and could merit a new sub-section. It should at least be mentioned and cited. [Valerie Kapos, United Kingdom (of Great Britain and Northern Ireland)]	We brought forest and water resources as set of EBA, and backed it up with a reference Muthee et al, 2017
5479	46	40	47	25	The chapter "Ecosystem-based adaptation" lists a lot of adaptation options and farming practices, but permaculture - which can also fall under ecosystem-based adaptation options - is not mentioned. [, Hungary]	Perennials polyculture, permaculture are added and a couple of new references also added.
12173	46	39			The climate change adaptation aspect is weak in this section. Be more specific about the climate element that the described practices help adapting to, e.g., temperature (extremes), drought, rainfall, storms, ...? [Hans Poertner and WGII TSU, Germany]	This was responded in previous comment as we included a new table where we mapped adaptations option to face various climate risks.
28669	46	40		47	Climate Change adaptation in many geographical and socio-economic regions. Agroforestry is an important integrated system in conservation of biodiversity and increase in crop production in relation to ecosystem based adaptation. I recommend an integrated system based adaptation measures, response in relation with biodiversity conservation, locally, regional and at global level. I recommend climate change adaptation in Africa in relation to an integrated agroforestry system along with ecosystem based adaptation measures, practice i biodiversity conservation system and process. Adoption of conservation farming practices in relation to the sample (Northern Iran) should be implemented for African farmers. [Abiodun Adegoke, Nigeria]	This is already in the first paragraph of this section

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Comment No	From Page	From Line	To Page	To Line	Comment	Response
7461	46	42		44	It has been shown that the agroforestry system has a high effectiveness to control erosion, comparatively with other agrarian uses. Taking into account the direct relationship between erosion and crop productivity, it would be important to highlight it. A comment like this could be included: "Agroforestry systems have been shown to reduce erosion through their canopy cover and their contribution to the litter layer." A study carried out in Nicaragua showed that erosion affected 10.4% of the study area (Blanco and Aguilar, 2015), far from the 88.4% achieved in Guatemalan corn crops under similar environmental conditions (Blanco and Enriquez, 2018) ". References at the end of the database. [Rafael Blanco-Sepulveda, Spain]	This aspect of agroforestry role as a buffer of climate change and erosion control, are added in just a short sentence, but we used another reference.
17201	46	42			Replace "crop productivity" with "agroforest productivity" or similar. [José Alfonso Domínguez-Núñez, Spain]	To avoid repetition we used "food productivity"
13897	47	1	47	10	It will be useful to clarify whether the benefits discussed here were achieved in a normal agricultural setting or whether the setting was specifically designed as a climate change adaptation measure. And if the later, it will be useful to provide information on what was the status quo prior to the introduction of the adaptation measure. Currently, the discussion seems sloppy and do not clarify whether the introduced practices were aimed to mitigating/adapting to the impact of climate change or just efforts to improve agricultural productivity beyond the status quo [Sunday Leonard, United States of America]	We made the clarification that Conservation ag was embedded in a normal setting not specifically to address climate changet in land use traditions.
1891	47	4	47	4	Is there a more common term for "Rhodo..."? [William Lahoz, Norway]	This is the scientific name of a Proteobacteria (Rhodopseudomonas palustris). But it was removed to have the sentence simpler
25511	47	12	47	15	"agroecological practices such as" need to be deleted, to make clear that it is these kind of amendments that lead to the described effects. cf. GENERAL COMMENT ON BIOCHAR [, France]	Segment deleted. Sentence start with "Soil amendements..."
27755	47	13	47	15	This example is one study using biochar produced through gasification, rather than slow pyrolysis, which is not the recommended process for production of biochar for use as a soil amendment. As discussed in chapter 4, biochar properties vary widely depending on the biomass feedstock and the pyrolysis conditions. There are many studies that demonstrate positive effects of biochar on soil microbial community structure and function eg Thieset al, 2015. Biochar effects on the abundance, activity and diversity of the soil biota. Biochar for environmental management: science, technology and implementation, 2, pp.327-389. Besides this observation of limited response to gasification (high temperature) biochar, it would be appropriate to acknowledge the body of evidence showing beneficial effects of slow pyrolysis (low temperature) biochar on soil microbiology. Thies, J.E., Rillig, M.C. and Graber, E.R., 2015. Biochar effects on the abundance, activity and diversity of the soil biota. Biochar for environmental management: science, technology and implementation, 2, pp.327-389. [Annette Cowie, Australia]	This section relative to Biochar is amended. Cross ref to SRCL Chap 4 is made.
21885	47	15	47	18	The formulation "development of chemical-resistant weeds and pests" is a bit unclear. Is the challenge to develop varieties that are resistant to weeds and pests or are weeds and pests a risk to crop-livestock systems? [, Finland]	Replaced by "persistent"
116	47	38	47	39	re. "reliance on social networks". This statement is insufficient. A better way to think of this is in terms of the theory of "moral economy" (cf Scott, Thompson). For a application of moral economy theory to food system resilience see: Reuter, Thomas A. - 2018. Environmental Limits and Uncertain Human Futures: Food System Vulnerabilities in Indonesia and Beyond. Culture, Agriculture, Food and Environment, published online on 3 June 2018 at <a href="http://dx.doi.org/10.1111/cuag.12135">http://dx.doi.org/10.1111/cuag.12135</a> . [Thomas Reuter, Germany]	The idea is the same and the moral economy concept is added

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Comment No	From Page	From Line	To Page	To Line	Comment	Response
26687	47	39	47	42	The account of the Ensor article is garbled - I believe it should refer to "drivers of vulnerability" not "drivers of perception" [John Morton, United Kingdom (of Great Britain and Northern Ireland)]	Wording changed
12175	47	43	47	46	This does not seem to be specific to Pacific islands, but to rural/traditional communities in general. [Hans Poertner and WGII TSU, Germany]	Sentence rewritten
28513	47	25	48	7	May be worth noting that CBA measures can improve the adaptive capacity of communities, thereby reducing their overall vulnerability to climate change hazards [Valerie Kapos, United Kingdom (of Great Britain and Northern Ireland)]	A bit of change at the beginning of the paragraph
29789	47	27	48	7	This section on community based adaptation could be strengthened with discussion of inherent adaptability. Tseil-Waututh have been adapting to changing climates since time immemorial by following their laws of stewardship, and sacred obligations. [Tanya Smith, Canada]	Out of scope of this section
39689	47	27	48	38	This section provides a weak connection to food security/food system framing, as currently worded. Further develop the role of community-level actions to enable food system/food security needs to deal with climate change impacts. Also, indicate for what types of impacts these actions are suitable. [, United States of America]	Here community based adaptation addresses food security and other climate change aspects. It is difficult to make it more specific
28671	47	1		2	Conservation agriculture techniques must be implemented in Africa to enhance large food production and for the purpose of biodiversity conservation. Educating the local farmers and empowering them with modern agriculture technology in relation to ecosystem conservation and biodiversity would increase the socio-economic transformation and also reduce food waste ,adaptation, protection and heavy investment in crop production in relation to food security and ecosystem conservation along with sustainable development in biodiversity conservation. Educating the local farmers most especially in Africa would be a major achievements for climate change adaptive response in relation with Agriculture conservation. [Abiodun Adegoke, Nigeria]	Some ideas are taken in this statement. We found it very policy prescriptive and we refrained to accept all this statement as it is.
25075	47	26			It is advised to add the following paragraph at this place: "Ecosystem-based approaches are a kind of green infrastructure, which is in contrast to human-built grey infrastructure (Palmer et al., 2015). Ecosystem-based approaches to crop and soil management can reduce evaporative losses of water from fields, and allow more efficient use of water in agriculture. Such approaches can enhance farmers' resilience and long-term adaptation to climate change (Palmer et al., 2015). Palmer M.A., Liu J.*, Matthews J.H., Mumba M., D'Odorico P., 2015. Manage water in a green way. Science 349 (6248): 584-585. [Junguo Liu, China]	This aspect is already there. We Added Palmer as a reference
22645	48	9	48	38	Consider deleting box [Anastasios Kentarchos, Belgium]	Box merged with Box on Pacific region (new Box 5.6)
27171	48	41	48	41	There are more studies that show this. Please do not only cite one paper. For example: Stevanović M, Popp A, Bodirsky B, Humpenöder F, Müller C, Weindl I, Dietrich J, Lotze-Campen H, Kreidenweis U, Rolinski S, Biewald A, Wang X: Mitigation strategies for greenhouse gas emissions from agriculture and land-use change: Consequences for food prices. Environmental Science & Technology, 51 (1), pp 365–374. DOI:10.1021/acs.est.6b04291. [, Germany]	Added more studies

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Comment No	From Page	From Line	To Page	To Line	Comment	Response
12545	48	44	48	44	Suggestion to add the following sentence after ' people with higher income demand more varied diets, and typically ones that are richer in meat and other food types that require more resources to produce.': For example, if every country in were to adopt the UK's 2011 average diet and meat consumption, 95% of global habitable land area would be needed for agriculture – up from 50% of land currently used (Alexander et al. 2016). For the average US diet, 140% of global land would be needed (Alexander et al. 2016). (Alexander, Peter, Calum Brown, Almut Arneth, John Finnigan, and Mark D. A. Rounsevell. 2016. 'Human Appropriation of Land for Food: The Role of Diet'. Global Environmental Change 41 (November): 88–98. <a href="https://doi.org/10.1016/j.gloenvcha.2016.09.005">https://doi.org/10.1016/j.gloenvcha.2016.09.005</a> . Bajželj, B. 2014. 'Importance of food-demand management for climate mitigation.' Nature Climate Change 4: 924–929.) [Carina Millstone, United Kingdom (of Great Britain and Northern Ireland)]	Very important contribution included
29791	48	40	49	20	This section could be strengthened with a brief discussion on the cultural significance of food and the challenges this poses for demand side adaptation. [Tanya Smith, Canada]	Very important aspect we brought a couple of sentences to reflect that
12177	48	40			The climate adaptation element is not clear in this section. At the moment it is more about demand-side measures to increase food security in general. [Hans Poertner and WGII TSU, Germany]	This adaptation section is beyond Climate change, rather adaptation related to food quality and health. Some clarifications are added
12561	49	11	39	12	Challenge to the sentence: ' Replacing beef in the US diet with poultry can meet caloric and protein demands of about 120 and about 140 million additional people consuming the average American diet'. This sentence risks being misconstrued as an endorsement to a shift to poultry protein. Suggestion to either remove this sentence or add at the end of this paragraph a study that highlights the benefits of moving to plant-based protein, such as the study on page 57- line 27-28 (Harwatt et al. 2017) [Carina Millstone, United Kingdom (of Great Britain and Northern Ireland)]	Added plant based protein such as bean and used the reference
13899	49	3	49	4	So what are the factors identified by Hunter & Roos, 2016? This sentence just leaves the reader wondering [Sunday Leonard, United States of America]	The phrase is deleted
25513	49	3	49	12	This paragraph should be restructured so as to distinguish consumption and diet aspects from loss and waste aspects. [, France]	Absolutely good comment. We reorganized the paragraph and separate diet aspect to food waste aspects
27757	49	6	49	6	While inefficient in terms of conversion of feed to meat, note however the unique capacity of ruminants to produce high quality food from low quality forage, from landscape that cannot be cropped, from cellulosic biomass that humans can't digest; note also the ecologically-important role of ruminants (domesticated and wild species) in landscape management, especially in the rangelands (eg Fuhlendorf & Engle 2001) , and the ecologically-important role of ruminants in mixed farming systems, where pasture leys sustain productivity of cropping systems. Note also the importance of sustainable harvest of wild species (eg bush meat) as a strategy to conserve biodiversity and deliver sustainable livelihoods eg Cawthorn & Hoffman; Child). Cawthorn, D.M. and Hoffman, L.C., 2015. The bushmeat and food security nexus: A global account of the contributions, conundrums and ethical collisions. Food Research International, 76, pp.906-925.; Child, B., 2012. The sustainable use approach could save South Africa's rhinos. South African Journal of Science, 108(7-8), pp.21-25. Fuhlendorf, Samuel D., and David M. Engle. "Restoring Heterogeneity on Rangelands: Ecosystem Management Based on Evolutionary Grazing Patterns: We propose a paradigm that enhances heterogeneity instead of homogeneity to promote biological diversity and wildlife habitat on rangelands grazed by livestock." AIBS Bulletin 51, no. 8 (2001): 625-632. [Annette Cowie, Australia]	These aspects are synthesised with additional evidence from Alexander et al 2017



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27173	49	6	49	12	Ruminants have positive ecological effects if they are fed extensively on grassland. Because there is a high variety of species which can only grow if the grassland is grazed. Please reflect these positive effects in this section. [, Germany]	The feed aspects from brassland is added in one sentence
39691	49	8	49	10	Clarify to what "two-years of growth in production" refers. It isn't two years of crops. [, United States of America]	The section on two years is deleted and the rest maintainaed without changing the sentence
39693	49	13	49	20	Awkward paragraph. Two unconnected thoughts. [, United States of America]	The paragraph was revised
1893	49	16	49	16	insect -> insects. [William Lahoz, Norway]	Corrected
25515	49	16	49	17	This assessment could be balanced with sanitary and risk assesment aspects as well as regulatory aspects. Moreover, this sentences should be part of another paragraph since it is not directly linked to the previous sentence. [, France]	Comment above address this one
13901	49	16	49	17	This is simplistic. What could be the impact of consuming insects on biodiversity. Things are not as easy as we make them sound here [Sunday Leonard, United States of America]	Yes a total reformulation is made
30659	49	31	49	31	what is the digital dependance of food system? [Lorenzo Giovanni Bellù, Italy]	Digital removed
180	49	39	49	41	In addition to 2012 US drought, I would suggest that 2016 French wheat yield loss which is well documented recently is included here. My suggestion is: "A record yield loss of 2016 in French that is attributed to a conjunction of abnormal warmness in late autumn and abnormal wet in the following spring (Ben-Ari et al., 2018) is another well-documented example. Citation: Ben-Ari, T., Boé, J., Ciais, P., Lecerf, R., Van der Velde, M., Makowski, D., 2018. Causes and implications of the unforeseen 2016 extreme yield loss in the breadbasket of France. Nat. Commun., 9, 1627, doi:10.1038/s41467-018-04087-x. [Toshichika Iizumi, Japan]	Accepted, text added
40739	49		49		Is the food system resilient in case of one or two major volcanic eruptions in the coming years / decades? This could also be relevant to mention as likely to happen given past recurrence. This would bring a temporary climate shock too. [Valerie Masson-Delmotte, France]	we limit the analyse of human impactson climate change. Natural volcanic eruption are not included.
22647	49	22	51	36	Where are challenges and opportunities as announced for this section? [Anastasios Kentarchos, Belgium]	We have introduced a table at the beginning to show these challenges and oportunities. The new paragraph shows also these challenges and opportunities.
39695	49	22	51	36	This section does not deal with the impact of multiple simultaneous failures in the food system across the globe affecting food security. Concurrent events related to storm damage, droughts, flooding, and so on can disrupt food access and delivery, storage and transportation, production and harvest, etc. [, United States of America]	Aspects of that are already addressed in 2 comment line above.
21455	49	22			You have an entire section dedicated to adaptation to extreme events - where in section 5.2 are the projected impacts of extreme events discussed, and is that discussion of impacts sufficient to motivate this discussion of adaptation needs? (My point is that I think the treatment of the impacts of extreme events is insufficient in 5.2, which makes the discussion of adaptation needs here weaker than it could and should be.) [Andy Reisinger, New Zealand]	A short paragraph is added as header of this section to bring these projected changes. We also made some cross ref to 5.6 where more details on synergies in adapatation is described.
30661	50	3	50	17	Reference you missed studying and citing in this paragraph is: FAO. 2018. The State of Agricultural Commodity Markets 2018. Agricultural trade, climate change and food security. Rome. <a href="http://www.fao.org/3/I9542EN/i9542en.pdf">http://www.fao.org/3/I9542EN/i9542en.pdf</a> [Lorenzo Giovanni Bellù, Italy]	Accepted, reference added in earlier paragraph
547	50	3	50	17	Many comodity prices are determined on financier markets [Nathalie Hilmi, France]	Accepted, this dependance to financial market is added

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182	50	3	50	17	<p>It would be nice if a brief description on efforts to provide objective crop production outlooks during the last years and its possible contributions to adaptation. After the food crisis of 2008 and 2010/2011, the Agricultural Market Information System (AMIS) and the Group of Earth Observation Global Agricultural monitoring (GEOGLAM) have operated since their launch at G20 Canes Summit 2011. The amplitude of interannual growing-season temperature variability is in general larger than that of long-term temperature change. Responding better to seasonal climate-induced food supply shocks therefore increases society's capability to adapt to climate change. Given these backgrounds, seasonal crop forecasting and early response recommendations, based on seasonal climate forecasts, are emerging to strengthen existing operational systems for agricultural monitoring and forecasting (FAO, 2016, Ceglar et al., 2018, Iizumi et al., 2018).</p> <p>Citations:                      Ceglar, A., Toreti, A., Prodhomme, C., Zampieri, M., Turco, M., Doblas-Reyes, F.J., 2018. Land-surface initialisation improves seasonal climate prediction skill for maize yield forecast. <i>Sci. Rep.</i>, 8, 1322. <a href="http://dx.doi.org/10.1038/s41598-018-19586-6">http://dx.doi.org/10.1038/s41598-018-19586-6</a>.                      Iizumi, T., Y. Shin, W. Kim, M. Kim, J. Choi, 2018. Global crop yield forecasting using seasonal climate information from a multi-model ensemble. <i>Clim. Serv.</i>, 11, 13-23, <a href="https://doi.org/10.1016/j.cliser.2018.06.003">https://doi.org/10.1016/j.cliser.2018.06.003</a>.                      FAO, 2016. 2015–2016 El Niño – Early action and response for agriculture, food security and nutrition. <a href="http://www.fao.org/emergencies/resources/documents/resources-detail/en/c/340660">http://www.fao.org/emergencies/resources/documents/resources-detail/en/c/340660</a> (accessed 10 December 2018). [Toshichika Iizumi, Japan]</p>	Accepted. This seasonal signal on crop production is added in the new section at the beginning with the new reference, and better forecasting added into comments on adaptation options
39697	50	7	50	8	In the parenthetical, change "food" to "crops". [, United States of America]	Food is replaced by crops
22649	50	1	51	2	Statement suggests that temperatures were responsible for dustbowls. They were caused by severe erosion on land. Link to climate change needs to be made clearer. [Anastasios Kentarchos, Belgium]	text adjusted to clarify
13631	50	23	51	22	Title of Box 5.6 is on what? In a discussion on food price spikes? Delete lines 16 to 22, page 51. [Lourdes Tibig, Philippines]	Box 5.6. title changed. Lines 16-22 modified to make context clear.
1895	51	2	51	2	Perhaps the authors could provide more details of this causality. Mentioning Rossby waves does not provide sufficient information, in my view. [William Lahoz, Norway]	Accepted, text modified to make clear
12179	51	6	51	6	"perhaps" sounds rather informal. Potential for a likelihood statement? [Hans Poertner and WGII TSU, Germany]	"perhaps" is removed
6197	51	6	51	6	the word manner appears to be a typo. The sentence is not clear [Margot Hurlbert, Canada]	Sentence revised
551	51	8	51	10	Maybe a reference here? [Nathalie Hilmi, France]	references are below
22651	51	24	51	36	Is this (brief) section necessary here? Consider revising. Ideally by pointing to general risk management lessons from Ch7 and complementing here with elaboration specific to food. [Anastasios Kentarchos, Belgium]	we revised the section
6387	51	24	51	36	This section on risk management is very short, yet it is very important for policy makers in vulnerable countries. The section should be expanded to include examples from smaller developing countries, and to elaborate on the challenges associated with risk management and the implications for managing loss and damage. What will future increases in climate change impacts mean for these mechanisms? What is needed to scale them up and make them appropriate for different contexts? [, Gambia]	New element along this comment are brought to this section. Also clarify brought by the IPCC Bureau during LAM4 used to address this comment

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Comment No	From Page	From Line	To Page	To Line	Comment	Response
33761	51	24	51	36	Please consider additional governmental compensation for crop-failure and financial losses that is practiced in some countries. Norway has a national measure available to all farmers who experience crop failure due to climatic causes. Payments are designed to secure economic viability of the producer and continued production following extreme weather events. Following the drought in Norway in 2018, the payments through this measure are projected to exceed 1,6 billion NOK. Extreme weather events also put pressure on the agricultural authorities to relax environmental rules regarding e.g. water extraction, cropping of conservation areas and restrictions on manure application to fields primarily due to changes in rainfall and temperature. [ , Norway]	this examples is added in addition to using agroecology in de eloping countries
30693	51	24	51	36	The concept of risk management and its link to food security need to be broaden and expounded. I it is currently very shallow. It will be useful to have a quantifiable assessment about the current and projected risks [ , United Republic of Tanzania]	Accepted
39699	51	24	51	36	Risk management is an important consideration and should be expanded related to insurance, relief and aid programs, etc. [ , United States of America]	yes we expanded the section
1897	51	26	51	26	I suggest authors provide more details of these mechanisms. What do they do? Same for L. 36. [William Lahoz, Norway]	examples re added
549	51	33	51	36	It would be interesting to develop more this paragraph [Nathalie Hilmi, France]	yes we did develop this paragraph
14071	51	11	52	11	Comment: It is important include among institutional measures, those related with legal frameworks which can favour implementation of adaptation measures. For example: the recent peasant rights declaration of UN [Ana Felicien, Venezuela]	the referecne of this comment is not accurate
14073	51	11	52	11	Comment: to see legal related literature see: De Schutter, O. (2012). Agroecology, a Tool for the Realization of the Right to Food. In Agroecology and strategies for climate change (pp. 1-16). Springer, and Dordrecht, Claeys, P., & Delgado Pugley, D. (2017). Peasant and indigenous transnational social movements engaging with climate justice. Canadian Journal of Development Studies/Revue canadienne d'études du développement, 38(3), 325-340. [Ana Felicien, Venezuela]	Noted
29793	51	24	52	36	This section could be strengthened with an example of Indigenous culture inherent risk sharing, transfer and resilience spread; for example, Tsleil-Waututh has agreements with neighbouring First Nations to crab, fish and hunt in their territories. [Tanya Smith, Canada]	Issues of multifunctionality and local agreements to buffer risk is added
22653	51	39	52	11	Very poor. Policies, laws, enabling environment => all need significantly more emphasis. [Anastasios Kentarchos, Belgium]	The section has been supplemented with new insight that respond to these missing aspects
6199	51	39	52	11	This section is an important addition. The linkage to chapter 7 which builds on institutions, policy and governance might improve the substance [Margot Hurlbert, Canada]	We added a cross reference with Chapter 7
12181	51	24			This section seems rather short for the important topic 'Risk management'. Check if literature has been covered adequately. [Hans Poertner and WGII TSU, Germany]	New elements have been developed to supplement this section
12183	51	39			This section does not really address 'institutions' - suggest to be more specific about which institutions this is. Need to consider also different institutional levels. [Hans Poertner and WGII TSU, Germany]	we added example on Nroway and how new rules and institutions helped addressed risk
18007	52	5	52	9	The Nepal example is highly relevant here but could be elaborated. It may worthwhile to mention Nepal's Local Adaptation Plan of Action or LAPA, which is an institutional innovation that aimed to better integrate local adaptation planning processes and institutions into national adaptation processes. [Beau Damen, Thailand]	Reference to the Nepal LAPA is included

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Comment No	From Page	From Line	To Page	To Line	Comment	Response
1899	52	6	52	6	"...in recent years manner..." sounds odd. I suggest rephrasing. [William Lahoz, Norway]	Accepted, deleted
22655	52	13	52	37	Purpose of this section is unclear [Anastasios Kentarchos, Belgium]	This section is to highlight the importance of culture and believe in various choices for food productions and consumption and at the same time mention the barriers that can hinder progress in addressing climate change adaptation
29797	52	14	52	37	This section should be amended to acknowledge the inherent adaptability of Indigenous peoples who are particularly connected to the land. This section could be more effective by acknowledging that Indigenous cultures across the world demonstrate alternative cultural beliefs that offer sustainable systems and pragmatic solutions to move forward in climate sustainability. [Tanya Smith, Canada]	These elements and other aspects of the importance of local culture are added and new reference brought to the section. Now we have risk and barriers separated.
13903	52	17	52	18	Incomplete/vague information here. There are several dimensions and aspects of culture. What specific aspect of culture posed a major barrier and what specific adaptation action was impacted? [Sunday Leonard, United States of America]	We made the choice to bring the highlights of the importance of cultural values and norms and some aspects of risk and barriers. New text added
13905	52	27	52	28	Vague statement again. Please give specific examples of perceptions and belief that resulted in this conclusion [Sunday Leonard, United States of America]	We used the Sahel example
13907	52	32	52	34	Please substantiate this conclusion with at least one example [Sunday Leonard, United States of America]	We gave some examples in Box 5.4 and cross-ref to that one
41511	52	39	52	39	Not convinced that "impact" is the adequate word here. Food systems as drivers of climate change? [Valerie Masson-Delmotte, France]	Rejected. The concept is indeed that "food systems" are drivers of climate change, through the emissions generated by the underlying activities.
25517	52	41	52	44	Could this assertion be sourced? And how are these tables obtained ? [ , France]	Accepted. See above.
17231	52	41	52	44	Table 5.5. does not support these estimates. The table only accounts for a minimum of 21% if you include crops and livestock in the supply chain or 27% if not included. [Hoang Anh Le, Vietnam]	Accepted. Edits inserted in the narratives of 5.4.2 and 5.4.3 to better to 5.4.1 and table 5.5, and relevant links to these numbers provided within sections 5.4.2-6
30663	52	41	52	45	Please specify what exactly activities of "storage, processing, transport, retail and other supply chain activities" you assign to food systems and how you account for the related emissions. Please name your reference. Given that these are estimates based on medium evidence and medium agreement, please rephrase using a conditional tense. [Lorenzo Giovanni Bellù, Italy]	Accepted. Conditional used when referring to the total estimate from food systems.
22657	52	43	52	45	18% emissions for storage, etc. should be cross-referenced to 5.4.5, where it is explained in more detail. [Anastasios Kentarchos, Belgium]	Accepted. Provided better links between 5.4.1 and following sections. Re-draw table 5.6 and inserted text that clarifies that the supply chain numbers are very rough estimates.
13633	52	40	53	5	References (in traceable accounts) for the calibrated language [Lourdes Tibig, Philippines]	Text rewritten
5389	52	40	53	32	This key section, which is also strongly represented in the Executive Summary, and particularly the central table 5.5. are not as well-referenced as should be expected for an IPCC assessment. It draws mainly on ch11 of AR5, WGIII, two publications by Tubiello and one from FAO. In my view, for a robust assessment, it would be required to cite the full range of studies and be a lot more transparent how the key numbers in Table 5.5 are derived. This is even more important as the attribution of important emissions to human activities (e.g. how land use and land-use change affect the C balance of land) are uncertain and intensively discussed, so traceability and comprehensive treatment of the literature are key. I understand that key processes are discussed in the following sections, but this link is not so clear and should be completely unambiguous. [Helmut Haberl, Austria]	Accepted. Section improved and made more robust

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15743	52	40	53	32	Not clear where this data in Table 5.5 and text comes from, especially for supply chain. An original detailed analysis worth checking out is "Energy Smart Food for People and Climate" , FAO 2011, ( <a href="http://www.fao.org/docrep/014/i2454e/i2454e00.pdf">http://www.fao.org/docrep/014/i2454e/i2454e00.pdf</a> ). It showed end-use energy into agri-food supply was around 32% of the global total and agri-food supply GHG emissions (excluding land use change) were around 24% of total global emissions. Behind the farm gate "supply chain" was around 35% of the total, a lower share than shown in Table 5.5. [Ralph Sims, New Zealand]	Accepted. Table 5.5 was entirely re-drawn to increase clarity and flow of text from 5.4.1 to following sections and back.
12941	52	41	53	7	These "GHG emissions" are presumably an aggregate of different gases. This needs to be explicitly stated. However there is no agreed conversion to convert between the gases. For instance the methane metrics in IPCC AR5 WG 1 table 8.7 vary by a factor of 20. It would be more scientifically accurate if CO <sub>2</sub> , methane and N <sub>2</sub> O mitigation were quoted separately, rather than aggregating them in an undefined way. [William Collins, United Kingdom (of Great Britain and Northern Ireland)]	Accepted in part. Inserted text to specify which GWP were used, and relevant separate % figures for ch <sub>4</sub> and n <sub>2</sub> o provided where they are well known. Rejected: there are agreed conversions into CO <sub>2</sub> eq, the most notable of which is embedded in the UNFCCC guidelines for national GHG inventories (non-annex I use SAR figures; annex I use AR4 figures). It's nonetheless incorrect to lump all methane GWPs in the AR5 and report a factor of 20 difference. One should at a minimum compare values across the same time horizon. For reference, the conversions used in the AR4 and AR5 were the SARs 100-years horizon GWPs.
12943	52	15	55	25	5.4.1-5.4.4 including figs 5.10 and 5.11. There is no agreed conversion to generate GtCO <sub>2</sub> -eq per year. For instance the methane metrics in IPCC AR5 WG 1 table 8.7 vary by a factor of 20. It would be more scientifically accurate if CO <sub>2</sub> , methane and N <sub>2</sub> O mitigation were quoted separately, rather than aggregating them in the controversial (and undefined in the report) CO <sub>2</sub> eq. [William Collins, United Kingdom (of Great Britain and Northern Ireland)]	Table has been updated
30739	52	39	57	39	Great that you have presented quiet the full picture of emission sources taking into account food systems impact/mitigation chaine. However more detail on farming systems is needed. [Constant Labintan, Benin]	Noted.
1661	52	39	76	12	5.4 and 5.5 parts are not close the food security. These 2 parts can be analyzed in 5.6 section. [Chao WEI, China]	Rejected. The comment is unclear, in any case these two sections address specific dimensions of food systems that are relevant in the food security analysis and cannot be moved to 5.6.

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Comment No	From Page	From Line	To Page	To Line	Comment	Response
21457	52	40			I don't think this section is adequate as an assessment of GHG emissions from food systems. There are several global databases, but here reference is made only to FAOSTAT. Please check and compare results from other databases (see AR5) and at least state the range of results before then settling on one to give the central estimate (is FAOSTAT central or at the high or low end compared to others?) Also and more importantly, a series of recent papers have applied Tier 2 approaches to emissions and found significant discrepancies with Tier 1 based estimates. While this is to be expected for individual countries, what this section needs to do is to provide an assessment that gives policymakers confidence (or not, as the case may be) whether using global Tier 1 databases such as FAOSTAT gives a reasonably robust estimate of global emissions, or are there reasons to think this estimate could be biased high or low, given recent studies? Also, how does this assessment of emissions compare to AR5 (and is any difference due to a change in global emissions or any methodological changes?) [Andy Reisinger, New Zealand]	Rejected. There were three global databases that were used in AR5 WGIII: FAOSTAT, EDGAR and EPA. Of the three, only FAOSTAT provides currently updates to 2016 (soon 2017). EDGAR is still not available past 2012, and EPA data past 2010 are projections that also existed at the time of AR5 and do not reflect actual observed activity data. This is the reason why the SRLCC uses FAOSTAT only. Additoinal text has been inserted to further explain this fact to the reader Secondly, there currently exist no global GHG assessments at Tier 2 that are comparable in detail to those offered by the three databases mentioned above. The reviewer does not indicate any reference to this end that could justify additoinal actions on our part. Thirdly, the IPCC Tier definitions guarantee that assessments made at the simplest Tiers are nonetheless accurate, in the sense that --even if they may be more uncertain than those made at higher tiers-- they provide neither over or under- estimates. Kindly note that the IEA disseminates a Tier 1 GHG database of energy emissions, which is considered a reference by the IPCC GHG guidelines as well as in all IPCC ARs published to date. Finally, the use of FAOSTAT was precisely an attempt to provide methodological and data continuity from the AR5, so that readers of this report can easily associate changes in emissions to underlying drivers (e.g., livestock numbers, production figures) rather than to structural changes in IPCC assessment methodology. ACTION: Added a sentence explaining why we are using only FAOSTAT compared to the AR5.
12185	52	40			5.4.1 is actually a higher level perspective than the following ones. Suggest to add cross-references to the respective elements of the food systems described in 5.4.2-6, so that also the confidence statements in 5.4.1 are linked to the respective evidence. Alternatively, move the individual synthetic statements and their confidence levels to the respective sections. [Hans Poertner and WGII TSU, Germany]	Accepted. Explicit links introduced between assessed emissions in 5.4.2-6 and 5.4.1, mainly by relating results of a select --thus incomplete- number of post-AR5 studies to the FAOSTAT figures that are used in 5.4.1 for the overall picture.
11505	53	4	53	5	the current statement "... May account for 8-10% of total GHG emission.."needs clarification (all sectors ?) and a reference [Jean-Luc Chotte, France]	Accepted. Added text to calrify that this fractin relates only to AFOLU emissions and added relevant FAO 2013 reference. <a href="http://www.fao.org/3/i3347e/i3347e.pdf">http://www.fao.org/3/i3347e/i3347e.pdf</a>
30665	53	7	53	7	Regarding table 5.5: Please name the reference. [Lorenzo Giovanni Bellù, Italy]	Accepted. See e.g. response to comment 17231 above
22659	53	7	53	8	Would be important to get the full range of assessments here and break down the emission categories further [Anastasios Kentarchos, Belgium]	Rejected. Not possible to break down further considering the sparse existing literature beyond the farm gate
21887	53	7	53	8	What is the reference of Table 5.5 (Contribution to GHG emissions from the food system as percentage of total emissions), where does the information of the supply chain come from? [, Finland]	Accepted. See above.
39701	53	7	53	8	Table 5.5 needs supporting citations. [, United States of America]	Accepted. Citations inserted in main text of 5.4.1
13909	53	7	53	8	Table 5.5. Please see previous comment on this table in the executive summary. Also note the information regarding the * in front of estimate. The explanation of the * is missing here [Sunday Leonard, United States of America]	Accepted. See above. RE-written accrodgindly and edits to clean th '*'

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21459	53	9	53	21	Please clarify and spell out very explicitly and clearly whether these estimates include changes in soil organic carbon (and if not, do we think there is a net source or net sink from soil organic carbon at present across the food system?) [Andy Reisinger, New Zealand]	Inserted a note to this end, and focus on those parts where in fact those changes are explicitly included (peatland degradation and fires). For the rest, there are no global databases nor studies that include these figures systematically.
27759	53	12	53	13	In keeping with the details provided for the other sources, mention specifically that fuel use on farm, and upstream (to produce inputs) and downstream of the farm (in processing, distribution) is included in the energy sector. [Annette Cowie, Australia]	Included
1901	53	28	53	29	Why are these numbers impressive? I suggest the authors avoid subjective comments. [William Lahoz, Norway]	Accepted.
40741	53		53		Implications of marine food production on GHG emissions to be assessed here. Not covered at all in SRCLL. Would be more coherent to look at all aspects. For Table 5.5 and others : please ensure traceability to the assessed literature (in the caption). [Valerie Masson-Delmotte, France]	Rejected. Though noted, this is a special report on Land, as much as the approach is about food systems, marine food production and associated GHG emissions (incidentally, largely linked to fuel use to power fishing vessels) are out of scope.
14075	53	35	54	7	Comment: It is needed present a differentiation among rural population and farm types related with this croplands ghg emmissions. Smallholders occupy the minor agricultural surface and produce the majority of food. It is important to include in the analysis a more detailed differentiation among crops and their farming practices , considering the important differences existing among larger farms and their crops and faming practices and smallholders and their crops and practices, to situate better the adaptation measures. [Ana Felicien, Venezuela]	Rejected though noted. This is a section summarizing global ghg emissions from cropland and soils. Although of course farming systems and intensive/extensive activities contribute differently to these totals, and provide different angles to analyses of adaptation and food security --however this is not the section for it.
14077	53	35	54	7	Comment: to include differences in ghg emissions related with farm tipologies, recommended: Seebauer, M. (2014). Whole farm quantification of GHG emissions within smallholder farms in developing countries. Environmental Research Letters, 9(3), 035006. [Ana Felicien, Venezuela]	Noted. Possible Action if not rejected: Add a sentence to this end. However these sections report on global and regona trends only and the data available do not allow for disaggregating between farm typologies (not even between intensive and extensive typologies, except perhaps to say that a large part of the farm gate emissions likely originate in intensive systems and go hand in hand with improved efficiencies and economies of scale).
14079	53	35	54	7	Comment: It is important to add a section of emissions from agricultural expansion and associated deforestation. [Ana Felicien, Venezuela]	Accepted. Deforestation and other land use dynamics are discussed in 5.4.1. Inserted language in 5.4.1 linking to subsequent sections that makes it easier to the reader to understand how the various contributions to the revised table 5.6. come together.
39703	53	34	57	39	Sections related to greenhouse gas emissions should relate back to categories depicted in Table 5.5. Conversely, categories of Table 5.5 should be further defined as to what is included under these headings. [, United States of America]	Accepted. See responses/suggested actions to similar good comments earlier.
13635	53	7			Sources (references) for the numbers? [Lourdes Tibig, Philippines]	Table updated. References provided
27761	54	26	43	27	unclear: presumably this refers to the contribution to global emissions [Annette Cowie, Australia]	Fixed
15745	54	29	53	31	Rather than a broad reference to AR5 to compare GHG/kg animal protein, it would be useful to show details for a range of meat and milk products compared with vegetable and synthetic proteins. For example, see Ripple et al., 2014. Ruminants, climate change and climate policy, Nature Climate Change 4(1), 2-5. [Ralph Sims, New Zealand]	Rejected. The AR5 reference points to a very detailed section in the AFOLU chapter where a detailed graph on GHG intensities of the relevant range of ag commodities was given (CHECK if the 2014 reference proposed added any useful info wrt the AR5 in which case could be mentioned. Nonetheless the original sentence could be modified for clarity (see also 40743). Change current sentence to " The intensities of cattle meat are nonetheless the highest in comparison to other agricultural commodities such as pork, milk and crops (IPCC AR5, Fig 11.15-16)."

