

#	ID	Ch	From Page	From Line	To Page	To Line	Comment	Response
1	35657	7	0	0	0	0	The chapter as a whole is still in a preliminary state; the reference section is quite chaotic and should not have been presented like this in a first-order draft; (Reimund Rötter, MTT Agrifood Research Finland)	The references are being taken care of. accept, modified soon. Agreed and we are working to get all references as pdfs. This was not completed by the FOD.
2	35658	7	0	0	0	0	There is considerable imbalance among the sections of the chapter; Section 7.3 is by far the largest in size; unfortunately it is just on issues that have been extensively addressed in previous IPCC assessment reports ("assessing impacts, vulnerabilities and risks); other, potentially more important sections (such as 7.2 on observed impacts, or, 7.4 on projected integrated CC impacts) are either with too little substance, or premature; also much more could be said in a 1st order draft on research and data gaps than is presented here in two small paragraphs; anyway, the many placeholders/annotations suggest that the authors are aware of many shortcomings/considerable scope for improvements (Reimund Rötter, MTT Agrifood Research Finland)	Thanks. The placeholders will address the gaps/shortcomings. Good comments, sections need balanced further
3	35897	7	0	0	0	0	I am not sure but maybe could fit on 7.6???. Discussions on spices and flavours are absent whereas these are groups that contribute in consuming foods (preparation, consumption and food utilisation as a whole) (Precillia Ijang Tata épouse Ngome, Institute of Agricultural Research for Development)	This is a good idea, but page limits make it infeasible. Maybe, but depending if any references. The chapter structure is decided by IPCC.
4	36425	7	0	0	0	0	general comment: the role of soil organic carbon for adaptation needs to be pointed out in this chapter - currently it is missing. It should be presented in relation to water management and it should be linked to practices that lead to increased soil carbon levels and it should also refer to the corresponding mitigation potential, which will be discussed in AR5, WGIII, chapter xx on agriculture, I assume. Above, I made some suggestion on where one could include this, but it would be good to further strengthen the role of soil carbon, e.g. already in the summary. (Adrian Muller, Research Institute of Organic Agriculture FiBL)	The author team will look into the role of soil organic matter in relation to water management vis-vis food security. More a WG3 issue. How is this relevant for a climate impacts chapter on food security and food production systems?
5	36503	7	0	0	0	0	In relation to fisheries, but probably also all other food production, I think there should be a paragraph in the Exec Summary on the interaction between all human pressures, including climate change. From this it follows that reducing other pressures (e.g. overfishing, pollution etc.) will help with adapting to climate change and is a robust, no-regret strategy. (Keith Brander, DTU)	Good idea, the CLAs may look into the interaction between all human pressures and food including fisheries. This also comes in the SPM.
6	37301	7	0	0	0	0	I am concerned by the way that meat and particularly beef production are handled (or not handled) in the chapter. It seems to be assumed from the outset that (principally grain-fed) meat consumption will increase according to current trends, and that this consumption should be assumed as a part of future food demands and needs. While I do not object to this assumption per se, it should be stated explicitly. As explained in Stehfest et al. 2009, for instance, it is clear that rising meat consumption creates most of the rising global demand for land use and crops and hence pressure on prices. Beef production also constitutes by far the largest share of rising GHG emissions from food production and land use, and adds tremendously to the costs of mitigation and adaptation. Reduced grain-fed beef production ought to at least be on the table here as a mitigation and adaptation option. Furthermore, negative impacts on cattle production from climate change may ease demand for grain and soybeans, and may also constitute a significant negative climate feedback, given GHG emissions from cattle and cattle-driven land use. Citation: Stehfest, Elke, Lex Bouwman, Detlef van Vuuren, Michel den Elzen, Bas Eickhout, and Pavel Kabat. "Climate Benefits of Changing Diet." Climatic Change 95 (2009): 83–102. (Samuel White, Oberlin College)	It is unclear how the grain-fed meat vs fodder-fed meat is a major issue in global food security and the impacts of climate change. Discussed partly in the husbandry section. Is this strictly relevant to chapter 7 given space constraints?
7	40867	7	0	0	0	0	My main comment would be to encourage you to add additional geographic specificity. For example, discuss unique challenges in sub-Saharan Africa and Southeast Asia. Also, given that North America exports large quantities of grains to the rest of the world, it's worth mentioning that declining ag productivity in North America would significantly impact food security in the rest of the world. For a discussion of the risk of declining ag productivity in North America, see the agriculture chapter in the 2009 U.S. National Climate Assessment (downloads.globalchange.gov/usimpacts/pdfs/climate-impacts-report.pdf). Here's an article that breaks down food security needs by region in Africa: http://leadingmatters.stanford.edu/dallas_ftworth/documents/Lobell_Environmental.pdf (John Posey, East-West Gateway Council of Governments)	The CLAs/LAs will look into whether a sub-section on geographic specificity (e.g. Sub-Saharan Africa, South Asia, North America) is needed or food situation of these areas may be described under the existing sub-sections. Comment also made by RE. In the FD we have made a regional box on this issue.
8	41568	7	0	0	0	0	My general observation on this chapter is that authors are doing a robust assessment. However, in this FOD draft the authors have not had the time to reflect on and describe all of the key messages that deserve to come to the top (ie in the Exec Summ and the conclusions) . It is quite difficult for reviewers to comment fully when authors have not made fully clear the complete range of their overall conclusions. Also, it can be a bit risky if you delay posting all draft conclusions at this stage because this can delay reviewer-feedback on overall conclusions until the SOD... and there is less time after the SOD to reflect and revise than there is at the FOD stage. It might be worth authors working up more fully their draft conclusions and sending these to the expert community, informally and BEFORE THE SOD (ie. in the next 2 months, c. Sept-Oct) so that authors can receive earlier feedback from a selection of experts which can be incorporated in the SOD draft. (Martin Parry, Imperial College)	The CLAs/LAs will look into how the key messages can be highlighted in the Executive Summary and Conclusion sections. Exec summary has to be delivered by 121207 and will be done. This is good point and we will try and do this. The comments on the SOD were on the one hand that we were too conservative (USA) and on the other that we were neo-Malthusians - so we think we are somewhere in the middle - conservative but relevant.
9	41627	7	0	0	0	0	Lacking confidence statements in detection and attribution (Lourdes Tibig, The Manila Observatory)	Accepted. The confidence limits will be added where appropriate.
10	41629	7	0	0	0	0	The sentence is ambiguous. (Lourdes Tibig, The Manila Observatory)	The comment is not clear. No sentence indicated.
11	41631	7	0	0	0	0	What is meant by "also damaging and occasionally lethal"? And which crops? (Lourdes Tibig, The Manila Observatory)	The page no. and line no. for the comment is not given. No sentence indicated.