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Comment No	From Page	From Line	To Page	To Line	Comment	Response
6081	54	5	54	5	50% of the world total emissions [, Poland]	Accepted. Edited accordingly but be careful that these are 50% of the world total emissions from cropland, not from all sectors.
5163	54	15	54	16	If possible, the case of intensive management would be better to be added. For GHG emissions from manure also come from intensive management. [, Japan]	Rejected. This section reports global numbers for livestock emissions. The main driver of these is actually total livestock numbers, while the nature of intensive/extensive systems is more important when discussing mitigation.
17345	54	16	54	16	It is not clear from which work the reference Herrero et al., 2016 refers to since there are two Herrero et al., 2016 in the literature: Herrero et al., 2016a and Herrero et al., 2016b) [Maria Helena Cruz de Carvalho, France]	Fixed
30451	54	30	54	31	Efficiency is measured as input/output. Output here is GHG emissions. But what is the input here? Ha of land? Kg of biomass? Red meat is high in terms of GHG emissions per kg of protein. But not high in terms of GHG emissions per kg of human-edible biomass. For example, in pastoral systems of grazing areas, ruminants are the only way to transform the natural biomass into food as land is not arable and humans cannot eat grass. This is true for more than 3 thirds of pasture area in the world (Mottet et al., 2017. Livestock: On our plates or eating at our table? A new analysis of the feed/food debate. Global Food Security) [Anne Mottet, Italy]	Rejected. This is not an analysis of GHG as a function of human edible protein consumed by animals. Regardless of what these animals eat, they do emit bulk amounts of CH4 and generate N2O fluxes as a function of their productivity. The degree of human edible protein they eat has of course important consequences about associated emissions from land use and change and/or crop management --but that is already covered in 5.4.1 and 5.4.2, at least implicitly.
40743	54		54		the livestock sector has reduced emission intensity by 60%". Explain how. [Valerie Masson-Delmotte, France]	Accepted.
24877	54	40	76	11	Similar to my previous comment, how does population increase/growth increase GHG emission from food system? Evidence provided throughout the chapter confirms the following: 1) that section 5.4 to 5.5 least provide any significant scientific evidence to suggest that population increase account for global GHG increase in food systems; 2) that 5.4 to 5.5 rather confirms that inefficiencies within the food system account for GHG increase in global food system; 3) that variables listed in both supply side and demand side that contribute to GHG emission did not include population. I suggest you revisit the literature to provide a plausible evidence to confirm your claims or revise to ensure consistency with current literature (empirical and theoretical). Section 5.5.2, P68, L26-30 of this chapter clearly shows that it is rather inefficiencies in global food system (demand side) and not population increases that causes increases in global food system. [Justice Issah Musah Surugu, Germany]	Rejected but noted otherwise. Population and economic growth are the main drivers behind increased food demand and associated increases in GHG emissions. Secondly, inefficiencies represent opportunities for mitigation, and in general to modify the dynamics of the growth curve due to the underlying population increase.
5165	54	21			It might be better to provide some examples of what is included in 'life-cycle analysis'. Consuming feed and producing chemical fertilizer are possible to be. Ref: Flysjö, A., Henriksson, M., Cederberg, C., Ledgard, S., Englund, J.-E. 2011: The impact of various parameters on the carbon footprint of milk production in New Zealand and Sweden, Agricultural Systems, 104(6), 459-469. [, Japan]	Accepted. Edited the current sentence from the beginning, and extend the reference to life cycle as follows: "Herrero et al. (2016) quantified non-CO2 emissions from livestock in the range 2.0–3.6 GtCO2-eq yr-1, with enteric fermentation from ruminants being the main contributor. This is consistent with more recent FAO estimates of 3.6 ± 1.1 Gt CO2-eq yr-1 for the period 2000–2016 (Tubiello, 2018; uncertainty of 30% from IPCC AR5). Additional emissions generated beyond the farm gate are relevant to a food system analysis and should be considered, for instance in relation to land use change, energy and fuel use for food storage, transport, processing, retail and waste disposal. By adding to farm gate livestock emissions a limited set of additional land use change, transport and energy processes, FAO (2014b) and Gerber et al. (2013) estimated a larger impact of the livestock food sector, about 5.3 ± 1.6 GtCO2-eq yr-1 (year 2010; uncertainty of 30%; GWP of the original studies scaled to the IPCC AR5 values), some 40-50% greater than the farm gate emissions estimated above.



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Comment No	From Page	From Line	To Page	To Line	Comment	Response
1903	55	6	55	6	"N form" is a term not clear to me. Perhaps authors could clarify this. [William Lahoz, Norway]	Accepted.
17347	55	10	55	10	It is not clear from which work the reference Herrero et al., 2016 refers to since there are two Herrero et al., 2016 in the literature: Herrero et al., 2016a and Herrero et al., 2016b) [Maria Helena Cruz de Carvalho, France]	Fixed
13911	55	13	55	13	change to "greenhouse gas emissions from fisheries and aquaculture because that is what was discussed at least in the first sentence of this section [Sunday Leonard, United States of America]	Rejected. The text appears to be clear already, representing the first line after a section title where GHG emissions are mentioned explicitly.
18009	55	13	55	31	The title here should refer to both fisheries and aquaculture. They are two distinct subsectors. [Beau Damen, Thailand]	Fisheries covered in SROCC
5167	55	15	55	15	"-1" after yr is not superscript. Suggest modification. [, Japan]	Accepted. Simple editorial change
40745	55		55		I suggest to refer to fisheries too. [Valerie Masson-Delmotte, France]	Rejected. If it is in reference to the title section, see comment above in response to comment 18009
21463	55	12			I'm missing a conclusion here that turns the literature review into an assessment. In summary, what are policy- and decision-makers meant to take away from this discussion: what is the emissions range and trend, uncertainty, and how confident are you in those numbers? [Andy Reisinger, New Zealand]	Accepted. Added conclusion
21465	55	13			Please clarify and state explicitly that aquaculture emissions are not currently included in AFOLU emissions inventories (correct!)? Is it included in the food system emissions given in section 5.4.1, and in all (or none, or some) of the global emissions databases? Was aquaculture as emissions source included in the AR5? [Andy Reisinger, New Zealand]	Accepted. A short clarification about insert or not in ghg inventories (not) was made in the opening sentence of this section. Also clarifying whether the aquaculture emissions were included or not in overall estimates in 5.4.1 (unclear) or AR5 (not). Certainly, it should also be stated that, limited to the farm gate approach, these emissions are quite small compared to crops and livestock that it does not matter whether they are included in the global afolu total or not. Another note, there should be N2O emissions not only from feed, but also for fertilizers used in ponds for algae growth --these may be important but are nonetheless already implicitly account for in the fertilizers section of the agriculture national ghg inventory.
27763	56	9	54	14	This sounds plausible for monogastrics but unlikely for beef and dairy, for which the enteric methane is a very high fraction. eg Eady, S.J., Sanguansri, P., Bektash, R., Ridoutt, B., Simons, L. and Swiergon, P., 2011. Carbon footprint for Australian agricultural products and downstream food products in the supermarket. In 7th Australian Conference on Life Cycle Assessment, The Australia Life Cycle Assessment Society (ALCAS). Melbourne. <a href="https://www.researchgate.net/profile/Bradley_Ridoutt/publication/267799818_CARBOON_FOOTPRINT_FOR_AUSTRALIAN_AGRICULTURAL_PRODUCTS_AND_DOWNSTREAM_FOOD_PRODUCTS_IN_THE_SUPERMARKET/links/54b598750cf28ebe92e7987e.pdf">https://www.researchgate.net/profile/Bradley_Ridoutt/publication/267799818_CARBOON_FOOTPRINT_FOR_AUSTRALIAN_AGRICULTURAL_PRODUCTS_AND_DOWNSTREAM_FOOD_PRODUCTS_IN_THE_SUPERMARKET/links/54b598750cf28ebe92e7987e.pdf</a> [Annette Cowie, Australia]	Noted, sentence rewritten
22661	56	1	56	36	Section is too short to give an overview. Consider summarizing different assessments rather than touching on some topics superficially. [Anastasios Kentarchos, Belgium]	Noted
30667	56	5	56	6	Where exactly in IPCC AR5 can your reader find the information you are citing? Please specify the chapter. [Lorenzo Giovanni Bellù, Italy]	Accepted. Added ref
15747	56	12	56	12	Change "energy emissions" to "emissions from fossil fuels used for direct and indirect energy inputs". As well as Weis and Lipp, 2014, check FAO 2011 quoted in comment 21 above. [Ralph Sims, New Zealand]	Accepted. "with approximately 40% of the overall emissions related to energy use and 60% to land use.
27765	56	19	56	20	breadbasket regions are not a recent phenomenon - eg Assyrian breadbasket of Mesopotamia [Annette Cowie, Australia]	Agree, deleted breadbasket regions

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27767	56	19	56	36	Food miles was shown decades ago to be of little importance compared with production system: Despite the transport distance, carbon footprint of produce grown and transported long distances can be lower than locally-grown food - eg apples from NZ consumed in Europe. Edwards-Jones, G., i Canals, L.M., Hounscome, N., Truninger, M., Koerber, G., Hounscome, B., Cross, P., York, E.H., Hospido, A., Plassmann, K. and Harris, I.M., 2008. Testing the assertion that 'local food is best': the challenges of an evidence-based approach. Trends in Food Science & Technology, 19(5), pp.265-274. [Annette Cowie, Australia]	Rejected. The dycotomy proposed by this comment is out of scope. Food miles per se obviously contribute to GHG emissions, which is the actual focus of the sentence. We are not comparing here the effects of the latter to other variables, such as type of production systems.
22663	56	23	56	26	How do the 80-86% direct emissions from agriculture relate to the the figures above. The baselines seem to be changing all the time. Very unclear section [Anastasios Kentarchos, Belgium]	Accepted. Edited to clarify that this is a statement that characterizes the make up of emissions in many (?) countries, as opposed to aplying to the global total- which would be incorrect accrodng to Tab. 5.6
39705	56	24	56	24	"commodity" not "community". [, United States of America]	Accepted. Already modified in proposed edits to the sentence, see comment 27765
15749	56	25	56	25	As well as Vermeulen, check FAO 2011 as in comment 21. [Ralph Sims, New Zealand]	Noted
15751	56	27	56	36	This Wakeland reference provides data only for USA so is of limited value. Again the FAO, 2011 analysis provides more details of transport emissions and covers high and low GDP countries to illustrate differences. Transport can be a relatively small portion of total emissions such that producing, for example, milk products in New Zealand with cows grazing all year round and exporting them to say a country (China, UK) where cows are housed for 5 -6 months each year due to winter weather (or even all year round) has a lower overall carbon footprint per unit of product. Locating production where inputs are less and/or productivity is higher usually more than offsets transport emissions. [Ralph Sims, New Zealand]	Noted. It is not necessarily relevant that transport ghg emissions costs can be "offset" by exporting less GHG intense commodities, compared to the commodity produced in the importing country. The relevant issue may nonetheless be how much more GHGs were emitted into the atmosphere in absolute, not relevant terms.
27769	56	31	56	32	most intensive measured how, and compared with what? [Annette Cowie, Australia]	Accepted. Slightly edited to increase clarity that the text refers to "energy intensity" and compares various US processes to each other in terms of how much domestic energy they use to produce food items.
24879	56	39	56	41	Read over those line for possible revision. The placement of the various citation might create confusion in the minds of readers. I am wondering how a research in 2016 updated research in 2018. Perhaps, It should be the other way round. [Justice Issah Musah Surugu, Germany]	Corrected
21183	56	40	56	41	How can a 2016 paper update a 2018 paper? Please check the references to ensure that this statement is accurate. [, United Kingdom (of Great Britain and Northern Ireland)]	Fixed
21185	56	40	56	41	5.4.6. Surely this is a typo - chronology does not work? "Nelson et al. (2016) updated Godfray et al. (2018) a previous systematic review of the literature on environmental impacts associated with food..." [, United Kingdom (of Great Britain and Northern Ireland)]	Corrected
12945	56	1	57	39	5.4.5 and 5.4.6: These sections refer to total GHG emissions and % of total GHG emissions. These presumably use some (here unspecified) factors to combine CO2, CH4 and N2O. However there is no agreed conversion to convert between the gases. For instance the methane metrics in IPCC AR5 WG 1 table 8.7 vary by a factor of 20. It would be more scientifically accurate if CO2, methane and N2O mitigation were quoted separately, rather than aggregating them in an undefined way. [William Collins, United Kingdom (of Great Britain and Northern Ireland)]	Rejected. See response to comment 12941, which applies here as well.

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Comment No	From Page	From Line	To Page	To Line	Comment	Response
22665	56	38	57	39	Other sections of the report cover emission implications of different diets. The different sections should be combined into, or at least reference each other and produce a coherent picture. <u>See Sections 5.5.2 &amp; 1.4.2. [Anastasios Kentarchos, Belgium]</u>	Sections have been consolidated and cross-references added
30669	56	38	57	40	Reference you missed studying and citing in this section is: FAO. 2018. The future of food and agriculture - Alternative pathways to 2050. Rome. <a href="http://www.fao.org/publications/fofa/en/">http://www.fao.org/publications/fofa/en/</a> . Please add another paragraph (it can be also at the end of the section, line 40) discussing the findings of the "towards sustainability scenario (TSS)" of the above mentioned reference on GHG emissions from livestock and crop production in high- as well as in low- and middle-income countries (Section 4.10, pp. 137-140). [Lorenzo Giovanni Bellù, Italy]	References included
24881	57	26	33	57	How does moving away from meat consumption to beans consumption reduces cropland? Basically changing dietary patterns towards healthier diets does not translate into reduction in cropland exploitation? The confounders on the causal pathway are numerous and hence such claims appears dangerous. Citing a single article (Harwatt et al., 2017) is relatively not enough to draw a conclusion for IPCC paper that should rather synthesis significant number of science to draw closer to the ultimate truth. I suggest more evidence is needed to support the claims of Harwatt et al. [Justice Issah Musah Surugu, Germany]	Accepted, deleted
30453	57	1	57	1	Land use is not an impact on the environment. Should be rephrased. [Anne Mottet, Italy]	Clarified
13913	57	1	57	3	This is unclear. What similar findings was found? Similar to what? [Sunday Leonard, United States of America]	Clarified
13915	57	3	57	5	I am struggling to appreciate this sentence. What are their findings in relation to the discussion on greenhouse gas emissions and diets? The fact that they amass an extensive database is of no use in this section unless we are told the findings and conclusion for this database exercise [Sunday Leonard, United States of America]	Sentence rewritten
33399	57	3	57	38	This would benefit from a consideration of inequality in diets within countries as well. Heller M.C. et al. (2018). Environmental Research Letters 13 (4). Which finds that a subset of eaters, even in rich high emitting countries like the United States, have much more carbon intensive diets than the rest of the population. [Kelly Stone, United States of America]	See Section 5.6 on synergies and trade-offs that raises these issues
30455	57	6	57	7	Weight of food is irrelevant to food security. The nutrition value is. 100 g of beef has twice as much protein as the equivalent in cooked weight of beans for example. And 2.5 times more iron. One can ingest only about 2.5 kg of food per day and not all food items are as dense in nutrition [Anne Mottet, Italy]	Accepted, added explanation
13917	57	8	57	8	What do we mean by diet-related emissions here. Need to be clarified to understand this 36 percent presented here. The sentence began with 4% of food sold and then ended with diet-related emissions. So, are we saying that beef accounts for 36% of emissions from food or 36% from a specific type of diet. Please kindly clarify the conclusion from Heller and Keoleian, 2015 [Sunday Leonard, United States of America]	Changed to food-related
21467	57	10	57	16	This para strikes me as more appropriate as overall conclusion to this section, than embedded within this section (especially if you add an indication of what types of diets have lower GHG footprints on average. [Andy Reisinger, New Zealand]	Accepted, paragraph revised. Added summary to end of section
12187	57	17	57	25	Suggest to refer here also to 5.5.2.1 and Figure 5.14, which address this issue. [Hans Poertner and WGII TSU, Germany]	Added cross-reference to section

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Comment No	From Page	From Line	To Page	To Line	Comment	Response
26689	57	17	57	25	I agree with the central point, but care should be taken to specify that a diet containing less livestock-based material is healthier for people in developed countries (and possibly for the better-off in developing countries). There is good evidence that *increased* consumption of animal-source protein, and micronutrients usefully derived from livestock, may be beneficial for poor people in developing countries. [John Morton, United Kingdom (of Great Britain and Northern Ireland)]	See Section 5.6 on synergies and trade-offs that raises these issues
33397	57	17	57	25	Springmann, M et al. (2016) "Analysis and valuation of the health and climate change cobenefits of dietary change." In the Proceedings of the National Academy of Sciences of the United States of America. 113(15). Very helpful analysis on the clear health and climate benefits of healthy diets, including a drop in mortality. [Kelly Stone, United States of America]	Added ref
33405	57	17	57	25	There is a huge overlap between healthy diets and climate friendly diets, but a diet can be healthy and still contain more meat and dairy than would be the most climate friendly diet option. This section should make that more clear. [Kelly Stone, United States of America]	We now refer to "healthy and sustainable diets" throughout chapter
13919	57	25	57	25	What is the content of the current average US diet. This is needed to understand the comparison. The content of the plant-based diet was provided so need that of the US diet in order for the reader to appreciate the comparison [Sunday Leonard, United States of America]	Changed to "meat-based" diet
32365	57	26	57	28	The whole sentence is repeated and is redundant. It should be deleted. [Ching-Cheng Chang, China]	Unclear
21891	57	26	57	29	What is the assumed land use afterwards in such models? How socio-economic impacts are taken into account? [, Finland]	Sentence removed
30457	57	26	57	33	Assessments of various diets and their impact on GHG emissions are based on the assumption that one can choose their diet, or in other words they're seen from the point of view of wealthy consumers in industrialized countries. This example here is based on a US diet which is far from being representative of the average world's diet! It is important to highlight that choosing one's diet is not an option for a large part of the population and that in many countries and agroecosystems, a nutritious enough diet does include animal source food. In addition, the analysis of various diets and their GHG emissions are all based on kcal and protein intake. They don't look at the whole nutritional balance of the various diets, in particular iron, calcium, zinc, vitamin A and vitamin B12. This statement should be rated as moderate evidence as 1) there is so far only one study looking at a range of micronutrient and 2) no "feasibility" aspect of changing diets has been studied, in particular when it comes to costs of products, incomes and access to markets. [Anne Mottet, Italy]	See Section 5.6 on synergies and trade-offs that raises these issues
13921	57	28	57	28	Do we mean 50% of the reductions needed to meet the 2020 GHG target for agriculture and livestock or 50% of total US 2020 GHG target in all sectors. Please clarify [Sunday Leonard, United States of America]	Sentence removed
5169	57	30	57	33	In addition to the comparative study of 'meat and rice diet', types of meat may also make difference. (Suggest adding i.e., beef gives larger emission than pork or chicken per kilogram (Vries & Boer, Livestock Sci 128 (2010) p8 fig6, this paper cited by AR5)). (MAFF) [, Japan]	Sentence removed
23913	57	33	57	33	As per the National Sample Survey Organization of India, a significant part of the population is vegetarian, also supported in Chapter 5 under section 5.5.2 on demand side demand side mitigation options. Vegetarianism is considered to be a mitigation tool. Hence increasing GHG emissions due to "meat and rice diet" is without any scientific basis and thus incorrect. [, India]	Sentence removed

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Comment No	From Page	From Line	To Page	To Line	Comment	Response
13923	57	33	57	33	give example of the content of "other dietary patterns. This will help your reader appreciate the text and conclusion better [Sunday Leonard, United States of America]	Sentence removed
6083	57	44	57	45	better to use: "such as: afforestation and reforestation, bioenergy with BECCS, soil carbon storage, enhanced mineral weathering, sustainable forest management and managing fire" [, Poland]	Rejected. All relevant activities linked to food systems are listed; the additional ones mentioned here are more related to land use and not clearly to food. In any case more specifics are discussed in the sub-sections.
2183	57	42	58	13	Mitigation and adaptation measures are put forward to face the global food crisis under the influence of climate change from both supply and consumer perspective. However, the importance of production, distribution, exchange and consumption between supply and consumer during the market process was not emphasized, especially under the different market economic systems. Under different models of global trade division and cooperation, facing the risk of both climate market, how can government and free markets guarantee food security and cope with climate change through policy interventions such as supply-demand regulation and internal structure improvement of food production system needs further explanation. [Xiangzheng Deng, China]	Accepted. However note that this is a valid consideration that is well beyond the scope of this section. Most of what is intended herein is covered in fact by introducing "demand side mitigation". Inserted the following sentence at the end of 5.5: "While this chapter focuses on identifying typologies of needed technical interventions, improved economic evaluations of natural capital and good governance of food systems at local, national and international scales will be required in order to deliver meaningful mitigation outcomes at scale."
25519	57	44	58	1	This sentence should be clarified. What "individual foods" means? Moreover the way meat is identified as having the greatest impact compared to the other food should be explained (figures?). Do the impact take into account the biodiversity? [, France]	Rejected. No apparent mention to "individual food" or "meat" is present in section 5.5 per se.
21187	57	41	67	22	The analysis does not appear to give sufficient weight to the potential to mitigate agricultural emissions via production efficiency (sustainable intensification) improvements. This may reflect the literature drawn upon - there is significant applied research in this area: UK research indicates improving production efficiency is likely to be the most significant supply side intervention for agricultural GHG mitigation. Particularly on the arable cropping commentary disproportionate weight is placed on the role of soil carbon (which may have limited potential in some agro-climatic zones, the UK included) with insufficient discussion of the role crop improvement, husbandry and integrated pest and pollution management strategies can play (IPPM). Please provide a discussion that reflects this. [, United Kingdom (of Great Britain and Northern Ireland)]	Accepted. Text describing supply side modified to also include a pointer to improved production efficiencies
21189	57	41	67	22	With reference to the comments above, I would direct attention to an EU continental scale assessment of agricultural mitigation potential prepared by Ricardo for the European Commission <a href="https://ec.europa.eu/clima/sites/clima/files/forests/lulucf/docs/cap_mainstreaming_en.pdf">https://ec.europa.eu/clima/sites/clima/files/forests/lulucf/docs/cap_mainstreaming_en.pdf</a> . The authors conclude that the most significant potential is likely to come from: - Use of improved fertiliser chemistry (nitrification inhibitors) - Make use of benchmarking and carbon auditing tools in supply chains - Improve fertiliser management through nutrient management plans - Improve N use efficiency through precision agriculture, better breeding, improved management and nutrient application practice - Make use of N fixing crops in rotations - Use catch/cover crops - Improve livestock health - Better management of biomass on farms (hedges, trees) including agroforestry  The text could be updated to reflect these findings [, United Kingdom (of Great Britain and Northern Ireland)]	Noted

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Comment No	From Page	From Line	To Page	To Line	Comment	Response
21191	57	41	67	22	<p>These results are similar in conclusion to independent work at the UK scale (Marginal Abatement Cost Curves for Agriculture commissioned by the UK Committee on Climate Change) concluding that the biggest opportunities were around:</p> <ul style="list-style-type: none"> <li>- Afforestation and biomass management on farms</li> <li>- Improving livestock health</li> <li>- Precision agricultural technologies</li> <li>- Addressing soil compaction ("poor soil health")</li> </ul> <p><a href="https://www.theccc.org.uk/wp-content/uploads/2015/11/Scotland%E2%80%99s-Rural-Collage-SRUC-Ricardo-Energy-and-Environment-2015-Review-and-update-of-the-UK-agriculture-MACC-to-assess-abatement-potential-for-the-fifth-carbon-budget-period-and-to-2050.pdf">https://www.theccc.org.uk/wp-content/uploads/2015/11/Scotland%E2%80%99s-Rural-Collage-SRUC-Ricardo-Energy-and-Environment-2015-Review-and-update-of-the-UK-agriculture-MACC-to-assess-abatement-potential-for-the-fifth-carbon-budget-period-and-to-2050.pdf</a></p> <p>The text could be updated to reflect these findings, perhaps by showing as a specific country level case study. [United Kingdom (of Great Britain and Northern Ireland)]</p>	Rejected, we are not focusing on individual countries
30671	57	41	76	12	<p>The entire section 5.5. on Mitigation options, challenges and opportunities misses to discuss changes in costs associated with any of the options you are discussing. How high are the mitigation costs? Are investments needed? Where, when and who should fund them? Please extend the chapter accordingly. [Lorenzo Giovanni Bellù, Italy]</p>	Accepted. However specific details cannot be addressed in this introductory section. The final sentence added at the end of this section in response to comment 2183 is a possible way to include this comment from an over-arching perspective.
30741	57	41	103	15	<p>Good, I really enjoy this part. However, could we presented the decision making approach to identified best mitigation options. Here I think more co-benefice analysis need to be emphasis. Moreover local and indigenous mitigation options should also be highlightd. [Constant Labintan, Benin]</p>	ILK is highlighted for both mitigation and adaptation in sections 5.1, 5.3, 5.6 and 5.7
21469	57	41			<p>Section 5.5 (or elsewhere in a preceding section) sorely needs an indication of how much mitigation from agriculture (to farm gate) is needed in pathways consistent with 1.5 and 2 degrees, to place the mitigation potentials into context. The SR15 gives ranges for agricultural CH4 and N2O emissions for 1.5 pathways, and similar ranges presumably can be extracted from existing emissions pathways databases for 2 degrees. This would (a) help corroborate the emissions target set in Wollenberg et al (2016) which is cited in various places in this chapter, and (b) then help understand and emphasise whether an increasing attention to policies is needed to actually realise this mitigation potential (and also there needs to be a discussion somewhere in this chapter whether this mitigation can in fact be achieved without jeopardising food security). [Andy Reisinger, New Zealand]</p>	Accepted. Inserted a sentence at the beginning of 5.5 which provides projected emissions numbers for agriculture under a range of scenarios to 2050. Wollenberg et al. Also included in terms of achieving Paris Agreement's goals.
12189	57	41			<p>Insert cross-references to the sections that discuss the respective measures introduced here. [Hans Poertner and WGII TSU, Germany]</p>	Cross-references added throughout chapter
15753	58	3	58	4	<p>"emissions from energy production can be saved through the substitution of fossil fuels by biomass" is a bizarre statement! A) Under basic energy laws we cannot "produce" energy. B) Fossil fuels can be substituted by all forms of renewable energy for heat, transport and electricity generation- not only biomass. C) Emissions can be reduced along the whole food supply change by improved energy efficiency that is not mentioned. This whole section needs rewriting. As well as energy efficiency being covered in the FAO 2011 report (Comment 21) other relevant reports include "Opportunities for food-chains to become energy smart" (<a href="http://www.fao.org/3/a-i5125e.pdf">http://www.fao.org/3/a-i5125e.pdf</a>) and "Adoption of climate technologies in the agrifood sector" (<a href="http://www.fao.org/3/a-i7022e.pdf">http://www.fao.org/3/a-i7022e.pdf</a>) and a Moroccan case study of implementing the methodology. [Ralph Sims, New Zealand]</p>	Accepted. New text reads: "while emissions from energy production use at all stages of the food system can be saved through the substitution of fossil fuels by biomassreduced through improvements in energy efficiency and fossil fuel substitution with carbon free sources including biomass."

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Comment No	From Page	From Line	To Page	To Line	Comment	Response
11507	58	8	58	8	Modify by "Cropping systems practices included avoiding land degradation restoring degraded land, and fertiliser management.." delete "improved land" [Jean-Luc Chotte, France]	Accepted. For brevity simply added the term "land restoration" in the existing list.
18011	58	15	58	27	It would be useful if further explanation could be provided regarding the range of mitigation values identified here for these supply side mitigation options. Further context may help balance the reader's view of the mitigation potential of these options. Do the ranges provided for example refer to economic and technical mitigation potential? If they refer to different studies, it would be useful if they are quoted directly after the estimate. [Beau Damen, Thailand]	Accepted. However, this is precisely what is already done. The initial figures presented are those from the AR5. However, edits were made to clarify this.
21471	58	16	58	27	It's not clear whether the stated numbers are all from Smith et al (2014) or elsewhere (no other studies cited - is this a summary of all the following sections? please clarify). Smith et al give 0.3 to 4.6 Gt mitigation potential at USD100 - I can't reconcile those figures with those stated in this para. Also, it is critical that there para state the cost at which that mitigation can be achieved (USD100?) Also, given the overarching context of food security, please clarify if those reductions can be achieved within the projected increase in production in baseline scenarios, or does it include some degree of product substitution? [Andy Reisinger, New Zealand]	Accepted. Section updated
27771	58	16	58	27	source for these figures? All AR5? [Annette Cowie, Australia]	Accepted. References provided
13925	58	16	58	27	please provide references for many of the facts and figures presented in this section [Sunday Leonard, United States of America]	Accepted.
12947	58	16	58	27	There is no agreed conversion to generate GtCO <sub>2</sub> -eq yr <sup>-1</sup> . For instance the methane metrics in IPCC AR5 WG 1 table 8.7 vary by a factor of 20. It would be more scientifically accurate if CO <sub>2</sub> , methane and N <sub>2</sub> O mitigation were quoted separately, rather than aggregating them in the controversial (and undefined in the report) CO <sub>2</sub> eq. [William Collins, United Kingdom (of Great Britain and Northern Ireland)]	Rejected. There are accepted GWPs at least at the level of UNFCCC reporting, which are implemented in most studies synthesized here in this report. See response to comment above in 5.4. It is well noted that there could be improvements made to this report by separating some of the mitigation into relevant gases. Unfortunately most literature studies do not do this.
11509	58	18	58	19	one should emphasize the need to avoid land degradation (responsible for CO <sub>2</sub> emission 0.9 gt per year) therefore "Options for GHG mitigation in cropping systems included SLM aimed at avoiding land degradation, restoring degraded land, improve the efficient use of fertilisers, bochar.." delete "include improved land" [Jean-Luc Chotte, France]	Accepted. However larger part of the comment cannot be included (no reference cited on the 0.9 Gt). We have modified a sentence in 5.5 that now states explicitly "land restoration" as a generic category of importance to mitigation in agriculture
6477	58	23	58	25	This sentence could be improved by adding that absolute emission reduction is key. By focusing on reduction emission intensity, some want to increase production. But the part that follows on food waste shows that reducing food insecurity is not linked to production, as we produce more food than needed to feed everyone. This rationale could be added here. [Sara Lickel, France]	Accepted. Text has been modified for a softer reading, specifying this is context specific and in any case needs adequate governance at the same time.
30153	58	26	58	27	Agroforestry seems to have a potential of 4.27 to 21.5 GtCO <sub>2</sub> per year? We doubt this is true. A reference is missing. It might be true if it is a cumulative amount. As also indicated in another comment, SPM 6 shows a potential of 0.1 to 0.55 GtCO <sub>2</sub> per year. [, Netherlands]	Accepted, section updated
8183	58	26	58	27	The interval of the mitigation potential, 4.27–21.5 GtCO <sub>2</sub> -eq yr <sup>-1</sup> seems quite wide and lacks information about which year [Harold Leffertstra, Norway]	Accepted, section updated

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Comment No	From Page	From Line	To Page	To Line	Comment	Response
13927	58	30	58	32	This is vague. How do you sustainably intensify land use. What are the specific actions to achieve this? [Sunday Leonard, United States of America]	Accepted. First part of sentence modified to increase clarity. The issue is more about "sustainable intensification" of production, leading to land sparing etc. (See relevant FAO literature on this--most recent: <a href="https://www.sciencedirect.com/book/9780128121344/sustainable-food-and-agriculture">https://www.sciencedirect.com/book/9780128121344/sustainable-food-and-agriculture</a> ; specifically <a href="https://doi.org/10.1016/B978-0-12-812134-4.00010-8">https://doi.org/10.1016/B978-0-12-812134-4.00010-8</a> ). Also added a note to a needed governance structure, because increasing efficiencies per se does not guarantee any land sparing, in fact in practice quite the opposite has happened historically (i.e. Jevons paradox)
27175	58	31	58	31	Bridging yield gaps is certainly an effective measure. On the other hand, increasing yield does certainly mean more fertilizer. So there is a trade-off. Could you discuss this issue? Maybe there is already a paper? [, Germany]	Accepted. Addressed by comments above--although specific references to a specific issue (i.e., fertilizer, as opposed to others) is not in scope in this section.
21473	58	36	58	40	Clarify what is meant by "economically feasible". If you mean "cost effective at a carbon price up to USD100", then please say so - whether that is economically feasible is an entirely different question, as many would argue to such carbon prices are not realistic for subsistence farming systems and it depends entirely on the policy instrument. If you mean that mitigation is cost-effective even without a carbon price, then say that explicitly - but I don't think this would be correct since the assessed potential in the AR5 was for carbon prices of USD100, not zero. This is important because it tells us something about the need to implement policies that creative incentives consistent with such emissions prices. [Andy Reisinger, New Zealand]	Accepted. "economically feasible" deleted in the context of a previous edit. The comment is valid though no longer applies. The concept of "economically feasible" was not relevant within the original sentence.
6479	58	36	58	40	More sustainable practices are to be implemented by food system actors, that is true. However political incentives play a crucial role in those practices: subsidies for synthetic fertilizers, trade policies favouring uniformization, large-scale production and international shipping are only some examples of policies that incentive a globalized, high GHG emission food system. [Sara Lickel, France]	Accepted. Sentence modified to include ""Recognising and empowering the underlying social roles within the right incentives and governance systems ""
13929	58	37	58	37	There should be detailed discussion on economic feasibility of mitigation actions [Sunday Leonard, United States of America]	accepted. Although a detailed discussion cannot be offered within the limited space available, sentence was modified to include this concern, to include ""Recognising and empowering the underlying social roles within the right incentives and governance systems ""
13027	58	42	58	42	Box 5.7- This box covers the important issue well. However, it seems to be a little out of date with regard to increased rates of deforestation in the Brazilian amazon since 2015 (e.g. <a href="https://www.nature.com/articles/d41586-018-05695-9">https://www.nature.com/articles/d41586-018-05695-9</a> ; Nogueira, E. M., Yanai, A. M., de Vasconcelos, S. S., de Alencastro Graça, P. M. L., & Fearnside, P. M. (2018). Brazil's Amazonian protected areas as a bulwark against regional climate change. <i>Regional Environmental Change</i> , 18(2), 573-579.) [Aidan Farrell, Trinidad and Tobago]	Partly accepted. Revised data about deforestation in the Brazilian Amazon and included the suggested publication. However, deforestation data in Brazil is based on INPE database and updated.
23441	58	44	58	44	CORRECT primary driven to 'driven in part' [John Dixon, Australia]	Accepted. Text revised.



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Comment No	From Page	From Line	To Page	To Line	Comment	Response
905	58	16	61	27	This section cites a number of possible mitigation options in agricultural farming and animal husbandry. One important option that may be highlighted in this section is the production of compressed biogas (CBG), which is as good as, or in some aspects even better than CNG. Production of CBG requires agro-waste as feedstock, which is available in plenty in India, and many other developing countries. In India, huge stocks of rice stubble is put to fire creating air pollution and emission. Situation could be similar in many developing countries where agro-waste could be put to better use of producing CBG. Use of CBG could replace fuelwood burning or energy from fossil fuels, thus reducing emissions. Indian Oil Corporation is planning to enter this uncharted territory in a big way in collaboration with State Governments. Added advantages of CBG are similar to that of CNG- better and cleaner environment and health benefits to users from fuel switch from fuelwood to CBG. [Jagdish Kishwan, India]	Rejected. This is a relevant and valid comment, however please note that those activities will be listed as mitigation in the "energy sector", including in most countries' NDCs. The more general comment is implicitly addressed in 5.5. when we now explicitly refer to improved energy efficiency and fossil fuel substitutoin (within the farm) as valid mitigitoin options.
22667	58	15	68	23	The summaries of previous findings should be briefly presented up front and then focus should be on new information. [Anastasios Kentarchos, Belgium]	Accepted.
39707	59	24	59	26	Following an optimistic discussion of initiatives that have promoted agricultural intensification to reduce expansion and land-use change, the text reads: "Nevertheless Azevedo et al. (2017) argue that the full potential of these financial incentives has not been achieved due to weak enforcement mechanisms and limited supporting public policies." This makes it sounds like sustainable intensification is mainly a success story with some hold-out detractors. That misrepresents the situation. More balanced treatment needs to be given to this issue. A more accurate message would be: It is a good idea but quite challenging to achieve. The text should refer to additional examples from the literature and should point out that the actual outcomes of sustainable intensification initiatives need to be assessed after a period of perhaps 10 years, as intensification can also encourage expansion but that results might not appear immediately. [, United States of America]	Partly accepted. The text was revised to include the need of implementation long-term monitoring programs to evaluate intensification programs benefits.
39709	59	31	59	32	Text reads: "Brazilian Cerrado deforestation was also effectively reduced from 2.9 Mha yr-1 in 2004 to an average of 0.71 Mha yr-1 in 2016-2017 (INPE 2018)." This is confusing because Cerrado is savanna and one of the concerns that emerged when Brazil first took aggressive measures to protect forests was that the Cerrado would suffer. [, United States of America]	Rejected. According to INPE statistics, the Cerrado deforestation rate decreased has written in the text. Please refer to: <a href="http://www.obt.inpe.br/prodes/index.php">http://www.obt.inpe.br/prodes/index.php</a> and <a href="http://terrabrasilis.dpi.inpe.br/dashboard/deforestation/biomes/cerrado/increments/">http://terrabrasilis.dpi.inpe.br/dashboard/deforestation/biomes/cerrado/increments/</a>
30673	59	33	59	33	Please specify which reference is FAO 2018 (in the list of references you have FAO 2018a and b). [Lorenzo Giovanni Bellù, Italy]	Accepted. Reference updated as FAO (2018b)
21475	59	34	59	34	Please clarify - what's a two-fold decrease? A halving? A thid? A quarter? [Andy Reisinger, New Zealand]	Accepted. Text corrected.
1369	59	60			It will be also good include that the Amazônia Legal region has a population greater than 25 million people. [Rodrigo Rudge Ramos Ribeiro, Brazil]	Accepted. Texted added in the footnote, as following: "The Legal Amazon is a Brazilian region of 501.6 Mha (ca. 59% of the Brazilian territory), which contains all the Amazon but also 40% of the Cerrado and 40% of the Pantanal biomes with a total population of 25.47 million inhabitants."
25521	60	32	60	35	We suggest to include the potential of legumes in this paragraph. [, France]	Rejected. The reviewer raises a good and important point, however no reference is provided for its possible uptake.
21477	60	37	60	39	Please please quantify the mitigation needed from agriculture. It is very unhelpful for decision-makers to be told that there is new work that has charted a pathway and then remain entirely silent as to what this pathway looks like. And do't forget about 1.5 degrees as this is part of the ambition of the Paris Agreement (numbers readily available from SR15). [Andy Reisinger, New Zealand]	Accepted. Inserted at the beginning of 5.5. See response to similar comment 21469

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Comment No	From Page	From Line	To Page	To Line	Comment	Response
13933	60	37	60	40	Some information on the findings of these works should be included. Currently, we are just telling the readers that these works exist but the reader will be more interested in the findings from these work and how they related to the interest of this section/chapter [Sunday Leonard, United States of America]	Accepted. See response above
11511	60	39	60	39	add Soussana, J.F., Saint-Macary, H., Chotte, J.L., 2015. Carbon sequestration in soils: the 4 per mil concept. In: Agriculture and Agricultural Soils Facing Climate Change and Food Security Challenges: Public Policies and Practices Conference, (Paris, Sept. 16, 2015. <a href="http://www.ag4climate.org/programme/ag4climate-session-2-3-soussana.pdf">http://www.ag4climate.org/programme/ag4climate-session-2-3-soussana.pdf</a> ). [Jean-Luc Chotte, France]	Rejected, conference proceeding
33763	60	30	61	27	It's positive to discuss about co-benefits of implementation of GHG mitigation in croplands and soils. It's also suggestible to include cost-benefit of implementing of climate mitigation measures that contribute to better water quality, increased biodiversity, better climate change mitigation etc. Moreover, in section 5.6.3 please consider additional supporting information on cost effective and cost-benefit of measures. [, Norway]	Rejected. The point being raised is a good one but shold be implemented in toto in 5.6.3
21193	60	37	61	2	An additional reference that would help support this discussion is Mayer et al 2018, which converts sequestration through agricultural land management into avoided temperature reductions. Please consider incorporating this paper <a href="http://advances.sciencemag.org/content/4/8/eaq0932">http://advances.sciencemag.org/content/4/8/eaq0932</a> [, United Kingdom (of Great Britain and Northern Ireland)]	Accepted, added reference
21195	60	39	61	1	This section references Altieri & Nicholls and Zomer and says what this two papers investigated, but doesn't actual specify what the main findings and conclusions were. It is not particularly informative to state that Zomer et al investigated global sequestration potential in cropland soils. Please provide the reader with the main findings from these two pieces of cited research. [, United Kingdom (of Great Britain and Northern Ireland)]	Rejected, introductory paragraph of new work since AR5
21197	60	39	61	1	The data presented in fig 5.12 is based on Paustian et al. How does this compare with the estimates presented in Zomer et al, for example? Please discuss how strong the consensus of mitigation potential is. [, United Kingdom (of Great Britain and Northern Ireland)]	Accepted. More references added in order to expanded info from the AR5. Removed figure
13931	60	30	62	9	For mitigation options discussed in Section 5.5.1, I think there are many more research work on the topics than reflected here. Discussions has mainly been based on a limited number of publications. [Sunday Leonard, United States of America]	Accepted. Added more references
5171	60	31			It would be better to put 'and grazing land' between cropland and managements? For pasture management is also critical. [, Japan]	Accepted. Text edited accordingly
5173	60	36			Put 'and verification' between 'reporting' and 'systems' for verification is one of the contents of MRV. [, Japan]	accepted. Edited accordingly
11513	61	1	61	1	add Fujisaki et al. (2018) identify drivers to increase soil organic carbon in tropical soils Fujisaki, K., Chevallier, T., Chapuis-Lardy, L., Albrecht, A., Razafimbelo, T., Masse, D., Ndour, Y.-B. and Chotte, J.-L. (2018). "Soil carbon stock changes in tropical croplands are mainly driven by carbon inputs: A synthesis." Agriculture, Ecosystems & Environment 259: 147-158. [Jean-Luc Chotte, France]	Accepted. Added reference

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Comment No	From Page	From Line	To Page	To Line	Comment	Response
15755	61	1	61	8	Direct energy use on farms (as well as outside the farm gate) is a gap in this chapter that merits a section "5.5.1.2 Greenhouse gas mitigation through reducing fossil fuel inputs" that should include not just biomass/bioenergy but also mention other forms of renewable energy substitution for fossil fuels in agri-food (wind, solar, geothermal, small hydro that are already being applied on farms and throughout the supply chain) and just as important, energy efficiency measures for refrigeration, conservation tillage, precision farming techniques (fertiliser and chemical application as well as water through precision irrigation, smart phones for disease diagnosis etc, use of drones. It seems none of the LAs are up to speed with technology developments that have major potential for rapid uptake. Some technologies are randomly mentioned in Fig. 5.13 but given the potential along the supply chain, further assessment is recommended. Since found on reading further is Cross-chapter Box 5. There is much confusion for the reader regarding mitigation options/ solutions and what appears in Section 5.5 " convinced that these Cross-Chapter boxes work for the comprehension of the reader when they pop up at random. Why not incorporate the key points into an extended chapter summary? [Ralph Sims, New Zealand]	Accepted, added other forms of renewable energy substitution
8185	61	5	61	12	The explaining text under fig 5.12 uses units – Mg, Pg that differ from Gt and ton used in the figure. Please make consistent [Harold Leffertstra, Norway]	Figure removed
25573	61	6	61	8	is there an analysis of important practices like intercropping, intermediaite crops, herbal strips? If yes they should be explicited and if no they should be part of the analysis. [, France]	Beyond scope
21479	61	10	61	11	To me, this sentence is a rather important finding that deserves to be brought out more strongly: most of the claimed mitigation potential in cropland relies on soil carbon sequestration, which is temporary, easily reversed, and fraught with MRV problems. This should find its way into the executive summary. [Andy Reisinger, New Zealand]	Accepted, caveat added to ES
27773	61	12	61	12	The biochar estimate is specifically stated as being the technical potential. Specify for the rest - also technical potential? [Annette Cowie, Australia]	Accepted. Modified language to indicate that biochar and root phenotype solutions are only initial, low confidence estimates.
25523	61	12	61	13	Biochar are very present in the SPM and in several chapters, too present we believe compared to the organic amendments and recycling of organic matters, which should, in many case, appear together. More emphasis should be given on the recycling of organic matters (including compost, biogas), giving benefits for the soil fertility, the cycles of N, P and K, and with benefits for biodiversity. The way biochar are presented should be a bit balanced. Indeed, Biochar are also in some cases presented as good solutions, whereas "evidence is limited and impacts of large scale application of biochar on the full greenhouse gas balance of soils, or human health are yet to be explored" (Chap 1 lign 28-29 p33). Indeed research is still undertaken to know if there aren't negative impacts when used on agricultural soils, and the costs can be important. Moreover, it should be explained in the report that life cycle analysis show that we need to differentiate the biochar made from wastes and with an optimised use of the heat produced during the pyrolysis, from the others. Finally, limitations of biochar should be better highlighted, and their capacity to ensure that the caron and nutrients ratios required for plant growth are respected need to be questioned. A reference : - Kavitha, B., Reddy, P. V. L., Kim, B., Lee, S. S., Pandey, S. K., & Kim, K. H. (2018). Benefits and limitations of biochar amendment in agricultural soils: A review. Journal of environmental management, 227, 146-154. [, France]	Biochar covered in Chapter 4

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Comment No	From Page	From Line	To Page	To Line	Comment	Response
27177	61	12	61	19	Biochar application is a technology which to our knowledge is still in a testing phase. The true potential is only a hypothesis and there is a lack of information on possible negative side effects. Could you please discuss this a bit more balanced way (Possible papers: Kammann, C. et al. (2012): Biochar and Hydrochar Effects on Greenhouse Gas (Carbon Dioxide, Nitrous Oxide, and Methane) Fluxes from Soils, J. Environm. Quality., Teichmann, I. (2014), Klimaschutz durch Biokohle in der deutschen Landwirtschaft: Potentiale und Kosten. DIW Wochenbericht Nr. 1+2, translation can be provided if needed). [, Germany]	Biochar covered in Chapter 4
6481	61	16	61	20	This part explains the risk of shifting arable land used for food production to produce perennial vegetation. The part could be clearer by explicitly saying that such a shift presents a threat for food security, as food production would be turned into other types of cultivation. [Sara Lickel, France]	Accepted. However specific comment rejected, since the sentence in object only separates, correctly, typologies of mitigation strategies between management based and land use based. Edited next sentence to this end,m which takes casre of this comment as well (see comment 6483).
13937	61	18	61	20	This sentence fits more with the next paragraph. Suggest moving it to the beginning of the next paragraph [Sunday Leonard, United States of America]	Accepted. Done
25525	61	25	61	27	This seems a bit strong ("all options require") and does not seem needed in all cases (moreover it is not supported by a publication) : sentence to be softened. [, France]	Accepted. Edited accordingly
6483	61	25	61	27	The evaluation needed that is mentioned here should also involve the potential effects on food security locally. This should be said explicitly. [Sara Lickel, France]	Accepted. Done. This also takes care of previous comment.
14007	61	3	62	8	The discussion here is based on just one study. Are there any other supporting research works? This will be useful to make the discussion more robust and rigorous. [Sunday Leonard, United States of America]	Accepted. Additional references and cross-checked with Ch 2 provided in order to expand available findings.
5175	61	7			To reflect local conditions, it might be good to put 'and organic amendments' among improved crop rotations, nutrient management and reduced tillage. [, Japan]	Added among examples "organic amendments"
21481	61	28			Again here I'm missing a conclusion that turns the literature review into an assessment. In summary, what are policy- and decision-makers meant to take away from this discussion, and how confident are you in that conclusion? The key policy-reevant questions being: how big is the mitigation potential, is this different from the AR5, does consideration of food security change the supply-side mitigation potential, and what carbon prices need to be visible to farmers to realise this potential? And how does this potential compare with what's needed for 1.5 and 2 degree compliant pathways? [Andy Reisinger, New Zealand]	Accepted. Linkages to the 1.5-2 targets introduced at the beginning of 5.5. And expanded summary now offers a synthesis of the findings in this sub-section.
5177	62	1	62	1	According to Figure 5.12, biochar application has the most GHG mitigation potential in several supply-side mitigation options, while only a little information on biochar can be found in the section 5.5.1. It would be much appreciated if further information on biochar or a clear description of how it was concluded that biochar application has the most potential could be provided here, as we could not find enough information is not available in the current text. [, Japan]	Accepted. Modified language in the text to indicate that biochar and root phenotype solutions are low confidence estimates. Excluded Figure for same reasons.
21199	62	1	62	1	In Figure 5.1 Biochar has the largest mitigation potential of all options presented: This result is surprising to me. Have the authors adequately considered the practical mitigation potential given potential risks around soil contamination with heavy metals, PAH etc? See for example <a href="https://www.tandfonline.com/doi/pdf/10.3846/16486897.2016.1254089?needAccess=true">https://www.tandfonline.com/doi/pdf/10.3846/16486897.2016.1254089?needAccess=true</a> [, United Kingdom (of Great Britain and Northern Ireland)]	Accepted. Modified language in the text to indicate that biochar and root phenotype solutions are low confidence estimates. Excluded Figure for same reasons.
40337	62	1	62	2	this paragraph is repeated in lines 31 - 32 [Thelma Krug, Brazil]	Not clear at what page (line 31-32) the repetition was made

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Comment No	From Page	From Line	To Page	To Line	Comment	Response
12949	62	1	62	7	Figure 5.12: There is no agreed conversion to generate GtCO <sub>2</sub> eq per year . For instance the methane metrics in IPCC AR5 WG 1 table 8.7 vary by a factor of 20. It would be more scientifically accurate if CO <sub>2</sub> , methane and N <sub>2</sub> O mitigation were quoted separately, rather than aggregating them in the controversial (and undefined in the report) CO <sub>2</sub> eq. [William Collins, United Kingdom (of Great Britain and Northern Ireland)]	Rejected. See previous responses to same comment, for instance in section 5.4 and its sub-sectoins
27179	62	1	62	8	Figure 5.12 is a very helpful figure. Please make clearer, if the potential amount of acres available for different measures overlap between measures or not. Also please describe the meaning of the dotted lines around the area potentials. [, Germany]	Accepted. Fig eliminated and language improved in section to clarify that these are independent technical mitigation figures
23443	62	2	62	8	CHECK CO <sub>2</sub> rate of 54 for retoring organic cultivated soils [John Dixon, Australia]	Figure removed
13939	62	13	62	13	change "alternative" to "options" [Sunday Leonard, United States of America]	Accepted and corrected
21485	62	16	62	20	It is critical that you state the assumed carbon prices for those numbers to make sense. Also please clarify whether this is a change from the AR5, and whether the explicit consideration of food security has affected the conclusions. It's also a bit odd to talk about one figure (2.4 Gt) being "in the same range" as another figure. Can you provide an uncertainty assessment to enable you to discuss a range? Note that the FAO 2013 study simply made the assumption that production would be held constant, and hence the mitigation options result indeed in absolute emissions reductions. However, this is an assumption only, since the measures discussed in FAO 2013 in many cases could equally (and in the absence of targeted policies, more plausibly) result in increased production and no reduction in emissions. [Andy Reisinger, New Zealand]	Accepted. A range is now provided based on additional literature and cross checks with Ch 2
17349	62	17	62	17	It is not clear from which work the reference Herrero et al., 2016 refers to since there are two Herrero et al., 2016 in the litterature: Herrero et al., 2016a and Herrero et al., 2016b) [Maria Helena Cruz de Carvalho, France]	Fixed
12951	62	17	62	17	The conversion of enteric fermentation benefits to CO <sub>2</sub> -eq depends entirely on the conversion factor used. For instance the methane metrics in IPCC AR5 WG 1 table 8.7 vary by a factor of 20. Choice of a different metric could substantially increase or decrease the apparent importance of methane. I suggest instead to quote these values in GtCH <sub>4</sub> /yr. [William Collins, United Kingdom (of Great Britain and Northern Ireland)]	Accepted. Sentence inserted to add calrity
13941	62	20	62	20	Please provide a useful synthesis of findings from the significant research done so far? Saying it has been a subject of significant research is not enough in an IPCC report [Sunday Leonard, United States of America]	Accepted. Synthesis provided at the end of sub-section
21483	62	22	62	22	"agricultural-based" -> "cropland-based" [Andy Reisinger, New Zealand]	Text changed
5179	62	14			Suggest sequestering C 'in' pasture, not 'from' pasture. [, Japan]	Accepted and corrected
27775	63	6	63	10	Fig 5.13 why is cover cropping classed as manure management? [Annette Cowie, Australia]	Cover cropping is also knows as green manure
21487	63	11	63	22	There has been a lot of work carried out by FAO in partnership with NZAGRC on mitigation options in a range of countries; it seems odd to have only one citation post-AR5 in this para. This report is meant to look at new information, not merely re-state existing information that was available at the time of the AR5 already. [Andy Reisinger, New Zealand]	Chapter was not focused on individual countries

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24707	63	11	63	26	Intensification of animal diets, e.g. decreasing grass based feeds (producing a lot of methane through fermentation in ruminant animals) and increasing easily digested cereals and other feedstuffs producing less methane, is in fact an economic decision and depends on the market prices of feed stuffs as well. This is the case at least in semi-intensive / intensive production systems, or in situations where farmers have to buy cereals or other non-grass feed stuffs. For this reason one might say that maintaining more intensive feed diets of animals and thus reduced level of GHG emissions require that farmers get some economic value of the GHG emissions, or other compensation for possible extra costs. It is nevertheless right to say that "A pre-requisite for these options to work is that the livestock systems need to be geared towards market-orientated production, as otherwise there is little incentive to improve feeding systems." However market price based decision making as such may lead to unstable feeding over time if feed prices change and of there is little or no incentive for a farmer to maintain intensive feed diets. [Heikki Lehtonen, Finland]	Accepted. Edited to specify "A pre-requisite for these options to work is that the livestock systems need to be geared towards market-oriented production, as otherwise there is little incentive to improve feeding systems. This in turn implies that costs and benefits to farmers are appropriate to incentivize specific management changes."
1905	63	16	63	17	Check use of parentheses. [William Lahoz, Norway]	Accepted. Done
21491	63	28	63	30	I don't think it is justifiable to devote a total of two lines to novel technologies that can reduce livestock emissions, in a report that has a time horizon of 2050 or beyond. This includes methane and nitrification inhibitors, methane vaccine, targeted breeding of lower emitting animals, genetically modified grasses with higher sugar content, etc. Some of those options have been tested at least as well as BECCS and their potential, if pursued through continued R+D, is considerable. To be silent on this in this report seems to me to give a rather skewed picture of the long-term opportunities and investment needs. [Andy Reisinger, New Zealand]	Accepted added novel technologies
40747	63		63		Missing information on e.g. confidence, scale, potential, level of scientific understanding etc [Valerie Masson-Delmotte, France]	Added summary statement
21489	63	11	64	4	This section has to make much clearer that intensification of animal diets in general does not reduce absolute emissions but only emissions intensity. It tends to increase production (which is the economic driver, as stated in lines 24-26). Which means that approaches based on intensification of animal diets must be combined with policies that constrain the growth in production in some way if the goal is to reduce absolute emissions. [Andy Reisinger, New Zealand]	Accepted. A sentence to this end was introduced at the beginning of this topic: It is well established that feeding better quality diets to animals reduces the amount of GHG produced per unit of animal product (Gerber et al. 2013b), which, within the appropriate implementation including governance, may lead to mitigation of absolute emissions
23531	63	2			Climate change has a large impact on food systems, and adaptation to climate change includes not only the ecosystem response to extreme climate events brought about by climate change, but also the social adaptation of communities. Based on these adaptive analyses, combined with relevant knowledge and technology, the corresponding policy planning and governance logic is relatively clear. we can build a clear and up-to-date analytical framework, flow charts to make the specific steps of adaptation clearer. [Huai Jianjun, China]	See revised adaptation section (5.3)

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Comment No	From Page	From Line	To Page	To Line	Comment	Response
26691	64	5	64	15	This paragraph overestimates the desirability and feasibility of switching to lower numbers of "higher-potential" animals for key categories of livestock-producers in developing countries. There is good evidence that larger herd numbers increases drought resilience for pastoralists, and many pastoralists and others may not be able to manage grazing in the ways specified. A separate point is that cross-breeding for "higher-potential" begs the question of the objectives of livestock production - for smaller-scale producers in developing countries these are classically multiple (e.g. milk+cash+draught power+security+ cultural value) while cross-breeding is most likely to improve performance in only one of these objectives. See Kitalyi, A., Mtenga, L., Morton, J., McLeod, A., Thornton, P., Dorward, A., & Saadullah, M. (2005). Why keep livestock if you are poor. In Owen et al. (eds.) Livestock and Wealth Creation, Improving the husbandry of animals kept by resource-poor people in developing countries. Nottingham University Press. Nottingham, UK. [John Morton, United Kingdom (of Great Britain and Northern Ireland)]	Accepted. Inserted sentence and reference.
27181	64	22	64	44	"Managing nitrous oxide emissions from manure": There are three issues you could mention: 1. Covering the tanks (and not using lagoons) can reduce Ammonia (a small part being transferred into nitrous oxide) and gastight tanks can also almost prevent the methane emissions (if methane is properly burnt or even used as bioenergy); 2. Grazing can here have advantages - the overall emissions can be reduced through the separation of the liquid and firm phase of manure (see Eurich-Menden, B (2012): Ammoniak-Emissionsfaktoren und Minderungsmaßnahmen – Milchkuh-, Mastschweine- und Legehennenhaltung. Fachartikel, Kuratorium für Technik und Bauwesen in der Landwirtschaft e.V. (KTBL), Darmstadt. Download: <a href="https://www.ktbl.de/fileadmin/user_upload/artikel/Tierhaltung/Allgemeines/Ammoniak-Emissionsfaktoren/Ammoniak-Emissionsfaktoren.pdf">https://www.ktbl.de/fileadmin/user_upload/artikel/Tierhaltung/Allgemeines/Ammoniak-Emissionsfaktoren/Ammoniak-Emissionsfaktoren.pdf</a> , translation can be provided if needed; 3. There is also no mentioning of stables (which could be a different paragraph) - the conflict between closed stables (catching methane hence good for the climate but not good for animals) and open stables (good for the animals (especially ruminants), but bad for the climate), should be mentioned. [, Germany]	Noted but not implemented for lack of space.
24213	64	24	64	25	It is a general problem also in Europe! Pig slurries are a big problem for farmers. Co-generation plants were developed but due to technical problems they do not properly work and slurries are just accumulated in ponds or illegally discharged in land. [Maria Luz Cayuela, Spain]	Accepted. Deleted regional reference.
27183	64	34	64	34	Nitrification inhibitors are a new methodology, where side effects on the environment are not clear yet. And it is also not clear, if the indirect emissions that are created when using the inhibitors do not outweigh the emission reductions. We therefore think that when they are mentioned, the potential problems should als be mentioned. (Literature that might help here: Scheurer, M., Sacher, F. & Brauch, H.-J. (2014): Abschlussbericht: Studie zur Bedeutung von Nitrifikations- und Ureaseinhibitoren für die Roh- und Öko-Institut Folgenabschätzung Sektorziele 2030 des KSP 2050, Trinkwasserbeschaffenheit in Deutschland (DVGW Deutscher Verein des Gas- und Wasserfaches e.V., Hrsg. Bonn, translation can be provided if needed) and Global Change Biology (February 2017): Using nitrification inhibitors to mitigate agricultural N2O emission: A double-edged sword? (Lam, S. K. et al.) Volume 23, Issue 2, S. 485–489). [, Germany]	Accepted. Edited text to insert "" plus 2017 reference. "Other options in more intensive grazing systems may also include nitrification inhibitors, stand-off pads, delayed manure spreading collected in milking sheds, although the fate of the full applied N and its partitioning between direct and indirect emissions as a result of the specific option chosen must be evaluated (e.g., Lam et al., 2017)."

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5181	64	48	64	48	We would suggest inserting a phrase, eg., 'appropriate managements (grazing intensity or manure recycling) are crucial to promote carbon sequestration and maintain the productivity in grassland.' after 'is not continuous and reaches a saturation point', in order to avoid sending a negative (or helpless) message that it is ok or unavoidable for grasslands to degrade. This would signal the message that pasutue management is one of the key points for carbon sequestration and sustainable production. Ref: Hirata, R., Miyata, A., Mano, M., Shimizu, M., Arita, T., Kouda, Y., Matsuura, S., Niimi, M., Saigusa, T., Mori, A., Hojito, M., Kawamura, O., Hatano, R. 2013: Carbon dioxide exchange at four intensively managed grassland sites across different climate zones of Japan and the influence of manure application on ecosystem carbon and greenhouse gas budgets, Agricultural and Forest Meteorology, 177, 57-68. [, Japan]	Accepted. Inserted some of these consideratoin in text, including a reference
27185	64	45	65	2	According to very recent literature (Garnett et al.) grassland has less potential for carbon sequestration as previously thought. On the other hand, the findings go in the direction that grazing grassland cannot by itself be considered as a mitigation measure and will not offset emissions from ruminants. It does not mean that grassland does not sequester (significantly) carbon. Soil below grassland is estimated to capture up to 50% more carbon than soils below forest. Please find here a literature suggestion: 47 Conant, Richard T. (2010): Challenges and opportunities for carbon sequestration in grassland systems. A technical report on grassland management and climate change mitigation. Plant Production and Protection Division. FAO, S.22. Please change your representation accordingly. [, Germany]	Accepted. Edited text accrodgngly and inserted reference
13943	64	45	65	2	what are the mitigation actions that result in carbon sequestration in livestock. Nothing has been said about the specific action or practices [Sunday Leonard, United States of America]	Accepted. Mitigation related to livestock is now discussed
21493	64	3			Again here I'm missing a conclusion that turns the literature review into an assessment. In summary, what are policy- and decision-makers meant to take away from this discussion, and how confident are you in that conclusion? The key policy-reevant questions being: how big is the mitigation potential, is this different from the AR5, does consideration of food security change the supply-side mitigation potential, and what carbon prices need to be visible to farmers to realise this potential? And how does this potential compare with what's needed for 1.5 and 2 degree compliant pathways? [Andy Reisinger, New Zealand]	Accepted. Reference to studies including projections to 2050 for the 1.5-2 achievements included at the beginning of 5.5, to provide context to the mitigation options discussed. An expanded synthesis included at the end of the sub-section
25527	65	6	65	8	This sentence is not clear : agroforestry consists in including more trees/perennial crops in crop and livestock systems. Increased application of organic manures and use of intercrops and green manures are interesting practices but not agroforestry ones. In addition to increasing carbon storage and soil organic matter in general, AF can also increase biological nitrogen fixation when leguminous trees are used, and therefore indirectly also contribute to mitigation. [, France]	Accepted. Edited for language and increased clarity
15757	65	8	65	8	A useful overview of the circular economy, and indeed most topics covered in Section 5, is the GEF/STAP paper "A Future Food System for healthy human beings and a healthy planet" 2018. <a href="http://stapgef.org/sites/default/files/publications/STAP%20Report%20on%20food%20system.PDF">http://stapgef.org/sites/default/files/publications/STAP%20Report%20on%20food%20system.PDF</a> [Ralph Sims, New Zealand]	Not included, grey literature



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25529	65	17	65	18	We understand the column "source" presents different types of agroforestry but 1. they have to be described (what are dominant parklands ? and rotational woodlots ? e.g.) 2. some are not (e.g. integrated land use and soil carbon) and therefore table not clear. This publication is related to research work in Africa and this should be mentioned as the most important agroforestry type in Europe is not mentioned (hedgerows). A reference of a French publication could be added (see publications from Christian Dupraz INRA and from ICRAF). This paragraph on agroforestry should be expanded as these practices have a high potential. [., France]	Noted. Not implemented for lack of additional information
13945	65	24	65	24	How? How do agroforestry systems can partially offset CH4 emissions. What is the mechanism? Just a mention will be useful [Sunday Leonard, United States of America]	Sentence removed
27777	65	24	65	25	CH4 from what source? Is this the correct reference? (Does not seem to contain these points.) [Annette Cowie, Australia]	Sentence removed
13947	65	26	65	27	How does agroforestry mitigate N2O and CO2 emissions from soils and increase methane sink strength and why is it better than annual cropping systems? Information on the specific mechanism may be useful [Sunday Leonard, United States of America]	Accepted. Edited for clarity to explain that it is the agroforestry-based sequestration that can provide offsets for other farm based emissions such as these.
40749	65		65		Check coherency of assessment of agroforestry across chapters. [Valerie Masson-Delmotte, France]	We have checked with other chapters
30215	65	4	66	5	the mitigation potential for agroforestry cannot be identified in this section because the data in table 5.6 do not allow to calculate the CO2 sequestration rates. As this paragraph is the only place in the report where this information can be found it is a mystery how the numbers in 5.5.1 (page 58, line 27) and table SPM 6 (these numbers are very different!!) are derived. [., Netherlands]	Accepted. Agro-forestry discussed in more clear terms, with a range and cross checks to Ch 2
6485	65	4	66	5	Compare the data presented with those contained in Dooley et al, 2018, Missing Pathways for 1.5°C: The Role of the Land Sector in Ambitious Climate Action, pp 24-26 [Sara Lickel, France]	Accepted. Dooley is cited
21495	65	4			I've been looking in this section, but could not find, anything that would support that claimed 21.5 Gt/yr mitigation potential stated in the executive summary. No line of sight. I also doubt that the numbers in table 5.6 can simply be added since some of them will be overlapping on certain lands (especially the rather non-specific "integrated land-use"). Of equal importance in the context of food security is the question, how would these approaches at those scales impact on production? Increasing the proportion of trees eventually has to come at the cost of reduced food production - it's a question of what density could be sustained before this occurs, which will differ widely between production systems, soil and climate etc. This is an important element given the focus of this chapter on food security rather than pure mitigation. [Andy Reisinger, New Zealand]	Accepted. Upper end of the range was eliminated.
17203	65	9			It can be added "...promote greater soil organic matter and nutrients". [José Alfonso Domínguez-Núñez, Spain]	Text changed
17205	65	10			It can be added: "The tree cover increases the microbial activity of the soil and increases the productivity of the grass under cover". [José Alfonso Domínguez-Núñez, Spain]	Accepted added
17207	65	16			It can be added: "The Agroforestry provides economic, ecological and social stability through diversification of species and products". [José Alfonso Domínguez-Núñez, Spain]	Accepted, added
13949	66	17	66	17	delete production at the end of the sentence. This is a replacement for soybeans as a feed not replacement of soybean production [Sunday Leonard, United States of America]	Accepted. Done

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12535	66	19	66	22	Challenge to the sentence suggesting that livestock feeding on food waste is neither 'economically feasible' or 'commercially viable': In Japan, 52% of waste from the food industry is now used as livestock feed, thanks to adequate policies and a certification system (FAO 2017). Japan and South-Korea have successfully scaled up the processing of food waste for feed in modern treatment plants to ensure safety (zu Ermgassen et al. 2016). Using all unavoidable food waste in animal feed offers an economically viable solution that is central to most effective dietary change mitigation scenario: limiting animal-source food to non-ruminant livestock fed on food waste and by-products (Luyckx, Bowman, and Woroniecka; Van Zanten et al. Forthcoming 2019) (FAO. 2017. 'Livestock Solutions for Climate Change'. Food and Agriculture Organisation of the United Nations. <a href="http://www.fao.org/3/a-i8098e.pdf?utm_source=twitter&amp;utm_medium=social%20media&amp;utm_campaign=faoclimate.">http://www.fao.org/3/a-i8098e.pdf?utm_source=twitter&amp;utm_medium=social%20media&amp;utm_campaign=faoclimate.</a> ; zu Ermgassen, Ben Phalan, Rhys Green, and Andrew Balmford. 2016. 'Reducing the Land Use of EU Pork Production: Where There's Swill, There's a Way'. Food Policy 58 (January): 35–48. <a href="https://doi.org/10.1016/j.foodpol.2015.11.001">https://doi.org/10.1016/j.foodpol.2015.11.001</a> .; Luyckx, Karen, Martin Bowman, and Kryisia Woroniecka. Forthcoming. 'Technical Guidelines Animal Feed. The Safety, Environmental and Economic Aspects of Feeding Treated Surplus Food to Omnivorous Livestock.' <a href="https://eu-refresh.org/results.">https://eu-refresh.org/results.</a> ) [Carina Millstone, United Kingdom (of Great Britain and Northern Ireland)]	Accepted. Edited accordingly and inserted references.
27187	66	23	66	23	Second generation-technologies such as pyrolysis or torrefaction are still premature in case of manure use and are associated with low energy efficiencies. For GHG emission reduction, an adequate handling of manure is probably more important than the choice of technology. As also shown in Figure 5.13, anaerobic digestion of manure is an accepted mitigation practice for manure management. However, for example in Germany, even after a huge subsidy - program for energy production from biogas, still only about 30% of the manure is used in biogas facilities. Thus, the use of manure for energy purposes with concurrent GHG mitigation even via the most "low-tech" option is not so easy to achieve. (In Germany, the increase in numbers in biogas facilities with a high proportion of manure is now going to be one of the main measures of the government to fulfil climate goals in the agricultural sector.) We are therefore surprised that there is no closer mention of the overall potential regarding energy and GHG reduction (and maybe also side-effects) and no related literature cited. We suggest adding further information to this regard. [, Germany]	Accepted. Edited text slightly to convey the well made point.

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Comment No	From Page	From Line	To Page	To Line	Comment	Response
12537	66	23	66	24	Clarification to follow the sentence: 'Waste streams form manure and food waste can also be used for energy generation' Feeding heat-treated liquid food waste to pigs is preferable to anaerobic digestion from a global warming perspective and all other LCA indicators (Ogino et al. 2007; Salemdaab et al. 2017). This scenario is true even when biogas energy generation is reverted to fossil fuel energy generation, as would occur in a country with a low proportion of renewables in the energy mix such as the United Kingdom (Salemdaab et al. 2017). (Ogino, Akifumi, Hiroyuki Hirooka, Atsuo Ikeguchi, Yasuo Tanaka, Miyoko Waki, Hiroshi Yokoyama, and Tomoyuki Kawashima. 2007. 'Environmental Impact Evaluation of Feeds Prepared from Food Residues Using Life Cycle Assessment'. Journal of Environment Quality 36 (4): 1061. <a href="https://doi.org/10.2134/jeq2006.0326">https://doi.org/10.2134/jeq2006.0326</a> ; Salemdaab, Ramy, Erasmus K.H.J. zu Ermgassen, Mi Hyung Kim, Andrew Balmford, and Abir Al-Tabbaa. 2017. 'Environmental and Health Impacts of Using Food Waste as Animal Feed: A Comparative Analysis of Food Waste Management Options.' Journal of Cleaner Production 140 (March): 871–880.) [Carina Millstone, United Kingdom (of Great Britain and Northern Ireland)]	Rejected. Noted but not possible to implement for lack of space beyond what is already discussed in the sub-section
21497	66	33	66	46	This discussion rather uncritically misses the point that the active compound in Asparagopsis taxiformis is bromoform, which is a confirmed animal carcinogen and suspected teratogen. CSIRO 2018 is not in the references but I am not aware of any peer reviewed study confirming its efficacy and compatibility with animal health and safety and product safety standards. I find it very biased to devote so much space to an unproven and highly problematic technology (because it relies on a carcinogen), whereas 3NOP has undergone multiple trials and is indeed close to commercial roll-out. It is misleading to give the impression that 3NOP would have implications for animal performance or welfare (as implied in lines 43-44) - this has been looked at in several peer-reviewed studies (in contrast to Asparagopsis). Also the statement that such a technology could get rid of large amounts of methane seems to be unjustifiably dismissed - methane is by far a bigger emission than nitrous oxide in livestock systems, and the biggest emission in agriculture. Finally, what are CO2 emissions from ruminants? (from ruminant supply chains yes, but not ruminants directly). [Andy Reisinger, New Zealand]	Accepted. Text on asparagus put second and indicated as "being tested" as opposed to 3-NOP.
27189	66	45	66	46	Please see our comment on page 64 line 34. [, Germany]	Repeat
4047	66	7	67	22	Recent whole farm modelling exercises have shown the economic and environmental (reduced GH emissions, reduced land use) benefits of integrated crop-livestock systems. See Gil et al. (2018) where different soy-livestock systems are compared across multiple economic and environmental indicators, including climate resilience. However it is important to note that potential benefits are very context specific.  References: Gil, J.D.B., R. Garrett, A. Rotz, V. Daioglou et al. Tradeoffs in the quest for climate smart agricultural intensification in Mato Grosso, Brazil. Environmental Research Letters (13) 064025 (2018) [Vassilis Daioglou, Netherlands]	Accepted, added to CSA section
5183	66	19			Preferable to insert the sentence like 'Regeneration to fodder from food waste may also help to reduce the GHG emissions because it can offset the amount of GHG which could come from initial amount of fodder crops'. Because it is one of the positive aspects of technology. [, Japan]	Accepted, added

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21499	67	1	67	22	This discussion fails to deliver an assessment but only provides an enumeration of various studies. What I would have expected from an assessment is a conclusion that tells me what the authors finding is about the economic mitigation potential at a range of prices. Whereas now, I get some figures in lines 1-7 (but no information how this compares with AR5 and if the numbers are different, why), and then in lines 8-12 I get a study that says the mitigation potential could be four times higher than in the AR5. So, is it higher than in the AR5 or is it not? What is your assessment? [Andy Reisinger, New Zealand]	Accepted, added carbon price assessment
22669	67	3	67	5	Shouldn't it be \$20/ ton CO2 rather than ton C? [Anastasios Kentarchos, Belgium]	Accepted. Typo from C to CO2 was corrected
8187	67	3	67	12	. The carbon price here is expressed per ton C. In most context GHG emissions are expressed in ton or Gt CO2 or CO2-eq. In the EU ETS system the carbon price is expressed per ton CO2, or per ton CO2-eq. Would it be possible to give an additional figure for the carbon price per ton CO2 or CO2-eq to compare more easily? [Harold Leffertstra, Norway]	Accepted. Typo from C to CO2 was corrected
12953	67	6	67	13	Presumably using a different climate metric for methane would significantly increase or decrease the feasibility of livestock mitigation measures. [William Collins, United Kingdom (of Great Britain and Northern Ireland)]	Reject. Amply discussed in earlier sections. No need to restate every time we mention CH4 mitigation vis a vis integrated emissions from the farm
13951	67	24	67	30	There are available literature on this topic that the discussion here should not be based on just one publication.  See: for example: (1) <a href="http://www.ecomarres.com/downloads/GlobalFuel.pdf">http://www.ecomarres.com/downloads/GlobalFuel.pdf</a>  2. <a href="https://search.proquest.com/docview/1932066944/fulltextPDF/363EF9CD02184995PQ/1?accountid=28957">https://search.proquest.com/docview/1932066944/fulltextPDF/363EF9CD02184995PQ/1?accountid=28957</a>  3. <a href="https://www.researchgate.net/publication/319702716_Greenhouse_Gases_Emission_and_Mitigation_from_Brackish_Water_Aquaculture_Systems">https://www.researchgate.net/publication/319702716_Greenhouse_Gases_Emission_and_Mitigation_from_Brackish_Water_Aquaculture_Systems</a>  4. <a href="https://www.unclearn.org/sites/default/files/inventory/fao70_0.pdf">https://www.unclearn.org/sites/default/files/inventory/fao70_0.pdf</a> [Sunday Leonard, United States of America]	More references added
15723	67	28	67	29	Edit "From fossil fuel to renewables" to "From High-Carbon fossil fuels to Low-Carbon fossil fuels or Renewables" [, Iran]	Accepted and corrected
39711	67	30	67	30	Percentage on a tonne basis makes no sense. [, United States of America]	Accepted, deleted