#	ID	Ch	From Page	From Line	To Page	To Line	Comment	Response
12	42412	7	0	0	0	0	<p>This chapter suffers from an exceedingly poor characterization of the issue of food security, and a failure to examine the trend in global food security in its long term context, and the factors driving those trends. Specifically, it should note that, despite increases in global food prices over the last decade (and long term increases in climate change), the long term trend (over several decades) has been an increase in global food security. First, trends from 1900 to 2008 in food affordability (defined as the ratio of food prices to GDP per capita) for two countries at almost the opposite ends of development, the U.S. and India, indicate that, although there was a slight decline in food affordability in the 2000s, the long term trend has been a remarkable increase in affordability (Goklany 2009d, pp. 10-11, Figure 8). Second, data from the 1930s to the present show that available food supplies per capita have increased for virtually all countries (that have data) (Goklany 2007b, Figure 2; Goklany 2007c, Figure 2.1 and 2.2). Third, the prevalence of malnutrition has declined (Goklany 2007b, Figure 3; Goklany 2007c, pp. 21-27). These trends are also generally consistent with trends in hunger. These trends indicate that the fraction of population suffering from chronic hunger has generally declined, although there was a slight uptick in the absolute numbers since the early 2000s (because of population growth, increased demand in highly populated developing countries which have seen incomes advance, and biofuel production which has diverted agricultural production and land away from food production) [see FAO (2010) and Goklany (2007c, 2011), and references therein]. Factors responsible for this include: increased yields [because of technological change, much of it underwritten by higher energy use; see Erisman et al. (2008), Pelletier et al. (2008), Goklany (1999)]; international trade in agricultural inputs and outputs; higher incomes and lower poverty worldwide because of economic growth (which enables people to purchase food) (Goklany 1998, 1999, 2007c); trade in food inputs and outputs; and improvements in global safety nets, also arguably enabled by increasing wealth and greater availability of food (Goklany 1995, 1998, 2007c, 2007d). As a consequence, famines such as those that plagued the world even a few decades ago are today due more to "failures of institutions, policies, and political systems causing greater poverty, civil strife, and disincentives to food production, [than] to the inability to physically produce food" (Goklany 1999, p. 110, and references therein). The decline in the sensitivity of food security to weather and crop failures is also evidenced by the fact that, although over the entire 20th century more people died from droughts than all other extreme weather events combined, global deaths from such events have declined 99.97% since the 1920s, and currently they constitute less than 1% of deaths from all extreme weather events (see Goklany 2009c, 2009d). (Indur Goklany, Independent)</p>	<p>The LAs are looking into proper characterization of the issue of food security, its longterm trends and driving factors for these trends. Many of these general points are referred to in the chapter and other parts of the WG2 report. References prior to AR4 are not considered since the literature since AR4 is more than sufficient for the synthesis. Thank your information, but we still concern about the relationship between food and CC, rather than food productivity itself. While some of the points made here are justified there is little in this comment that specifically deals with the issue of climate and food security and food production systems. We have cited Goklany, I.M., 2007: Integrated Strategies to Reduce Vulnerability and Advance Adaptation, Mitigation and Sustainable Development. Mitigation and Adaptation Strategies for Global Change, 12, 755-786 in the FD.</p>
13	42586	7	0	0	0	0	<p>In regards to agricultural systems, the 'whole of climate approach' to agricultural decision systems can be located/referred to in Meinke and Stone (2005) and Stone and Meinke (2005): References - Stone, R. C., and Meinke, H. (2005) 'Operational seasonal forecasting of crop performance'. Philosophical Transactions of the Royal Society B 360, 2109-2124. Meinke, H. and Stone, R.C., (2005). Seasonal and inter-annual climate forecasting: the new tool for increasing preparedness to climate variability and change in agricultural planning and operations. Climatic Change 70, 221-253. (Roger Stone, University of Southern Queensland)</p>	<p>Thanks. The identified papers will be reviewed. Papers are dated as pre AR4 and thus not very useful for AR5. What is this referring to? Unclear comments</p>
14	43217	7	0	0	0	0	<p>I have three general comments about this chapter: 1) The emphasis on food systems and food security, in contrast to food production alone, is to be welcomed. However, much of the chapter is about production and adaptations to production with very little about food and human nutrition; 2) Many of the sections appear as a flow of consciousness rather than a well-constructed review, so that it is difficult to gain from the information presented a general feeling for what is important - I could not give it to a final year undergraduate student as a state of the art summary; 3) The majority of the population now lives in urban areas and future increases in people will largely be in urban areas - this chapter is largely silent about the consequences of this change for food security. (Peter Gregory, University of Reading)</p>	<p>Food and human nutrition aspects are covered in the chapter on Human Health, and food situation in urban areas is covered under chapter Urban Areas (MMI). We agree, we need a balance between food production and food security. We have actively searched the post-2007 science literature and there is a dearth of papers specifically on climate impacts of food security and food systems. We will continue to look but suggestions for papers in which food security has been detected and attributed to climate change would be welcome. Please see Figure 7-1 in the FD to see the balance of literature - which we are asked to synthesise and evaluate. No refs = no synthesis.</p>

#	ID	Ch	From Page	From Line	To Page	To Line	Comment	Response
15	44234	7	0	0	0	0	Although titled "Food Security and Food Production Systems", the food security is very much dependent on distribution, access and consumption patterns. Existing studies on access and consumption patterns are limited as indicated in the research gap section (7.6). However, existing studies are not sufficiently reflected. Entry points would be: Kearney, J. (2010) Food consumption trends and drivers. Philos Trans R Soc Lond B Biol Sci 365, 2793—2807; Alexandratos, N. (2006) World agriculture: towards 2030/2050, (Food and Agriculture Organization, Rome), Technical report; Bruinsma, J. (2003) World agriculture: towards 2015/2030: an FAO perspective. (Earthscan, London) (Dominik Reusser, Potsdam Institute for Climate Impact Research)	the comment is relevant with the following response/action. We assume that work such as Bruinsma 2003 and Alexandratos 2006 which are global projections of demand and supply are covered in other sections (e.g. its focussed mostly on availability)so we don't think this is particularly relevant for our section. However adding reference to potential effects of changes in consumption pattern on other dimensions of food security is relevant, particularly for utilization. There is literature available about the change in consumption on these other dimensions of FS - including the Kearner (2010) reference - but any specific impact of climate change is not included. Therefore we think it would only be useful to note that changes in consumption patterns may have impacts on non-availability dimensions of food security (cite relevant literature) but climate change specific impacts of this effect have not been investigated.We added a para in the intro section 7.3.that raises the issue of changing consumption patterns on food security citing relevant literature.Would be good to boost these ideas as indicated and refs
16	44507	7	0	0	0	0	General: References to WGI AR5 Chapters and/or SREX currently are rather unspecific (sometimes not even providing the Chapter number, e.g., Section 7.2.1, page 5) or completely missing (e.g., Sections 7.3.2.1.1 and 7.3.2.5.1 on Mean and extremes of temperature and precipitation, 7.3.2.1.2 on Impacts from CO2 and Ozone – see WGI AR5 Ch6/11; or 7.3.2.5.2 on Ocean Acidification Impacts – see WGI AR5 Ch3/6). (Thomas Stocker, IPCC WGI TSU)	Thanks. References to WGI AR5 and SREX will be provided, as appropriate. We have tightened up the numbering in the FD
17	44508	7	0	0	0	0	Section 7.4: Projected Integrated Climate Change Impacts mentions the need to wait for CMIP5 but does not refer to any of the WGI Chapters 11, 12, or 14 dealing with climate change projections in WGI AR5. Encourage authors to make use of, and carefully cross-reference the relevant information from these WGI AR5 chapters. (Thomas Stocker, IPCC WGI TSU)	It is not CMIP5 per se that we are dependant on, but rather food production assessments that use CMIP5. Hopefully a number of these will appear in the literature over the next few months. However, the review rightly points out that there is WG1 work of direct relevance.
18	45474	7	0	0	0	0	Overall this section should include more information on other food security impacts of climate change, such as food price volatility, access to markets, nutrition - and not solely focus on food production. We suggest consulting the following reference (which can be found in Supplementary Materials) for more information: WFP and UK Met Office Hadley Centre (2012) Climate impacts on food security and nutrition. WFP/UK Met Office: Rome/Exeter. (Carlo Scaramella, World Food Programme)	The comment is relevant with the following response/action. Most of the section does actually cover issues such as food price volatility and the access dimension to FS (hence the significant write up on net buyers and net sellers of food!) However we will add this reference (which is a map) We consulted the map an have included a discussion of global model outputs on food security in section 7.3.there need a balance between food production and food security. Two figures in the FD address this now.
19	45654	7	0	0	0	0	The scope of the chapter is clear: food systems. However the chapter focuses on "producing food" as a food system activity, and "food availability" as a food system outcome (as in Figure 7-1). Much more discussion beyond these two aspects is necessary for the chapter to provide a balanced overview of the relationship between food security and climate change. (Hideki Kanamaru, FAO)	Thanks. The comment will be taken into account (MMI).Yes, there need a balance between food production and food security.The chapter is a synthesis and review of existing work. There is little on the topics raised by the reviewer to be found in the literature and thus little to be included in the chapter.Agree we need to get more in on food access and utilisation to give a more balanced overview. Can we include a sentence or two on each of the 9 bullets in Fig 7.1?
20	45656	7	0	0	0	0	Throughout the chapter, discussion on water availability for agriculture (impact on food systems, adaptation through water management, vulnerability characterized by water resources factors) is insufficient. No link is made with chapter 3 discussions. Water issues are discussed at length, only in section 7.3.2.6 (livestock), (Hideki Kanamaru, FAO)	Thanks. The comment will be taken into account. Addressed at the LAM3 meeting.should discuss water. There is a cross chapter box in the FD including water.
21	45657	7	0	0	0	0	Biophysical impacts are well covered but there is insufficient discussion of socio-economic factors in the food systems. More integrated discussion of both biophysical and socio-economic aspects is also necessary. (Hideki Kanamaru, FAO)	Very little literature is available on socio-economic impacts of climate change.The chapter is a synthesis and review of existing work. There is little on the topics raised by the reviewer to be found in the literature and thus little to be included in the chapter.
22	45659	7	0	0	0	0	For crop agriculture, I understand there are a lot of studies about crop yields. However more discussoin about area harvested and crop production is warranted. Here a link should be made between biophysical assessments of crop yileds and economic assessment of crop production through agricultural markets (domestic and international). (Hideki Kanamaru, FAO)	Thanks. More discussion on economic assessment through agricultural markets is beyond the scope of this chapter. It can be best covered in chapter on economic assessment of climate change impacts - see chapter 10.

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23	45660	7	0	0	0	0	There is no discussion about disaster risk reduction or disaster risk management in relation to adaptation in agriculture sectors. Coping better with disasters is often considered as an entry point to adaptation in many poor countries that are prone to extreme weather events. (Hideki Kanamaru, FAO)	The LAs will look into adding discussion on disaster risk reduction and disaster risk management in agriculture. Such discussion can best be covered in Adaptation chapters (7.5)
24	46283	7	0	0	0	0	Chapter is well written but not well interwoven and properly linked. Chapter mainly focuses on Food production and very less has been reported on Other parts of the food system besides production. The chapter also not covers the socio-economic impacts of food insecurity. This point is requested to be taken care of. (Arif Goheer, Global Change Impact Studies Centre (GCISC))	Thanks. The comment will be taken into account. There needs a balance between food production and food security. The chapter is a synthesis and review of existing work. There is little on the topics raised by the reviewer to be found in the literature and thus little to be included in the chapter.