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Comment No	From Page	From Line	To Page	To Line	Comment	Response
12563	67	31	67	31	Suggestion to add a paragraph to highlight that the prevention of food waste at primary level ought to be thought of as a supply side intervention rather than a demand-side intervention. Further suggestion to re-arrange 5.5.24 to reflect the distinction of food waste and loss prevention as both a supply and a demand side measure 5.5.1.6 Greenhouse gas mitigation through the prevention of food loss and waste at primary production level 78% of global food waste and losses occurs before it reaches the consumer with the highest waste levels occurring at agricultural level, representing 32% of global food waste (FAO 2011). While primary production losses are usually thought of as an issue for low-income countries, some estimates suggest that EU agricultural-level waste accounts for 36% of overall EU waste, a greater proportion than consumer level waste (34%) (FAO 2011). Other estimates put the EU's primary production waste at 30% (FUSIONS 2016) Overall, there is a lack of comprehensive and reliable data on the scale of primary production waste in different countries but high estimates suggest that the prevention of loss and waste generated in primary production- in fields, aquaculture and livestock production- should not be overlooked as a supply-side intervention. (FAO. 2011. Global Food Losses and Food Waste: Extent, Causes and Prevention. Rome: Food and Agriculture Organization of the United Nations; FUSIONS. 2016. Estimates of European Food Waste Levels. <a href="http://edepot.wur.nl/378674">http://edepot.wur.nl/378674</a> .) [Carina Millstone, United Kingdom (of Great Britain and Northern Ireland)]	Food loss and waste section (5.5.2.5) expanded. FAO 2011 cited
25531	67	32	67	32	This chapter has to be balanced with sanitary and regulatory aspects as well as nutritional aspects. risks and evidence gaps should also be developed. [, France]	Added regulatory aspects in section 5.7
22671	67	33	67	43	Further key factors that may hinder (or favour) further development of cultured meat technology, such as impact on rural development/landscapes, organoleptic properties, food safety requirements, etc. should be addressed as well. [Anastasios Kentarchos, Belgium]	Partially accepted. Text modified accordingly
21503	67	38	67	39	As per my comment on the related statement in the executive summary, I think the generic statement about limited potential in developing countries is a bit too weak and could do with more work to clarify the issue and especially the future potential, given dietary and development trends. [Andy Reisinger, New Zealand]	Rejected: Developing countries were not mentioned in this section
25533	67	40	67	42	"Zoonotic and food born diseases": from which risk assesment is it deduced, if there is one ? [, France]	Accepted. Removed from text
25535	67	41	67	41	About « reduce GHG emissions » : the life cycle analyse is not consistant with page 68 line 19 ("as commercial production process is still largely undefined, its actual contribution to avoid climate change and contribute to food security is largely uncertain and challenges are not negligible" [, France]	Prospective LCA are discussed and text was modified accordingly from "reduced GHG emissions" to "claimed reduced GHG emissions"
25537	67	41	67	41	Animal rights does not exist. it should be "animal welfare". [, France]	Accepted. Removed from text
25539	67	42	67	42	The reduction of harmful fatty acids should be completed with a study on nutritional content. [, France]	Beyond scope

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Comment No	From Page	From Line	To Page	To Line	Comment	Response
21501	67	32	68	23	This discussion is useful. I would however try to also bring in more of a discussion of alternative sources of protein (i.e. meat substitution - either 'traditional' such as soy-based, or insects or other novel protein sources), to get an overall sense of the extent to which the demand for protein (from a food security perspective) could be met by sources other than traditional (and emissions-intensive) livestock systems. This would also provide a useful bridge to the following demand discussion (which tends to present a contrast between meat and vegetarian diet, whereas insect-based protein or meat-substitutes may help soften this apparent divide). [Andy Reisinger, New Zealand]	Rejected. This sections is only about cellular agriculture. Diet shifts are discussed elsewhere. This was forwarded for the chapter coodinators for discussion of red meat substitution in other sections of the chapter.
12191	67	24			Suggest to add information on the scale of implementation possible, as well as regions, as done for the previous sections. [Hans Poertner and WGII TSU, Germany]	Accepted. Done
30459	68	13	68	23	there is assessment of the impact on cultured meat on other dimensions than GHG emissions. For example energy use, nutrient use efficiency etc. Not to mention its implication in terms of rural poverty and use of extensive grazing areas with no alternative (2 thirds of pastures in the work, Mottet et al., 2017. Livestock: On our plates or eating at our table? A new analysis of the feed/food debate. Global Food Security). In addition, there is no analysis available of the cost of production and the affordability of such products. [Anne Mottet, Italy]	Partially accepted: Some of those issues are treated in a new "Just Transitions" section where analysis of the unintended consequences are made
15193	68	13	68	23	It seems a premature bias for this paragraph to betray a rather negative view of cultured meat, particularly without noting the extraordinary growth rate of financial investment in the technology, including by "mainstream" entities in the protein business. [Daniel Zarin, United States of America]	Rejected. Text is based on published information only. Financial investments are not taken into account.
24697	68	16	68	37	Here "vegetarian diet" and "flexible diet" are vaguely defined. Thus it may look surprising that vegetarian diet means higher GHG emissions than flexible diets which still include livestock products. At least the confidence level of this statement could be decreased. See further comments on this concerning SPM below. [Heikki Lehtonen, Finland]	Added more definitions of diets
21505	68	19	68	20	This innocent sentence for me deserves to be developed into a far more imprtant anchoring statement. I.e. the main point of dietary change is not that it reduces agricultural emissions, but that it allows land to be used for other purposes, crucially, for carbon sequestration as assumed in most 1.5 and 2 degree compliant pathways. Without dietary change, the land needed to sequester this carbon is simply not there. This for me is potentially one of the most powerful messages that could come from this entire report. Because of this, it needs a lot of work and cross-chapter coordination, but it has to be a key consideration in this assessment, especially given that it follows the SR15. [Andy Reisinger, New Zealand]	These concepts are developed substantially in Section 5.6 Synergies and Tradeoffs
21201	68	25	68	41	This section could be improved by providing relevant context from the findings of the IPCC 1.5SR. Specifically that it is easier to achieve ambitious climate targets, consistent with the Paris Agreement, if more sustainable lifestyles are followed (i.e. SSP1). This would strengthen the discussion and make the link between sustainable demand side options and successful mitigation clearer. The IPCC report is clear on this, but if you would like a specific reference to a paper then see Rogelj et al 2018 <a href="https://www.nature.com/articles/s41558-018-0091-3">https://www.nature.com/articles/s41558-018-0091-3</a> [United Kingdom (of Great Britain and Northern Ireland)]	Accepted, added SR1.5, SSP1 and Rogelj reference
5391	68	25	68	41	This text is completely devoid of references. As this is a key part, and also includes assessments of agreement and evidence, it must be clarified which literature is assessed here and supports these statements. [Helmut Haberl, Austria]	References added and text moved to main body of section

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Comment No	From Page	From Line	To Page	To Line	Comment	Response
12955	68	33	68	35	Presumably using a different climate metric for methane would significantly increase or decrease the mitigation potential of dietary changes measures. [William Collins, United Kingdom (of Great Britain and Northern Ireland)]	See section 5.5.1 on supply for individual gases. See also FAQ 5.2
13953	68	33	68	37	Please provide references for this important finding which is also included in the executive summary [Sunday Leonard, United States of America]	Text changed in text and ES. Overall ranges given in ES, not specific diets. References provided for different diets
13955	68	35	68	35	This comment is also in the executive summary: I am struggle with this. what is the definition of healthy diet. Does it mean that other diet such as mediterranean and vegetarian and flexitarian are not healthy. Suggest changing this to a neutral name that doesnt bring in the debate about healthy [Sunday Leonard, United States of America]	Text changed in text and ES. Overall ranges given in ES, not specific diets. References provided for different diets. Healthy diet defined as "reduced meat consumption" in text
25541	68	37	68	37	Is there a unambiguous definition of "high-income industrial countries"? Would not "high-income countries" be more relevant? [, France]	Accepted, text changed
553	68	38	68	38	Typo: produce. Maybe products [Nathalie Hilmi, France]	The related paragraph has been deleted
12539	68	39	68	41	Suggestion to add the following sentence: Policies to encourage low carbon diets must include removing agricultural production subsidies for 1) ingredients for processed foods and 2) foods with high land or GHG footprints. Maintaining agricultural production subsidies for these foods increases their availability, making them cheaper and more attractive to all (Siegel et al., 2016), thus mimising the effectiveness of policies to support low-carbon alternatives [Carina Millstone, United Kingdom (of Great Britain and Northern Ireland)]	Accepted, added
25543	68	39	68	41	This is not clear, we suggest to briefly describe this assessment. [, France]	Accepted, text moved to and explained in Sections 5.6 and 5.7
25545	68	41	68	41	« Have been tested in differing contexts » : would it be possible to characterize the efficiency of these actions. [, France]	Accepted, text moved to and explained in Sections 5.6 and 5.7
25547	68	43	68	43	The diets described in this part and particularly in Fig 5.14 are not well defined and some are not recognized such as climate carnivore. [, France]	Figure was updated to be an assessment from the Chapter, not only from a single study. Diet definitions and assumptions included now in Figure
555	68	43	68	43	Very interesting section [Nathalie Hilmi, France]	Noted, thank you
29799	68	25	70	42	It would be interesting to include an Indigenous / First Nations based example here because food system adaptations are inherent to traditional practices. [Tanya Smith, Canada]	ILK discussed in sections 5.3 and 5.7
30461	68	43	70	42	The section mostly cites studies based on US diets and one on NL. Way more balance should be found here as US diets are far from being representative of an average global diet and as diets should always be considered in a local context and agroecological system. [Anne Mottet, Italy]	This is discussed in the following section: role of dietary preferences
34023	68	43	70	42	There are several papers missing in showing how dietary transition can help mitigation. E.g. Van Vuuren et al. 2018 shows that much less BECCS is needed when diets are changing. [Elke Stehfest, Netherlands]	Accepted, added van Vuuren ref. See also Section 5.6 for more references on synergies between diets and mitigation.
34027	68	43	70	42	Think about better title for 5.5.2.1, as suggested above. Several studies do not use a sceanrio appraoch, but examine current diets for their impact on GHGs.e.g Tilman and Clark collected only studies on current diets as far as I know... [Elke Stehfest, Netherlands]	Accepted, changed to Mitigation potential of different diets
158	68	43	70	42	Are there any more studies about 'vegan' diets? It would be useful to add vegan and completely meat free to the comparison. It would be best if you could create Figure 5.14 yourself based on your own review. [Tommy Wiedmann, Australia]	Added vegan and completely meat free to Figure. This Figure is a chapter assessment
30675	68	43	70	43	Reference you missed studying and citing in this section is: FAO. 2018. The future of food and agriculture - Alternative pathways to 2050. Rome. <a href="http://www.fao.org/publications/fofa/en/">http://www.fao.org/publications/fofa/en/</a> . Please add another paragraph discussin the findings of the "towards sustainability scenario (TSS)" on per capita food consumption (Section 4.5, pp. 102-105) and on GHG emissions (Section 4.10, pp. 137-140). [Lorenzo Giovanni Bellù, Italy]	Accepted. We added a reference to the FAO 2018 study in terms of projected GHG emissions to 2030 (beginning of section 5.5) as well as in section 5.1 (framing and context) for the increases in per capita food consumption.

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Comment No	From Page	From Line	To Page	To Line	Comment	Response
23445	68	44	70	40	ADD the point that these assessments are rather speculative [John Dixon, Australia]	Added section on uncertainties in demand-side mitigation potential
33401	68	44	70	42	Röös, E. et al. (2017) Greedy or Needy? from Global Environmental Change is an excellent paper that looks at different diet's health impacts. It would strengthen this section [Kelly Stone, United States of America]	Added reference
33403	68	44	70	42	There is clearly strong evidence in the literature that a less meat and dairy intensive diet has climate benefits. The less meat and dairy message comes through here, but its worth putting more numbers on estimates for vegetarianism and veganism, since there is a lot in the literature. It's also worth spelling out here the assumptions that the models are making on production methods, since that impacts the footprint of a given diet as well. Finally, what "less" looks like should be defined in terms of servings per week/month/year to better illustrate what this would mean for diets. [Kelly Stone, United States of America]	Vegetarian and vegan diets are discussed. Servings per week, month, etc beyond scope
3837	68	25			Comments about page 98 of Ch2 apply here too. [Philippe Waldteufel, France]	Noted
12541	69	1	69	4	Clarification on the optimal scenario for land sparing achieved through demand side measures: In a vegan dietary scenario, crop residues stay on the field to feed the soil–food web; co-products from the food industry become a bio-energy source or are wasted; and grasslands are not utilized for food production. Because animals do not recycle these biomass streams back into the food system, additional crops have to be cultivated to meet the nutritional requirements of the vegan population. Therefore, the most effective dietary change mitigation scenario consists of limiting animal-source foods to non-ruminant meat and eggs from livestock produced solely from feed that does not compete directly for arable land with human edible crops: unavoidable food waste and by-products (Van Zanten et al. 2018). This scenario also allows for restricted growth in consumption of animal source food in Africa and Asia. It is important that the production of ruminant livestock on marginal grassland is removed from ecological leftover models (Röös et al. 2017; Schader et al. 2015) to demonstrate the climate mitigation potential of non-ruminants fed on food waste and by-products. (Van Zanten, Hannah H. E., Mario Herrero, Ollie Van Hal, Elin Röös, Adrian Muller, Tara Garnett, Pierre J. Gerber, Christian Schader, and Imke J. M. De Boer. 2018. 'Defining a Land Boundary for Sustainable Livestock Consumption'. Global Change Biology 24 (9): 4185–94. <a href="https://doi.org/10.1111/gcb.14321">https://doi.org/10.1111/gcb.14321</a> .; Röös, Elin, Bojana Bajželj, Pete Smith, Mikaela Patel, David Little, and Tara Garnett. 2017. 'Greedy or Needy? Land Use and Climate Impacts of Food in 2050 under Different Livestock Futures'. Global Environmental Change 47 (November): 1–12. <a href="https://doi.org/10.1016/j.gloenvcha.2017.09.001">https://doi.org/10.1016/j.gloenvcha.2017.09.001</a> .) [Carina Millstone, United Kingdom (of Great Britain and Northern Ireland)]	Added text and references
30677	69	6	69	6	Please specify what are the "FAO assumptions". [Lorenzo Giovanni Bellù, Italy]	Text changed
14707	69	9	69	10	In Figure 5.14 the standard error bar for the pescetarian diet is missing. [Adalberto Benavides-Mendoza, Mexico]	Fixed. However, there is no error bar on the Climate Carnivore diet as it is based on a single study
21203	69	9	69	10	Fig 5.14 I don't think these dietary definitions are easily distinguished and do not correspond to common use or understanding of the terms used (e.g. vegetarian = still eating meat!) – but that's down to the original article. Personally I think Springman's scenarios (2016 and 2018) are more easily understood. I think there is scope for negative press/public reaction here and it would benefit the report or use a more consistent nomenclature [, United Kingdom (of Great Britain and Northern Ireland)]	Figure was updated to be an assessment from the Chapter, not only from a single study. Diet definitions and assumptions included now in Figure



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Comment No	From Page	From Line	To Page	To Line	Comment	Response
17901	69	9	69	12	This is an interesting and useful figure, but it would be helpful to explain what the baseline is, and it would be helpful to understand why a flexitarian diet results in greater emissions reductions than a vegetarian diet - is this because of the different dietary composition (i.e. reduced dairy?) or different model assumptions? [Quentin Lejeune, Germany]	Figure was updated to be an assessment from the Chapter, not only from a single study. Diet definitions and assumptions included now in Figure
21881	69	10	69	12	In relation to Fig. 5.14, it seems the values for mitigation potentials of different diets originate from different studies with different assumptions and may therefore not be fully comparable. For example, it is not clear if all scenarios include assumptions on reducing food waste, or if the reference scenario is the same for all of the presented mitigation potentials. This could be possibly clarified in the figure caption. [, Finland]	Figure was updated to be an assessment from the Chapter, not only from a single study. Diet definitions and assumptions included now in Figure
27191	69	11	69	12	Please revisit the provided literature source. [, Germany]	Added the additional references for the figure
17343	69	11	69	12	Title of Figure 5.14 has a misused reference. The work by Herrero et al, 2016a did not evaluate the mitigation potential of changing diets. Several other references later mentioned did (from Stehfest et al 2009 to Springmann et al., 208) and this figure has probably been based on the results of those studies (and not on Herrero et al. 2016a). [Maria Helena Cruz de Carvalho, France]	Removed Herrero 2016a and added specific references
30463	69	19	69	21	the statement about natural afforestation should be balanced. Land abandonment after agricultural use as proven to also include negative environment impact. [Anne Mottet, Italy]	Added caveat
40751	69		69		Please make assumptions on diets more explicit. Vegetarian means no meat no fish but eggs and dairy products. Vegan could be considered too. Explain how demography changes are combined with types of diets to explore mitigation potentials. [Valerie Masson-Delmotte, France]	Figure was updated to be an assessment from the Chapter, not only from a single study. Diet definitions and assumptions included now in Figure
25077	69	14	70	42	Here shows a list of publications with key results. I prefer that the authors summarize the knowledge gained from these publications rather than showing the list. [Junguo Liu, China]	Added summary statement at end of section
12957	69	1	71	25	Presumably using a different climate metric for methane would significantly increase or decrease the mitigation potential of dietary change. There is no agreed conversion to generate GtCO <sub>2</sub> -eq yr <sup>-1</sup> . For instance the methane metrics in IPCC AR5 WG 1 table 8.7 vary by a factor of 20. [William Collins, United Kingdom (of Great Britain and Northern Ireland)]	See section 5.5.1 on supply for individual gases. See also FAQ 5.2
25549	69	11			We believe that this figure is relevant and justified, but we consider that it is currently subject to several defects that must be corrected. In particular: <ul style="list-style-type: none"> <li>• We suggest producing a new figure based on the findings of the SRCL rather than using an existing figure from an isolated scientific article. In this new figure IPPC could define its own diets based on the WHO recommendations and calculate their effects, and present them compared to the actual diets in different regions of the world.</li> <li>• We suggest to improve consistency between Figure SPM-6 page SPM-20 (also Figure 2.32 page 2-95) and Figure SPM-7 page SPM-23 (also Figure 5.14 page 5-69) and to clarify the information you wish to provide with these figures. Considered together, these figures are currently very confusing.</li> <li>• If the actual figure is kept, we suggest to check all the diets definitions. Vegetarian does not include meat or seafood in the diet in the usual meaning; healthy diet is not clearly defined; and climate carnivore is not widely used and not recognised.</li> <li>• We suggest to add, in the figure and/or in its caption, the health effects of these diets, the associated costs to society, the WHO recommendations and deviations from current diets.</li> <li>• To be consistent with Figure SPM-4 page SPM-14 (also Figure 1-4 page 1-33) and Table SPM-1 page SPM-17, we suggest to include also value chain options and risk management options. See also GENERAL COMMENT ON FIGURES. [, France]</li> </ul>	Figure was updated to be an assessment from the Chapter, not only from a single study. Diet definitions and assumptions included now in Figure

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Comment No	From Page	From Line	To Page	To Line	Comment	Response
30679	70	15	70	15	Please specify what are the "FAO projections". [Lorenzo Giovanni Bellù, Italy]	Text removed
39713	70	16	70	16	"reference 37" is an improper citation. [, United States of America]	Text removed
22673	70	31	70	32	"The feasibility of how to create transitions to more sustainable and healthy diets is still the subject of more research." Some citations needed, if possible. [Anastasios Kentarchos, Belgium]	Repeat of 21205
21205	70	31	70	32	This isn't a particularly informative statement. While understanding feasibility is clearly key, simply saying that more work needs to be done doesn't really inform the reader. I find it hard to believe that there is a complete lack of evidence here, such that you can say nothing on feasibility. A quick google scholar search reveals a number of papers (e.g. <a href="https://www.sciencedirect.com/science/article/pii/S0195666315003189">https://www.sciencedirect.com/science/article/pii/S0195666315003189</a> ). Please consider revising this statement to include information on what current evidence says regarding feasibility. [, United Kingdom (of Great Britain and Northern Ireland)]	Changed to "an emerging area of research". Added Garca et al
557	70	44	70	44	link between 5,5,2,2 and the SDG about food security (SGD 2), health (SDG 3), and climate change (SDG13) [Nathalie Hilmi, France]	Accepted, text added
33407	70	45	71	2	The questions being posed seems the wrong ones (though the substance of this section is largely very good). First, if benefits of a healthy diet could drive a transition to a lower emissions diet alone, that would have likely already happened. Instead, the world is globally trending in the wrong direction on diets as it gets wealthier, from both a climate and a health perspective. The question is can a climate friendly diet also be healthy (which the following section answers clearly in the affirmative). As to whether or not the benefits of a climate friendly diet can outweigh the substantial barriers to adoption, that's not a question for this report. This report should be considering what those benefits are (in the forms of carbon, health, livelihoods etc), what it means for the overall emissions pathways, and possible barriers to adoption. Whether or not to adopt it is a policy decision. And again, if the climate benefits were incentive enough without policy measures, they would have already been adopted, and that's clearly not the case. [Kelly Stone, United States of America]	Comment is interesting, but there is significant evidence against the assertions that "it would already have happened" as discussed in Section 5.7, Ch 7 etc. Indeed, whether or not to adopt is a policy decision, but flagging up the magnitude of potential health savings highlights potential for avoiding specific needs for climate financing. Whilst we disagree with the comment, we have nonetheless modified the text in response.
559	71	18	70	20	What are the estimates? [Nathalie Hilmi, France]	Accepted, text added
21893	71	3	71	30	Since chapter 5 deals with food security and its four pillars (including nutritional quality) it could be mentioned that (also) the vegetarian diet does not always provide all the necessary vitamins (especially B12) and minerals needed. [, Finland]	Accepted, added note to dietary definition table: All diets need to provide a full complement of nutritional quality, including micronutrients (FAO et al. 2018)
33409	71	8	71	8	Springmann, M et al. (2016) "Analysis and valuation of the health and climate change cobenefits of dietary change." In the Proceedings of the National Academy of Sciences of the United States of America. 113(15). Very helpful analysis on the clear health and climate benefits of healthy diets, including a drop in mortality. [Kelly Stone, United States of America]	Accepted, reference added plus refs to EAT and OBESITY lancet reports
13957	71	9	71	9	If we say several studies, I will expect at least 3 example references and not just one... If only one study is available, then change several in the sentence accordingly [Sunday Leonard, United States of America]	Accepted, text modified
8189	71	11	71	12	Could it made clear that these reductions are in percent of the emissions from the agriculture sector if that is correct. [Harold Leffertstra, Norway]	Accepted, text modified
13959	71	16	71	16	please insert "indirectly" between also and mitigate [Sunday Leonard, United States of America]	Accepted, text modified

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Comment No	From Page	From Line	To Page	To Line	Comment	Response
25079	71	17	71	18	<p>Add the following sentences. Liu et al. (2008) was a very first study to link diets with food and water security.                      Liu et al. (2008) found that the dietary shift towards more meat consumption has increased China's annual per capita water footprint for food production by a factor of 3.4 from 1961 to 2003. Changes in food-consumption pattern worsen China's water scarcity, and such a diet shift may also have detrimental effects on human's health. Promoting healthy eating habits is of importance for both food and water security.</p> <p>By assuming that all population follow a healthy diet with a total per capita dietary calorie supply of 3000 kcal day<sup>-1</sup> and 20% of this supply coming from animal products, the total world nitrogen demand will not increase much because many countries have already higher calorie supply (Liu et al., 2016). However, such an assumption will lead to significant increase in nitrogen demand in many countries currently suffering from hunger, e.g. Sub-Saharan Africa and South Asia (Liu et al., 2016).                      Liu J.*, Yang H., Savenije H.H.G., 2008. China's move to higher-meat diet hits water security. Nature 454 (7203): 397.                      Liu J., Ma K., Ciais P., Polasky S., 2016. Reducing human nitrogen use for food production. Scientific Reports 6: 30104. [Junguo Liu, China]</p>	space precludes us focussing on water, nitrogen or other broader ecosystem service provision associated with changing diets. Our focus here is on climate change and food security (i.e. "healthy diets")
21207	71	18	71	30	<p>I note that all of these papers discussing the link between diet and health come from the environmental and not the medical literature. This may undermine their credibility, given that this is a complex and evolving area of research. For example, see Grosso et al 2017 (<a href="https://www.ncbi.nlm.nih.gov/pubmed/28969358">https://www.ncbi.nlm.nih.gov/pubmed/28969358</a>) which states that "the results suggest a potential role of diet in certain cancers, but the evidence is not conclusive and may be driven or mediated by lifestyle factors." Therefore please provide authoritative references from the medical literature and ensure that your discussion is fully balanced. [United Kingdom (of Great Britain and Northern Ireland)]</p>	Some of the references we cite are from the medical literature (e.g. EAT and Obesity commissions published in the Lancet). The latter two are the most comprehensive surveys in the recent literature, and whilst for specific diseases there are some uncertainties, the consensus is (as the Grosso paper concludes "However, an overall trend toward increased and decreased cancer risk associated with unhealthy and healthy dietary patterns, respectively, was found, suggesting that diet-related choices could significantly affect the risk of cancer. "). Text modified in response.
13961	71	19	71	20	<p>What did they find in the study? That is the information of interest to the reader but it is missing [Sunday Leonard, United States of America]</p>	Accepted, text modified
8191	71	21	71	23	<p>could it be clarified what «healthier diets» implies? [Harold Leffertstra, Norway]</p>	Accepted, text modified
13963	71	24	71	24	<p>what are the caveats? [Sunday Leonard, United States of America]</p>	accepted and reworded - less caveats than detailed differences from study to study
40753	71		71		<p>6 why is the US diet used as a reference here? What about other regional examples? Could this section assess potential avoided burden of health costs with dietary changes? Last paragraph should be conveyed in ES/ SPM. [Valerie Masson-Delmotte, France]</p>	accepted, text modified. See Section 5.6
12761	72	1	72	1	<p>Figure 5.15 contains an asterisk, but the meaning of the asterisk cannot be found [Tiziana Susca, United Kingdom (of Great Britain and Northern Ireland)]</p>	accepted, clarified. Moved to Section 5.6
12195	72	2	72	30	<p>This is a very generalised statement - based on a single (American) study? [Hans Poertner and WGII TSU, Germany]</p>	Moved to section 5.6. Many regional studies are cited
18013	72	4	72	6	<p>Unclear what is meant by the closing of this sentence. [Beau Damen, Thailand]</p>	Accepted, text added
8193	72	4	72	6	<p>This sentence is incomplete and therefore lacks meaning. Please complete [Harold Leffertstra, Norway]</p>	Accepted, text added
34019	72	4	72	20	<p>The first sentence after the question, and also the rest of this section suffers from grammar problems and spelling errors. The first sentence is weird, how can current diet trends make achieve the Paris agreement? Reformulate. [Elke Stehfest, Netherlands]</p>	accepted, see Section 5.6. Text modified

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Comment No	From Page	From Line	To Page	To Line	Comment	Response
34021	72	4	72	20	Also this section also seems to be about the total potential of dietary transition to contribute to mitigation. It is unclear how this relates to section 5.5.2.1. which summarize all the current evidence on diets and their GHG mitigation effect.... Resolve. Also look into titles. Maybe 5.5.2.1. should not be called scenarios, but explicitly about mitigation potential of dietary transitions, and then 5.5.2.2. just about health .... and 5.5.2.3. about implementation ... [Elke Stehfest, Netherlands]	accepted, titles modified. Section moved to 5.6
13965	72	5	72	6	"and that this would make achieving the Paris Agreement targets" is an incomplete sentence. [Sunday Leonard, United States of America]	accepted, text added
22675	72	6	72	6	word missing [Anastasios Kentarchos, Belgium]	Accepted, text modified
21507	72	6	72	6	Incomplete sentence? [Andy Reisinger, New Zealand]	Accepted, text modified
1907	72	6	72	6	Agreement. [William Lahoz, Norway]	Accepted, text modified
12543	72	8	72	20	Suggestion to remove the reference to the Birney et al (2017) study which is misleading and confusing: The increase in energy use assumes an increase in dairy intake in the healthier food scenario. As the Birney et al. study assumes a significant increase in dairy consumption in the healthier diet scenario whilst also stating that in the current scenario dairy consumption is already above what is recommended it is misleading to include this result as part of a discussion of healthier diets. The study also states that "The calculations in this study do not account for fertilizer used to produce feed for animals." As this would affect the results it is misleading to include the fertilizer results here. If this study is included in the text, it is essential to detail its assumptions and limitations. [Carina Millstone, United Kingdom (of Great Britain and Northern Ireland)]	Accepted, text modified
13967	72	12	72	13	The interest is not whether similar studies has been conducted in China and India but the findings from the studies and whether the findings answer the question that this section is set to answer. Please provide the findings from China and India. [Sunday Leonard, United States of America]	Accepted, text modified
12193	72	14	72	20	This section lists the findings from several studies, but the synthesis and critical appraisal is missing. [Hans Poertner and WGII TSU, Germany]	Accepted, text modified
13969	72	19	72	19	change to "read" to "red" meat [Sunday Leonard, United States of America]	Accepted, text modified
13971	72	20	72	20	correct the spelling of "saturated" [Sunday Leonard, United States of America]	Accepted, text modified
13087	72	27	72	28	What evidence shows men prefer meat and women prefer fruits and vegetables? Is this global? [Kristi Tabaj, United States of America]	References provided
13089	72	31	72	31	Broadly speaking, given the limitations of women's decision making power globally, it is inaccurate to conclude that changes to diets could come through women. Awareness raising and behavior change efforts should follow findings from a gender analysis. [Kristi Tabaj, United States of America]	Accepted, text changed
34025	72	22	73	3	It is unclear what this paragraph is about. The title "role of dietary preference in mitigation" suggest that it is about the role that dietary changes can play in mitigation. But the current text does not deliver this. These papers all show mitigation INCLUDING dietary transition (Stehfest et al. 2009, Van Vuuren et al. 2018) and show that mitigation needs are lower, or that less BECCS need to be applied. ... given the current text, a different title like "factors influencing dietary preferences" would be more adequate. [Elke Stehfest, Netherlands]	Accepted, text modified

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Comment No	From Page	From Line	To Page	To Line	Comment	Response
29801	72	23	73	3	Consumers' choice and dietary preferences are also guided by observed environmental changes. For example, Tsleil-Waututh have not accessed the traditional clam harvests for decades, because the clams are deemed unsafe. Tsleil-Waututh monitors the productivity, travel patterns and health of the local elk herd so as to not overhunt or endanger them at a vulnerable point in their cycle. Indigenous in particular respond to environmental change by adapting dietary preferences [Tanya Smith, Canada]	Accepted, text modified
6737	72	25	73	3	I think the role of dietary preferences in mitigation is greatly important. However, the content of current section 5.5.2.3 is too short to reflect its importance. For example, it only tells the dietary preferences by genders, but the territory is also a non-negligible factor when considering dietary preferences. [JINGLI FAN, China]	Accepted, text modified
8739	72	19			"animal-based proteis" should be "proteins"? "ad" should be "and"? "read meat" should be "red meat" or "ready meat"? [Changxiao Li, China]	Accepted, text modified
21509	72	22			I don't feel this section works as a stand-alone section, it feels like an add-on. Could this be integrated into the preceding discussion? [Andy Reisinger, New Zealand]	Accepted, title changed
12961	73	1	73	3	MMT is not a unit used elsewhere in this report, presumably it uses a (here unspecified) conversion factor for methane. using a different climate metric for methane would significantly increase or decrease the mitigation potential of dietary change. For instance the methane metrics in IPCC AR5 WG 1 table 8.7 vary by a factor of 20. [William Collins, United Kingdom (of Great Britain and Northern Ireland)]	Accepted, text changed
118	73	5	73	5	in this section an important dimension of food waste is ignored: poor cooking recipes. Optimal combinations of foods in a recipe can vastly improve nutrient bioavailability (eg nixtamalisation of maize by adding lime) [Thomas Reuter, Germany]	Beyond scope
21511	73	6	73	12	I don't feel this summary statement works up-front, as it duplicates the same information that comes in the subsequent para, and it's not clear whether it is citing specific studies, or is a summary of what's to come. Provide the detailed review first, and then conclude with a summary assessment. Also, what's the citation for the 4.4 Gt figure - I can't find this? Also note that chapter 6 gives different figured for food loss and waste emissions - please reconcile. [Andy Reisinger, New Zealand]	Summary statement moved to end. Emissions numbers updated and coordinated across chapters
30681	73	6	73	12	As we speak there are no official statistics on how high food losses and waste are. So how do you know how high their GHG emissions are? and to what exactly do these emissions refer to? to producing what is lost and wasted? to use land? to transport it? please specify. [Lorenzo Giovanni Bellù, Italy]	Text revised, findings coordinated with FAO
13973	73	7	73	10	Provide supporting reference(s) for this [Sunday Leonard, United States of America]	Text revised
8195	73	12	73	12	Wouldn't avoiding of loss and waste also reduce emissions from animal production? This in addition to the emission reduction from less agricultural expansion? If so add; «and emissions from animal production» [Harold Leffertstra, Norway]	Specific emissions from animal production now assessed
5185	73	15	73	16	The phrase, "During the last 50 years, the global food loss and waste increased from around 540 Mt in 1961 to 1630 Mt in 2011." seems to overlap with the expression in same page, line 7-8, "Between 1961 and 2011, global food loss and waste has tripled from 540 million tonnes /yr to 1.6 billion tonnes / yr....". [Japan]	Corrected. The first paragraph has been deleted
13975	73	15	73	16	Repetition. This was already stated in the paragraph above [Sunday Leonard, United States of America]	Corrected. The first paragraph has been deleted

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Comment No	From Page	From Line	To Page	To Line	Comment	Response
13977	73	18	73	19	another repetition. Please review this and the previous paragraph and make them more succinct [Sunday Leonard, United States of America]	Corrected. The first paragraph has been deleted
561	73	22	73	23	sentence to be linked with the comment below [Nathalie Hilmi, France]	Unclear
563	73	29	73	30	sentence to be compared to the one in my previous comment [Nathalie Hilmi, France]	Unclear
29803	73	29	73	30	It is hard to believe that this statistic took into account Indigenous food systems. It would be interesting to include information on the average percentage of food loss in Indigenous communities. [Tanya Smith, Canada]	Please provide reference
31735	73	29	73	41	Consider replacing "was lost" with "went to waste" and "loss" to "waste" as this is clearer in the context of food waste under discussion here [Elizabeth Migongo-Bake, Kenya]	Corrected
6487	73	29	73	41	It would be good to have percentages for all the data mentioned here, so that the data is comparable. [Sara Lickel, France]	Added percentages
21513	73	46	73	46	"seven percent" - please translate into the same units used in the other statements, I can't tell whether the percentage wastage in China is higher or lower than e.g. in Europe based on this information, which makes this confusing. [Andy Reisinger, New Zealand]	Added percentages. Sentence on China deleted
40755	73		73		education could be highlighted in ES as key for transformation enabling condition ; acting on demand (diet) can facilitate system transition (outcome of SR15). Also relevant for end of section (page 75). [Valerie Masson-Delmotte, France]	Education featured in Enabling Conditions (5.7.4.3)
34029	73	5	75	31	This section 5.5.2.4 mentions so many numbers, but has no figure ... try to produce a figure for the mitigation potential! [Elke Stehfest, Netherlands]	Could not add figure due to limited space
27193	73	5	75	31	The subchapter on food waste presents many interesting facts in particular about the extent of, the reasons for and the mitigation options of food waste. Please consider the following remarks to further improve this subchapter: - A graphical illustration (map, diagram) would help the reader to follow the many numbers provided on absolute and per capita food waste in different regions that are presented. - The section about methods to reduce food waste could be further developed please and we encourage the authors to add more references. It would be very important to be provided with a more comprehensive assessment about potential food waste mitigation options (or with references to the relevant chapters). - Please merge the discussions on numbers of global food waste and GHG mitigation potential (p. 5-73 ll. 6-18, p.5-74 ll. 4-11, p.5-75 ll. 8-18). [Germany]	Could not add illustration due to limited space. Added references. Kept discussion on mitigation potential of GHG mitigation potential in the dedicated FLW section
12959	73	5	75	31	There is no agreed conversion to generate GtCO <sub>2</sub> -eq yr <sup>-1</sup> . For instance the methane metrics in IPCC AR5 WG 1 table 8.7 vary by a factor of 20. It would be more scientifically accurate if CO <sub>2</sub> , methane and N <sub>2</sub> O mitigation were quoted separately, rather than aggregating them in the controversial (and undefined in the report) CO <sub>2</sub> eq. [William Collins, United Kingdom (of Great Britain and Northern Ireland)]	Accepted, units in the report have been redone
39715	74	12	74	26	This needs to be two paragraphs (two thoughts) and the first paragraph could possibly be expanded to clarify from where the losses come -- i.e., only grain/fruit harvested, conversion in meat production, etc. [United States of America]	Text removed
8197	74	12	74	26	important information-- almost 50 % of food is lost and wasted when we include overeating. Consider if it should be in the SPM [Harold Leffertstra, Norway]	Rejected, too focused on developed countries

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Comment No	From Page	From Line	To Page	To Line	Comment	Response
25551	74	17	74	19	We propose another formulation "Overconsumption, defined as food consumption in excess of nutritional requirements, leads, similarly to food waste, to GHG emissions. In Australia for example, overconsumption accounts for about 33% GHGs associated with food (Hadjikakou 2017). In addition to GHG emissions, overconsumption also can lead to severe health conditions such as obesity or diabetes". Indeed the original formulation could mean that you change the definition of food wastes, which is quite widely accepted. [., France]	Accepted, text changes
32367	74	27	74	43	1. For completeness, regional review of food loss and waste (FLW) reduction may be extended from EU, Africa, China, and USA to those APEC-wide research results. New references include: (1) Chang, C.-C. and S.-H. Hsu, 2017. APEC Survey Report on Food Loss and Waste Reduction Policy. Retrieved from APEC-FLOWS: <a href="http://apec-flows.ntu.edu.tw/upload/Publication/File/APEC-survey-report-on-FLW-reduction-policy.pdf">http://apec-flows.ntu.edu.tw/upload/Publication/File/APEC-survey-report-on-FLW-reduction-policy.pdf</a> (2)Hsu, S.H., C.-C. Chang, and N.T.T. Trang, 2018. APEC Survey Report on Feasible Solutions for Food Loss and Waste Reduction. A report published by APEC Secretariat under SOM Steering Committee on Economic and Technical Cooperation (SCE), Agricultural Technical Cooperation (ATCWG), and Policy Partnership on Food Security (PPFS). Publication Number: APEC#218-AT-01.2. The report is available at: <a href="https://www.apec.org/Publications/2018/09/APEC-Survey-Report-on-Feasible-Solutions-for-Food-Loss-and-Waste-Reduction">https://www.apec.org/Publications/2018/09/APEC-Survey-Report-on-Feasible-Solutions-for-Food-Loss-and-Waste-Reduction</a> . (3) Hsu, S.H., 2018. Summary of Activities, Findings and Recommendations from the APEC High Level Policy Dialogue on Enhancing Public and Private Partnership to Reduce Food Losses and Waste for a Sustainable APEC Food System. Retrieved from APEC-FLOWS: <a href="http://apec-flows.ntu.edu.tw/upload/Publication/File/APEC%20HLPD%20FLW%20Summary%20_APEC_official.pdf">http://apec-flows.ntu.edu.tw/upload/Publication/File/APEC%20HLPD%20FLW%20Summary%20_APEC_official.pdf</a> (SCE). [Ching-Cheng Chang, China]	Added references
26177	74	28	74	28	After "including" insert "reliable energy supplies, " [Reid Detchon, United States of America]	Accepted and corrected into "stable energy supplies"
26179	74	34	74	34	After "including" insert "distributed energy resources to support" [Reid Detchon, United States of America]	Accepted and corrected
12573	74	35	74	35	Addition at the end of the paragraph: Producers in low-income countries exporting to high-income countries are at risk of market practices that lead to food waste. Power imbalances in EU supply chains that enable buyers to set the terms of business can lead to food waste in exporting countries (European Court of Auditors 2016). Opportunities to access international markets through more effective supply chains do not necessarily lead to food waste reduction. (the Resource-Efficiency of the Food Supply Chain'. Luxembourg: European Court of Auditors. 2016) [Carina Millstone, United Kingdom (of Great Britain and Northern Ireland)]	Accepted, added
32373	74	36	74	37	More references can be added for hi-income countries on food waste at the retail and consumer levels, for example, Buzby, J. C. and J., Hyman, 2012. "Total and Per Capita Value of Food Loss in the United States." Food Policy 37, 561–571. [Ching-Cheng Chang, China]	Older reference. Not included
25553	74	40	74	43	Concerning this sentence, we suggest to take into account International food standards ((CODEX) for food safety and quality aspects. [., France]	Added food standards

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Comment No	From Page	From Line	To Page	To Line	Comment	Response
12547	74	43	74	43	Suggestion to add the following sentence at the end of the paragraph: Standardised, accurate and clear product date labelling is also an important intervention to minimise consumer food waste (WRAP (2017) ( Labelling Guidance: Best Practice on Food Date Labelling and Storage Advice (available at <a href="http://www.wrap.org.uk/sites/files/wrap/labelling-guidance.pdf">http://www.wrap.org.uk/sites/files/wrap/labelling-guidance.pdf</a> ) ) Further research is needed to understand how different shopping habits present different risks of overpurchase, resulting in waste generation in the home. Some studies for example suggest that Western-style supermarkets tend to result in overpurchase (Heard and Milller 2016, study referred to on page 102, line 42) [Carina Millstone, United Kingdom (of Great Britain and Northern Ireland)]	Added food standards. Shopping habits beyond scope
12581	74	43	74	43	Suggestion to add at the end of the paragraph: There is little robust data on primary production waste in field high-income countries, but some studies indicate that it could be substantial. Only 0.26 million tonnes of the UK's food waste occurs at retail level compared to 1.85 million tonnes at manufacturing level (WRAP 2018) and an estimated 2.5 million tonnes at primary production level. Trading practices and power imbalances in markets are a direct driver of primary production food waste and effective market regulations can help reduce waste ('WRAP Restates UK Food Waste Figures to Support United Global Action   WRAP UK'. 22 May 2018. <a href="http://www.wrap.org.uk/content/wrap-restates-uk-food-waste-figures-support-united-global-action.">http://www.wrap.org.uk/content/wrap-restates-uk-food-waste-figures-support-united-global-action.</a> ) [Carina Millstone, United Kingdom (of Great Britain and Northern Ireland)]	Rejected, not linked to climate change
13979	74	45	74	46	Why is it debatable? Please explain [Sunday Leonard, United States of America]	Text revised
32261	74	12	77	25	There is some ambivalence in judgements of surplus biomass/residues. Inspired by page 74, residues may be likened to post-harvest losses/waste. Inspired by page 77, residues may be feedstock for soil fertility. It would be helpful to sort out this ambivalence by pointing out practical approaches so that soil generative processes dominate over degrading processes. [Jon Magnar Haugen, Norway]	Residues removed
25081	75	7	75	8	Add the following sentences Liu et al. (2013) made a first attempt to quantify the food waste and losses and their impacts on land and water resources. It was found that the average rate of food loss and waste was 19% ± 5.8% in China (Liu et al., 2013), which is much lower than many developed countries. However, such losses imply a waste of water footprint (WF) of 135 ± 60 billion m <sup>3</sup> , equivalent to the WF of Canada, and 26 ±11 million hectares of land were used in vain, , equivalent to total arable land area of Mexico. Liu J., Lundqvist J., Weinberg J., Gustafsson J., 2013. Food losses and waste in China and their implication for water and land. Environmental Science & Technology 47(18): 10137-10144 [Junguo Liu, China]	Important work but beyond scope of chapter
14709	75	12	75	13	Repeated text (line 12 and 13): 'By 2050, GHG emissions associated with food waste may increase tremendously to 1.9–2.5 Gt CO <sub>2</sub> -eq yr <sup>-1</sup> (Hiç et al. 2016).' [Adalberto Benavides-Mendoza, Mexico]	Text removed
8199	75	12	75	15	The sentence «By 2050, GHG emissions associated with food waste may increase tremendously to 1.9–2.5 Gt CO <sub>2</sub> -eq yr <sup>-1</sup> (Hiç et al. 2016).» seems to be less- or non consistent with the following: « Compared to the baseline scenarios (Bajželj et al. 2014) halving the food waste reduces the global need for cropland area by around 14% and GHG emissions by 22–28% (4.5 Gt CO <sub>2</sub> -eq yr <sup>-1</sup> ), and the figure 4.4 Gt CO <sub>2</sub> -eq yr <sup>-1</sup> emissions from food waste in 2011 in line 4, page 74 [Harold Leffertstra, Norway]	Text removed



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Comment No	From Page	From Line	To Page	To Line	Comment	Response
12551	75	18	75	18	Suggestion to add the following sentence at the end of the paragraph: The land mass used to grow food that is lost and wasted is equivalent to the land area of India and China, with most of it attributable to meat and dairy waste (FAO 2013). The land sparing potential of food loss and waste prevention is significant, and food loss and waste prevention is therefore an important enabler of carbon dioxide removal technologies such as afforestation and reforestation. (Food Wastage Footprint: Impacts on Natural Resources - Summary Report. Rome: FAO 2013.) [Carina Millstone, United Kingdom (of Great Britain and Northern Ireland)]	FAO 2013 cited in text
13981	75	20	75	20	So what are the technical and non-technical solutions? We cant assume that the readers already know. Give examples [Sunday Leonard, United States of America]	Accepted, added
32369	75	26	75	31	A food waste hierarchy which identifies and prioritizes the most appropriate options for the prevention and management of food waste may affect the mitigation potential of different food waste 3R (i.e., Reduction, Recovery and Recycle) options. The food waste hierarchy posits that prevention, through minimization of food surplus and avoidable food waste, is the most attractive option. The second most attractive option involves the distribution of food surplus to groups affected by food poverty, followed by the option of converting food waste to animal feed. Although the proposed food waste hierarchy requires a fundamental re-think of the current practices and systems in place, it has the potential to deliver substantial environmental, social and economic benefits, esp. mitigation options for combating climate change. The major reference is: Papargyropoulou E, Lozano R, Steinberger J, Wright N, Ujang Zb, The food waste hierarchy as a framework for the management of food surplus and food waste, Journal of Cleaner Production (2014), doi: 10.1016/j.jclepro.2014.04.020. [Ching-Cheng Chang, China]	Accepted, 3Rs and reference added
21517	75	40	75	40	The statement of a single figure strikes me as extremely dubious, given the enormous diversity of carbon footprints of food production within Europe and in the Global South. Please be more careful to recognise uncertainties and assumptions before leaping into generalisations that are difficult to support without clear caveats. [Andy Reisinger, New Zealand]	Text deleted
12575	75	40	75	40	Addition at the end of the paragraph: Long and fragmented supply chains, which lead to disrupted price signals, unequal power relations perverse incentives and long transport time, were also identified as a key barrier to reducing post-harvest losses in India (CIPHET 2007, 26) CIPHET. 2007. 'Vision 2025 - CIPHET Perspective Plan'. Central Institute of Post Harvest Engineering and Technology,. [Carina Millstone, United Kingdom (of Great Britain and Northern Ireland)]	Accepted, added
21519	75	47	75	47	Reference is made to section 5.5.1 but I cannot find any relevant discussion of this in that section. Overall I find this discussion somewhat confusing; simply state that whether locally grown food has a lower carbon footprint depends on the on-farm emissions intensity as well as the transport emissions, and in some cases, imported food may have a lower carbon footprint than locally grown food because some distant countries can produce food at much lower emissions intensity. [Andy Reisinger, New Zealand]	Text revised. Call out removed

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Comment No	From Page	From Line	To Page	To Line	Comment	Response
5393	75	33	76	11	The literature on these effects is a lot larger. As far as I can see, the overall statements are okay, but there is a lot more empirical evidence to support this analysis. For example, vegetables produced in open fields can have much lower GHG emissions than locally produced vegetables from heated greenhouses, See e.g. Theurl, M.C., et al. 2014. Contrasted greenhouse gas emissions from local versus long-range tomato production. Agron. Sustain. Dev. 34, 593–602. <a href="https://doi.org/10.1007/s13593-013-0171-8">https://doi.org/10.1007/s13593-013-0171-8</a> [Helmut Haberl, Austria]	Accepted, Theurl cited
15759	75	33	76	11	This text presents a fairly narrow, and hence misleading, view of the complex issue. See <a href="#">comment 25 above</a> . [Ralph Sims, New Zealand]	Added more discussion of local food production
21515	75	32			This is a good discussion, but given that it is in nobody's interests to waste food (especially given that consumers have paid for the food they then waste), what are the plausible interventions to reduce wastage? How much of the wastage can realistically be avoided and what wastage is simply unavoidable? [Andy Reisinger, New Zealand]	Accepted, interventions and projected effects added
12197	76	1	76	11	The emission reduction potentials of food transport could be presented more systematically, especially given that there is 'robust evidence'. [Hans Poertner and WGII TSU, Germany]	Important point but did not include due to lack of space
5187	76	4	76	9	Same two references (Tobarra et al.) are noted here. [, Japan]	Corrected
21521	76	9	76	11	Nice concluding summary statement. But please change "is a climate mitigation strategy" to "can be", because in some cases it clearly is not (as the second part of the sentence recognises). "is" makes an absolute statement that in this absolute form is simply incorrect. [Andy Reisinger, New Zealand]	Accepted, changed to 'can'
12627	76	12	76	12	Suggestion to add another paragraph: 5.5.2.6 Girls' education and women's rights as demand-side measures: Increasing demand on land from food production is both linked to the increased global adoption of high-carbon diets similar to the diets of high-income, industrialised countries, as it is to global population growth. Ensuring women are able to choose the size of their families, through increased educational opportunities for girls and professional opportunities for women, as well as universal access to family planning is therefore an essential, critical demand-side measure for climate mitigation and adaptation through the food system. Pathways to a sustainable food system assume population stabilisation, with fertility rates at replacement level by 2050 (world Resources Institute 2018, Creating a Sustainable Food Future) [Carina Millstone, United Kingdom (of Great Britain and Northern Ireland)]	See section 5.1.3 and Box 5.1 for discussion on gender. Population beyond scope of chapter
21209	76	13	76	14	Section 5.6 is focusing on how mitigation can impact the land sector and associated sustainability challenges. However, it is missing one crucial sector - bioenergy. 5.6.1 discusses CDR, under which BECCS is included. However, in integrated assessment models BECCS is not the sole driver of bioenergy. Indeed, even when BECCS deployment is low, bioenergy still tends to be used extensively (for example, see Bauer et al 2018 <a href="https://link.springer.com/article/10.1007/s10584-018-2226-y">https://link.springer.com/article/10.1007/s10584-018-2226-y</a> ). This is not always widely appreciated, with many people assuming that it is BECCS specifically that produces sustainability concerns, rather than bioenergy. Therefore bioenergy warrants explicit discussion. As many of the challenges it raises overlaps with CDR, this could be achieved by reframing 5.6.1 as bioenergy and CDR, perhaps. Regardless of how this is undertaken, please include a clear discussion of bioenergy and not just conflate it with BECCS and CDR, [, United Kingdom (of Great Britain and Northern Ireland)]	Following the suggestion, we change the section title to "Land based CDR and bioenergy".

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Comment No	From Page	From Line	To Page	To Line	Comment	Response
21523	76	15	76	17	I fully agree with this opening sentence, but I don't feel this is then carried through in the following discussion. I.e. the focus (as far as mitigation is concerned) tends to be on reducing emissions from agriculture, whereas from a food security and global mitigation perspective, the issue is only partly agricultural emissions, but far more importantly the need to spare land, in ways that don't affect food security, that allow other carbon sequestration activities (such as afforestation and BECCS) to take place. This should be the central, anchoring theme and challenge for the remaining discussion (as far as mitigation is concerned, but obviously in interaction with adaptation). [Andy Reisinger, New Zealand]	We address this discussion in the revised version.
1691	76	15	76	17	The Paris agreement was made in 2015. reference is from 2014 [Renske Hijbeek, Netherlands]	We added additional recent citation.
13983	76	25	76	28	Figure 5:16. This figure and its caption needs to be clarified. When we say impacts on mitigation, due we mean potential contribution implementing mitigation actions? If so, this should be used. Impact can be interpreted in different ways  Also, some scientific information on how the conclusion on the mitigation and adaptation contributions (impacts) are derived will be useful. I do not think everyone will necessarily agree with the conclusions presented in the figure so it will be useful to provide justifications. [Sunday Leonard, United States of America]	We develop a new figure with response options instead of food system components.
18015	76	26	76	26	It is unclear why storage, either cold storage which would involve energy consumption or product storage, which may help to avoid food loss or waste, is not considered to create synergies with food system mitigation. [Beau Damen, Thailand]	We develop a new figure with response options instead of food system components.
12199	76	27	76	27	Figure 5.16: It is not clear where the evidence for this figure can be found. [Hans Poertner and WGII TSU, Germany]	We develop a new figure with response options instead of food system components. We also refer to chapter 6.
23447	76	27	76	27	CORRECT impact to potential impact [John Dixon, Australia]	Thank you we changed this.
21211	76	31	76	32	"are expected" - by whom? Better to say "Many climate modellers have invoked large-scale deployment of NETs in their emission scenarios for avoiding unacceptable climate change." [, United Kingdom (of Great Britain and Northern Ireland)]	Accepted. Text has been revised to clarify that NETs are not well established and face significant constraints to be fully scaled up.
6085	76	32	76	32	Remove the word "technologies" after CDR, There may be some controversy if all CDRs are technologies such as afforestation [, Poland]	Accepted. The section reflect nomenclature adopted in the report glossary.
40757	76		76		provide a caption to understand the figure (source references, method). Level of confidence? [Valerie Masson-Delmotte, France]	Noted, figure changed to cover food system response options
1521	76	31	77	1	Unclear what this sentence is trying to say: "Among the available NETs, carbon dioxide removal (CDR) technologies are receiving increasing attention", since NETs = CDR. Maybe there's a word missing? Like "terrestrial", as in "terrestrial carbon dioxide removal technologies"? [Oliver Geden, Germany]	Partly accepted. The text has been revised and adjusted to reflect the overall definitions in the glossary and nomenclature in the entire report. Carbon dioxide removal (CDR): Anthropogenic activities removing CO2 from the atmosphere and durably storing it in geological, terrestrial, or ocean reservoirs, or in products. It includes existing and potential anthropogenic enhancement of biological or geochemical sinks and direct air capture and storage, but excludes natural CO2 uptake not directly caused by human activities. Negative emissions: Removal of greenhouse gases (GHGs) from the atmosphere by deliberate human activities, i.e. in addition to the removal that would occur via natural carbon cycle processes.
34033	76	30	78	22	Section 5.6.1: why is here this overview on CDR and BECCS placed. Please think about the most logical place for this in the entire report, and then refer to it in other chapters only very briefly. If the best place is here, there is even more need to change the chapter title! [Elke Stehfest, Netherlands]	Rejected. This section 5.6.1 was a request of other review comments in FOD. It is well developed and prepares the ground to a deep analysis in chapter 6.

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Comment No	From Page	From Line	To Page	To Line	Comment	Response
17907	76	30	78	22	This section lacks references to three relevant papers: Minx et al 2018, Fuss et al 2018 and Nemets et al 2018. The section is also mostly about BECCS, despite the title being more general (CDR), therefore it would benefit from additional paragraphs on other CDR options, e.g. A/R and biochar, and further information about potential synergies with SDGs would be valuable and relevant for the section. Fuss et al. 2018 is a good resource for this. [Quentin Lejeune, Germany]	Partially accepted. References of systematic reviews conducted by Minx et al 2018, Fuss et al 2018 and Nemets et al 2018 were added in the text. Further discussions on other CDR technologies and SDG interactions are further developed in chapter 6 and in the x-chapter box on bioenergy. This chapter is mainly focused on food security and land interactions.
4057	76	30	78	22	In section 5.6.1 a discussion on how the effectiveness of BECCS (both technical and economic, as well as its interaction with food production) depends strongly on technological and socio-economic contexts. The SSP scenario analyses conducted by IAMs offer some insights on this. Daiglou et al. (2019) present different biomass and bioenergy (including BECCS) supply and demand scenarios highlighting the potential futures of this resource across different SSPs. The scenarios show that the CDR potential of BECCS varies significantly due to different LUC emissions (scenarios have different constraints on lands where BECCS can be applied) and technological development. Furthermore, Daiglou et al. (2017) also highlights the importance of amortisation period when determining the potential contribution of BECCS (with the conclusions applicable to other land-based CDR measures). The point I am trying to raise is that the key question is not "can land-based CDR help or not?", but rather "under what conditions are these technologies helpful, and under what conditions are they a burden?". These arguments are also supported by already cited literature Popp et al. (2017), Doelman et al. (2018).  References: Daiglou, V., Doelman, J. C., Wicke, B., Faaij A. & van Vuuren, D. P. Integrated assessment of biomass supply and demand in climate change mitigation scenarios. Global Environmental Change 54, 88-101, doi: 10.1016/j.gloenvcha.2018.11.012 (2019).  Daiglou, V., Doelman, J., Stehfest, E., Müller, C., Wicke, B., Faaij, A., & van Vuuren D.P., Greenhouse gas emission curves for advanced biofuel supply chains. Nature Climate Change 7, 920-924, 10.1038/s41558-017-006-8 (2017). [Vassilis Daiglou, Netherlands]	Accepted. References suggested were added in the sections and a deepen assessment of biomass resources/land were included.
11515	76	30	78	24	in this section soil organic carbon sequestration in view as a co-benefit of CDR, SOC is more than a co-benefit it could be the target since increasing soil organic carbon has multiple impact on crop productivity, crop quality (see Wood et Baudron 2018 (Wood S. A., Baudron F (2018) Soil organic matter underlies crop nutritional quality and productivity in smallholder agriculture. Agriculture, Ecosystems and Environment 266 (2018) 100-108. [Jean-Luc Chotte, France]	Partially accepted. The suggested reference and SOC benefits were added in the text.
33411	76	31	78	22	This report talks about BECCS throughout, but the purpose in this section should be NETs or CDRs impact on food security, but it is barely discussed at the end of the section. This should be reframed to better breakdown possible food security impacts (which are highlighted in chapter 6) including land grabs and food price. This is a huge issue, as many climate pathways rely heavily on this technology and yet it has likely negative impacts on food security which will at best make it politically contentious and may well make it unfeasible to deploy at scale. [Kelly Stone, United States of America]	Partially accepted. The text has been revised to include potential conflicts of land competition. This creates ground to chapter 6 deepen discussion. [The following references were included: (Vaughan et al. 2018; Muratori et al. 2016; Burns and Nicholson 2017.

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Comment No	From Page	From Line	To Page	To Line	Comment	Response
3839	76	13			Section 5.6, where synergies and trade-offs between mitigation, adaptation, food security, and land use are reviewed, points out repeatedly the issue of growing population; see page 5-76 lines 19-20, page 5-83 lines 2-3, page 5-84 (in box 5) lines 6-9. Keeping in mind that helping to reduce/halt the population growth would serve efficiently both mitigation and adaptation purposes, the fact that actions to this end are never mentioned, never discussed, is disturbing for a mind oriented toward science. [Philippe Waldeufel, France]	This issue of population is out of the adopted outline of the report.
21527	76	30			I read the entire section and still don't feel I get an answer at the end to key questions for policymakers: how much land do we think can be spared for BECCS before food security is becoming jeopardised? How could this land be spared? What rate of expansion is feasible? Where are pressure points most likely and most early going to arise (and hence, where do policy interventions need to focus?) [Andy Reisinger, New Zealand]	Partially accepted. Highlight literature gaps. The potential depends on local conditions and land use governance. Detail text as following: There is low confidence and low agreement on how much low productivity land is available (Lambin et al., 2013) (Gibbs & Salmon, 2015), low confidence and low agreement if the transition to BECCS will take place directly on low productivity grasslands (Johansson & Azar, 2007), incipient studies of the BE crops and climate risk zoning of BECCS options (Köberle et al. 2019) and uncertainty on the governance on agricultural frontier expansion in the deployment regions (Keles, Choumert-Nkolo, Combes Motel, & Nazindigouba Kéré, 2018). Food security may be threatened if land-based mitigation displaces crops to regions with lower productivity potential, higher climatic risk and higher vulnerability. In the hypothesis of deployment over low productivity grasslands associated with strong governance, P1 - P3 scenarios in the IPCC SR15C, i.e. up to seem reasonable to produce negative emissions without jeopardizing food security, but this relies on strong and uncertain assumptions. Reducing yield gaps and creating incentives for consumption of food items associated with high energy and protein land productivity would contribute to spare land for BECCS. There is, however, low confidence about the stability of production, risk and vulnerability to climate change in the conditions of prioritizing agricultural productivity at expenses of grasslands in large scale. Relying only on directly human edible vegetal production, particularly on the most efficient nutrient producing ones, can be very challenging from ecosystem and economic perspectives. The regional presence and the rotation with grasslands are well recognized as important to reduce biotic stress, particularly in the control of weeds, pests and diseases and to improve soil quality (Bell, Moore, & Kirkegaard, 2014), (Ernst, Dogliotti, Cadenazzi, & Kemanian, 2018), nutrient cycling, resource-use efficiency, climate resilience (Derner et al., 2017), stabilize yield and decrease economic risk (Moraine, Duru, & Therond, 2017). The answer is related to the same uncertainties of the how much land question. However, expansion rates also imply in how much more attractive to investments the BECCS option is in relation to other land use options and in relation to other investment options in the economy. So, in theory, the higher the economic attractiveness compared to food producing crops, the higher the
6087	77	1	77	2	CDR includes more activities such as sustainable forest management, therefore we suggest to change the sentence to: "CDRs include afforestation and reforestation (AR), sustainable forest management, biomass energy with carbon capture and storage (BECCS) and biochar (BC) production." We suggest to remove the word "technologies" as argument above. Afforestation and reforestation are not technologies but activities. [, Poland]	Partly accepted. The section reflect nomenclature adopted in the report glossary.

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Comment No	From Page	From Line	To Page	To Line	Comment	Response
13015	77	1	77	42	The text in this section discusses some limitations and trade-offs of CDRs. Initially afforestation and reforestation (AR) are included as CDRs. However, in most cases the trade-offs do not apply to AR (e.g. AR does not require high biomass-producing crops nor is it particularly likely to take place in meadows and pasturelands). Consider dealing with AR separately, perhaps by making reference to sections elsewhere in the document. [Aidan Farrell, Trinidad and Tobago]	Rejected. Afforestation and reforestation will indeed require land for implementation. The lowest impact of this CDR on food security would be for this to take place on meadows and pastures (see Zomer et al. 2000). 1.5C scenarios suggest that mitigation responses without BECCS, mainly based on bioenergy and AR, require large land use change, putting more pressure on food commodities and prices. See: Muratori et al. 2016.
21213	77	2	77	3	We question the assertion that of the 3 CDRs listed, BECCS is the least mature. The review "Greenhouse gas removal" by the UK's Royal Society/Royal Academy of Engineering (published September 2018, <a href="https://royalsociety.org/topics-policy/projects/greenhouse-gas-removal/">https://royalsociety.org/topics-policy/projects/greenhouse-gas-removal/</a> ) concluded Biochar has a TRL (Technology Readiness Level) of 3-6 whereas the TRLs for bioenergy are 7-9 and for CCS, 4-7. We suggest removal of the sentence "Among them, BECCS is the least mature as they face challenges similar to fossil fuel CCS." [United Kingdom (of Great Britain and Northern Ireland)]	Accepted. Text revised: BECCS are currently immature, but we do not compare it against other CDRs
1523	77	2	77	3	Not sure if it's safe to say that BECCS is the least mature of the mentioned methods, given that there is no large-scale biochar production in facilities that control emissions yet. Maybe it's not really necessary to make that comparison here? [Oliver Geden, Germany]	Accepted. Text revised: BECCS are currently immature.
21215	77	5	77	7	I would question some of the choices of reference here. Anderson and Peters are not questioning the effectiveness of BECCS as such, rather they are primarily critiquing the reliance on it in IAMs. Hoegh-Guldberg is chapter three of SR1.5, so it's not really clear what relevance that has in this context. Instead, I would suggest the following - To question the effectiveness of BECCS, use Vaughan et al 2016 ( <a href="http://iopscience.iop.org/article/10.1088/1748-9326/11/9/095003/meta">http://iopscience.iop.org/article/10.1088/1748-9326/11/9/095003/meta</a> ). For alternatives to BECCS heavy pathways, use Grubler et al 2018 ( <a href="https://www.nature.com/articles/s41560-018-0172-6">https://www.nature.com/articles/s41560-018-0172-6</a> ) and van Vuuren et al 2018 ( <a href="https://www.nature.com/articles/s41558-018-0119-8">https://www.nature.com/articles/s41558-018-0119-8</a> ). Although please also point out that the scenarios without BECCS still have afforestation as this is an important point that often gets missed and is clearly relevant to land use issues. [United Kingdom (of Great Britain and Northern Ireland)]	Accepted. Suggested references added.
21217	77	5	77	7	Please include Fuss et al 2018 in the references - it's a key reference in SR1.5 and is particularly valuable as a review of CDR potentials. Fuss, S. et al., 2018: Negative emissions – Part 2: Costs, potentials and side effects. Environmental Research Letters, 13(6), 063002, doi:10.1088/1748-9326/aabf9f. [United Kingdom (of Great Britain and Northern Ireland)]	Accepted. The reference to Fuss et al (2018) is relevant to the paragraph as it was included.
6489	77	5	77	7	This critical view of BECCS is extremely important and must stay; it could even be improved by linking this to threats on food security caused by BECCS. [Sara Lickel, France]	We have improved the text to stress this point (however a deeper discussion on BECCS, its benefits and threats is further developed in ch6)
13013	77	14	77	19	The great potential of biochar is a strong theme in this chapter and in the rest of this report. Biochar is still a relatively new innovation and the full implications are not explained here. It would be good to direct the reader to the key argument for biochar, by linking to section 4.11.7 or perhaps by adding a cross chapter box. [Aidan Farrell, Trinidad and Tobago]	Partially accepted. The text has been modified to better reflect the interlinkages with Section 4.11.7. However, a new x-chapter box is not possible at this stage.
27195	77	14	77	19	Please support this statement with more scientific evidence and cite more than one article. [Germany]	We refer to Chapter 4 for more evidence

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Comment No	From Page	From Line	To Page	To Line	Comment	Response
21219	77	16	77	19	The conclusions about biochar are based on just 2 references, one from 2006, and do not acknowledge the risks associated with biochar. We'd prefer this text to be replaced with "The resulting biochar can be applied to soil, but there is considerable uncertainty about the benefits and risks of this practice." followed by a reference to an existing review of the literature eg the Royal Society report referenced above. The literature should not be reviewed here, that's out of scope. [, United Kingdom (of Great Britain and Northern Ireland)]	Accepted. The text has been modified and the reference to the Royal Society SR included
21221	77	16	77	19	Cross reference section 4.11.7 of chapter 4. [, United Kingdom (of Great Britain and Northern Ireland)]	Accepted
17903	77	20	77	20	Is it correct to say "CDRs"? Should it rather be "CDR" or "CDR technologies"? [Quentin Lejeune, Germany]	The use of CDR and NET terminology is in accordance to glossary nomenclature.
14081	77	20	77	25	Comment: It is important to broaden (but briefly) the discussion related with biodiesel production and its associated ghg emissions. [Ana Felicien, Venezuela]	Rejected. The discussion around biodiesel and GHG emisisions while relevant is out of scope of this section.
14083	77	20	77	25	Comment: Include Fargione, J., Hill, J., Tilman, D., Polasky, S., & Hawthorne, P. (2008). Land clearing and the biofuel carbon debt. Science, 319(5867), 1235-1238. [Ana Felicien, Venezuela]	Rejected. This reference is from 2008. As much as possible the SR aims at revising literatue post AR5.
14085	77	20	77	25	Comment: Include Searchinger, T., Heimlich, R., Houghton, R. A., Dong, F., Elobeid, A., Fabiosa, J., ... & Yu, T. H. (2008). Use of US croplands for biofuels increases greenhouse gases through emissions from land-use change. Science, 319(5867), 1238-1240. [Ana Felicien, Venezuela]	Rejected. This reference is from 2008. As much as possible the SR aims at revising literatue post AR5.
7545	77	20	77	25	This should be rephrased to BECCS; not all CDRs require biomass. [Durwood Zaelke, United States of America]	Accepted. Text modified accordingly. The updated versin included Land based CDR
7621	77	20	77	25	This should be rephrased to BECCS; not all CDRs require biomass. [Kristin Campbell, United States of America]	Accepted. Text modified accordingly. The updated versin included Land based CDR
12553	77	25	77	25	Suggestion to add the following sentence at the end of the paragraph: Moreover, there is a significant opportunity cost with using land for CDR technologies over food production. Food demand-side measures must therefore be prioritised over the deployment of CDR technologies. Where CDR technologies are used, due attention must be paid to biodiversity, soil health and the preservation of ground cover, in addition to carbon sequestration potential. Failure to do this would result in increased global warming potential and negative net environmental impact of crops grown for CDR technologies, as has been the case with maize grown for energy generation through anaerobic digestion. (Styles et al. 2015; Farnworth & Melchett, 2015). (Styles, D., Gibbons, J., Williams, A. P., Dauber, J., Stichnothe, H., Urban, B., ... & Jones, D. L. (2015). Consequential life cycle assessment of biogas, biofuel and biomass energy options within an arable crop rotation. Gcb Bioenergy, 7(6), 1305-1320.; Farnworth, G., & Melchett, P. (2015). Runaway maize: Subsidised soil destruction. Soil Association. Available at <a href="https://www.soilassociation.org/media/4671/runaway-maize-june-2015.pdf">https://www.soilassociation.org/media/4671/runaway-maize-june-2015.pdf</a> ) [Carina Millstone, United Kingdom (of Great Britain and Northern Ireland)]	Parrrtly accepted. Potential trade-offs between ecosystem services and large scale expansion of land based CDRs were included. Notheless detailed interlinkage assessment of demand and supply side mitigation responses is included in ch6 of this SR.
6391	77	26	77	34	Can anything be added here about crop residues? Some scenarios rely to a large degree on crop residues for biomass, which have very different implications for land use requirements. Additionally, niche options for bioenergy were covered briefly in SR1.5, and inclusion here would be valuable. [, Gambia]	Rejected. Out of scope.

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Comment No	From Page	From Line	To Page	To Line	Comment	Response
21223	77	26	77	34	Re-ordering the sentences of this paragraph would allow very important conclusions to be stated. Eg keep first sentence, follow this with the last sentence but omitting "In comparison", then say something like "We conclude that scenarios with BECCS deployment rates requiring expansion in land use much in excess of this level are...." unsustainable? infeasible? We leave it to the authors to make their own assessment, comment on the scenarios cited in IPCC 2018, make recommendations about the choice of scenarios for modelling in future and add these important point to section B4 of the SPM. [, United Kingdom (of Great Britain and Northern Ireland)]	Partly accepted. Text changed accordingly.
14711	77	28	77	28	Change `109°990` to `109-990`. [Adalberto Benavides-Mendoza, Mexico]	Accepted
39717	77	28	77	28	Typo: 109°990 [, United States of America]	Accepted
28515	77	28	77	28	Check symbol used in range values for BECCS [Valerie Kapos, United Kingdom (of Great Britain and Northern Ireland)]	Accepted
1909	77	28	77	28	Strange representation of a number, 109°990. Is there a typo? [William Lahoz, Norway]	Accepted
21225	77	29	77	31	BECCS, AR and biochar are different forms of CDR and I don't think that providing one headline number of 20Mha is very informative. The situation is likely much more complex than this single number suggests. For example, in terms of forest area, in the scenario database the range in a 1.5C scenario is -4.8 to 23.7MHa p/a (see Table2.9 of SR1.5). Whilst forest area isn't a specific technology, this example demonstrates the uncertainty and complexity here. Therefore, please provide annual change per CDR technology. [, United Kingdom (of Great Britain and Northern Ireland)]	Accepted. Text modified to include the range of land required to CDRs in 1.5C scenarios.
21227	77	35	77	42	I am unclear about the point of this paragraph. Is it saying that sustainable intensification should be considered as an alternative to CDR? Why is SI being introduced into a paragraph that primarily seems to be about the most likely locations for CDR? Additionally, it seems to be making a generally quite positive point about the prospects for CDR - if it is likely to take place on currently unproductive land, then presumably many of the related sustainability concerns are less significant. Therefore, please reword to make your point on the land use implications of CDR clearer. [, United Kingdom (of Great Britain and Northern Ireland)]	Partly accepted. Text revised to include uncertainty and risk associated to SI.



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Comment No	From Page	From Line	To Page	To Line	Comment	Response
12555	77	37	77	38	Challenge to the sentence: 'SI of pasture would procure co-benefits through increasing soil carbon stocks as well as mitigating livestock emissions.' and suggested replacement with the following sentence: While it has been argued that ruminant methane emissions can be offset by carbon sequestration in grass-based ruminant systems (de Oliveira Silva et al. 2016), a recent comprehensive study found that – although there is potential for significant sequestration in certain localized situations – at an aggregate global level, the potential benefits from sequestration are substantially outweighed by the animal’s methane and other emissions (Garnett et al., 2017). In the absence of a technological solution, this trade-off between grassland use and GHG emissions from ruminants will be unavoidable (Van Zanten et al. 2019). Relying on uptake and offsetting of emissions through pasture carbon sequestration, compared to emission avoidance, is associated with several complications and uncertainties; carbon sequestration rates will diminish with time as soils become saturated (while methane emissions from livestock continue), soil carbon sequestration is reversible (Smith 2012), a larger sequestration potential could potentially be achieved with wild and planted forests (Röös et al. 2017).(Garnett, Tara, Cécile Godde, Adrian Muller, Elin Röös, Pete Smith, Imke de Boer, Erasmus zu Ermgassen et al. Grazed and Confused?: Ruminating on Cattle, Grazing Systems, Methane, Nitrous Oxide, the Soil Carbon Sequestration Question-and what it All Means for Greenhouse Gas Emissions. Food Climate Research Network, 2017.; Smith, Pete. 2012. 'Soils and Climate Change'. Current Opinion in Environmental Sustainability, Terrestrial systems, 4 (5): 539–44. <a href="https://doi.org/10.1016/j.cosust.2012.06.005">https://doi.org/10.1016/j.cosust.2012.06.005</a> ; [Carina Millstone, United Kingdom (of Great Britain and Northern Ireland)])	Please note that the reasoning of the challenge is to present evidence that the changes in soil carbon stocks are not enough to outweigh ruminants' emissions. However, the text been challenged is indicating that the increasing demand for land-based mitigation, in absence of deforestation, will promote higher productivity in the remaining area. Greater productivity (higher NPP) is associated with greater soil carbon stocks and this is very strongly supported in the literature, e.g. (Guo & Gifford, 2002); (Neely, Bunning, & Wilkes, 2009); (Gerber et al., 2013); (Soussana et al., 2019; Stahl et al., 2016); (Viglizzo, Ricard, Taboada, & Vázquez-Amabile, 2019). Also, there is plenty of evidence that higher livestock productivity is associated with lower emission intensities (e.g. Opio et al., 2012; Gerber et al., 2013). Text was improved for clarity.
1911	77	40	77	40	periodic flooding. [William Lahoz, Norway]	changed
27197	77	20	78	22	Some of the statements here do not hold true for all CDR approaches. At times the term CDR seems to imply only BECCS or possibly afforestation. Please use the most specific term applicable to each statement in this section. For example if only BECCS and afforestation are meant (as opposed to DACCS or Enhanced Weathering), then it is better to refer to "BECCS and afforestation". [ , Germany]	Accepted. Full revision of BECCS/CDRs/NET nomenclature throught out the chapter to make sure we use an consistent terminology.
21525	77	43	78	9	This discussion seems to be predicated on the assumption that BECCS can only be used to meet local demand. But if it were used to produce hydrogen, it could be transported around the world like fossil fuels. Oil exports from the middle east are not constrained by the low energy demand of the middle east! [Andy Reisinger, New Zealand]	Rejected. While relevant this discussion is out of the scope of the section. BECCS could eventually be used to meet international demand. To do so, however, we need an international institutional capacity to account for carbon credits and to consolidate the international carbon market.
1525	77	43	78	9	The regional CDR distribution demands a more nuanced treatment. It should distinguish between AF/RF and BECCS. In the first case, regional distribution is strongly affected by (avoidance of negative) albedo effects, which leads to prominence of tropical zones (see Kreidenweis et al. 2016, in Env Res Letters 11, 085001). In the latter case, models usually only count where negative emissions are credited (location of the BECCS facility), not where the biomass comes from or where the CO2 is finally stored (see Peters/Geden 2017, in Nat. Clim. Change 7, 619-621) [Oliver Geden, Germany]	Partly accepted. The need of a World institutional governance to account for BECCS carbon credits has been included in the text.
13017	78	1	78	9	The use of different units in diffeent sentences is confusing- can this be rationalised. [Aidan Farrell, Trinidad and Tobago]	Partially accepted. Units were standardised using the IPCC SRCL guidelines.
28517	78	3	78	3	Should 'mtoe' be capitalised? [Valerie Kapos, United Kingdom (of Great Britain and Northern Ireland)]	Accepted.
17905	78	6	78	9	If projected increases in energy demand are considered, how does this change the calculation? [Quentin Lejeune, Germany]	In 1.5C pathways, as presented in the IPCC SR15C, the global final energy demand scenarios in 2100 varies from 235 to 948 EJ/yr, compared to 317-414 EJ/yr in 2010.