25	46284	7	0	0	0	0	Language of the chapter needs to be improved for clearing ambiguities found at various places (Arif Goheer, Global Change Impact Studies Centre (GCISC))	The ambiguities have not been pointed out.
26	46285	7	0	0	0	0	The references at places are missing, incomplete and also not in alphabetical order. Also what is the need of additional references. These can be merged in the actual references list. (Arif Goheer, Global Change Impact Studies Centre (GCISC))	The issue of references are being taken care of. Agreed and we are working to get all references as pdfs. This was not completed by the FOD.
27	46286	7	0	0	0	0	At some places double brackets are used (e.g; Page 2 line 54, Page 3, Line 2; Page 3, Line 15 etc). A uniform procedure needs to be adopted (Arif Goheer, Global Change Impact Studies Centre (GCISC))	clarified, the double brackets will be corrected.
28	46694	7	0	0	0	0	In general, the chapter might need further elaboration and inclusion of more diverse and emerging thoughts on food security and food production systems. Particularly, the linkages and analysis of food security issues with respect to few extreme events could have been highlighted as several severe events have far-reaching implications on the food security and production systems in last few years time. For example, the Thailand flood in 2011 and Pakistan flood in 2010 had massive implications on the food security where the events are often linked with climatic changes and adaptation issues. Similarly, the effect on fisheries and livestock could have been better documented in the chapter. The discussions on salt-tolerant varieties or drought or flood-tolerant rice cultivation in various climatically stressed areas/deltas or even the "Climate Smart Agriculture" could have been brought in to give the reader a good reflection on the adaptation measures emerging in a proactive manner. My impression is quite a lot is happening in recent time which has a great potential to portray in the AR5. (Atiq Kainan Ahmed, Asian Disaster Preparedness Center (ADPC))	The comment is relevant with the following response/action. We have added some material about the food security impacts of the Pakistan Flood. However, we have not addressed comments focused primarily on food production/availability and adaptation responses; we presume these will be addressed elsewhere. Agreed but it would be more useful to give actual publications that can be used.
29	48874	7	0	0	0	0	The chapter rightly looks at the various dimensions of food security: access, availability, utilization and stability. However, it is very difficult to not focus on food production -- the availability dimension -- and to look at only major crops at the global level. However, climate change impacts on the food security of the poor and vulnerable will not be well understood by looking at aggregate measures of food production. As correctly analyzed in one of the sections of the report, the poor are not very integrated into markets. To assess climate impacts on their food security, the analysis will need to look at impacts on their production systems -- where they get their food, i.e., not global markets, not aggregate production/yield data. The chapter should include as much disaggregation as possible of impacts on food systems in order to really answer the question of impacts on food security. (Doreen Stabinsky, College of the Atlantic)	We agree that it is important to disaggregate the assessment of CC impacts on Food Security to the extent possible given space constraints. This is why we included material about the differential impacts of CC on net buyers and net producers of food - which gets at the issue raised by this reviewer. But we will strengthen the point that the projected effects are quite varied even within countries. This is a very important comment, there are many differences that need to be concerned in developing countries (especially small countries with large population) to developed countries. Some cases could be used in AR5 if can not describe the differences generally. Agreed but it would be more useful to give actual publications that can be used. True, but also reflects the literature... A key value of this Chp is to make this point...
30	48875	7	0	0	0	0	As temperatures rise, soils will hold less moisture. Yes, the local precipitation regime is important here, but there will be significant shortening of growing seasons around the world. In some regions the reduction in soil moisture will lead to reduction of cropping (and transition to perhaps livestock herding) or it will mean lands being taken out of production completely. Some look at where these regions are likely to be necessary. (Doreen Stabinsky, College of the Atlantic)	Geographic specificity with respect to rising temperature, reduction in soil moisture, changes in rainfall regime, e.g. in South Asia, will be looked into. This is a new issue in chapter 7, could think about it. Agreed but it would be more useful to give actual publications that can be used. It is also in the SPM.
31	48876	7	0	0	0	0	It is difficult to attribute drought events to climate causes, but it is possible, and this chapter should quantify, costs of recent drought events that have had impacts on food production and food security. Drought conditions will increase under increasing temperatures. Some areas, such as the southwest of the US and northern Mexico are very likely to become drier in the coming decades. The last few years have seen unprecedented drought, crop and livestock loss in northern Mexico. Last year saw \$9 billion in crop loss in Texas. This year we have an exceptional drought and heat waves throughout the Midwest of the US. These are the sorts of impacts, and the order of magnitude of costs expected from climate change. (Doreen Stabinsky, College of the Atlantic)	Thanks. The LAs will look into the impact of drought on food production and food security. Good cases of extreme event impact under CC, also see in northeast China. Agreed but it would be more useful to give actual publications that can be used. We now have a regional box in the FD.
32	48877	7	0	0	0	0	The chapter should go into more depth on the limits of adaptation. For example, breeding and adoption of new varieties is suggested as a very promising adaptation method. However, as climate changes, breeding efforts will become a Red Queen race -- doing all we can to keep up with the changing climate that we cannot describe in advance. There are limits to adaptation also in areas that become too hot for human and animal life, and in areas where soil moisture status declines to the point of not being able to bring a crop to maturity. There are limits to transformation -- the Australian wine industry might be able to move, but the options for a pastoralist on the margins of the Sahel or the Tarahumara cultivating maize in northern Chihuahua are not promising. (Doreen Stabinsky, College of the Atlantic)	The limits of adaptation have been discussed in the Adaptation chapters. This is being done. This is a key point in ch 7, more references are welcomed. Agreed but it would be more useful to give actual publications that can be used. The FD gives limits to adaptation.

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33	48878	7	0	0	0	0	"slow onset" impacts (defined in UNFCCC COP decision 1/CP.16 as things like sea level rise, temperature rise, salinization, glacial melt, ocean acidification) are often not given the same prominence as extreme events. However in the long-term (and for some impacts the not so long term), these are likely to be much more important for the food security of the most vulnerable. The chapter should include a section looking at these -- in particular temperature rise/soil moisture/growing season and ocean acidification as long-term, possibly irreversible events with food security impacts. (Doreen Stabinsky, College of the Atlantic)	The CLAs/LAs will look into whether a new section is needed on long term impacts (of temperature rise/soil moisture/growing season/ocean acidification) (MMI). Good suggestion, but it depends on references, and the uncertainty will increase with long-term impact. Agreed but it would be more useful to give actual publications that can be used.
34	48879	7	0	0	0	0	climate impacts on important crops for food security in different regions should also be addressed. The argument is not compelling that only global/major crops can be dealt with. If the question to be addressed is climate change impacts on food security, then those crops that contribute to the food security of those most vulnerable, who are not principally participating in the market, absolutely need to be addressed. This should include climate impacts on wild plants that make up a significant portion of the nutrition needs of many people. (Doreen Stabinsky, College of the Atlantic)	The wild plants apparently do not form a significant portion of global food security (MMI). Should be considered. Agreed but it would be more useful to give actual publications that can be used.
35	48880	7	0	0	0	0	I'm happy to provide more comments and references. I ran out of time. (Doreen Stabinsky, College of the Atlantic)	Thank you for the contribution that you had time to make. See above responses.
36	49060	7	0	0	0	0	In chapter 19, section 19.3.2.2.2. the effect of a change in diet on land use is mentioned. Such a change seems also relevant to mention in chapter 7 dealing with food systems and food security. (Oyvind Christophersen, Climate and Pollution Agency)	Thanks. The comment will be taken into account, good suggestion. The SPM has more on these cross chapter studies. We have been very open in releasing chapter 7 to chapter 19.
37	50392	7	0	0	0	0	1) Overall -- In preparing the 2nd-order draft, the chapter team should prioritize making each section of the chapter a polished, comprehensive treatment of topics considered. From these sections, the chapter team is then encouraged to maximize the utility of its findings, ensuring that they are robust, compelling, and nuanced. Themes to consider informing in constructing findings include decisionmaking under uncertainty, risks of extreme events and disasters, avoided damages, and limits to adaptation. To these ends, the chapter team has prepared a good foundation for the chapter with the 1st-order draft. In an effort to inform subsequent development of the chapter, I provide some general and specific comments below. (Katharine Mach, IPCC WGII TSU)	Thanks. The suggestion will be kept in view while preparing SOD. The FOD is just that with our main concern to get material onto the paper. Smoothing will occur before the SOD. Useful - no comment.
38	50393	7	0	0	0	0	2) Highlighting key findings -- In developing the 2nd-order draft, the chapter team should aim to present key findings in all chapter sections, using calibrated uncertainty language to characterize its degree of certainty in these conclusions. In this way, a reader of the chapter will be able to understand how the literature reviews and syntheses in the chapter sections--the traceable accounts--support the conclusions of the chapter, especially those presented in the executive summary. Additionally, identification of key findings throughout the chapter will enable the author team, building from comprehensive assessment of the literature, to present robust and nuanced characterization of key trends and determinants in the context of the executive summary. (Katharine Mach, IPCC WGII TSU)	The key findings will be highlighted (MMI), will improve. Useful - no comment.
39	50394	7	0	0	0	0	3) Usage conventions for calibrated uncertainty language -- The author team should continue with conventions adopted: Where used, calibrated uncertainty language, including summary terms for evidence and agreement, levels of confidence, and likelihood terms, should be italicized. In addition to incorporating these terms directly into sentences, the author team may find it effective to present them parenthetically at the end of sentences or clauses. Casual usage of the reserved uncertainty terms should be avoided, as has been flagged in some specific comments throughout the chapter. (Katharine Mach, IPCC WGII TSU)	The calibrated uncertainty language will be used to describe uncertainty (MMI), will improve. Useful - no comment.
40	50395	7	0	0	0	0	4) Complete chapter development -- By the 2nd-order draft, the author team should ensure full development of the chapter, with all sections, figures, and other aspects of the chapter complete. (Katharine Mach, IPCC WGII TSU)	The chapter will hopefully be fully developed by SOD. See above. Useful - no comment.
41	50396	7	0	0	0	0	5) Specificity of described observations and projections -- The chapter team should continue ensuring specificity in describing observed and projected impacts, while still presenting information succinctly. The author team is encouraged to continue with the following approach: indicating relevant time periods, geographic areas, etc. for observations; indicating relevant time frames, scenarios for climate change or socio-economic development, geographic regions, or other assumptions for projections; and characterizing key driving factors where ranges of outcomes are presented. (Katharine Mach, IPCC WGII TSU)	Geographic specificity and time period of observed impacts will be specified, as appropriate. See above. Useful - no comment.
42	50397	7	0	0	0	0	6) Conditional constructions -- The chapter team is also encouraged to further adopt conditional constructions that explicitly separate a given physical change from its corresponding conditional impact. With such constructions, the chapter team can then separately characterize the degree of certainty for the physical change and conditional outcome where appropriate. (Katharine Mach, IPCC WGII TSU)	The degree of certainty for the physical change will be provided, as appropriate. This is very difficult to do when there are multiple causes of a single effect (such as food security) and where a single cause has many effects (like global warming). Useful - no comment.
43	50398	7	0	0	0	0	7) Coordination across the Working Group 2 contribution -- In developing the next draft of the chapter, the author team should consider treatment of topics not only in this chapter, but also across the report as a whole. For each topic, the chapter team should ensure that treatment here is reduced to the essence of what is relevant to the chapter, with cross-references made to other chapters as appropriate, also minimizing overlap in this way. (Katharine Mach, IPCC WGII TSU)	Further cross referencing the appropriate chapters in WG II will be done, where needed. Useful - no comment.
44	50399	7	0	0	0	0	8) Harmonization with the Working Group 1 contribution to the AR5 -- At this stage of chapter drafting, the author team should carefully consider the working group 1 contribution. Wherever climate, climate change, climate variability, and extreme events are discussed, the chapter team should ensure that their treatment is harmonized with the assessment findings of working group 1. (Katharine Mach, IPCC WGII TSU)	The LAs will look into further harmonization with WG I assessments. Useful - no comment.
45	52486	7	0	0	0	0	More women than men are not only in extreme poverty in Sub-Saharan Africa, but also 80% of food is produced in orchards by women in this region. They are also in charge of food processing, storing and marketing. (Ursula Oswald-Spring, Centro Regional de Investigaciones Multidisciplinarias (CRIM) UNAM)	Thanks for the comment. Gender literature is being investigated for the SOD. region and gender should consider. Is this comment specific enough to the chapter to be useful?

#	ID	Ch	From Page	From Line	To Page	To Line	Comment	Response
46	52813	7	0	0	0	0	This chapter has an exemplary discussion of the detection and attribution - thank you. It is important that the links to chapter 18 are maintained to make sure that confidence statements and contents are consistent throughout the report. (Maximilian Auffhammer, University of California, Berkeley)	Thanks.the LAs will maintain links with Chapter 18 to ensure consistency of confidence statements.We are doing this and thanks for the comment.
47	54411	7	0	0	0	0	GENERAL COMMENTS: I would like to thank the authors for their work on the FOD. When considering the expert review comments received on your chapter and the next round of revisions, I suggest several overall priorities. (1) Keep in mind that the preparation of the SOD is the time to ensure that each section of the chapter presents a comprehensive treatment of relevant literature, and that the Executive Summary presents findings that capture the key insights that arise from the chapter assessment. (2) This is also the time to focus on distilling the chapter text, not just fine-tuning wording but editing with a critical eye to improving quality by making discussions succinct and synthetic, while still being comprehensive. (3) Cross-chapter coordination is also important at this stage, as it should now be possible to identify topics that overlap with other chapters and to coordinate with other chapter teams to minimize that overlap. (4) Cross-Working Group coordination is important as well, and relevant chapter sections should cross-reference chapters from the other Working Groups, particularly in the case of statements about changes in mean or extreme climate conditions that are assessed in the contribution of Working Group I. (5) Continue to look for opportunities for the creation of figures that synthesize across results from the literature. (Michael Mastrandrea, IPCC WGII TSU)	Thanks. The author team will take them into account for next revisions. All points raised are on our agenda for the SOD.Useful - no comment.
48	54412	7	0	0	0	0	EXECUTIVE SUMMARY: Thank you for developing an initial draft of an Executive Summary for the FOD. For the SOD, the author team should focus on constructing assessment findings of the form employed by other chapters. Each paragraph should present an assessment finding in bold with calibrated uncertainty language, followed by additional nonbold sentences providing further explanation and context, as well as line of sight to supporting chapter sections where the traceable account appears. In general, I would recommend the author team consider ways to more clearly identify assessment findings in the chapter text to link with the Executive Summary. A primary location for this may be in the summary sections of 7.3, 7.4, and 7.5, which require further development and provide opportunities for developing synthetic findings. In the context of linking chapter text with Executive Summary findings, I would also suggest providing some explanation of the calibrated uncertainty language used in the Executive Summary in the corresponding chapter section(s) where the traceable account appears for each finding. For example, in situations where confidence in a finding is not high (and/or evidence and/or agreement is not robust and/or high), it would be useful to understand why the author team has made this judgment (e.g., why is confidence not high, evidence not robust, and/or agreement not high). Some chapter sections include confidence and/or agreement/evidence statements that provide a basis for Executive Summary findings, but the links to the current version of the Executive Summary are not clear. Finally, here and in places in the chapter text, some statements are assigned a level of confidence (with agreement/evidence terms also provided as the basis for the confidence assignment), while some are only assigned agreement/evidence terms. The distinction between these cases is not clear, and in general, I suggest using the agreement/evidence assignments as a basis for confidence wherever possible (e.g., unless limited evidence and/or low agreement prevent an assignment of confidence, which could then be explained). We in the TSU are also available to discuss these issues. (Michael Mastrandrea, IPCC WGII TSU)	Thanks. The CLAs/LAs will take these points into account.Useful - no comment.
49	54907	7	0	0	0	0	The author team should update the reference list and remove citation inconsistencies between in text citations and full citations given in the reference list. Please see supplementary document named WG2AR5-Chap7_Reference Checks.pdf at https://ipcc-wg2.gov/AR5/author/FOD/SuppMat (Monalisa Chatterjee, IPCC WGII TSU)	The reference list will be updated and inconsistencies removed (Attention: JJ and LAs) (MMI).Agreed - work in progress.
50	37095	7	0	10	0	0	It is relevant that FAO food price index was above the 2008 "spike for virtually all of 2011 and is still well above the 2009 and pre-2008 values (http://www.fao.org/worldfoodsituation/wfs-home/foodpricesindex/en/) (Robert Norton, International Plant Nutrition Institute)	Thanks. Probably line 10 on page 3 is being referred (MMI).to be clarified.We have included this in the FD.
51	41112	7	1	1	1	1	I think some things are missing. Livestock is not treated all that well nor is aquaculture. The notion of regional vulnerability is not very strong. The notion of adaptation stress on infrastructure is not developed (Attavanich, W., B.A. McCarl, S.W. Fuller, D.V. Vedenov, and Z. Ahmedov, "The Effect of Climate Change on Transportation Flows and Inland Waterways Due to Climate-Induced Shifts in Crop Production Patterns pr", Selected paper presented at the 2011 Annual Meetings of the Agricultural and Applied Economics Association, Pittsburgh, July, June, 2011.) (Bruce McCarl, Texas A&M University)	The Section being referred is probably 7.3.2.5. 'Fisheries and Aquaculture'. Cannot cite conference proceedings.livestock and aquacultureshould consider.Can we use this as a non-refereed source. References from this author have now been incorporated.