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Comment No	From Page	From Line	To Page	To Line	Comment	Response
12549	78	9	78	9	Suggestion to add the following sentence at the end of the paragraph: Strong governance for sound implementation of CDRs technologies will need to be instituted in investment countries to ensure the climate benefits of BECCs technologies are reaped. [Carina Millstone, United Kingdom (of Great Britain and Northern Ireland)]	Accepted. Text modified as follows : "There is high agreement and strong evidence that deployment of BECCS will require ambitious investments and policy interventions (Peters and Geden 2017) with strong regulation and governance of bioenergy production to ensure protection of forests, food security and climate benefits (Vaughan et al. 2018; Muratori et al. 2016; Burns and Nicholson 2017), and that such conditions may be challenging for developing countries."
26181	78	16	78	18	Delete the conjectural end to this sentence ("but those impacts could be strong, with food prices doubling under some model x scenario combinations.") [Reid Detchon, United States of America]	Accepted. Text revised.
12557	78	17	78	17	Suggestion to add the following sentence at the end of the paragraph: Moreover, crops grown for CDR technologies will also contribute to soil depletion and loss of fertility. As one inch of topsoil takes from 500-1000 years to form (Singh and Kant, 2007), the overuse of land for CDRs risk further jeopardising future food security. [Carina Millstone, United Kingdom (of Great Britain and Northern Ireland)]	Rejected. See Cowie et al 2006. "although there may be some decline in soil carbon associated with biomass production, this is negligible in comparison with the contribution of bioenergy systems towards greenhouse mitigation"
1913	78	17	78	17	"...some model x ..." sounds vague. I suggest rephrasing. [William Lahoz, Norway]	Accepted.
11517	78	17	78	18	I would suggest to include after line 17 a paragraph addressing the role of soils as a Carbon sink and its multiple co-benefits introducing the LDN putting forward the fact that managing SOC stock impact the 3 Rio Conventions. References Cowie et al. (2017); Soussana et al. (in press), Minsnany et al. (2017), Nath et al. (2018); Zomer et al. (2017) [Jean-Luc Chotte, France]	Accepted, added text.
6491	78	18	78	22	This part calling for more impact assessments of BECCS implementation, especially on socio-economic consequences and food security must stay and appear in the SPM. [Sara Lickel, France]	Rejected. The impacts of mitigation responses are developed in ch6.
1915	78	29	78	29	"Somehow" is vague. I suggest omission. [William Lahoz, Norway]	"somehow" is removed.
21229	78	32	78	46	This discussion of Hasegawa et al could be shortened. A detailed description of a single paper is inconsistent with the way individual references are treated elsewhere in the text. The key message to convey from this paper is that a carbon tax increases food prices and also reduced land availability etc. You do not need to describe the SSPs etc. [, United Kingdom (of Great Britain and Northern Ireland)]	The discussion has be shortened.
1917	78	33	78	35	The phrase is incomplete, as it does not state the purpose of the work of Hasegawa et al. [William Lahoz, Norway]	This phrase has been changed.
13019	78	35	78	38	The interpretation of the scenarios and of figure 5.17, is not clear. Perhaps expand the figure legend. [Aidan Farrell, Trinidad and Tobago]	We included an improved figure here.
1711	78	38	78	39	Your sentence "Increasing food production by using more fertilisers in agricultural fields could maintain crop yield in the face of climate change, but may result in greater overall GHG emissions" . Would be good to mention also the negative effects of intensive use of chemical fertilizers in the soil fertility. [Sisira Withanachchi, Germany]	We are unable trace back this comment.
6493	78	39	78	46	showcasing how taxing GHG emissions or land-based mitigation options can threaten food security and livelihoods of the poorest is extremely important in the face of the challenge we are facing. The authors should make sure this parts stays in and is well reflected in the SPM. [Sara Lickel, France]	We try our best to highlight this in SPM.

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Comment No	From Page	From Line	To Page	To Line	Comment	Response
34045	78	24	79	11	I do not see any mentioning of the beneficial effect of higher product prices on producers and income. This income effect can be substantial, is the other side of the story of food prices and food security. And this income effect is both relevant for high-income countries, and as well for lower-income countries where large parts of the population are producers. [Elke Stehfest, Netherlands]	The beneficial effect is mentioned.
29689	78	32	79	2	This study only seems to look at global costs in the near-term - what about longer term costs and regional and local effects? Could this assessment describe what climate change impacts are included here, are what assumptions underlie the analysis? [, Saint Lucia]	This is an important point aspect. However, we did not find studies in this direction.
17909	78	32	79	2	Can these studies be compared with Lotze-Campen et al. 2013: Impacts of increased bioenergy demand on global food markets: an AgMIP economic model intercomparison, <a href="https://doi.org/10.1111/agec.12092">https://doi.org/10.1111/agec.12092</a> ? [Quentin Lejeune, Germany]	The suggested study is included.
17911	78	32	79	2	The assessment of Hasegawa et al. 2018 should include a more critical / balanced view of the study. The cost effects are only considered globally, and the authors acknowledge that local and longer-term (beyond 2050) climate change impacts could be more serious than mitigation effects (and how does this differ regionally?). This should be highlighted. What impacts are included in the study? Often extreme events are excluded. It should also be noted earlier on that the potential side effects of mitigation can be avoided, and that the economic indicators used in the study should be considered alongside institutional and ethical considerations. Finally, the study also highlights some elements of mitigation that can have benefits for food security, and that carbon tax revenues can be used as a new source of income. [Quentin Lejeune, Germany]	Many thanks. We provided the information provided in the study.
21529	78	32	79	11	I feel the authors need to make much clearer that Hasegawa and Fujimore studies basically used a "blunt" price instrument, that prices all emissions wherever they occur with no regard to social impacts. Almost no actual policy is actually constructed like that. So I think these studies have to be presented as counterfactuals to any real-world price-based policy, to avoid the impression that pricing agricultural emissions is inherently bad thing. The authors should also review and include the study by Henderson et al 2017: The power and pain of market-based carbon policies: a global application to greenhouse gases from ruminant livestock production. Mitigation and Adaptation Strategies for Global Change, 1-21. [Andy Reisinger, New Zealand]	We agree with you. However, we did not discuss policy instrument here.
21231	78	32	79	11	It should be made clear whether CDRs are included when "mitigation" is mentioned in this section. The definition of "Mitigation" in SR1.5's glossary does not explicitly include CDRs and in this respect is different from the definition for SRLand. The phrase "land based mitigation" (page 78, row 42) is not included in the glossary. CDRs are defined, but the definition is different to that used in SR1.5. The SRLand definition says CDRs are "a special type of mitigation" but the SR1.5 definition doesn't say that. Why? Ideally IPCC should be sticking to one single set of definitions in all products of the 6th cycle. In short, this section needs to state very clearly what kind of "land based mitigation" leads to less land availability for food production, eg by defining the phrase in the glossary and using it consistently throughout the report. The definition needs to be clear whether it refers just to CDRs or includes mitigation measures which are not CDRs. We've made the same comment against the SPM. [, United Kingdom (of Great Britain and Northern Ireland)]	CDR is now included in the glossary of the SRCL report.

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Comment No	From Page	From Line	To Page	To Line	Comment	Response
30683	78	24	80	6	Reference you missed studying and citing in this section is: FAO. 2018. The future of food and agriculture - Alternative pathways to 2050. Rome. <a href="http://www.fao.org/publications/fofa/en/">http://www.fao.org/publications/fofa/en/</a> . Please add a paragraph on discussing the findings of the business as usual scenario and of the towards sustainability scenario on agricultural prices (Section 4.3, pp. 98-100), highlighting also the different RCPs that underlie these two scenarios (RCP 6.0 and 4.5 respectively) and their impacts on crop yields (Section 3.8, pp. 76-82), cropping intensities (Section 3.9, pp. 83-85), land and water expansion potential (Section 3.10, pp. 85-90) as well as livestock (Section 3.11, pp. 91-92) and fish production (Section 3.12, p. 93). [Lorenzo Giovanni Bellù, Italy]	This section is more about adaptation mitigation synergeis. Thus, we did not discuss about this important publication of FAO.
34035	79	3	79	11	There is more literature on how the possibly adverse effect of land-based mitigation can be avoided. E.g. Doelman et al (in review), Van Vuuren et al. 2018, and .... Please add all there, and make this part more substantive. Given the current debate, one might even state that there is agreement that additional policies re required to make CDR works and avoid negative interference with food security and other SDGs. [Elke Stehfest, Netherlands]	We discuss CDR in the next section.
21233	79	5	79	11	This section downplays the adverse effects of "mitigation policies" by avoiding stating what these effects are. Most readers will already know that reduced supply will lead to higher prices. How much higher? Are there circumstances in which there would simply not be enough food?The FAO Strategic Objectives say "Current agricultural and food systems must increase production by 60 percent since not much new land is available." (to feed an expected population of 9 billion, <a href="http://www.fao.org/about/what-we-do/en/">http://www.fao.org/about/what-we-do/en/</a> ). Is it possible to say what will be the net effect of mitigation policies and improved agricultural practices on the feasibility of meeting this increase in production? Likewise most readers will already know that international aid and reallocation of income can shield the most vulnerable, but such measures have their limitations. If it is likely that mitigation policies will increase the need for such measures this is a very important finding which should be stated in the SPM. [, United Kingdom (of Great Britain and Northern Ireland)]	We discuss CDR in the next section.
27199	80	1	80	5	Figure 5.17 provides evidence for potentially dramatic conclusions. According to this figure mitigation efforts based on bioenergy that will result in a 2°C world could have greater negative impacts on food security than resulting from a 2.7°C warmer world. This should be summarized in a statement in the text (with the appropriate qualifier for evidence and agreement) and be considered for the executive summary as well as the SPM. If we understand correctly, this figure is based on results of multiple model studies. However, it should made clear how and which "climate effects" on the food system are considered in this analysis (e.g. increased risks of extreme events such as droughts or hurricanes at 2.7°C compared to 2°C, loss of ecosystems). In addition, also a 2.7-degree world requires mitigation actions. Hence, why are no "mitigation effects" shown for this pathway in Figure 5.1.1.7? [, Germany]	We modify the figure.
17913	80	1	80	5	Given the caveats in Hasegawa's analysis (see comment above), this figure is not very useful. At the very least it should be accompanied by clear explanations of assumptions, timescales, and what climate change impacts are not included. [Quentin Lejeune, Germany]	We disagree this comment. Would be glad to cite other papers that investigate this issue in the holistic way.
1919	80	4	80	5	I suggest the authors introduce MAgPIE (as well as MAGNET in L. 5) in the caption. [William Lahoz, Norway]	thanks we did this.

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Comment No	From Page	From Line	To Page	To Line	Comment	Response
25555	80	7	80	7	We suggest to entitle this section « sustainable integrated agricultural practices ». Moreover it should be precised that the different approaches (agroecology...) are not exclusive from one to another. [ France]	Agreed and changed
34037	80	7	81	6	Section 5.6.3. The SPM talks about "sustainable land management", and I would expect to see this expression used and explained here. [Elke Stehfest, Netherlands]	Changed the title accordingly to match with SPM.
26183	80	7	81	6	This introduction would benefit from a definition of terms, especially agroecology - or perhaps a Venn diagram showing how the approaches overlap and/or conflict. Perhaps a summary statement could be added to elucidate that these are similar and in many cases complementary approaches that offer much promise for benefit to farmers as well as to the environment. [Reid Detchon, United States of America]	An introduction is added to clarify integration and the existence of complementarity/differences among the options
2485	80	7	81	7	Please consider including a brief explanation what you consider to be "integrated" agricultural practices. [Sigrid Kusch-Brandt, Germany]	An introduction is added to clarify integration and the existence of complementarity/differences among the options
26693	80	8	81	6	Are these real and discrete systems or more a set of labels to discuss improved agricultural practices, many of them overlapping or contested in meaning? [John Morton, United Kingdom (of Great Britain and Northern Ireland)]	An introduction is added to clarify integration and the existence of complementarity/differences among the options
14087	80	7	83	43	Comment: include recovering indigenous and traditional sustainable farming practices, these are associated to agroecology but deserves an own section because their cultural specificity [Ana Felicien, Venezuela]	The reliance of Agroecology on ILK has been highlighted, but there is a section on ILK previous in the chapter
14089	80	7	83	43	Comment: Include Altieri, M. A., & Nicholls, C. I. (2017). The adaptation and mitigation potential of traditional agriculture in a changing climate. Climatic Change, 140(1), 33-45. [Ana Felicien, Venezuela]	The reference was already in the text
14091	80	7	83	43	Comment: Include Lin, B. B., Perfecto, I., & Vandermeer, J. (2008). Synergies between agricultural intensification and climate change could create surprising vulnerabilities for crops. AIBS Bulletin, 58(9), 847-854. [Ana Felicien, Venezuela]	Old reference
14093	80	7	83	43	Comment: Include Nyong, A., Adesina, F., & Elasha, B. O. (2007). The value of indigenous knowledge in climate change mitigation and adaptation strategies in the African Sahel. Mitigation and Adaptation strategies for global Change, 12(5), 787-797. [Ana Felicien, Venezuela]	It has been added to the indigenous knowledge sub-section in the adaptation section
28523	80	7	83	43	The importance of agrobiodiversity for the resilience of food production, as described in this section and mentioned elsewhere in the chapter, is not captured in the executive summary. [Valerie Kapos, United Kingdom (of Great Britain and Northern Ireland)]	We reject this suggestion due to limited space at ES.
18017	80	7	88	8	The quality of the assessment of each of these practices seems to vary widely. The discussion of agro-ecology and climate-smart agriculture would benefit from the more critical approach adopted for the review of conservation agriculture and intensive agriculture. [Beau Damen, Thailand]	The agro-ecology and CSA is now discussed from both positive and negative sides
22677	80	7	88	9	A lot of duplication with previous sections on adaptation and mitigation. It is also very unclear what is 'in' and what is 'out' of the section. [Anastasios Kentarchos, Belgium]	We tried to remove the duplications.
23879	81	1	81	1	Consider adding the reference 'Pratibha, G. Srinivas, I. Rao, K.V. Shanker, A.K., Raju, B.M.K., Choudhary, D.K., Srinivas Rao, K. Srinivasarao, Ch. and Maheswari M. 2016. Net global warming potential and greenhouse gas intensity of conventional and conservation agriculture system in rainfed semi arid tropics of India. Atmospheric Environ. 145: 239-250' [ India]	Added

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Comment No	From Page	From Line	To Page	To Line	Comment	Response
23857	81	1	81	2	The benefits of conservation agriculture in mitigation and adaptation of climate change in Indian context has been extensively reviewed and presented in the paper by Indoria et al., (Indoria, A. K., C.H. Srinivasa Rao, K. L. Sharma, and K. Sammi Reddy, 2017: Conservation agriculture – a panacea to improve soil physical health. Curr. Sci., 112, 52–61). This reference may be included along with Aryal et al 2016., Sapkota et al., 2015) [, India]	Added
17889	81	5	81	6	Title change to "Vulnerability and resilience measures to increasing extremes and volatility" as the first part, section 5.3.2.1 does not actually address resilience (as a positive concept), rather the exposure and vulnerability of the global food system. [Quentin Lejeune, Germany]	We are unable trace back this comment.
11519	81	6	81	6	add the following sentence. Sanz et al. (2017) provide an analyse of multiple benefits of sustainable land managemen. [Jean-Luc Chotte, France]	Thank you. A summary of the report included in sustainable integrated agricultural practices
26695	81	8	81	22	This does not adequately convey the range of meanings that different authors ascribe to "agroecology" , from its definition as a science ("The science of sustainable agriculture, studying interactions between plants, animals, humans and the environment within agricultural systems - Royal Society) to its use in a political sense by Altieri [John Morton, United Kingdom (of Great Britain and Northern Ireland)]	We address comment together with 100
32599	81	8	81	22	<p>Agrobiodiversity, use of indigenous knowledge and local knowledge and developing local food systems are all included and part of agroecological practices practiced by farmers from millennia across geographies and cultures. The report clumps these terms together and (perhaps) unwittingly undermines agroecology as a tool for climate change mitigation and adaptation, without giving agroecology its due in the document.</p> <p>It is important to parse out these terms- indigenous knowledge, local knowledge, and agroecology- their role in local food systems and in being tools for climate change adaptation and mitigation. Clearly, indigenous knowledge and local knowledge cannot be substituted to agroecology. Based on current text, these are used interchangeably- diminishing their value and impact as tools that can change the course of climate events.</p> <p>Indigenous knowledge mentioned many times in all the chapters is a dynamic knowledge system and a way of life of diverse indigenous peoples. The knowledge of the indigenous communities evolve over time, landscapes, social and cultural practices and structures, a result from their close relationships with and responsibilities to the natural resources (land, water, forests-plants/animals etc.) which is vital to the nurture indigenous people and it reflects the dynamism and plurality of this knowledge, also reflecting the living indigenous governance systems, cultural contexts and access to resources (Berkes et al 2000).</p> <p>Agroecology provides a multidimensional view of food systems within ecosystems, building on traditional knowledge, indigenous knowledge and co-evolving with the experiences of local people, the available autochthonous natural resources, access to these resources, and the ability to pass-on/share knowledge between and with communities and generations, emphasizing the inter-relatedness of all agroecosystem components and the complex dynamics of ecological processes (Vandermeer, 1995). Agroecological practices recycle biomass, regenerate soil biotic activities, strive to attain balance in nutrient flow securing favorable soil and plant growth conditions, minimize loss of water, nutrients and better harvesting of solar radiation by efficient microclimate management, soil cover, appropriate planting time and diversity, promoting ecological processes and services such as nutrient cycling, predator/prey interactions, competition, symbiosis, successional changes etc. to benefit human and non-human communities in the ecological sphere, with fewer negative environmental or social impacts and fewer external inputs (Vandermeer, et al., 1998,</p>	Terms have been clarified. The text on agroecology has been expanded and references proposed added

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Comment No	From Page	From Line	To Page	To Line	Comment	Response
6495	81	8	81	22	We welcome the inclusion of agroecology as a way to enhance food security and to rethink food systems in the light of climate change. This part should be strengthened by broadening the scope of agroecology to more than only "poor smallholder farmers in marginal environments". Agroecology should be presented and analysed both from an adaptation point of view (crop diversification, soil conservation, etc), from a local and territorial food system perspective, and from a GHG reduction perspective (from the use of less fertilizers, local food systems requiring less transport, etc). [Sara Lickel, France]	Suggestion added
6497	81	8	81	22	For useful reference to strengthen this part: Dooley et al., 2018, Missing pathways to 1.5°C, pp 22-27; Secours catholique - Caritas France, Supporting the agroecological transition, 2018 [Sara Lickel, France]	Could not find the reference
12559	81	13	81	13	Suggestion to add the following sentence at the end of the paragraph: The climate change adaptation potential of agroecology is in addition to its mitigation role. Agroecology requires few inputs, especially fertilizers and that sequesters soil carbon (Goh, 2011). (Goh, K. M. (2011). Greater mitigation of climate change by organic than conventional agriculture: A review. <i>Biological Agriculture &amp; Horticulture</i> , 27(2), 205-229.) [Carina Millstone, United Kingdom (of Great Britain and Northern Ireland)]	The idea has been added, reference added too
25557	81	14	81	22	If this objective is relevant, they are more objectives that could be developed. For instance, agroecology is relevant as well for large scale agriculture in North and South so we propose to add "and any other farmers" after (Altieri 2002) line 15. We also suggest to put "benefits" instead of objectives line 14. Diversification of agriculture, agroforestry, ecosystem based adaptation and others are quite often mentioned, but agroecology no, so we propose to add a box in the SPM, and in the chapter 6 and 7, and in the glossary, to clarify that agroecology encompasses all this, so it's present even when not mentioned. [, France]	Thank you edits incorporated as suggested. We cannot include box in SPM due to length limit.
27201	81	25	81	26	Please refer to the FAO definition, see <a href="http://www.fao.org/docrep/018/i3325e/i3325e.pdf">http://www.fao.org/docrep/018/i3325e/i3325e.pdf</a> . We are very surprised that the FAO sourcebook, the key source at UN level, is not cited in the discussion of CSA and we strongly request considering this source and adding it to the references. In addition, please check the more recent FAO publication from Lipper et al., if positive examples can be extracted, e.g., produce more with less (input) while increasing resilience and reduce GHG emissions. In addition, please replace "Some have put forward ..." by "The FAO has defined in the Climate Smart Agriculture Sourcebook (FAO, 2013) ...", please refer to CSA as a concept developed at UN level. [, Germany]	Thank you. The suggested reference is cited and added in the references

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Comment No	From Page	From Line	To Page	To Line	Comment	Response
27203	81	26	81	29	<p>Please be consistent with the FAO-definition and mention adaptation and mitigation at the same level as development and food security in the first sentence, as outlined e.g. at the FAO website at <a href="http://www.fao.org/climatechange/epic/activities/what-is-climate-smart-agriculture/en/#.XDxm8xi1Ks8">http://www.fao.org/climatechange/epic/activities/what-is-climate-smart-agriculture/en/#.XDxm8xi1Ks8</a>: "What is Climate Smart Agriculture? Climate Smart Agriculture (CSA) aims to enhance the capacity of the agricultural systems to support food security, incorporating the need for adaptation and the potential for mitigation into sustainable agriculture development strategies. CSA proposes more integrated approaches to the closely linked challenges of food security, development and climate change adaptation/mitigation, to enable countries to identify options with maximum benefits and those where trade-offs need management. CSA recognizes that the implementation of options will be shaped by specific country contexts and capacities, as well as enabled by access to better information, aligned policies, coordinated institutional arrangements and flexible incentives and financing mechanisms. The concept of CSA is evolving and there is no one-size-fits-all blueprint for how it might be pursued." Please see also our comment on the glossary and amend it accordingly. [ , Germany]</p>	Thank you. The suggestion addressed, suggested reference cited and included in the reference section.
12577	81	29	81	29	<p>Addition at the end of the paragraph: These goals must be pursued in conjunction with demand-side measures: indeed, food security is not threatened only by low productivity but by high-carbon diets in high-income countries and high levels of global food loss and waste as outlined in earlier sections. The greenhouse gas emissions reduction and land sparing potential of dietary change and food waste prevention dwarf the contributions of supply-side interventions. [Carina Millstone, United Kingdom (of Great Britain and Northern Ireland)]</p>	Agreed. This issue is covered under demand-side miigation section
23849	81	30	81	31	<p>Extensive work has been done on climate resilient agriculture in 151 vulnerable districts in India and the results were published in Advances in Agronomy. This reference may be quoted (Srinivasa Rao, C. H., K. A. Gopinath, J. V. N. S. Prasad, Prasannakumar, and A. K. Singh, 2016: Climate resilient villages for sustainable food security in tropical India: Concept, process, technologies, institutions, and impacts. Adv. Agron., 140, 101–214, <a href="https://doi.org/10.1016/bs.agron.2016.06.003">https://doi.org/10.1016/bs.agron.2016.06.003</a>) [ , India]</p>	Suggested reference cited and included
25559	81	30	81	37	<p>This part corresponds also to agroecology. this could be put as well in para 5.6.3.1. Diversification of agriculture, agroforestry, ecosystem based adaptation and others are quite offer mentioned, but agroecology no, so we propose to add a box in the SPM, and in the chapter 6 and 7, and in the glossary, to clarify that agroecology encompasses all this, so it's present even when not mentioned. [ , France]</p>	It better fits here as examples of CSA practices
25561	81	41	81	47	<p>This part corresponds also to agroecology. this could be put as well in para 5.6.3.1. Diversification of agriculture, agroforestry, ecosystem based adaptation and others are quite offer mentioned, but agroecology no, so we propose to add a box in the SPM, and in the chapter 6 and 7, and in the glossary, to clarify that agroecology encompasses all this, so it's present even when not mentioned. [ , France]</p>	It better fits here as examples of CSA practices
14099	81	24	82	16	<p>Comment: there are a lot of literature which explore these underlying socio-economic factors, it is important to broaden the anylis mentioning the specific issues associated to these underlying factors [Ana Felicien, Venezuela]</p>	we add the underlying factors



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Comment No	From Page	From Line	To Page	To Line	Comment	Response
22679	81	24	82	16	There is a lot of overlap between CSA and other approaches mentioned here (eg, agroecology, SI). CSA is more like an umbrella for most of the options mentioned here. (See the FAO guidebook on CSA) [Anastasios Kentarchos, Belgium]	understand this but our stucuture permits us more precise definition of individual parctices
32371	81	24	82	16	As the IPCC Working Group II AR5 chapter on Food Security and Food Production Systems has broken new ground by expanding its focus beyond the effects of climate change primarily on agricultural production to include a food systems approach as well as directing attention to undernourished people (Porter et al. 2014b). I suggest that the review and discussion on "Climate-Smart Agriculture" may be expanded to "Climate-Smart Food System". The major reference is: Thomas Reardon and David Zilberman, "Climate-smart food supply chains in developing countries in an era of rapid dual change in agrifood systems and the climate" in Climate Smart Agriculture: Building Resilience to Climate Change, Rome: FAO. Edited by D. Zilberman, N. McCarthy, L. Lipper, S. Asfaw, G. Branca, 2018. [Ching-Cheng Chang, China]	We agree. The whole chapter is about climate smart food system. This section, however, deals mainly at the level of production.
6499	81	24	82	16	Climate-smart agriculture raises many controversies, mainly because of its lack of criteria and proper framing. Those controversies should be reflected in this part. [Sara Lickel, France]	Climate-smart agriculture raises many controversies, mainly because of its lack of criteria and proper framing. Those controversies should be reflected in this part.
14101	82	12	82	16	Comment: include Newell, P., & Taylor, O. (2018). Contested landscapes: the global political economy of climate-smart agriculture. The Journal of Peasant Studies, 45(1), 108-129. [Ana Felicien, Venezuela]	Included
14103	82	12	82	16	Comment: include Taylor, M. (2018). Climate-smart agriculture: what is it good for?. The Journal of Peasant Studies, 45(1), 89-107. [Ana Felicien, Venezuela]	Included
14105	82	12	82	16	Comment: include Vaarst, M., Escudero, A. G., Chappell, M. J., Brinkley, C., Nijbroek, R., Arraes, N. A., ... & Halberg, N. (2018). Exploring the concept of agroecological food systems in a city-region context. Agroecology and Sustainable Food Systems, 42 [Ana Felicien, Venezuela]	Reference does not fit with the substance
13091	82	14	82	16	From a gender perspective, recommended approaches in extension have been put forth by the INGENEAS project: <a href="http://ingenaeas.illinois.edu/wp-content/uploads/ING-Key-Publications-Overview-2-Pages.pdf">http://ingenaeas.illinois.edu/wp-content/uploads/ING-Key-Publications-Overview-2-Pages.pdf</a> [Kristi Tabaj, United States of America]	Thanks but we cannot cite project document
1693	82	25	82	26	the statement "CA has been reported to increase farm productivity by reducing cost of production and increasing yield" is only valid for specific locations (as for example in the cited references relate to only India). In other regions results might be different, see for example the difference in outcomes of using non inversions tillage between different agro-ecological zones in Europe a recent paper from Bijttebier et al (2018): <a href="https://www.sciencedirect.com/science/article/pii/S0264837717312437">https://www.sciencedirect.com/science/article/pii/S0264837717312437</a> ; or the paper by Giller et al (2009) on differences observed in Africa: <a href="https://www.sciencedirect.com/science/article/pii/S0378429009001701">https://www.sciencedirect.com/science/article/pii/S0378429009001701</a> and on the differeing SOC potential of conservation agriculture the paper by Chivenge (2007): <a href="https://www.sciencedirect.com/science/article/pii/S0167198706001917">https://www.sciencedirect.com/science/article/pii/S0167198706001917</a> [Renske Hijbeek, Netherlands]	Thanks. The limitation of SOC sequestration (e.g. Powlson et al), limited adoption in Africa (Giller et al) is discussed
21235	82	29	82	30	Cross reference Chapter 2 Section 2.7.1.1. [ , United Kingdom (of Great Britain and Northern Ireland)]	Accepted
23449	82	39	82	39	ADD, after 'implmentation', although there is promising uptake recently in east and southern Africa. [John Dixon, Australia]	Added
23451	82	42	82	44	CORRECT I Replace with 'In the global South, CA generally reduces labour (especially women) and production cost requirements and generally leads to increased returns to family labour. [John Dixon, Australia]	Added

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Comment No	From Page	From Line	To Page	To Line	Comment	Response
27205	82	12			Please replace "Climate-smart agriculture, if it is to address resilience and adaptive capacity .." by Climate-smart agriculture, as it addresses resilience and adaptive capacity .." [, Germany]	The phrase removed during revision
7463	82	19		45	Only the benefits on organic matter and carbon sequestration are indicated. CA was originally thought to reduce erosion. Taking into account the direct relationship that exists between erosion and crop productivity, this point should be highlighted. A comment like this could include: "CA is considered to be a sustainable agricultural system that responds satisfactorily under both economic and environmental pressures This agricultural production system uses a body of soil and biomass management practices that produces satisfactory results with respect to controlling erosion in tropical mountains (Blanco and Aguilar, 2016) and at the same time to improve soil quality, by increasing the content of organic matter and improving porosity, structural stability, infiltration and water retention (Carr et al., 2013; Nyamangara et al., 2014 Chowdhury et al., 2015) ". References at the end of the database. [Rafael Blanco-Sepulveda, Spain]	All potential benefits of CA summarized
17209	82	36			It can be added: "...more diversified cropping systems, agroforestry, afforestation and reforestation, can... [José Alfonso Domínguez-Núñez, Spain]	Added
13191	83	1	83	43	This intro to SI could usefully reference Pretty et al 2018. [David Cooper, Canada]	Added
23453	83	9	83	9	INSERT after Jat et al 2016 'Sustainable intensification can be combined with selected other improved management practices, notably with conservation agricultural based sustainable intensification or with agroforestry with additional economic, ecosystem services and carbon benefits. [John Dixon, Australia]	Thank you. Added
25563	83	15	83	15	Sustainable intensification should be defined in the glossary. [, France]	Included in glossary
25565	83	20	83	23	Agroecology also improves food security (cf. 6.3.1.14) and should be mentioned here. Diversification of agriculture, agroforestry, ecosystem based adaptation and others are quite often mentioned, but agroecology no, so we propose to add a box in the SPM, and in the chapter 6 and 7, and in the glossary, to clarify that agroecology encompasses all this, so it's present even when not mentioned. [, France]	Agreed. We have a dedicated section (i.e. 5.6.3.1) for agro-ecology
22681	83	1	88	8	The section on SI can be significantly shortened, but the box is well written [Anastasios Kentarchos, Belgium]	We keep upto this length for now
21531	83	1			The term "sustainable intensification" should be in the glossary, and needs to be more clearly defined here, to make crystal clear what is meant and how it can result in reductions of absolute emissions (rather than a licence to increase emissions - which may of course be fine in some contexts, but it should not be called sustainable). [Andy Reisinger, New Zealand]	Included in glossary, elaborated in greater details in chapter box
39719	84	4	84	4	There is a typo on this line: Unite Kingdom should be United Kingdom. [, United States of America]	Corrected
12579	84	9	84	9	Challenge to the sentence: 'The projected demand for more food, fuel and fibre for a growing human population necessitates intensification of current land use to avoid conversion of additional land to agriculture' ignores the research findings presented in section 5.5.2.1, which states that 'where no animal products are consumed at all, adequate food production in 2050 could be achieved on less land than is currently used' (68-46; 69-1) The contribution of dietary change and food waste prevention must be stressed alongside agricultural intensification. [Carina Millstone, United Kingdom (of Great Britain and Northern Ireland)]	Accepted - the importance of dietary change and food waste prevention to meet the goals of SI along with intensification have now been included in the third paragraph of the introduction section.

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Comment No	From Page	From Line	To Page	To Line	Comment	Response
13193	84	36	84	48	This para could usefully refence Strassburg et al "When enough should be enough: Improving the use of current agricultural lands could meet production demands and spare natural habitats in Brazil" Global Environmental Change Volume 28, September 2014, Pages 84-97 [David Cooper, Canada]	added
12201	84	36	85	2	Can you estimate the potential and limits to SI for meeting the demand 'sustainably'. How far can we get with SI? Such a synthetic statement in combination with confidence level would be very helpful. [Hans Poertner and WGII TSU, Germany]	Taken into account - the end of the third paragraph now includes a statement on the potential and limitations of SI.
17897	84	43	85	2	The limits and constraints to sustainable intensification and land sparing are buried in this paragraph but should have their own subtitled section. [Quentin Lejeune, Germany]	We prefer on this way.
17333	84		88		I would suggest the authors to consider also including "intercropping with legumes" for agricultural sustainable intensification. This systems naturally increases soil fertility by providing a pathway for N2 fixation, reduces soil erosion and globally increases yield (Wang, Z.-G., Jin, X., Bao, X.-G., Li, X.-F., Zhao, J.-H., Sun, J.-H., et al. (2014). Intercropping Enhances Productivity and Maintains the Most Soil Fertility Properties Relative to Sole Cropping. PLoS ONE, 9(12), e113984. <a href="http://doi.org/10.1371/journal.pone.0113984.s004">http://doi.org/10.1371/journal.pone.0113984.s004</a> ; Kermah, M., Franke, A. C., Adjei-Nsiah, S., Ahiabor, B. D. K., Abaidoo, R. C., & Giller, K. E. (2017). Maize-grain legume intercropping for enhanced resource use efficiency and crop productivity in the Guinea savanna of northern Ghana. Field Crops Research, 1–13. <a href="http://doi.org/10.1016/j.fcr.2017.07.008">http://doi.org/10.1016/j.fcr.2017.07.008</a> [Maria Helena Cruz de Carvalho, France]	Accepted - intercropping with legumes has now been added to table 5.1 as par of system redesign options to achieve sustainable intensification of agriculture. More detailed discussion of this is not possible within the limited length of this box.
17335	84		88		I would suggest the authors to consider also including "management of soil microfauna such as earthworm populations" which have a positive effect on soil fertility and plant growth (Bertrand, M., Barot, S., Blouin, M., Whalen, J., de Oliveira, T., & Roger-Estrade, J. (2015). Earthworm services for cropping systems. A review. Agronomy for Sustainable Development, 35(2), 553–567. <a href="http://doi.org/10.1016/0038-0717(92)90162-Q">http://doi.org/10.1016/0038-0717(92)90162-Q</a> ). Another indirect use for earthworms on sustainable agricultural intensification would be by the use of vermicompost as biofertilizer and biocontrol agent reducing the need of the use of chemical fertilizers (Joshi, R., Singh, J., & Vig, A. P. (2014). Vermicompost as an effective organic fertilizer and biocontrol agent: effect on growth, yield and quality of plants. Reviews in Environmental Science and Bio/Technology, 14(1), 137–159. <a href="http://doi.org/10.1080/01448765.2006.9755017">http://doi.org/10.1080/01448765.2006.9755017</a> ) [Maria Helena Cruz de Carvalho, France]	Accepted - vermicompost has now been added to table 1 on approaches to sustainable intensification in agriculture. A detailed discussion of the promotion of microfauna such as earthworms is somewhat beyond the scope (and limited length) of this cross chapter box. We noted also that soil function and its importance is highlighted in the introductory paragraph of the box.
23455	85	2	85	2	ADD. There are no single global solution to these questions which need to be resolved in situ for different types of farming system. [John Dixon, Australia]	Accepted - sentence has been added (but in an edited form) to the paragraph.
12631	85	3	85	3	Challenge to the setnence: 'Improving Efficiency: Farm size scale up: increasing farm scale can lead to greater efficiency per unit input' evidence for this is not provided in the report. Suggested addition: Increasing farm size leads to trade offs such as loss of livelihood for smaller family farms, concentration of profits to investors and the resultant removal of income from the local community [Carina Millstone, United Kingdom (of Great Britain and Northern Ireland)]	Taken into account - this table entry has been reworded as organisational scale-up and places the emphases of this now on co-operative approaches delivering this collective benefit of scale. The trade-offs between farm size and livelihood are important topics but fall beyond the scope of this cross-chapter box.

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12633	85	3	85	3	Addition to: "Substitution: Green fertiliser: replacing chemical fertiliser with digestate [from] anaerobic digestion"- Suggested addition: However use of digestate requires proper governance and legislation to ensure financial support is conditional on meeting sustainability criteria. In the UK digestate storage and application are poorly regulated (Styles, 2015). Sustainability of digestate is further mitigated by the Indirect Land Use Change from crops grown as Anaerobic Digestion feedstocks (Styles, 2015) or when food waste is suitable for human or animal consumption is used. (Styles, D., Gibbons, J., Williams, A. P., Dauber, J., Stichnothe, H., Urban, B., ... & Jones, D. L. (2015). Consequential life cycle assessment of biogas, biofuel and biomass energy options within an arable crop rotation. Gcb Bioenergy, 7(6), 1305-1320.) [Carina Millstone, United Kingdom (of Great Britain and Northern Ireland)]	Taken into account - this is a valid point and the need to consider implementation and appropriate governance is mentioned in the section on landscape approaches. However the addition of this level of detail for digestate would not be in keeping with the current style of the table (to add this level of information here would necessitate similar additions for other examples).
12203	85	3	85	3	Suggest to add references/sources in the caption or table [Hans Poertner and WGII TSU, Germany]	References added
12635	85	16	86	16	Suggested addition after: 'High-tech precision agriculture...often replacing manual labour with technology': Replacing labour with technology is only justified where there is evidence that the methods will improve soil health. Without this evidence the means do not justify the loss of employment as unemployment can threaten to localised food security. [Carina Millstone, United Kingdom (of Great Britain and Northern Ireland)]	Taken into account - the part of this sentence 'often replacing manual labour with technology' has been removed.
13195	86	23	86	30	Cross chapter Box 5, Fig 1. In my view this figure is misleading since it applies inverse relationship between productivity and sustainability in a way that is almost contrary to the concept of SI. Up to a limit, productivity could increase alongside sustainability. surely SI means shifting the production curve up at any point on a sustainability axis. The figure also avoids the issue of time lags (cf: page 87 lines 49-50). I suggest to reconceptualize and redraw. [David Cooper, Canada]	Accepted - the figure has been redrawn, with care taken to indicate that the inflection points on the hypothetical curves are system specific. The importance of time-lags has also been recognised and included in the figure - through new axis labels.
1695	86		86		Cross-Chapter Box 5, Figure 1: Labeling of the right y-axis could be improved. As 'system sustainability' includes production (food security), the hypothetical opposition between system sustainability (right) and yield per unit area (left) is incorrect. Also, I would not agree that the optimal sustainability of a system lies at the most extreme left (green line), probably this optimum is rather somewhere in the middle. Instead of finding a different term this figure could also be redrawn. [Renske Hijbeek, Netherlands]	Accepted - the figure has been redrawn, the axes labels have been changed to indicate different time lag associated with them. Also care has been taken to indicate in the figure caption that the inflection points on the hypothetical curves are system specific. The figure shows a 'window of opportunity' to achieve SI and does not indicate optimum levels in the hypothetical system.