52	41113	7	1	1	1	1	also adaptation and ecosystem effects could be mentioned (Attavanich, W., B. Rashford, R.M. Adams, and B.A. McCarl, "Land Use, Climate Change and Ecosystem Services", Oxford Handbook of Land Economics, edited by Joshua M. Duke and JunJie Wu, forthcoming, 2011.) could mention tropical storms , droughts, cold disasters (there is a paper forthcoming in climatic change about snow events in mongolia (Druz?) (Bruce McCarl, Texas A&M University)	The page no. and line no. for the comment are not correct.Can we use this as a non-refereed source.
53	38883	7	1	21	58	31	See my supplementary comments emailed to <wg2-ar5-supportingmaterial@ipcc-wg2.gov>. (Evan Fraser, University of Guelph and University of Leeds)	OK - good suggestion. Need the full comments.
54	52482	7	1	48	2	48	In the summary is missing the present critical food situation and the projections for Africa and Asia. Also the theme of overconsumption, increase of greenhouse gases due to more meat consumption and health related problems should be in the summary. (Ursula Oswald-Spring, Centro Regional de Investigaciones Multidisciplinarias (CRIM) UNAM)	The CLAs/LAs will look into the comment.Is this comment specific enough to the chapter to be useful? We have a regional box now.

#	ID	Ch	From Page	From Line	To Page	To Line	Comment	Response
55	50400	7	2	19	0	0	Executive Summary -- In subsequent work on the executive summary, there are several aspects of development for the author team to consider further: 1st, it would be preferable to present the paragraphs of the executive summary with a key finding in bold text followed by explanatory non-bold text. 2nd, for each key finding and wherever else relevant, the author team should continue using calibrated uncertainty language to characterize its degree of certainty in these conclusions, especially considering summary terms for evidence and agreement and levels of confidence, as well as likelihood terms where supported by probabilistic information. Please note that the summary terms for evidence and agreement are as follows: low, medium, and high agreement; limited, medium, and robust evidence. Variants on these terms should be avoided for clarity. 3rd, for each statement presented in the executive summary, the chapter team should provide a line-of-sight reference to the chapter section or sections supporting that conclusion. Finally, throughout the executive summary, the author team should aim to present both the big-picture overarching conclusions of the chapter and meaningfully specific and nuanced synthetic conclusions. For instance, there may be further opportunity for trends identified to indicate more specifically where, when, why (what specific drivers are relevant), illustrating in maximally informative terms where the current state of understanding lies. (Katharine Mach, IPCC WGII TSU)	Response is similar to the comment at serial no. 49..Useful - no comment.
56	49061	7	2	19	2	48	The executive summary of chapter 7 should be more in line with what is current practise in previous IPCC reports and the other chapters. (Oyvind Christophersen, Climate and Pollution Agency)	Thanks. The CLAs will look into it. good suggestion. Up to the TSU to guide us.
57	52481	7	2	19	2	48	General Comments. The food The food system in this chapter is basically related to food production, crop yields, plagues, commercial farming and male organized production structure without distinguishing between rain-fed agriculture and irrigation farming. The institutional and socioeconomic barriers must be interrelated with climate change challenges. A crop system is not a food system and the complexity and contradictions of outcomes must be clearly worked out. There is also a link between food intake, nutrition, health, and greenhouse gases that is not addressed. A food system without a gender perspective is missing key items for at least 5 billion people, who depend on rain-fed agriculture and subsistence crops, mostly in the hands of women. 80% of the world's agricultural areas generate 63% of food in rainfed fields whereas drylands cover 40% of land with 40% of people (FAO, 2010). Climate change may increase hunger for an additional 10 million children by 2030 (UNICEF, 2011). Both women and children are highly vulnerable human groups. Finally, there is pressure on land and food as fish and aquaculture food items are becoming scarce obliging people to feed on crops. The improvement of socioeconomic conditions in Asia has induced new food patterns, some of them (more meat), have increased GHG.Finally, there is an interesting approach to food security developed by Via Campesina called food sovereignty. It is taking into account together with production, market and consumption also land tenure, access to credit, tools, education, gender sensitive division of labor and food culture. (Ursula Oswald-Spring, Centro Regional de Investigaciones Multidisciplinarias (CRIM) UNAM)	The CLAs/LAs will look into factors other than food production and into other approaches. More concrete references would have been useful.Is this comment specific enough to be useful?
58	42413	7	2	20	0	0	Insert a new paragraph that reads as follows: "Despite any climate change and the increases in global food prices over the last decade, the long term trend (over several decades) has been an in increase global food security as measured by the affordability of food, increase in available food supplies per capita, and declines in the prevalence of hunger and malnutrition. Factors responsible for this include: increased yields (because of technological change, much of it underwritten by higher energy use); international trade; higher incomes and lower poverty worldwide (because of economic growth), supplemented by improvements in global safety nets." Rationale: See comments on page 0. (Indur Goklany, Independent)	Where is the evidence from the literature to support this paragraph? Is this person not a US government employee?While the points made here are justified there is little in this comment that specifically deals with the issue of climate and food security and food production systems. The chapter is required to be policy relevant but not prescriptive.
59	42414	7	2	21	0	0	Insert a new paragraph here that reads as follows: "Global food security is much less sensitive to weather and local and regional crop failure today than in prior times. In the 20th century more people died from droughts than all other extreme weather events combined, global deaths and death rates from such events have declined 99.97% and 99.99% since the 1920s." Rationale: See comments on page 0. (Indur Goklany, Independent)	Where is the evidence from the literature to support this paragraph? Is this person not a US government employee? While the points made here are justified there is little in this comment that specifically deals with the issue of climate and food security and food production systems. The chapter is required to be policy relevant but not prescriptive. A paper from this reviewer is in the FD.
60	41611	7	2	21	2	22	Confidence language not consistent with the IPCC Uncertainty Guidance (Lourdes Tibig, The Manila Observatory)	The IPCC uncertainty language will be used.good suggestion.
61	42415	7	2	21	2	22	Delete the first sentence. Rationale: There is no evidence furnished in the current chapter to support the claim that climate change has affected food security. In fact, it states on page 8, lines 11 -14 that "quantifying [the] effect [of climate change on food security] is an extremely difficult task, requiring assumptions about the many non-climate factors that interact with climate to determine food security. There is thus limited direct evidence that unambiguously links climate change to impacts on food security." The last sentence overstates the strength of this link, and is contradicted by the evidence furnished in comments on page 0. (Indur Goklany, Independent)	Thanks. The LAs will consider the comment. The LAs acknowledge that many factors affect food security and state this clearly in the chapter. The influence of climate and climate change on food security will increase significantly with global warming and mostly in a negative direction. See figures 7-6 and 7-7 in the FD which look at 1090 studies to produce these figures. We also say clearly that some regions will benefit.
62	50402	7	2	21	2	24	For phrases such as "the effects of climate change" or "many of the elements in the human food system," it would be helpful to indicate concisely what kinds of effects or elements are meant, to increase clarity for the reader. Also, if "likely" on line 22 is being used per the uncertainties guidance for authors (reflecting a probabilistic basis for its assignment), it should be italicized; casual usage of this reserved likelihood term should be avoided. Finally, it would be helpful to indicate more specifically what is meant by "the near to medium term"--approximately how many decades? (Katharine Mach, IPCC WGII TSU)	Thanks. The LAs ill look into the comment.good suggestion.

#	ID	Ch	From Page	From Line	To Page	To Line	Comment	Response
63	45475	7	2	21	2	26	This paragraph states that climate change is not likely to be a major driver of food security for the near to medium term. This is contradictory to other parts of the chapter, the AR5, IPCC SREX, and significant recent empirical evidence. For example, plenty of global evidence from IFPRI (2009, 2010, 2011), WFP (2009, 2011), UNDP (2008), and WFP and UK Met Office Hadley Centre (2012) suggests the opposite. Several empirical works on food security impacts of climate change in Nepal (WFP, NPC and CCAFS, 2012), Senegal (WFP, ANACIM and CCAFS, forthcoming), Ethiopia (WFP, DRMFS, University of Addis Ababa, CCAFS, forthcoming), and Mali (IRI and WFP, in press) also indicate that climate change will likely have negative impacts on the food security of the most vulnerable communities. IPCC SREX also suggests that food security is among the most vulnerable sectors to climate-related extreme events. All of the National Adaptation Programmes of Action (NAPAs) submitted to the UNFCCC include food security and/or agriculture as one of the most sensitive sectors to climate change in the near to mid-term. We suggest revising this paragraph to reflect these research trends. Suggested text includes: "The effects of climate change on food security are becoming increasingly evident in some regions of the world (good evidence, good agreement). In the absence of adaptation measures, climate change will exacerbate existing risks to food security in some regions through higher disaster frequency, intensity and duration which could affect lives and livelihoods, medium- and long-term changes in yields, higher food prices driven by changes in agricultural production, and other related factors." (Carlo Scaramella, World Food Programme)	Thanks. The LAs will look into the comment (MMI).OK - good suggestion. The conclusion from the relevant SPM from SREX reads - Extreme events will have greater impacts on sectors with closer links to climate, such as water, agriculture and food security, forestry, health, and tourism. For example, while it is not currently possible to reliably project specific changes at the catchment scale, there is high confidence that changes in climate have the potential to seriously affect water management systems. However, climate change is in many instances only one of the drivers of future changes, and is not necessarily the most important driver at the local scale. Climate-related extremes are also expected to produce large impacts on infrastructure, although detailed analysis of potential and projected damages are limited to a few countries, infrastructure types, and sectors. [4.3.2, 4.3.5]. In the FD we have been much more quantitative about this point.