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Comment No	From Page	From Line	To Page	To Line	Comment	Response
24699	87	2	87	13	<p>Multispecies grasslands: "Multi-species grasslands may provide a route to SI, as even a modest increase in species richness in intensively managed grasslands can result in higher forage yields without increased inputs"</p> <p>This has been observed and tested in the context of dairy milk production in northern Europe as well (Ergon et al. 2015). However multi-species grasslands may imply some reduction in the dry-matter yield of forage grass as well as changes manure management. All livestock manure has to be spread as a fertilizer on field parcels in any case. If multi-species forage grass, including e.g. leguminous crops, require reduced fertilization then more land area is needed for manure spreading. This may increase costs and/or keep some part of intensive single specy forage grass in production. Thus manure management conditions may imply that multi-species grasslands have limited potential. While increasing multi-species grasslands is most likely feasible, all grasslands cannot be less fertilized multi-species grasslands, as indicated e.g. Lehtonen&amp;Niskanen 2016). Lehtonen, H. &amp; Niskanen, O. 2016. Promoting clover-grass: Implications for agricultural land use in Finland. Land Use Policy 59: 310-319. DOI:10.1016/j.landusepol.2016.09.005</p> <p>Ergon, Å., Kirwan, L., Bleken, M. A., Skjelvåg, A. O., Collins, R. P., Rognli, O. A. Species interactions in a grassland mixture under low nitrogen fertilization and two cutting frequencies: 1. dry-matter yield and dynamics of species composition. Grass and Forage Science, October, 2015, 1–16. DOI:10.1111/gfs.1225 [Heikki Lehtonen, Finland]</p>	<p>Taken into account - a detailed discussion of the use of grassland management and use of clover in grasslands is beyond the scope (and limited length) of this cross chapter box. However the limitation of the use of grass-clover mixture regarding stocking rates and associated manure spreading has now been noted in the text - where reference is made specifically to the replacement of chemical fertilizer requirements (thus not now including manure).</p>
24701	87	15	87	30	<p>At this paragraph chapter 5 is a little too optimistic on the GHG abatement potential of e.g. agroforestry (which surely may have some potential to produce biodiversity and other environmental benefits). Even if individual studies conducted e.g. in Australia show that agroforestry can have significant environmental and economic benefits, such benefits are nevertheless quite dependent on local production and value chain conditions. Extensive production practices often require more land / labour / other inputs and large shifts to extensive production systems may result in a significant decrease in production. Chapter 5 swallows too easily the argument that agroforestry would have significant income diversification impacts for farmers - this would require high value of wood and/or short rotation of wood biomass harvest etc. At northern latitudes, for example, short grazing periods and the requirement of producing sufficient high quality grass forage feed for long in-house feeding periods for cattle and dairy cows imply that agroforestry has a limited feasibility and potential, whereas some extensive semi-agroforestry / nature management cattle grazing has realized but also much with the help of agri-environmental payments paid for high nature value production (at least in northern Europe). [Heikki Lehtonen, Finland]</p>	<p>Agroforestry is discussed as one of many options</p>
1443	87	35	87	37	<p>For discussion on definition of landscapes and landscape approach: --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. [Henry Scheyvens, Japan]</p>	<p>Many thanks. We did not include this policy brief.</p>
40761	87		87		<p>Links to adaptation, mitigation, climate change could be strengthened in this box. [Valerie Masson-Delmotte, France]</p>	<p>Accepted - where possible links to climate change, adaptation and mitigation have been added and/or emphasised.</p>
13021	88	3	88	4	<p>sentence repeated [Aidan Farrell, Trinidad and Tobago]</p>	<p>Many thanks this is removed.</p>
12205	88	11	88	12	<p>Suggest to add confidence level. [Hans Poertner and WGII TSU, Germany]</p>	<p>Added</p>

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Comment No	From Page	From Line	To Page	To Line	Comment	Response
39721	88	11	88	26	The women's empowerment section is very short and limited in scope. The implications of empowering women are huge. The majority of small holder farmers are women and their impact on what is grown and how it is grown has significant implications to changes in response to climate change. Furthermore by empowering women there is a greater opportunity for more extensive change across the entire agriculture system. Greater reference to research that has taken place relating to Climate Change and Women should be cited in this section. [, United States of America]	The section has been expanded
32547	88	31	88	32	Need more information about 'group-based approaches' in the following sentence to clarify how they are helpful in increasing women's empowerment: "Group-based approaches have been shown to improve women's assets to manage risk (Ringler et al. 2014)." [Hanna Paulose, United States of America]	Clarification added
12637	88	33	88	33	Suggested new paragraph: Global population growth is putting increasing pressure on land and other resources. Ensuring women are able to choose the size of their families, through increased educational opportunities for girls and professional opportunities for women, as well as universal access to family planning is therefore an essential, critical demand-side measure for climate mitigation and adaptation through the food system. Pathways to a sustainable food system assume population stabilisation, with fertility rates at replacement level by 2050 (World Resources Institute 2018, Creating a Sustainable Food Future) [Carina Millstone, United Kingdom (of Great Britain and Northern Ireland)]	Added
13985	88	34	88	41	Please add that urban agriculture can also help improve biodiversity and strengthen associated ecosystem services.  See references: <a href="https://scholar.google.com/scholar?as_ylo=2015&amp;q=urban+agriculture+and+biodiversity&amp;hl=en&amp;as_sdt=0,21&amp;as_vis=1">https://scholar.google.com/scholar?as_ylo=2015&amp;q=urban+agriculture+and+biodiversity&amp;hl=en&amp;as_sdt=0,21&amp;as_vis=1</a> [Sunday Leonard, United States of America]	Added
23457	88	38	88	38	CHECK statement that 14% of global population is fed from urban and peri-urban systems -- unless peri-urban is defined to include large farming areas. [John Dixon, Australia]	We cross-check this. It includes large farming areas near cities.
13023	88	41	88	41	'Urban agriculture can contribute to adaptation to heat extremes through evaporative cooling.' - I am not clear on what the mechanism for this is- is this referring to evapotranspiration from crops cooling the earth's surface? Does this impact on air temperature in a significant way? [Aidan Farrell, Trinidad and Tobago]	Yes. This is the case. We also include an additional reference here.
40763	88		88		Aspects linked to gender, urban agriculture are disseminated across sections in this chapter and other chapters. Coordination is needed to identify key common messages and convey them at the level of ES+SPM. [Valerie Masson-Delmotte, France]	Many thanks. We did this.

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Comment No	From Page	From Line	To Page	To Line	Comment	Response
907	88	34	91	18	Rightly, the paragraph highlights the role urban agriculture can play in contributing towards food security more significantly in developing countries. One aspect that could be added here is the changing urban demography in developing countries following the universal phenomenon of migration from rural to urban areas in search of better livelihood options and living conditions. The trend is increasing populations in urban agglomerates, and proportionate reduction in rural populations. This would imply more requirement of food items in urban areas compared to rural areas. Thus, utilising the available horizontal and vertical spaces in urban areas for food production will greatly reduce responsibility and stress of rural areas to be traditional grower and provider of food items for entire population- rural and urban. Even meeting 50% of the food needs of urban population from urban agriculture would be a significant step forward as that would mean meeting 50% needs of 70% of population in due course of time. Remaining food requirement could continue to be met from farms in vast rural landscapes. One caveat that is necessary here is to ensure that the urban agriculture utilising horizontal and vertical spaces is based on the state-of-the-art technologies that are environment and climate friendly, i.e., which reduce emissions, and also the pollution load. [Jagdish Kishwan, India]	We would like to but due to page limitation we did not add this.
156	88	34	91	18	A sub-section on indoor / vertical agriculture (glasshouse/warehouse) and its advantages and disadvantages should be included. [Tommy Wiedmann, Australia]	We would like to but due to page limitation we did not add this.
12207	88	34			Suggest to focus more on the climate change adaptation and mitigation potentials and co-benefits of urban agriculture, especially in the two subsections. [Hans Poertner and WGII TSU, Germany]	We tried to strengthen to climate change connection by adding two references in the following sections.
22683	89	17	89	22	redundant [Anastasios Kentarchos, Belgium]	We cross-checked for redundancy and did not find it.
13987	89	32	89	36	The logic behind this sentence is incomplete. Currently the sentence suggest that migrating to informal settlements results in urban food and nutrition insecurity. This is not necessarily true unless we describe the characteristics of informal settlements that contributes to food and nutrition insecurity [Sunday Leonard, United States of America]	Statement improved.
13991	89	34	89	34	This can only be true if we assume that all urban migrants are poor which is not necessarily true.  As stated in my general comments, many of the arguments in the chapter need to be tightened and made more succinct [Sunday Leonard, United States of America]	Many thanks. Statement improved.
13989	89	34	89	36	What was Crush 2013 reason for this findings? [Sunday Leonard, United States of America]	Reason for this is included
144	89	41	89	41	It is estimated that 60 per cent of the places that will be urbanized by 2030 have not yet been built – so there is a window of opportunity to design food systems that reduce emissions and are resilient. <a href="https://unhabitat.org/wuf10/">https://unhabitat.org/wuf10/</a> [Sharelle Polack (nee Hart), Switzerland]	This suggestion is included.
1713	89				Urban food security - Urban farming also encounters the access to quality water and soil. Due to the air, water and soil pollutions in urban areas, local people cannot grow health food. The driect usage of gray water increases the heavy metals or biological pollutants in the foods. [Sisira Withanachchi, Germany]	This has been discussion in the next section.
142	90	5	90	5	Need to update Kriewald et al reference once published [Sharelle Polack (nee Hart), Switzerland]	Many thanks. We will update this reference.

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Comment No	From Page	From Line	To Page	To Line	Comment	Response
23459	90	5	90	6	CHECK and CORRECT Implausible that 11% and 60% of the global irrigated croplands lie in urban and peri-urban areas -- unless 'urban' is defined as town instead of city. [John Dixon, Australia]	Many thanks. The statement is clarified
13993	90	5	90	6	Please clarify this sentence. The percentages and respectively used here is confusing. What does 11% and 60% of global irrigated cropland mean? Do you mean 11-60% of ..... Same for 5% and 35% of the global rain-fed croplands? [Sunday Leonard, United States of America]	Many thanks. The statement is clarified
22685	90	22	90	36	Food self sufficiency should not be treated in such a haphazard way. Either drop it or give this proper attention. [Anastasios Kentarchos, Belgium]	The term is dropped.
565	90	30	90	30	it can be mentioned to "contaminated water" for peri-urban agriculture. Water is contaminated through effluents and emitters as well as urban domestic effluents and sewage (the case of mega cities like Teheran in developing countries). There are several risks associated using such polluted water for agriculture (Jonstone in handbook of water and wastewater microbiology, 2003) [Nathalie Hilmi, France]	"water" is added.
14095	90	37	90	47	Comment: include Vaarst, M., Escudero, A. G., Chappell, M. J., Brinkley, C., Nijbroek, R., Arraes, N. A., ... & Halberg, N. (2018). Exploring the concept of agroecological food systems in a city-region context. Agroecology and Sustainable Food Systems, 42(6), 686-711. [Ana Felicien, Venezuela]	Rejected. Sorry, we do not find this reference relevant here.
14097	90	37	90	47	Comment: include de Zeeuw, H., & Drechsel, P. (Eds.). (2015). Cities and agriculture: Developing resilient urban food systems. Routledge. [Ana Felicien, Venezuela]	Although this is relevant book, we did not see which chapter reviewer is suggested to refer.
13995	90	37	90	47	As in previous comment, please add that urban agriculture can also help improve biodiversity and strengthen associated ecosystem services at the end of this paragraph and give examples based on the provided references below.  See references: <a href="https://scholar.google.com/scholar?as_ylo=2015&amp;q=urban+agriculture+and+biodiversity&amp;hl=en&amp;as_sdt=0,21&amp;as_vis=1">https://scholar.google.com/scholar?as_ylo=2015&amp;q=urban+agriculture+and+biodiversity&amp;hl=en&amp;as_sdt=0,21&amp;as_vis=1</a> [Sunday Leonard, United States of America]	Biodiversity and Ecosystem services included.
40765	91	15	91	15	ex of finding relevant for ES/SPM [Valerie Masson-Delmotte, France]	Thank you. We will try our best to include in ES.
12565	91	20	91	20	Suggestion for a box case study: SDG 12 on responsible production and consumption is of high relevance to food system demand-side measures. In particular, SDG 12.3 aims to, 'halve per capita global food waste at the retail and consumer levels and reduce food losses along production and supply chains, including post-harvest losses' by 2030 (UN 2016). The global implementation of this SDG is being driven by a high-profile group of Champions, Champions 12.3, formed of leaders across governments, civil society and business. This group has championed for an extensive interpretation of the SDG, recommending that the halving food loss and waste per capita target should encompass all edible food- from the moment it is ready to harvest or slaughter to the plate. (Hanson 2017) (Hanson, Craig. 2017. 'Guidance on Interpreting Sustainable Development Goal Target 12.3'. Champions 12.3.) [Carina Millstone, United Kingdom (of Great Britain and Northern Ireland)]	Thank you very much for the wonderful comment. However, we are out of space to include an additional box.
28519	91	26	91	28	grammar needs checking [Valerie Kapos, United Kingdom (of Great Britain and Northern Ireland)]	Many thanks. Language had been edited.
13999	91	29	91	30	please make this sentence more understandable [Sunday Leonard, United States of America]	Many thanks. Language had been edited.
14001	91	33	91	33	find an alternative word for "sustaining" here to make this sentence simpler [Sunday Leonard, United States of America]	Many thanks. Language had been edited.



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Comment No	From Page	From Line	To Page	To Line	Comment	Response
22687	91	20	93	2	The SDGs would merit a much more in-depth treatment. Also check for coherence and duplication with other SDG sections of the report (e.g. in Chapter 7) [Anastasios Kentarchos, Belgium]	Many thanks. Due to page limitation we do not include a detailed discussion on the SDG interactions. However this is provided in chapter 7. We provide a cross-reference to the sections of this chapter for clarification.
27207	91	20	93	2	Most part of the discussion of the SDG linkages of SDG 2 and SDG 13 is based on one publication. This publication analyses SDG linkages only in a statistical sense using the official indicators of the UN. The resulting Figure 5.18, on the one hand, comprises a lot of data, but, on the other hand, does not allow for a detailed analyses, why and on which exact issue trade-offs or synergies exist between two SDGs. For example, how can SDG13 (climate action) have more trade-offs with SDG 3 (good health), SDG 4 (quality education) and SDG 7 (affordable and clean energy) than synergies? This is not in line with the results of the SR1.5 stating in particular that synergies exist for SDG 13 and SDG 3 and 7. Causal relationships and comprehensive understanding as found in SR1.5 based on dozens of publications are paramount to provide a robust knowledge base for decision makers. Therefore, we urge the authors to revise this subchapter and discuss the SDG in line with the discussion of SR1.5 and add references that can explain linkages between SDGs rather than only presenting statistical relations. If this is rather done in another chapter, e.g. chapter 7, please replace the incomprehensive discussion here with references to that chapter. If a comprehensive discussion is not possible due to a lack of literature, please indicate this knowledge gap at the end of the section. [, Germany]	Thank you very much for the wonderful comment. However, due to space we do not to describe the interlinkages in depth. Nevertheless, we refer to SR15 report and Chapter 7 for the detailed description. We also try to high the reason for the differences.
11521	91	20	93	2	Some citations that would support what has been written here: Vlek et al. 2017. Trade-Offs in Multi-Purpose Land Use under Land Degradation Sustainability 2017, 9(12), 2196; <a href="https://doi.org/10.3390/su9122196">https://doi.org/10.3390/su9122196</a>  Wolff et al. 2018. Meeting global land restoration and protection targets: What would the world look like in 2050?, Global Environmental Change, Volume 52, 2018, Pages 259-272, <a href="https://doi.org/10.1016/j.gloenvcha.2018.08.002">https://doi.org/10.1016/j.gloenvcha.2018.08.002</a> .  Allen et al. 2016. National pathways to the Sustainable Development Goals (SDGs): A comparative review of scenario modelling tools. Environmental Science & Policy, Volume 66, 2016, Pages 199-207, <a href="https://doi.org/10.1016/j.envsci.2016.09.0">https://doi.org/10.1016/j.envsci.2016.09.0</a> [Jean-Luc Chotte, France]	Many thanks. Some of these references are included.
6501	91	20	93	2	This part shows synergies and trade-offs between climate change or climate measures and the SDG. Seeing how SDGs and the Paris Agreement are two major policy documents adopted more or less conjunctly, they could be framed as SDGs being the minimum that must be guaranteed to ensure dignity of human lives and human rights; when the Paris Agreement and more generally fight against climate change is the threshold that must be respected so to ensure a planet with good conditions to live. On that, see Raworth Kate, 2017, Doughnut Economics: seven ways to think like a 21st century economist. [Sara Lickel, France]	Many thanks. We included the suggestion.
6503	91	20	93	2	An interesting analysis to be added here would be to analyse the contribution of agroecology to both GHG reduction and the different SDGs. This framing helps understanding how rethinking food systems is crucial to face climate change and food security challenges. [Sara Lickel, France]	Indeed, this is an interesting idea. However, due to time and space limitation, we opt not to include it.

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Comment No	From Page	From Line	To Page	To Line	Comment	Response
13997	91	20	93	2	<p>This section has only scratch the surface. One would have expect to there will be detailed discussions on the role of mitigation and adaptation actions in achieving the SDGs and vice versa given that this section is suppose to cover benefits. The section should have also discussed the need for integrated action and policies for achieving multiple SDGs. All we have here is a surface discussion on synergies and trade-offs based on a few publications.</p> <p>See:</p> <p><a href="https://www.researchgate.net/profile/Florencia_Montagnini/publication/322706103_The_Contribution_of_Agroforestry_to_Sustainable_Development_Goal_2_End_Hunger_Achieve_Food_Security_and_Improved_Nutrition_and_Promote_Sustainable_Agriculture/links/5aadbd78aca2721710faadbb/The-Contribution-of-Agroforestry-to-Sustainable-Development-Goal-2-End-Hunger-Achieve-Food-Security-and-Improved-Nutrition-and-Promote-Sustainable-Agriculture.pdf">https://www.researchgate.net/profile/Florencia_Montagnini/publication/322706103_The_Contribution_of_Agroforestry_to_Sustainable_Development_Goal_2_End_Hunger_Achieve_Food_Security_and_Improved_Nutrition_and_Promote_Sustainable_Agriculture/links/5aadbd78aca2721710faadbb/The-Contribution-of-Agroforestry-to-Sustainable-Development-Goal-2-End-Hunger-Achieve-Food-Security-and-Improved-Nutrition-and-Promote-Sustainable-Agriculture.pdf</a></p> <p><a href="https://onlinelibrary.wiley.com/doi/pdf/10.1002/ldr.3006">https://onlinelibrary.wiley.com/doi/pdf/10.1002/ldr.3006</a></p> <p><a href="https://repository.cimmyt.org/bitstream/handle/10883/19621/59693.pdf?sequence=1">https://repository.cimmyt.org/bitstream/handle/10883/19621/59693.pdf?sequence=1</a></p> <p><a href="https://link.springer.com/article/10.1007/s13280-018-1101-4">https://link.springer.com/article/10.1007/s13280-018-1101-4</a></p> <p><a href="https://www.soil-journal.net/2/111/2016/soil-2-111-2016.pdf">https://www.soil-journal.net/2/111/2016/soil-2-111-2016.pdf</a></p> <p><a href="https://journals.sagepub.com/doi/full/10.1177/1940082917720667">https://journals.sagepub.com/doi/full/10.1177/1940082917720667</a></p> <p><a href="http://opus.sanbi.org/bitstream/20.500.12143/5597/1/Cumming_2017_Achieving-the-national-development-agenda-and-the-Sustainable-Development-Goals-SDGs-through-investment-in-ecological-infrastructure-A-ca.pdf">http://opus.sanbi.org/bitstream/20.500.12143/5597/1/Cumming_2017_Achieving-the-national-development-agenda-and-the-Sustainable-Development-Goals-SDGs-through-investment-in-ecological-infrastructure-A-ca.pdf</a></p> <p><a href="http://www.diva-portal.org/smash/record.jsf?pid=diva2%3A972258&amp;dsid=1134">http://www.diva-portal.org/smash/record.jsf?pid=diva2%3A972258&amp;dsid=1134</a> [Sunday Leonard, United States of America]</p>	<p>Many thanks for giving hints of the literature. Due to page limitation we do not include a detailed discussion on the role of mitigation and adaptation actions in achieving the SDGs and vice versa in this section. However this is provided in chapter 7. We provide a cross-reference to the sections of this chapter for clarification.</p>
28521	91	20	93	3	<p>International policy processes other than SDGs would also be worth discussing in relation to synergies and trade-offs with food security objectives, for example the Convention on Biological Diversity, UNCCD, Sendai Framework for DRR. The importance of the international policy context is not captured in the executive summary. [Valerie Kapos, United Kingdom (of Great Britain and Northern Ireland)]</p>	<p>Many thanks. Yes, indeed. However, page limitation does not allow us to do so.</p>
40767	92		91		<p>Fig 5.18 difficult to understand. What is shown? How is it obtained? Only one study? Conclusions of the associated section missing. [Valerie Masson-Delmotte, France]</p>	<p>Conclusion added. Yes only one study in the figure due to quantitative study. The figure and its caption improved for clarity.</p>

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Comment No	From Page	From Line	To Page	To Line	Comment	Response
17915	92	1	92	12	In principle this is a useful figure, but the method behind this figure is difficult to understand, and regional effects are not captured. E.g. it is not intuitive why there should be so many trade-offs between SDG3 and SDG13, given the impacts of climate change and related pollution on health (air pollution, crop nutrition, food insecurity, deaths from extreme events etc.). Presumably this is because of the indicators for SDG13, but many indicators are for adaptation, which would have benefits for health. The text that refers to the figure (lines 25-26) refers to the ""current development paradigm"" - what does this mean in the context of the figure? Can this be explained in the caption? Does the figure assume that sustainable approaches that could avoid trade-offs are not used? The figure should very clearly state that it shows POTENTIAL linkages. [Quentin Lejeune, Germany]	The figure and its caption improved for clarity. However, please note that the figure is about the current status instead of the potential linkages.
14003	92	1	92	12	Figure 5.18: Please separate the part of the figure containing the icons of the SDGs to stay as a legend to the main figure on SDG2 and SDG13 linkages. The way the two are presented very close to each other and at the same scale makes the readers to think that the SDGs icon section of the figure presents a separate information linked to the SDG2 and 13 linkage section of the figure apart from just being a legend [Sunday Leonard, United States of America]	The figure and its caption improved for clarity. However, please note that the figure is about the current status instead of the potential linkages.
14005	92	11	92	12	What is meant by data pair? What type of data? [Sunday Leonard, United States of America]	The figure and its caption improved for clarity.
7011	92				Figure 5.18 Instead of using dot size with a logarithmic scale - which is very difficult to read/interpret - simply include the actual number of data points. [Debra Roberts, South Africa]	The figure and its caption improved for clarity.
13093	93	4	93	4	This section lacks specific mention of recommendations linked to gender and social inclusion. Cross-chapter Box 6 in Chapter 7 can provide additional details for gender. [Kristi Tabaj, United States of America]	The part on gender has been moved to a different section. Authors from this chapter have also contributed to cross-chapter box 6 in chapter 7.
21237	93	4	93	13	In section 5.7, please include further information on the social science that underlies the understanding of enabling conditions. For example, a recent paper by Amundsen & Biardeau 2018 ( <a href="http://www.pnas.org/content/115/46/11652.full">http://www.pnas.org/content/115/46/11652.full</a> and see references therein) argues that the potential of soil carbon sequestration is unlikely to be met because of a poor understanding amongst researchers of the cultural barriers posed by stakeholders. This complexity needs to be better reflected in this discussion (and probably chapter 6 also) [, United Kingdom (of Great Britain and Northern Ireland)]	The section has been reorganised and new text added, as well as non-relevant text deleted. The reference has been added
28437	93	4	93	21	Add the concepts and practice of the concepts of 'access to natural resources on a sustainable basis and control over resources in terms of the policy needs/options which are to be in place for building an enabling environment for climate resilient and sustainable food systems while avoiding land degradation; for the theory of access, see Ribot and Peluso (2003). Ribot, J. C. & Peluso, N. L. (2003): A Theory of Access. Rural Sociology 68(2): 153-181. Riisgaard, L & Ponte, S. (2011): Pro-poor value chain development: 25 guiding questions for designing and implementing agroindustry projects. Vienna: United Nations Industrial Development Organisation (UNIDO). [Barron Joseph Orr, Germany]	The issue of access/control over resources is addressed in chapter 7
39723	93	4	93	21	Link this preamble to SDG material and the consideration of role of SDG actions that strengthen adaptation/mitigation options for food security. [, United States of America]	Most of the text in this section has been removed in re-writing, so this comment no longer applies
1921	93	9	93	9	I think it should be adoption -> adaptation. [William Lahoz, Norway]	the text has been rewritten

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22689	93	9	93	13	The two statements, one on global and local supply chains and the other on food systems threatening indigenous knowledge provide false equivalency when placed next to each other. Neither of the statements should be 'robust evidence with high agreement'. [Anastasios Kentarchos, Belgium]	the text has been rewritten
22693	93	29	93	29	add "drivers" to policies, e.g.: "... a product of drivers impacted by a range of policies". The food system has never been the product of policies alone. [Anastasios Kentarchos, Belgium]	text changed in rewriting
22691	93	29	93	39	Next to the scientific literature supporting the need for coherent policies addressing climate change mitigation throughout the food system, it may be worth mentioning policy related initiatives such as the EU's R&I Policy Framework to future-proof our food systems FOOD 2030, including e.g. the latest Report by the Independent Group of Experts elaborating on mitigation options throughout the food system: <a href="https://publications.europa.eu/en/publication-detail/-/publication/d0c725de-6f7c-11e8-9483-01aa75ed71a1/language-en">https://publications.europa.eu/en/publication-detail/-/publication/d0c725de-6f7c-11e8-9483-01aa75ed71a1/language-en</a> . On this basis, specific effort is being put into mainstreaming scientific evidence in policy making, see e.g. the annex to "A European strategic long-term vision for a prosperous, modern, competitive and climate neutral economy" at <a href="https://ec.europa.eu/clima/policies/strategies/2050_en/">https://ec.europa.eu/clima/policies/strategies/2050_en/</a> [Anastasios Kentarchos, Belgium]	Reference to food2030 added to discussion of integrated policies
12647	93	39	93	39	Suggested addition at the end of the paragraph: ' Approaches to land tenure, land rights and ownership will further need to evolve to reflect new priorities for land use, be it for food production and for the deployment of CDR techniques.' [Carina Millstone, United Kingdom (of Great Britain and Northern Ireland)]	Added comment on land rights and tenure
22695	93	40	93	43	It is a pity these important aspects receive so little attention (while there is an abundance of redundant material elsewhere. [Anastasios Kentarchos, Belgium]	This section has been strengthened but the real analysis of policy options is Ch 7
40769	93		93		How can this chapter contribute to the identification of food systems in a climate resilient development pathway (to continue and expand on SR15)? [Valerie Masson-Delmotte, France]	We do not have space to explicitly identify this (though it is an active area of research for at least one of the authors and editors). However, implicitly - it is one that delivers nutrition sustainably and resiliently, not one that maximises "yield"
6505	93	23	94	5	Those crucial elements regarding policy coherence, especially within the SDG framework and in relationship with international trade should appear in the SPM. [Sara Lickel, France]	Policy coherence is now planned to be in the SPM.
21239	93	24	94	6	5.7.1 Although touched upon on lines 29 to 39 of page 93, there is scope to explicitly bring out an integrated food systems approach here, which would strengthen the arguments presented [, United Kingdom (of Great Britain and Northern Ireland)]	Explicit reference now made to integrated approaches.
34039	93	23	97	31	As the focus of the entire chapter is unclear (just food security, also GHG from the food system, mitigation in the food system), it is also unclear what a section on "policy intervention" would refer to. The sub-sections suggest that just trade and health policies are most relevant, though more is mentioned in the table.... why are not all aspects covered for which the mitigation potential is described earlier ... it is also confusing that you seem to collect all diet shift under "reduce consumption of excess food", while substitution of meat by plant-based product cannot be called reduction of excess food consumption in all cases.... [Elke Stehfest, Netherlands]	This section reviews the main policy drivers that have shaped the food system, and the various policy families that could contribute to shaping it in future. It is not an in-depth analysis of specific policies as that is outside the scope of this chapter (see Ch 7). Re-structuring the text should signpost the flow of logic better. The specific point about "reduce consumption of excess food" has been addressed through rewording.
11631	93	3	103	15	One sub-topic is "Key areas for climate change, food systems, and food security research" is and the other "areas for policy intervention". In this case rise a question. Why there is no sub-topic in this report like: "climate change and food security research policies" [Nazimi Acikgoz, Turkey]	The section knowledge gaps is now implicitly a section on the research agenda. Supporting R&D also appears in the table of policy options.

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1663	93	4	103	15	5.7 section should be analyzed more specifically to meet the attention of public. [Chao WEI, China]	The section has been reorganised and new text added, as well as non-relevant text deleted
39725	93	4	103	48	Section 5.7 is somewhat weak and not comprehensive. Could be improved through a review of the recent literature on governance and also agricultural innovation systems. See "Governing Food and Agriculture in a Warming World" Global Environmental Politics 18:2 (2018), and articles by Hallie Eakin. [, United States of America]	The section has been reorganised and new text added, as well as non-relevant text deleted. The reference has been added although the author is not Hallie Eakin, but Newell et al.
21535	93	23			I'm puzzled why this section does not include a section on emissions pricing and the different approaches that exist and are under discussion or implementation in various countries, but also fundamentally to make clear that if emissions are not exposed to a price, the mitigation potential stated in this chapter cannot be realised. This section could then usefully include a discussion of key barriers to agricultural emissions pricing, including issues around leakage, livelihoods, competitiveness etc. [Andy Reisinger, New Zealand]	Emissions pricing is mentioned in T 5.7. It is more fully covered in later chapters, and was not included in detail here for that reason. This section reviews the main policy drivers that have shaped the food system, and the various policy families that could contribute to shaping it in future. It is not an in-depth analysis of specific policies as that is outside the scope of this chapter (see Ch 7)
39727	94	4	94	5	Point out that maintaining the mid-century food system represents major challenges in the operation of food systems that may lead to social impediments in addition to the alluded public health co-benefits. Need to balance the statement on this line. [, United States of America]	Line modified to point out the need for equity in any just transition, as well as new section on just transitions added.
22697	94	7	94	7	The table is misleading because it suggests that all it takes to achieve the goals is a single type of intervention. That entirely misses the point of how successful laws, policies and measures are introduced and scaled up. [Anastasios Kentarchos, Belgium]	The table lists areas of policy that have been used to intervene. At no point is it implied "all it takes is a single intervention". The text in fact makes the opposite point that not single policy can be deployed.
1923	94	7	94	7	: In the row "Precision agriculture" of Table 5.7, perhaps the authors could add in the third column "citizen science". [William Lahoz, Norway]	This comment is unclear as what policies around citizen science might support precision agriculture.
6201	94	1	95	3	Chapter 7 reviews many policies and overlaps with this section. Reference to chapter 7 and the elaboration of these policies would help in integrate the chapters. [Margot Hurlbert, Canada]	Greater signposting added
39729	94	7	95	1	Table 5.7 is neither called out in the text nor the content of well described related to policy mechanisms useful to enhancing resilience of food system in support of food security. Consider deleting it. [, United States of America]	It is called out in the text (and was in the SOD). More detail has been added, as well as cross-referring to /from Chpts 6 and 7 and SPM
21533	94	7			Table 5.7: (a) needs citations, or are the entries purely the creation of the authors (in which case you need some rationale for what's included and how); (b) first row, why only public money and not public-private (very successful model for this in New Zealand; (c) column "intervention" should always state a POLICY, not an outcome (e.g. 'precision agriculture' is not a policy; (d) and most important: a key policy element has to be exposing agricultural GHG emissions to a price, otherwise the mitigation potential stated in earlier sections by definition cannot be realised. [Andy Reisinger, New Zealand]	Citations re-added (they had been removed in editing for space)
12639	95	1	95	1	Strong challenge to the notion that 'Changing food choices' will be achieved through ' Education campaigns': Replace with 'Changing Food Options' to be achieved through 'Taxation, regulation, incentives' [Carina Millstone, United Kingdom (of Great Britain and Northern Ireland)]	Agreed that education will not change food choices, but comment taken out of context of the text that emphasises that multiple policies are needed; public understanding of the need for "taxation, regulation and incentives" is needed for social license.
12641	95	1	95	1	To ' subsidies, standards, mandates, regulations, carbon taxes' as a way to support the ' Promotion of healthier and more sustainably produced foods' Add: Removal of production subsidies for ingredients for processed food will end the artificially low prices that make these foods more attractive than healthier alternatives [Carina Millstone, United Kingdom (of Great Britain and Northern Ireland)]	The sense of the comment is already implicit. Changing subsidies to incentivise healthier food can come about making healthier food cheaper and unhealthy food more expensive.