64	42630	7	2	21	2	48	The mixture of terminology: evidence/agreement vs. confidence is not always clear in the executive summary. (Erin Coughlan, Red Cross / Red Crescent Climate Centre)	The IPCC uncertainty language will be used (MMI).Thanks for the comment.
65	41560	7	2	22	0	0	Line 2 of Exec Summ: "climate change is not likely to be a major driver of food security for the near or medium term". This could be taken as a headline by media and could be misleading: eg a) medium in IPCC generally is taken to be c 2050s, but later section on food security indicates potentially significant effects on food security by that time; b) CC might be a major driver of food security regionally or locally rather than globally. Could re-phrase as "CC is not likely to a major driver of GLOBAL food security over the NEAR term". However, given interdependence of the global food system, there could be (eg) CC-related local droughts in key producing areas which could affect global prices and food availability...which leads me to think this phrase could be taken as complacent. And then there is the issue of 'CC as major driver' as compared with other drivers which are not named: Better to re-phrase as something like: "Social and economic issues rather than CC will continue to remain the main drivers of food insecurity over the near-term at both regional and local levels; but by mid-century many elements of the food system (including food security) will be affected by projected changes in climate,...etc." (Martin Parry, Imperial College)	Thanks. The author team will look into it. We wish to make the point that many factors effect food security and that the climate signal is highly likely to increase in the future - but this was put clumsily in the FOD under time pressure. The SREX conclusions were not very strong on this point (see comment 63). We are aware that regional differences are very important and that evidence of effects has started to appear. Our problem is how to convey this complicated message in a simple and clear manner and your comments have helped a lot and thank you.good suggestion. In the FD we have been much more quantitative about this point and see the earlier comment response tot he SOD USA comments.
66	49063	7	2	22	2	22	"Driver of food security" could be written: "Driver of reduced food security" (Oyvind Christophersen, Climate and Pollution Agency)	Thanks for the comment..Chapter is about food security.
67	50401	7	2	22	2	47	For the summary terms for evidence and agreement used on these lines, the author team should employ the terms provided in the guidance for authors: low, medium, high agreement; limited, medium, robust evidence. (Katharine Mach, IPCC WGII TSU)	Accepted.The IPCC guidance will be followed.
68	39150	7	2	22	6	18	on Page 2:22 you say that "climate change is not likely to be a major driver of food security in the short to medium term", but on page 6:18 you state that "warming [over the last few decades] has had significant negative impacts on crop yield trends". How can these two statements both be true, given that they contradict one another? The first statement - in the exec summary - is the one that climate change deniers will pick up, and they will ignore the other statements... More generally, this chapter is much more readable than the preceding ones, and may serve as a positive model in that regard. (Thomas Reuter, University of Melbourne)	Thank you. Please see comment 65.We need to resolve this. Probably via the confidence statements - where there is discussion in the literature. We are also clearer about the differences between 2degC and 4degC and over time.
69	41559	7	2	23	0	0	Executive Summary. What are the AR5 conclusions concerning confirmation or revision of these following 4 statements in AR4 2007: 1) with medium confidence, in mid- to high-latitude regions moderate warming will raise crop and pasture yields. 2)However, even slight warming will decrease yields in low-latitude regions. 3) adaptation could avoid a 10-15% reduction in yield corresponding to 1-2°C local temperature increase 4) adaptive capacity might NOT be able to cope with warming greater than 3 deg 5) the 4 conclusions about global food security (see comments on text of chapter p 26) (Martin Parry, Imperial College)	OK - thanks.The CLAs/LAs will look into the comment. Time pressure for the FOD!!
70	35659	7	2	23	2	26	in line 23, it might be useful to specify how "near to medium term" is defined; I wonder what the "robust evidence" is that supports the statement that "many of the elements in the human food system will be adversely affected by projected CC from about the mid-21st century onwards" - why only from 21st century onwards ? There is a lot of literature about the differentiated picture over CC impacts; there will be quite a number of regions in which the human food system is with high likelihood expected to be adversely affected before mid 21st century (see, e.g. Schlenker & Roberts, 2009; Thornton et al., 2006;); Schlenker & Roberts is the the list of referencnes; full reference for Thornton et al., 2006 is: Thornton, PK, Jones, PG, Owiyo, T, Kruska, RL, Herrero, M, Kristjanson, P, Notenbaert, A, Bekele, N, Omolo, A (2006) Mapping vulnerability and poverty in Africa, Report to the Department for International Development, ILRI, Nairobi, Kenya, 200 pp. (Reimund Rötter, MTT Agrifood Research Finland)	Thanks. The author team will look into it. See comment 65.

#	ID	Ch	From Page	From Line	To Page	To Line	Comment	Response
71	42416	7	2	23	2	26	Delete these sentences. They are speculative. With respect to ozone, it overlooks the fact that in most areas where ozone is a problem, there are laws that control the precursors of ozone. Therefore, the notion that ozone will continue to deteriorate assumes that these laws will not be enforced. What is the basis for this? With respect to competition for water resources, there is substantial analysis that indicates that the net global population at risk of water shortage will decline (that is, more water will be available in the more populated areas of the world) due to climate change [see: Arnell (2004), Oki and Kanae (2006), Alcamo et al. (2007), van Vuuren et al. (2011), Arnell et al. (2011), Goklany (2009a, 2009b, 2012a)]. Finally, it has been shown elsewhere that over the long term there is a tendency for impact assessments to systematically overstate the net negative impacts of climate change because they generally do not fully account for increases in adaptive capacity due to increases in economic development, human capital and technological change that would and should occur over these long periods if one wants to be consistent with growth scenarios assumed in the analyses (Goklany 2007b, 2009b, 2009d, 2009e, 2012a). Notably, if the world (and climate change) unfolds per the SRES scenarios, the world should be a lot wealthier in the future than it is today, which means it's adaptive capacity should be that much greater. This increase in adaptive capacity would be compounded by secular technological change as well as advances in human capital (Goklany 2007b, 2009d, 2012a). (Indur Goklany, Independent)	The points about O3 are in Chapter 4. What is a 'net global population'? Food is mainly grown in the non-populated areas of the world. What is the evidence that adaptive capacity is able to account for all SRES scenarios? There is little in this comment that specifically deals with the issue of climate and the biology of food security and food production systems. The chapter is required to be policy relevant but not prescriptive.
72	46974	7	2	24	0	26	Also the problem of urban encroachment on rural land as cities are expanding in an unplanned manner in developing countries including India. Productive agricultural land being used for urban and industrial developments. (RAIS AKHTAR, ALIGARH MUSLIM UNIVERSITY)	Thanks for suggesting unplanned urbanization as a factor contributing to food insecurity. Not relevant to the chapter.
73	46975	7	2	24	0	26	Another important factor is the urban encroachment of productive rural land as cities are expanding in an unplanned manner in developing countries. (RAIS AKHTAR, ALIGARH MUSLIM UNIVERSITY)	Same as for serial no. 72..Not relevant to the chapter.
74	49064	7	2	25	2	25	"Other factors"; should be written: "other factors that that might reduce food production" (Oyvind Christophersen, Climate and Pollution Agency)	Thanks for the comment (MMI).
75	49065	7	2	26	2	26	State of agreement and evidence is missing with respect to "competition for water resources..." (Oyvind Christophersen, Climate and Pollution Agency)	OK - thanks. The author team will look into it. Common box created (see SPM and TS).
76	45476	7	2	34	2	35	IPCC SREX highlights that extreme weather events also affect livelihoods and incomes, with adverse impacts on food security. We suggest including this here. (Carlo Scaramella, World Food Programme)	Thanks for suggesting adverse impacts of extreme events on livelihood and income. Where does SREX say this in connection to food security? - see comment above.
77	50403	7	2	34	2	36	It would be helpful to indicate more specifically what is meant by "important" on line 34. Additionally, would it be most accurate to use the phrase "extreme weather and climate events" on line 34, given the inclusion of examples such as drought on line 36? (Katharine Mach, IPCC WGII TSU)	Thanks. Accepted. The author team will look into it.
78	43218	7	2	34	2	48	I found this section difficult to understand. It is mostly about production not food security. I have no idea what the sentence in lines 45-48 means. (Peter Gregory, University of Reading)	Thanks. The author team will look into it. Time pressure.
79	49062	7	2	35	2	35	Please consider to replace the sentence "Such weather events are defined as extremely" with "Examples of such weather events are extremely high and low temperatures and droughts and floods" (Oyvind Christophersen, Climate and Pollution Agency)	yes, thanks. Ok - where are the papers about this?
80	45477	7	2	35	2	36	In addition to extreme temperatures and floods and droughts, we suggest including storms and heavy snowfall events as weather events that can have a negative impact on food security. (Carlo Scaramella, World Food Programme)	Thanks for the comment..
81	45204	7	2	39	2	41	The statement about models, uncertainty and robustness is not very clear. (Eline Vanuytrecht, KU Leuven)	OK - thanks. Clarified
82	41612	7	2	41	0	0	Confidence language not consistent with the IPCC Uncertainty Guidance (Lourdes Tibig, The Manila Observatory)	Confidence language will be used as per the IPCC guidance.
83	42417	7	2	41	0	0	Add the following sentence, "In some cases, adaptation may more than compensate for any yield reductions from changes in climatic factors." (Indur Goklany, Independent)	Adaptation is covered in the subsequent paragraph. Where is the evidence? We are clearer about this in the FD.
84	42418	7	2	42	0	0	Add the following paragraph: "Mitigation, if it increases energy costs, could adversely affect food security because the global food system is extremely dependent on energy inputs (e.g., nitrogen for fertilizer; pesticides; and fuel to power machinery, transportation of agricultural inputs and outputs, and pumps to transport water) [Erisman et al. (2008); Pelletier et al. (2011); Taub (2010)]. Similarly, mitigation measures that would divert agricultural produce or land away from the production of food or feed could increase hunger and poverty, which would exacerbate all the problems associated with these conditions (FAO 2010; Goklany 2011 and references therein). Finally, if, as several global impacts assessments indicate, mitigation reduces the availability of water in a number of highly populated water basins, that would reduce water for irrigation or other agricultural uses (Arnell 2004; Alcamo et al. 2007; Oki and Kanae 2006; van Vuuren et al. 2011; Arnell et al. 2011; Goklany 2009a, 2009b, 2012a). This, too, would reduce food production and exacerbate food security." With respect to the second point, Goklany (2011) estimates that the increase in the global poverty headcount of about 35 million due to higher biofuel production between 2004 and 2010 (per De Hoyos and Medvedev 2009) implies 192,000 additional deaths and 6.7 million additional lost DALYs in 2010 alone. (Indur Goklany, Independent)	Thanks. The author team will look into it. Not relevant to the chapter.
85	38241	7	2	43	2	45	Executive Summary. "Adaptation possibilities of food systems to climate change show a very wide range in effectiveness and with medium confidence (good evidence, medium agreement) point to adaptation having increased effectiveness with increasing temperature changes." Question: Is it possible to know how this effectiveness is varying for both developed and developing countries? (Abdalah Mokssit, Direction de la Météorologie Nationale (DMN))	Thanks. The author team will look into it. Good point and we will try and do this.

#	ID	Ch	From Page	From Line	To Page	To Line	Comment	Response
86	35660	7	2	43	2	48	What is said about the "effectiveness of adaptation" in this paragraph is based on a very limited amount of studies - definitely, it's not justified to present a single figure on differences in yield reductions (here 20%) between adaptation cases and non-adaptation cases; the basis for the statements in this paragraph is too thin; there exists a whole range of recent studies (see, my comments on section 7.5, page 28 ff), which, if included, would lead to a much more differentiated picture /revision of this executive summary (Reimund Rötter, MTT Agrifood Research Finland)	The number of studies has been increased. The text has been finessed.
87	41613	7	2	44	0	0	Confidence language not consistent with the IPCC Uncertainty Guidance (Lourdes Tibig, The Manila Observatory)	The confidence language consistent with IPCC guidance will be used.
88	50404	7	2	44	2	48	"Medium confidence," as calibrated uncertainty language on line 44, should be italicized. Then, for the paragraph overall and especially for the 2nd sentence, the author team should clarify the overall timeframe intended--are these observed or projected results? (Katharine Mach, IPCC WGII TSU)	The author team will take the comment into account.
89	41614	7	2	45	0	0	Confidence language not consistent with the IPCC Uncertainty Guidance (Lourdes Tibig, The Manila Observatory)	Response same as to serial no. 87.
90	41615	7	2	47	0	0	Confidence language not consistent with the IPCC Uncertainty Guidance (Lourdes Tibig, The Manila Observatory)	Response same as to serial no. 87.
91	49066	7	2	47	2	48	"Some adaptations options more effective than others"; At least one example on successful and unsuccessful adaptation should be mentioned here. (Oyvind Christophersen, Climate and Pollution Agency)	The author team will take the comment into account. Successful and unsuccessful adaptations are given in the FOD. We do this in the later section.
92	52132	7	2	53	3	6	In providing definitions of "food security" here, the chapter team could also consider cross-referencing the definition in the report glossary. (Katharine Mach, IPCC WGII TSU)	Thanks. The author team will take them into account - see FAQs.
93	42419	7	2	53	3	16	See comments on page 0. (Indur Goklany, Independent)	Not clear.
94	37094	7	3	5	0	0	Food security also has a dimension of food quality as defined in the FAO quote. (Robert Norton, International Plant Nutrition Institute)	Thanks. I think we said this. this is covered in "utilisation" bullets in Fig 7.1.
95	52483	7	3	8	3	8	Subsistence crops are part of the food system (Ursula Oswald-Spring, Centro Regional de Investigaciones Multidisciplinarias (CRIM) UNAM)	Thanks. Is this comment specific enough?
96	35661	7	3	8	3	16	Many good papers have been written by scientists (from CGIAR, World Bank as well as gathered in IAASTD 2009) on (the ups and downs of) food security being on policy /development agendas, and on the complex interaction of factors that led to the food price crisis; this paragraph could be amended using these - as well as a variety of publications by von Braun et al (2009 ff) , Beddington et al. (e.g. 2012), Soussana et al (in press) on the recent (and still latent) food price crisis! see, some of those references in e.g.: Beddington, JR, Asaduzzaman M, Clark ME et al (2012) What next for agriculture after Durban? Science 335, 289-290. (Reimund Rötter, MTT Agrifood Research Finland)	Thanks. The author team will take the comment into account (MMI). Construct a graphic on decile changes in yields and prices - thanks for the references. We have about 490 references in the FD.
97	52484	7	3	9	3	9	price spikes are also related to speculation in almost 30% (IMF, 2010) (Ursula Oswald-Spring, Centro Regional de Investigaciones Multidisciplinarias (CRIM) UNAM)	Thanks. Is this comment specific enough?
98	50405	7	3	19	0	0	Section 7.1.1. For clarity in this section, it would be preferable to provide explicit reference to the chapter from which conclusions here were drawn. (Katharine Mach, IPCC WGII TSU)	Thanks. The author team will look into it.
99	50406	7	3	23	3	25	For the statement on lines 23-24, is there an associated timeframe for which the conclusion would hold? For the statement on lines 24-25, does the author team mean changes in extreme events due to climate change would have these effects? (Katharine Mach, IPCC WGII TSU)	Thanks. The author team will look into it.
100	52133	7	3	35	3	39	In providing a definition of "food system" here, the chapter team could also consider cross-referencing the definition in the report glossary. (Katharine Mach, IPCC WGII TSU)	Thanks. The author team will take it into account.
101	49067	7	3	36	3	36	Suggest to add "storage". This is an important element in the food system. (Oyvind Christophersen, Climate and Pollution Agency)	Thanks for the useful comment. storage is important, and is part of distribution notion. But have added "storage" in the list of Activities in 7.1.2
102	45231	7	3	53	3	53	It should be explained, WHY understanding this interaction is challenging. In the current form, it is just an unproven statement without any further explanation and could be deleted. (Marcus Kaplan, German Development Institute)	Thanks. The author team will look into it..It can be deleted as self evident. Additional sentence added
103	45232	7	3	54	3	54	"50% more food will be needed" - would be interesting to have the regional distribution of this additional demand. As most of this demand can be expected to be in developing countries, which will be hit particularly hard by climate change, this would be a valuable additional information. (Marcus Kaplan, German Development Institute)	Thanks. The author team will look into it. Can this be found? Assuming no reduction in food waste - which could help hugely in addressing the "extra needed" issue, with all the benefits this would bring.
104	42420	7	3	54	4	1	Delete: "given current food consumption.... and the risk of food insecurity will likely grow." This is speculative. See comments on page 2, lines 23-26. Also, my reading of Godfray et al. (2010b) is that while the challenges are great it does not necessarily follow that the risk of increasing food insecurity will be greater than they are today. In fact, they note that, "But the world can produce more food and can ensure that it is used more efficiently and equitably [in 2050]." (Indur Goklany, Independent)	Thanks. The author team will take it into account. But what is likely given 9 billion and climate change? What is the balance between demand and supply?
105	45233	7	3	54	4	1	"given current food consumption trends" - however, food consumption trends (particularly meat consumption) will change for the worse. (Marcus Kaplan, German Development Institute)	Thanks for the comment. Where is the evidence?