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25083	95	7	95	8	<p>Please add the following sentences.</p> <p>It was found that global food trade has saved water resources, including blue water, green water, and gray water (i.e., reduced the total pollution) due to the difference of water productivity of different commodities among regions (Liu et al., 2019). The estimated water saving, where major crops were included, presented high variations with a range from 263 (Fader et al., 2011) to 950 km<sup>3</sup>/year (Biewald et al., 2014), mainly due to the different number of food commodities considered and the selected approaches for estimating virtual water content. But Liu et al. (2019) also concluded that the significance of water savings is dimmed by the fact that the savings are often not driven by water scarcity. The virtual water flows through commodity trade often go from less developed regions to more developed regions, rather than from water rich regions to water poor regions (Zhao et al., 2015; Zhao et al., 2016).</p> <p>Biewald, A., Rolinski, S., Lotze-Campen, H., Schmitz, C., &amp; Dietrich, J. P., 2014. Valuing the impact of trade on local blue water. <i>Ecological Economics</i>, 101, 43–53.</p> <p>Liu W., Antonelli M., Kumm M., Zhao X., Wu P., Liu J., Zhuo L., Yang H., 2019. Savings and losses of global water resources in food-related virtual water trade. <i>WIREs Water</i> 6: e1320.</p> <p>Fader, M., Gerten, D., Thammer, M., Heinke, J., Lotze-Campen, H., Lucht, W., &amp; Cramer, W., 2011. Internal and external green-blue agricultural water footprints of nations, and related water and land savings through trade. <i>Hydrology and Earth System Sciences</i>, 15(5), 1641–1660.</p> <p>Zhao X., Liu J., Liu Q., Tillotson M.R., Guan D., Hubacek K., 2015. Physical and virtual water transfers for regional water stress alleviation in China. <i>Proceedings of the National Academy of Sciences of the United States of America</i> 112(4): 1031-1035.</p> <p>Zhao X., Liu J., Yang H., Liu Y., Duarte R., Hubacek K., 2016. Burden-shifting of water quantity and quality stress from mega-city Shanghai. <i>Water Resources Research</i> 52 (9): 6916-6927 [Junguo Liu, China]</p>	<p>Interesting references and glad to have them pointed out. But of tangential relevance to the topic of climate change, so space requires preclude adding discussions of the role of embedded resources (water, soil, biodiversity etc) into this section.</p>
6507	95	8	95	16	<p>this part is extremely important and the authors should make sure it stays in the final version of the text. A definition of food sovereignty should be proposed and elaborated in the framework of trade, need for GHG reduction and adaptation of agriculture to climate change. [Sara Lickel, France]</p>	<p>The section modified, but the sense of the referee's "must be kept" retained. Space precludes an in-depth analysis of food sovereignty here.</p>
39731	95	14	95	15	<p>This should focus on climate-related aspects of trade in the agriculture sector. Discussions of cartels and food sovereignty may be within the realm of food security issues, but the multivariate factors affecting food security and food sovereignty need to be more clearly discussed so that the role of climate change as one of these factors can be understood by the reader. [, United States of America]</p>	<p>Some text added to signpost: if a country enters international markets by reducing local crop varieties it exposes itself to climate risks, including from speculation and asymmetric competition, which may enhance vulnerability to climate risks.</p>
6509	95	17	95	21	<p>As I understand it, the text explains that trade can help reduce vulnerability to climate impacts if it is managed in a way that doesn't increase international competition. It would be helpful to provide an assessment of today's situation because this is certainly not the case everywhere. [Sara Lickel, France]</p>	<p>The section about food price spikes in Section 5.4. implicitly does this. An evidence-based appraisal is difficult because the evidence comes largely from analysing historical events. Many proponents of free markets have significant faith that lessons are learned and markets adapt, so evidence of past market failures is often contested as applied to today's conditions.</p>
40771	95		95		<p>missing traceability to source literature, confidence in method, potential [Valerie Masson-Delmotte, France]</p>	<p>More signposting added to Section 5.3 (food price spikes) and summary statement put in place.</p>

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6513	95	2	96	8	This part could also benefit from showing how international trade agreements affect local markets, and what policies are beneficial for local markets, and put in relation the GHG impacts of both. [Sara Lickel, France]	This would be good to do, but unfortunately haven't found papers that do this decomposition.
27209	95	3	96	8	There are publications that show that global trade of food can reduce emissions. Also, in the light of climate change, the dependence on trade, especially of countries in the global South, might increase. We therefore find it unbalanced to discuss trade here in such a negative way. Also, more papers should be cited. A possible older paper to cite could be: Schmitz, C., Biewald, A., Lotze-Campen, H., Popp, A., Dietrich, J.P., Bodirsky, B., Krause, M., Weindl, I. (2012): Trading more Food - Implications for Land Use, Greenhouse Gas Emissions, and the Food System. Global Environmental Change. Volume 22, Issue 1, February 2012, Pages 189–209. There are also papers that show that developing countries can profit from exports, for example because they are not able to produce some agricultural products themselves. For example: Höffler et al., 2018, Wirkungen der Importbeschränkung auf die kamerunische Geflügelbranche, giz; translation can be provided if needed. [, Germany]	Indeed, there are lots of papers that indicate that long supply chains can be more efficient than short supply chains. This section reworked to emphasise the positives of trade more.
30685	95	2	97	32	Reference you missed studying and citing in this section is: FAO. 2018. The State of Agricultural Commodity Markets 2018. Agricultural trade, climate change and food security. Rome. <a href="http://www.fao.org/3/I9542EN/I9542en.pdf">http://www.fao.org/3/I9542EN/I9542en.pdf</a> [Lorenzo Giovanni Bellù, Italy]	Reference added.
22699	96	1	96	4	The question that needs to be answered is: how would these shocks look like without trade? Without providing the appropriate framing the statements are not valid. Unfortunately, there are many places where these kind of statements are made without providing the right framing questions. [Anastasios Kentarchos, Belgium]	The literature is clear that markets can amplify climate signals. Had the drought affected Australian agricultural sector not been linked by trade, the 2007/8 food price spike would not have happened, and effects would have been localised to Australia, rather than propagating worldwide.
6511	96	5	96	8	Here the text recognizes the trade-offs of international trade in terms of GHG emissions, but doesn't really articulate this idea with the benefits of locally produced food and its benefits. [Sara Lickel, France]	We are very pushed for space and the focus is on the relationship between policy and the way the food system is affected by or affects climate - so this comment seems out of scope. The re-writing should have helped to sharpen the focus appropriately.
22701	96	10	96	42	This box does not appear to have a clear focus, more a collection of anecdotes. Also, the argumentation of the 1st two paragraphs is not convincing and contains a lot of false equivalence. [Anastasios Kentarchos, Belgium]	Box now removed
22703	97	1	97	31	Despite its title, this section is not focused on policies [Anastasios Kentarchos, Belgium]	The section has been changed extensively. The re-write has addressed this issue
6205	97	34	97	44	A reference for the statement, "the leading concepts in mitigation are specific and often quantifiable..." would improve this statement. [Margot Hurlbert, Canada]	Reference was there, is Huitema et al., 2016
22705	97	33	98	29	The topic needs much more depth and should start from existing governance frameworks and address their shortcomings to manage food systems sustainably. [Anastasios Kentarchos, Belgium]	The entire section has been changed and more focused on current debates and evidences on food systems governance. Now in Supplementary material
11629	97	33	98	29	5.7.2 Governance and institutions: This paragraph has been clarified nicely, but unfortunately messages are missing. [Nazimi Acikgoz, Turkey]	The entire section has been changed and more focused on current debates and evidences on food systems governance. Now in Supplementary material
1367	97	34	98	29	no reference is made to the legal framework, which is instead fundamental e.g. in reducing food waste (examples are the Italian law n. 166/2016 or the French law n. 2016-138) [Francesca Spagnuolo, Italy]	Policies and legal frameworks are in the policy section
6203	97	34	98	30	this section might improve with reference to the definition of institution and governance in chapter 7 as well as recognition of the multi level perspective of governance. [Margot Hurlbert, Canada]	Multilevel perspective has been added, also cross-chapter reference to chapter 7. Now in Supplementary material

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6207	97	45	98	29	It is unclear how the three recommendations fit together or better yet are operationalized. Ostrom's common pool regime, the diagnostic framework of Termeer and the socio technical literature? Why these three and how are they specific to food security? Operationalizing these literatures would be beneficial. [Margot Hurlbert, Canada]	More practical examples of food systems governance have been added. Now in Supplementary material
12209	97	33			This section is very conceptual. Is there any evidence, examples, of e.g., polycentric governance systems dealing with food security in a way that is relevant for the climate change context?  Also informal and traditional institutions, rituals, and norms, need to be acknowledged explicitly (linking to section 5.7.3.3) [Hans Poertner and WGII TSU, Germany]	More practical examples of food systems governance have been added. Now in Supplementary Material
25277	98	1	98	1	Limits and limitations of technology in adaptation framework needs to be discussed [Naresh Kumar Soora, India]	The section has been moved and focused now on enabling conditions for knowledge
23797	98	1	98	31	Limits and limitations of technology in adaptation framework needs to be discussed [, India]	The section has been moved and focused now on enabling conditions for knowledge
39733	98	9	98	12	This sentence is syntactically confusing. Also, recommend including who suggests this approach. Additionally, the definition of social-ecological justice is unclear and it is not established that social-ecological justice or common principles based on resilience are necessary conditions for addressing climate change and food security, as implied in this passage. Change the language to be more clear and remove this assertion or qualify it with, for example, "may be able to address". [, United States of America]	text has been changed
6515	98	9	98	19	this passage is extremely interesting and should stay in the final iteration of the report. It could also be articulated with local participation, local governance and empowerment concepts. In research circles as well as in development agencies, such as the Agence Francaise de Developpement, reflections are increasingly being developed around the management of the Commons. A paradigm change is needed to shift our starting point. We need to move beyond thinking in terms of ownership and start thinking in terms of decisions and management – “The Commons is to think as a co-activity and not as a co-membership, co-ownership or co-possession”(Etienne le Roy, 2017) According to the anthropologist Etienne Le Roy, in reality between a quarter and a third of humanity already has recourse to the Commons in a more or less exclusive manner . This means that this pre-existing rationale provides for long term secure land tenure for populations, without the need to introduce market dynamics. As a consequence, governance models also need to be examined. The aim is to ensure that collective ownership and the social and cultural role of land and water are integrated into agrarian and land policies and reforms. By empowering peasants through creating spaces for dialogue, exchange and participation, agroecology enables a transformation in relations of power and provides new decentralised and locally adopted power structures. The self-organisation this encourages is especially pertinent for land related issues. To achieve this, it is vital to recognise the right to consultation for all inhabitants of a territory, and to expand it beyond the indigenous peoples alone. [Sara Lickel, France]	participation in governance structures added. Now in Supplementary Material



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Comment No	From Page	From Line	To Page	To Line	Comment	Response
15739	98	19	98	23	Lines 19 to 23 are suggested to be deleted because of below arguments: 1. Renewable subsidies are given to production of renewable energy with the objective of making the market price of this type of energy competitive with other energy sources. Whereas fossil fuel subsidies are given to consumption of fossil fuel. 2. Definition of what constitute as fossil fuel subsidies is controversial, hence, estimate by the IEA of 260 US\$ Billion subsidies is challenged depending on what is measured as subsidies. 3. Statement on moving subsidies from fossil fuels to renewables is wrong. [, Iran]	this refers to text that was not in the SOD but FOD.
29805	98	32	98	33	It is unhelpful to pair scientific and Indigenous knowledge as it is in this section; much of Indigenous knowledge is scientific. They do not preclude one another. We recommend amending this phrase accordingly. [Tanya Smith, Canada]	we differentiate iLK from scientific knowledge because in institutional terms they are different. The section is not about the scientific method
39735	98	35	98	43	The three main approaches listed here are primarily for knowledge transmission, not "developing and using knowledge for food security and land sustainability under climate change." Suggest rephrasing this more simply and breaking up into multiple sentences. Further, none of these approaches promote "farmer participation" as referenced on the next page. [, United States of America]	Sentence rephrased to transmission
22707	98	38	98	40	Farmer field schools and rural resource centers were not invented by CGIAR or ICRAF, respectively. [Anastasios Kentarchos, Belgium]	Sentence has been deleted
40773	98		98		education could be covered in 5.7.3 (eg healthy diets) and social nearing / training (experience of transformation, barriers, rates of changes etc). Where are eco labels mentioned and associated literature assessed? This was mentioned in Ch 1 but I could not find it here. [Valerie Masson-Delmotte, France]	this has been now mentioned in the policy section
39737	98	35	99	7	Needs to address the social aspects of moving information to the land, things like biases, social pressure, and methods to overcome (need for policy and incentive programs). [, United States of America]	this is linked to values, which are now addressed within the governance section
39739	99	3	99	7	Farmer participation is mentioned here, but nothing from the extensive literature available is referenced. How can the need for farmer participation and local and indigenous knowledge be reconciled with the top-down knowledge sharing approaches listed on the previous page? More effort and nuance should be put into the 5.7.3 introductory section. [, United States of America]	farmer to farmer experience has now been added as example to the other three in non-formal knowledge mobilisation.
11523	99	35	99	36	I would add a item "technology for monitoring, reporting and verification addressing land degradation issues since degraded land has severe impact on Food Security" see UNCCD GM initiative [Jean-Luc Chotte, France]	We have limited space and cannot add this. MRV in section 5.5
39741	99	36	99	36	There is a typo on this line: 'sciencet' should be 'science'. [, United States of America]	This section has been deleted
6517	99	36	99	38	The text would benefit from developing on the security of land tenure aspects, by unpacking land tenure recognition procedures, options and how it empowers local communities, which has incidences in terms of local participation, local democracy, natural resources management and therefore on climate. [Sara Lickel, France]	land tenure is on chapter 7
22711	99	39	99	41	This bullet point is unclear: why does the explanatory text only refer to financial institutions to provide micro-credits. There is so much more ... [Anastasios Kentarchos, Belgium]	Noted, bullets removed. Knowledge gaps section expanded

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21537	99	9	100	34	I would have expected a lot stronger emphasis on MRV under capacity building. A critical issue is that very few countries have Tier 2 inventories, which precludes any nuanced mitigation policy since Tier 1 based inventories cannot "see" the mitigation achieved by productivity gains. A useful review for this is Wilkes A, Reisinger A, Wollenberg E, van Dijk S. 2017. Measurement, reporting and verification of livestock GHG emissions by developing countries in the UNFCCC: current practices and opportunities for improvement. CCAFS Report No. 17. Wageningen, the Netherlands: CGIAR Research Program on Climate Change, Agriculture and Food Security (CAAFS) and Global Research Alliance for Agricultural Greenhouse Gases (GRA). Also see resources on www.agmrv.org [Andy Reisinger, New Zealand]	MRV now in 5.5
21539	99	9	100	34	The discussion should recognise the range of international organisations that are active in the fields of capacity building and collaborative research, such as CCAFS, GRA, FAO, CCAC. If policymakers where they need to engage to get traction, this would be useful pointers, rather than an abstract discussion of intended outcomes. What are successful strategies to make progress in these areas? [Andy Reisinger, New Zealand]	text changed in rewriting
22709	99	24	100	3	Nice way to present information (could be done in this synthesized form much more frequently throughout the chapter), but needs refinement to get the messages right. [Anastasios Kentarchos, Belgium]	This section has been deleted
12211	99	9			This section lacks references. [Hans Poertner and WGII TSU, Germany]	This section has been deleted
21241	100	5	100	34	5.7.3.2 Is this list broad / ambitious enough? It feels like there is a lot more potential in this space e.g. biofortification, precision agriculture, AI / machine learning, crop breeding / GMOs, biological controls, etc.  It might be useful to dedicate some attention to the potential role of the bioeconomy in integrated supply chains (food, fuel, fibre, renewable materials, chemicals, pharmaceuticals etc.), including potential mitigation and adaptation benefits. [United Kingdom (of Great Britain and Northern Ireland)]	The sub-section has been deleted
39743	100	5	100	34	Section 5.7.3.2 seems extremely limited in scope and somewhat out of place (considering agricultural mitigation is addressed several times in other sections of the report). Suggest rewriting this section to review existing literature on agricultural knowledge systems and innovation (including demand-driven innovation) and how they relate to climate adaptation and mitigation, rather than reviewing a limited set of technologies. [United States of America]	The sub-section has been deleted
2185	100	5	100	34	In the context of foreign trade and domestic market, farmers knowledge, the innovation and application of technology play a key role. However, under the condition of the complex and changeable market environment, it's important to ensure the efficiency of exchange between producers, products and consumers and protect convenient and low-cost transaction. Therefore, policy-makers should pay attention to promoting the innovation of agricultural production organization mode, improving the agricultural services and extending the industrial chain. Please consider adding materials in this aspect. [Xiangzheng Deng, China]	future research needs and challenges have been added
14695	100	6	100	34	Suggest adding mention of artificial intelligence (e.g. application of AI to monitoring, risk assessment, modelling, forecasting and predictive capacity). [Canada]	The sub-section has been deleted
22713	100	19	100	19	There is much more up-to-date information on early warning than Downing et al. 2004, nor is this the first ever reference on the topic. [Anastasios Kentarchos, Belgium]	The sub-section has been deleted

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22715	100	25	100	30	mention: big data; AI algorithms; [Anastasios Kentarchos, Belgium]	The sub-section has been deleted
6519	100	37	100	41	those elements should appear in the SPM [Sara Lickel, France]	ILK is included in the SPM
12215	100	38	100	38	The reference "McLean and Nakashima 2018" seems to be wrong. Suggest to refer to: Nakashima, D. J. et al., 2012: Weathering Uncertainty: Traditional Knowledge for Climate Change Assessment and Adaptation. UNESCO and UNU, Paris and Darwin [Available at: <a href="http://unesdoc.unesco.org/images/0021/002166/216613E.pdf">http://unesdoc.unesco.org/images/0021/002166/216613E.pdf</a> ]. [Hans Poertner and WGII TSU, Germany]	Done
29807	100	38	100	39	Tsleil-Waututh strongly supports the call for greater inclusion of Indigenous knowledge in IPCC reports. Currently the report material acknowledges, but does not adequately fold-in Indigenous knowledge with equal weight to the peer-reviewed literature. [Tanya Smith, Canada]	A new cross-chapter box has been accepted to address this gap
6209	100	36	101	29	This section would improve with cross reference to the Indigenous and Local knowledge section in chapter 7 [Margot Hurlbert, Canada]	The section has been moved to the adaptation section and cross-reference added
12213	100	36			The section does not explicitly address 'Indigenous' knowledge yet. Choice of terminology needs to be clear: ILK, IK or LK, or traditional knowledge... What is really addressed in the literature? [Hans Poertner and WGII TSU, Germany]	There was a general agreement in the report to refer to all the different types of IK, LK, TEK, ILK as ILK
25567	101	31	101	40	This part should include the knowledge gaps related to cellular agriculture : risk assessment and nutritional properties. [, France]	added
23461	101	42	101	42	INSERT subsection on research on differentiation of types of farming systems (each with different opportunities and solutions, and supply-side integration (integrating land, crops, livestock, people and climate). The supply-side integration mirrors the demand side integration listed below. [John Dixon, Australia]	Knowledge Gaps section restructured to cover adaptation, mitigation and synergies and trade-offs
11525	101	42	102	47	I would suggest to add an item dealing with "Increasing the CO2 sink function of soils" [Jean-Luc Chotte, France]	partly added
21541	101	42			Building on an earlier comment, I would argue that a key knowledge gap is the pace and extent to which novel mitigation technologies (inhibitors, targeted breeding, etc) will be able to contribute to deep emission reductions in the long run, as this could fundamentally influence the extent to which emissions reductions from agriculture (especially livestock can only be achieved by land-use change, or by on-farm application of novel technologies. Methane inhibitors are as well tested as BECCS, but for some reason we have no hesitation to include BECCS in mitigation pathways to the tune of tens of Gt CO2 per year, but the potential from novel technologies in agriculture doesn't even get a mention and certainly is almost never included in integrated assessment model runs. So what their future potential is constitutes in my view a key uncertainty. [Andy Reisinger, New Zealand]	Added
27211	102	15	102	15	Please add "theoretically" after "could" and try to improve the language of this sentence. [, Germany]	Done
27213	102	16	102	16	Please insert ", monitored and verified" after "implemented" because these aspects are part of any trustworthy inventory. [, Germany]	Added
22717	102	22	102	33	There is a lot of information on this topic. Why hasn't it been assessed? (Also in the context of food security and adaptation) [Anastasios Kentarchos, Belgium]	This is mainly due to approved outline of the chapter.
12643	102	26	102	26	Suggested addition: Further research is also needed to understand the climate and soil benefits of increasing perennial crops over annual crops. [Carina Millstone, United Kingdom (of Great Britain and Northern Ireland)]	Added

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13029	102	28	102	30	Given the above sentences it would be good to include citations that deal with fruit and vegetable crops e.g.:  Nankishore, A., & Farrell, A. D. (2016). The response of contrasting tomato genotypes to combined heat and drought stress. <i>Journal of plant physiology</i> , 202, 75-82.  Kole, C., Muthamilarasan, M., Henry, R., Edwards, D., Sharma, R., Abberton, M., ... & Cai, H. (2015). Application of genomics-assisted breeding for generation of climate resilient crops: progress and prospects. <i>Frontiers in plant science</i> , 6, 563.  Beebe, S., Ramirez, J., Jarvis, A., Rao, I. M., Mosquera, G., Bueno, J. M., & Blair, M. W. (2011). Genetic improvement of common beans and the challenges of climate change. <i>Crop adaptation to climate change</i> (Yadav SS, Redden RJ, Hatfield JL, Lotze-Campen H and Hall AE. eds.). John Wiley & Sons, Ltd., Published by Blackwell Publishing Ltd, Richmond, Australia, 356-369. [Aidan Farrell, Trinidad and Tobago]	Added
26185	102	37	102	37	After "food waste" insert: ", and these risks could be mitigated by the use of renewable energy resources" [Reid Detchon, United States of America]	Done
12645	102	43	102	43	Suggested addition: Add 'regulate and tax' in the sentence: 'Areas for study include how to incentive, regulate and tax and raise awareness of the co-benefits of healthy consumption' [Carina Millstone, United Kingdom (of Great Britain and Northern Ireland)]	Added
22719	102	43	102	47	There is a lot of information out there. It's just not necessarily under 'climate change'. [Anastasios Kentarchos, Belgium]	But still we lack information in how to change behavior.
40775	102		102		what could not be assessed due to lack of evidence in literature? The section could be improved with this angle of analysis. [Valerie Masson-Delmotte, France]	Many thanks we included this approach in the revised version.
22721	103	1	103	15	Probably too short; where is health in this context? Nexus is always very fuzzy [Anastasios Kentarchos, Belgium]	we try to elaborate this. However, we need to keep it short due to page limit.
33421	103	1	103	15	The following reference precisely elaborates and opens perspective on the epistemological dimension, challenges and potential of the WEF Nexus approach: Cudennec C., Liu J., Qi J., Yang H., C. Zheng, Gain A.K., Lawford R., de Strasser L., Yillia P.T., 2018. Epistemological dimensions of the water-energy-food nexus approach. <i>Hydrological Sciences Journal</i> , 63, 12, 1868-1871, <a href="https://doi.org/10.1080/02626667.2018.1545097">https://doi.org/10.1080/02626667.2018.1545097</a> [Christophe Cudennec, France]	We elaborated this.
13025	103	17	103	17	Frequently asked questions. I think there is a gap here with regard to- What is the role of food miles/ local food in addressing climate change. There seems to be a reluctance to give a definitive statement that reducing 'food miles' is a good mitigation option. If this uncertainty is due to a gap in knowledge this should be highlighted as an area in need to research, if not can a more definitive statement be added? [Aidan Farrell, Trinidad and Tobago]	Many thanks. However, we briefly touched the issue of food miles in FAQ 5.2
12217	103	22	103	23	FAQ 5.1: It might be helpful to clearly name the "three pillars" again. [Hans Poertner and WGII TSU, Germany]	Many thanks. We clearly named the pillars of the food security.
12219	103	22	103	23	FAQ 5.1: Readers might appreciate a definition of "undernourished" and "overweight". Or could the source of this information be mentioned in the text? [Hans Poertner and WGII TSU, Germany]	We avoided these terms in the revised FAQ.
12221	103	25	103	25	FAQ 5.1: Can "some regions" be replaced by more precise information? [Hans Poertner and WGII TSU, Germany]	For having clarity, we omitted this term.
26187	103	30	103	30	After "reducing" insert: "the nutritional value of crops; affecting" [Reid Detchon, United States of America]	We included this piont in the revised version.

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1365	103	31	103	31	used to prepare "and produce" (?) food [Francesca Spagnuolo, Italy]	In revised version, this is omitted.
34041	103	37	103	48	as this is a FAQ section, make the sentence on mitigation potential of diets better readable, e.g. using brackets, and maybe relate these potentials to the total mitigation challenge [Elke Stehfest, Netherlands]	In the revised version, we did not provide any specific number. Instead, we described the mechanism.
12963	103	38	103	48	FAQ 5.2: It is extremely unwise to quote GtCO <sub>2</sub> -eq for dietary changes that mostly effect methane emissions. The conversion from methane to CO <sub>2</sub> can vary by a factor of 20 depending on the metric used (AR5 Table 8.7). Therefore these numbers could be very misleading to the public. These should be quoted in terms of methane only. [William Collins, United Kingdom (of Great Britain and Northern Ireland)]	In the revised version, we did not provide any specific number. Instead, we described the mechanism.
12223	103	41	103	41	FAQ 5.2: Please explain for people without background knowledge what a "low-carbon footprint diet" is or indicate in the previous sentence which aspects of a diet are considered "low-carbon" or "high-carbon". [Hans Poertner and WGII TSU, Germany]	In the revised version, we did not provide any specific number. Instead, we described the mechanism.
12225	103	43	103	44	FAQ 5.2: Please make sure readers without background knowledge understand the differences between Mediterranean, healthy, vegetarian and flexitarian diets. Can vegan diets be included as well? [Hans Poertner and WGII TSU, Germany]	In the revised version, we did not provide any specific number. Instead, we described the mechanism.
1925	103	46	103	46	If UK spelling should be "programmes". [William Lahoz, Norway]	Many thanks. In the revised version this word has been removed.
12227	103	46	103	48	FAQ 5.2: This reads as if the difference between developed or high-income countries on the one hand and developing. Lower-income countries on the other is the only aspect that determines scope for reduction in meat-based diets. There may be others worth including here as well, e.g. cultural aspects. [Hans Poertner and WGII TSU, Germany]	We revised the FAQ to describe the mechanism behind dietary change reducing agricultural GHG emissions.
33041	103	46	103	48	The statement mentions here "In high-income industrial countries, there is scope for reducing meat consumption with tangible environmental benefits; in developing countries, high meat-based diets are not as prevalent and the scope for reductions may be limited" needs to be substantiated with references. With growing economies developing countries are accelerating in meat consumption, and the trend in developed countries remain unchanged.  References: WHO <a href="https://www.who.int/nutrition/topics/3_foodconsumption/en/index4.html">https://www.who.int/nutrition/topics/3_foodconsumption/en/index4.html</a>  The Nutrition Transition: New Trends in the Global Diet. Adam Drewnowski Ph.D Barry M. Popkin Ph.D. Nutrition Reviews, Volume55, Issue2, February 1997, Pages 31-43  Global Production and Consumption of Animal Source Foods. Andrew W. Speedy. The Journal of Nutrition, Volume 133, Issue 11, 1 November 2003, Pages 4048S–4053S.  Delgado CL. Rising consumption of meat and milk in developing countries has created a new food revolution. J Nutr. 2003 Nov;133(11 Suppl 2):3907S-3910S. doi: 10.1093/jn/133.11.3907S. [Neeraja Havaligi, United States of America]	Sorry, we do not have space for references in FAQ.

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34043	103	47	103	48	als state that many emerging economies have strongly growing meat demands, and substantial levels of meat consumption, and thus potential for reduction. And for countries with currently low levels of meat consumption you should rather state that it is important to avoid that growing incomes will results in western high-meat dietary patterns. [Elke Stehfest, Netherlands]	We agree with you. We revised the FAQ to describe the mechanism behind dietary change reducing agricultural GHG emissions.
12229	103	48	103	48	FAQ 5.2: "high meat-based" or "animal-based"? [Hans Poertner and WGII TSU, Germany]	We revised the term to animal source food.
40777	103		103		framing or final section? I am surprised to find this at this final place. [Valerie Masson-Delmotte, France]	We now have a final concluding section: 5.8 Future challenges to food security
23249	103	31			change to waterborne diseases instead of diarrheal [Elizabeth Diego, Kenya]	Text changed
13033	104	1	104	1	I did not check the references systematically, but I did see a number of errors, e.g.: Dinesh etal. (2017)-incomplete reference Prohens, etal. (2015)-incorrect first author [Aidan Farrell, Trinidad and Tobago]	Corrected
40779	104		104		positive outcomes to be mentioned in FAQ1 (eg longer growing season). FAQ2 could provide numbers at the individual scale (not global scale) / types of diets (annual emissions / avoided emissions). Trends could be mentioned. [Valerie Masson-Delmotte, France]	We agree with you. However, we revised the FAQ to describe the mechanism behind dietary change reducing agricultural GHG emissions.
6635	104	1	164	27	Include the next references for previous comment: 1) Mallinger, R.E.; Gratton, C. 2015. Species richness of wild bees, but not the use of managed honeybees, increases fruit set of a pollinator-dependent crop. <i>Journal of Applied Ecology</i> , 52 (2): 323-330.; 2) Pires, V.C.; Silveira, F.A.; Sujii, E.R.; Torezani, K.R.S.; Rodrigues, W.A.; Albuquerque, F.A.; Rodrigues, S.M.M.; Salomão, A.N.; Pires, C.S.S. 2014. Importance of bee pollination for cotton production in conventional and organic farms in Brazil. <i>Journal of Pollination Ecology</i> , 13 (16): 151-160.; 3) Rader, R.; Edwards, W.; Westcott, D.A.; Cunningham, S.A.; Howlett, B.G. 2013. Diurnal effectiveness of pollination by bees and flies in agricultural Brassica rapa: Implications forecosystem resilience. <i>Basic and Applied Ecology</i> , 14: 20-27. [, Mexico]	not clear which comment
6639	104	1	164	27	Include the next references for previous comment: 1) Ibrahim, M., Camero, A., Camargo, J.C., Andrade, H., 2000. Sivopastoral systems in Central America: experiences from CATIE. In: <i>The agroforestry systems of Latin America and the low deciduous forest in Mexico</i> . IICA. INIFAP. UAEM, Zacatepec, Morelos, Mexico, pp. 117e141.; 2) Murgueitio, E., Cuellar, P., Ibrahim, M., Gobbi, J., Cuartas, C.A., Naranjo, J.F., Zapata, A., Mejia, C.E., Zuluaga, A.F., Casasola, F., 2006. Adoption of livestock agroforestry systems. <i>Forage Pastures</i> 29, 1e11.; 3) Jose, S., 2009. Agroforestry for ecosystem services and environmental benefits: an overview. <i>Agrofor. Syst.</i> 76 (1), 1e10. [, Mexico]	not clear which comment
6643	104	1	164	27	Include the next references for previous comment: 1) Monterroso-Rivas, A. I., Conde, C., Gay, C., Gómez-Díaz, J. D., & López, J. (2014). Two methods to assess vulnerability to climate change in the Mexican agricultural sector. <i>Mitigation and Adaptation Strategies for Global Change</i> , 19(4), 445–461; 2) PNUMD-INECC, 2017. Estimation of potential yields with climate change scenarios for various agricultural crops in Mexico. Project 86487 " Collaboration platform on climate change and green growth between Canada and Mexico ", 218 pp, Antonio R. Arce Romero, Mexico.; 3) Gabriel Morales, J. (2003). Socioeconomic typology of agricultural activities. A tool for estimating potential yields with climate change scenarios for various agricultural crops in Mexico 198 synthesis for ecological ordering (First Ed). Mexico, DF: INE, SEMARNAT.; 4) INEGI. (2015). National Agricultural Survey 2014. Relevant information (Bulletin 328/15) Aguascalientes, Mexico. [, Mexico]	not clear which comment

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23859	116	16	116	18	The Bibliography details of Dinesh et al, 2017 is incomplete. May please be verified. [, India]	Corrected
27215	134	20			Please check the Lippert et al. reference in the bibliography: shouldn't it be "Lipper et al., L., 2018: Climate Smart Agriculture - Building Resilience to Climate Change. 52nd ed. Natural resources Management and Policy, FAO, Springer."? Please see <a href="https://link.springer.com/content/pdf/10.1007%2F978-3-319-61194-5.pdf">https://link.springer.com/content/pdf/10.1007%2F978-3-319-61194-5.pdf</a> the bibliography. [, Germany]	Corrected
22191	151	7	151	7	Please fill DOI or volume and page [Junhwan KIM, Republic of Korea]	Corrected
22193	151	9	151	9	Please fill DOI or volume and page [Junhwan KIM, Republic of Korea]	Corrected
18025	4	33	4	34	When reread in the context of the information presented in Section 5.2.4.3, this sentence is unclear. Does it imply that CO2 effects are dependent on the nutritional status of the crops in question? Or is meant to refer more to nutritional concentration? Based on the information in the corresponding Section, would nutrient availability be more suitable? [Beau Damen, Thailand]	Noted, paragraph has been rewritten
18027	6	35	6	37	This sentence is unclear and may be trying to summarize too much. Possible rewording could be "...consideration of gender, equity, culture and ethnicity as well as access to food and (local) capacity are important in devising context-specific mitigation and adaptation measures and adoption....". [Beau Damen, Thailand]	Noted, text has been deleted
6953					Please see comment on Ch 2 7:29 - it would be helpful to translate information on diet choices into language that can be used by individuals, e.g. grams of meat (per type) per day that could be considered sustainable, or grams of food type per day that represents daily protein requirements. Such information would be a useful yardstick to keep in mind. [Debra Roberts, South Africa]	Beyond the scope
32859					Steve Gliessman (2018) Defining agroecology. Agroecology and Sustainable Food Systems 42(6): 599-600. [Doreen Stabinsky, United States of America]	Accepted, cited
32861					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: <a href="http://climatelandambitionrightsalliance.org/report">climatelandambitionrightsalliance.org/report</a> [Doreen Stabinsky, United States of America]	Accepted, cited
23159					After including sections 5.2.5.3, 5.2.5.4 and 5.2.5.5, then this is to remind you to insert appropriate references for the knowledge review that has been made [Girma Diga, Ethiopia]	References have been included in all sections
23161					Please include, evidences for the injustice policy decisions by the governments, that the drylowland areas,(where temeprature and evapotranspiration is still on the rise; while rainfall is declining trend) havie less potentail for productivity enhancement and thefore must be removed from the potetail breadbasket maps (bright spots map). . [Girma Diga, Ethiopia]	Beyond the scope
23163					Evidences are also important for the likely climate change impact on the injustice statements that "lowlanders are physiologically weak, as they do not eat enough food (less consuers)", compared to their fellow highlanders (may be over-consumers) and therefore, the contribution of lowlanders to the econpmic developemnt of a nation is lower.. [Girma Diga, Ethiopia]	Section on Just Transitions included
23165					Additional literatures on the climate change induced opportunity eg; annexing new land (bright spots) can be includd in this REPORT, as linked to food secuiry or food system [Girma Diga, Ethiopia]	Unclear

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39745					Wild-caught terrestrial and aquatic animals are globally important sources of food/protein, particularly for the food-insecure rural poor. Wild-caught terrestrial meat serves as a key contributor to the food security of millions of individuals throughout the developing world, often where domestic alternatives are scarce and expensive (Brashares et al., 2011; Swamy and Pinedo-Vasquez, 2014). By some estimates, wild-caught meat contributes 80-90% of the animal protein consumed in certain regions of West and Central Africa (Pearce, 2005) and plays an important role in dietary diversity for modern forest societies (van Vliet et al., 2015). Wild-caught fish is a highly nutritious food that contributes to food security and livelihoods for over 400 million Africans in both inland and coastal areas (BRIDGE, 2018). Dependence on coastal fisheries in West Africa has increased by about 2% per decade as climate stressors negatively impact crop productivity (Belhabib et al., 2015). The exclusion of wild-caught meat/fish from this chapter diminishes the importance of this critical food source for millions of people and disregards thoughtful synthesis of the impact climate change may have on this food source. This chapter neither highlights the importance of wild-caught fisheries, both marine and freshwater, to food security and nutrition for billions of people nor does it mention how improving fisheries management can offset many of the negative effects of climate change. For example: (i) over 3 billion people depend upon fish for food security and nutrition (FAO, SOFA, 2018); (ii) about 10% of the world's population is at risk of malnutrition if the decline in fisheries due to poor management is not addressed, and more nutrition-sensitive fishing policies are adopted (Golden et al., 2016); (iii) fish is the world's most widely traded food commodity [the export value of fish from developing countries is greater than the export value of rice, tea, bananas, sugar, and cocoa combined (FAO, 2018)]; and (iv) according to a recent paper in Science, improved fisheries management could offset many negative effects of climate change (Gaines et al., 2018). [, United States of America]	Fisheries covered in SROCC
39747					The chapter is very a good summary of the current literature; however, it lacks a clear focus and target message that provides guidance for policymakers to move forward with policy change. The chapter also tends to be slanted towards food security for the urban and 'developed' world and does not address the key issues for the most vulnerable. [, United States of America]	Assesment statements provided in many sections. Both developed and developing regions are covered
39749					The chapter covers a number of critical aspects of food security related to climate change. The chapter incorporates aspects of the food system as the nexus of climate change interactions related to food security. However, the chapter needs major restructuring to clarify system interactions related to food security and enhanced clarity on how the various sections of the chapters are interconnected with the overall conceptual framework (which needs further work). [, United States of America]	Some sections have been restructured to focus on the pillars of food security
39751					Conceptual framing and context is poorly articulated. Additional effort to enhance the connection between food system components to food security warrants further elaboration. Usage of the conceptual framing to outline the following sections of the report would provide a more coherent presentation of the scope of the chapter and allow the authors to better gage the relative volume of material to be included relative to assumed importance to the critical aspects of the climate / food system / food security interactions. Conceptual framing should enhance the context of local cultural social-ecological system aspects affecting vulnerabilities and opportunities to deal with food security. [, United States of America]	Some sections have been restructured to focus on the pillars of food security



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Comment No	From Page	From Line	To Page	To Line	Comment	Response
39753					The chapter is unbalanced related to the climate impacts on food systems and within food systems. In addition, implied changes in the food system are poorly connected or connected with uneven reference to food security issues and implications. [United States of America]	Chapter is more balanced now
39755					Connections with SDGs, food-energy-water nexus, and social-ecological connections across the globe (globalization considerations) are not well integrated into the report as system aspects that create vulnerabilities to climate change and opportunities to ameliorate impacts to climate change. [United States of America]	Accepted, added text.
39757					The assessment report "Climate Change, Global Food Security, and the U.S. Food System" (USDA, 2015) is an important contribution to this topic but is not discussed or cited. Consider including. [United States of America]	The chapter did not focus on food security in specific countries
249					The contents of research paper of Karimi et.al. (2018), can be use for climate change impact assessment on food security, e.g. wheat and maize in Iran. The various sub titles of chapter 5, e.g. 5.1.2.2 Status of food insecurity - 5.2.2.2 Observed impacts on crop production - 5.2.3.1 Future impacts on crop production and 5.3.1 Adaptation options can be use the findings the above reference to declare the condition of Iran. [Hamidreza Solaymani Osbooei, Iran]	Accepted, cited
16187					The contents of research paper of Karimi et.al. (2018), can be use for climate change impact assessment on food security, e.g. wheat and maize in Iran. The various sub titles of chapter 5, e.g. 5.1.2.2 Status of food insecurity - 5.2.2.2 Observed impacts on crop production - 5.2.3.1 Future impacts on crop production and 5.3.1 Adaptation options can be use the findings the above reference to declare the condition of Iran. [Hamidreza Solaymani Osbooei, Iran]	Karimi et al is cited
15771					This second version of the report is really quite excellent and addressed most of my earlier concerns effectively. My only suggestion is for the authors to elaborate a bit more what enhancing capacity building to promote sustainable food systems entails. On page 99, the authors talk about systems thinking and co-design. I would have liked to see this concept introduced earlier in the chapter and further elaboration provided with regards to how these could be put to use in different contexts, including in marginalized environments. Once again, congratulations on all the hard work that has gone into this report. The outcomes and recommendations are clear. [Helena Shilomboleni, Canada]	Noted, thank you. Capacity building included in Enabling Conditions
4105					Provide more focus on migration, human fluxes, under food poverty worsened by climate change with short, mid, long term projection. [Noureddine Yassaa, Algeria]	Section on migration is included
4107					Focus on projected conflicts and assess the conflict types with regards to access to water, energy, land,... [Noureddine Yassaa, Algeria]	Section on conflict is included
7481					Chapter 5 is tightly written. However, there is need to have a flow chart or diagram to show the relationship between geosystems, climate change, socio-economic impact, ecosystem, and vulnerability. [Onema Adojoh, United States of America]	Figure 5.1 has been updated and show the interlinkages between the climate system, food system, ecosystem (land, water and oceans), and socio-economic system.
1327					Coral bleaching will lead to severe disruptions in fisheries, affecting protein intake of more than 1 bln people worldwide. This has not been addressed in the chapter [Oswaldo Lucon, Brazil]	Fisheries covered in SROCC
1329					No mention seen to pasture dieback, common in Amazon and Queensland regions [Oswaldo Lucon, Brazil]	Beyond the scope
1331					No mention to impacts from packaging plastics of processed food [Oswaldo Lucon, Brazil]	Impacts from packaging is discussed

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Comment No	From Page	From Line	To Page	To Line	Comment	Response
1707					The general comment: One of main missing point of the chapter is the focus on water quality - climate change and food security interlinkage. The latest international publication on "Developing a Global Compendium on Water Quality Guidelines" (2018). clearly outlines that the water quality should be a one of focal point of the climate change impacts on water resources. The report elaborates the discussion on how water quality influence on the food production, preparation and distribution. Due to the harsh climate conditions diminish the access to improved water for food production, preparation and distribution. Water pollution is a major cause of food poisoning. Any effect on the water quality directly influences the sustainability of the food system. : Ref Developing a Global Compendium on Water Quality Guidelines at <a href="https://www.iwra.org/wp-content/uploads/2018/11/WQ-compendium-final-1.pdf">https://www.iwra.org/wp-content/uploads/2018/11/WQ-compendium-final-1.pdf</a> Withanachchi, S. S. (2018). Sustainable Water Resource Management for a Safe Food System in Georgia: A Study of Water Quality Governance, Focusing the Mashavera River Basin (Doctoral dissertation). [Sisira Withanachchi, Germany]	Water quality is covered. Bond et al cited. Doctoral dissertation not a valid reference
1709					Under the section of Integrated agricultural practices : There is no direct mention about the organic agricultural system of patterns. As we are talking about the Agroecology and Climate-smart agriculture, the organic agricultural system should be pointed out. Soil organic carbon pool protection, soil fertility and water retention capacity is increasing through organic agriculture. This is a proved fact. [Sisira Withanachchi, Germany]	We consider that organic production systems are part of the more general description of agroecology
29795					There is a general emphasis on commercial agrisystems to the detriment of local and Indigneous food systems. This presents a skewed picture of the climate change impacts, vulnerabilities, adaptation and resilience on food systems. [Tanya Smith, Canada]	Smallholder farming systems are also discussed
40759					I have a specific request to chapter 5. I often get in outreach events questions about GHG emissions due to just human metabolism (respiration) + indirect ones (food systems). I identified only one paper on this (Prairie and Duarte, about a decade ago). Could an update be provided for this, as well as implications in projections of growing human population (= implications to reduce food system emissions)? [Valerie Masson-Delmotte, France]	Beyond the scope