106	50407	7	4	1	4	1	"likely" -- If this term is being used per the uncertainties guidance for authors (reflecting a probabilistic basis for its assignment), it should be italicized. Casual usage of this reserved likelihood term should be avoided. (Katharine Mach, IPCC WGII TSU)	Thanks for the comment. Now deleted.
107	46287	7	4	6	4	6	Which are the eight elements of food security (needs elaboration) (Arif Goheer, Global Change Impact Studies Centre (GCISC))	Thanks. The author team will look into it. See bullets Fig 7-1
108	45234	7	4	6	4	7	"in principle..." - very general statement without any prove; please specify (Marcus Kaplan, German Development Institute)	Thanks. The author team will look into it. To be deleted.

#	ID	Ch	From Page	From Line	To Page	To Line	Comment	Response
109	45478	7	4	10	0	0	This section needs to be revised carefully. Several times in this section, it is stated that the poorest people depend on their own consumption for their food security. However, empirical data from different countries shows that the poorest rural people are net purchasers, especially during the lean seasons. We suggest revising this section to reflect this. Suggested references: IRI and WFP (in press) Climate risk and food security in Mali. IRI/WFP: New York/Rome. NPC, WFP, and CCAFS (2012) Climate risk and food security in Nepal: Analysis of climate impacts on food security and livelihoods. NPC/WFP: Kathmandu. (Carlo Scaramella, World Food Programme)	Thanks. The author team will look into it. JI comments and figures to be revised. See Table 7-2.
110	54260	7	4	10	0	0	Section 7.1.3: The author team might consider a global map or other figure to summarize information presented in this section. (Michael Mastrandrea, IPCC WGII TSU)	Thanks for the suggestion. The author team will look into it. In the SPM.
111	42421	7	4	12	5	5	See comments on page 0. (Indur Goklany, Independent)	Not clear. Not specific enough comment.
112	45235	7	4	15	4	16	Smith 2006 is cited here; are there no more updated figures available, as the number might have changed within the last 6 years? (Marcus Kaplan, German Development Institute)	Thanks. Included new IFPRI papers in the FD.
113	52487	7	4	18	4	19	More women than men are not only in extreme poverty in Sub-Saharan Africa, but also 80% of food is produced in orchards by women in this region. They are also in charge of food processing, storing and marketing. (Ursula Oswald-Spring, Centro Regional de Investigaciones Multidisciplinarias (CRIM) UNAM)	Thanks. The author team will look into it. What is the climate aspect here?
114	35895	7	4	18	4	20	The authors starts by mentioning sub sahara Africa and then moves to south Asia. I am not sure if the next lines 21 - 23 are discussing these two regions or which? (Precillia Ijang Tata epouse Ngome, Institute of Agricultural Research for Development)	Thanks. The author team will look into it. See Table 7-2 and the relevant section.
115	46288	7	4	18	4	20	What is the difference between "Highest rate" and "Largest No." -- Need clarification (Arif Goheer, Global Change Impact Studies Centre (GCISC))	The author team will look into it. See Table 7-2 and the relevant section
116	45206	7	4	26	4	29	Is this update information? Population dynamics are changing rapidly and many people are moving to urban areas. Since recently, more people live in urban areas than in rural areas worldwide. (Eline Vanuytrecht, KU Leuven)	The author team will look into it. See Table 7-2 and the relevant section
117	48277	7	4	27	0	0	The sentence beginning with "This is partly because most poor countries have a greater fraction..." This has to be specific. This sentence can imply several statistics and providing a statistic like a headcount ratio would make it clear (Malini Nair, Indian Institute of Science)	Thanks. The author team will look into it. See Table 7-2 and the relevant section
118	45207	7	4	27	4	27	"This is partly because..." This follows a little bit unlogically from the previous sentence (better "only one-fourth" (or updated information))? (Eline Vanuytrecht, KU Leuven)	Thanks. The author team will look into it. See Table 7-2 and the relevant section
119	52488	7	4	33	4	33	health impacts for undernourished children, life expectancy, intellectual development (Ursula Oswald-Spring, Centro Regional de Investigaciones Multidisciplinarias (CRIM) UNAM)	Thanks. See also the health chapter and the SPM.
120	45481	7	4	35	4	47	One of the main reasons why smallholder farmers are vulnerable to the impacts of climate change is that they depend on climate-sensitive activities, such as rainfed agriculture, for their livelihoods. We suggest highlighting this in this paragraph. Suggested references include: IRI and WFP (in press) Climate risk and food security in Mali. IRI/WFP: New York/Rome. NPC, WFP, and CCAFS (2012) Climate risk and food security in Nepal: Analysis of climate impacts on food security and livelihoods. NPC/WFP: Kathmandu. (Carlo Scaramella, World Food Programme)	Thanks. The author team will look into it. See Table 7-2 and the relevant section.
121	50408	7	4	45	4	45	"likely" -- If this term is being used per the uncertainties guidance for authors (reflecting a probabilistic basis for its assignment), it should be italicized. Casual usage of this reserved likelihood term should be avoided. (Katharine Mach, IPCC WGII TSU)	Term removed.
122	45236	7	4	47	4	47	Is this sentence logical? The two aspects (most poor are rural and they are net buyers of food) are linked with an "although", however, I do not see a contradiction in these two aspects (Marcus Kaplan, German Development Institute)	Reworded for clarity. See Table 7-2 and the relevant section.
123	43219	7	5	1	5	5	This paragraph mixes areas of land and people. (Peter Gregory, University of Reading)	all numbers refer to population, not area.
124	42422	7	5	1	5	12	The emphasis in this paragraph is misplaced. First, we should be concerned not just about the rural poor but all the poor. Second, it does not present the up side of market integration. Third, it overlooks the role of income in determining food security. I recommend rewriting this paragraph to read: "In summary, the poor spend a large share of their income on acquiring more food, which means that they are hurt by price increases. Therefore, an increase in their income would render them less vulnerable to price fluctuations. With respect to the rural poor, although they do not interact very much with the market, which partly shields them from price fluctuations in the market place, it also means that they are more vulnerable to decreases in local food production. Thus, as they become more integrated with markets, they are likely to improve overall incomes and productivity, which could increase overall food security despite increased sensitivity to price shocks. In fact, market integration (leading to trade) is one of the reasons why local reductions in food production do not lead to famine and hunger." Sources: Goklany (1995, 1998, 1999, 2007b, 2007c, 2009d). See also comments on page 0. (Indur Goklany, Independent)	Paragraph has been edited to reflect these issues, although in a more concise way than the reviewer proposed.
125	39009	7	5	8	0	0	The observations section in this chapter is very well-written and appears to be fully in line with the principles laid out in chapter 18. (Wolfgang Cramer, Potsdam Institute for Climate Impact Research)	Thanks
126	45479	7	5	8	0	0	This section needs to be revised carefully. We suggest covering the different elements of food security (availability, access, utilisation and stability) and then linking those to climate impacts as a starting point for framing the impacts. Suggested reference: WFP and UK Met Office Hadley Centre (2012) Climate impacts on food security and nutrition. WFP/UK Met Office: Rome/Exeter. (Carlo Scaramella, World Food Programme)	the elements of food security are outlined in 7.1. the point of this section is not to link to climate impacts, but just to briefly give the context for how many food insecure there are and where they live.

#	ID	Ch	From Page	From Line	To Page	To Line	Comment	Response
127	41080	7	5	9	5	9	you may wish to look at two papers that try to look at yield and technological change effects one on the effects of climate trends on rates of return to research (McCarl, B.A., X. Villavicencio, X.M. Wu, and W.E. Huffman, "Climate Change Influences on Agricultural Research Productivity", Climatic Change, under sencond review, 2012). the other on how much co2 is contributing to technical progress (Attavanich, W., and B.A. McCarl, "How is CO2 Affecting Yields and Technological Progress? A Statistical Analysis", 2012. or Attavanich, W., and B.A. McCarl, "The Effect of Climate Change, CO2 Fertilization, and Crop Production Technology on Crop Yields and Its Economic Implications on Market Outcomes and Welfare Distribution", Selected paper presented at the 2011 Annual Meetings of the Agricultural and Applied Economics Association, Pittsburgh, July, 2011.) (Bruce McCarl, Texas A&M University)	Cannot cite paper still under review. Have checked for paper in climatic change but does not yet appear. refereed paper?
128	45237	7	5	10	0	0	Section 7.2.1: It would be good to briefly explain the potential fertilization effect of CO2 on crop growth or at least refer to another section where this explanation has been given (Marcus Kaplan, German Development Institute)	We have added reference to section 7.3.
129	45655	7	5	10	0	0	Section 7.2.1. The section focuses primarily on crop agriculture. A few paragraphs are spent on fisheries. However livestock is mentioned only once and no further discussion on livestock is given. (Hideki Kanamaru, FAO)	We agree. This reflects lack of livestock studies, but we have now included a separate paragraph on livestock systems with the sparse literature we could find.
130	50409	7	5	10	0	0	Section 7.2.1. The author team may consider adding subsections to this section to organize the material further. (Katharine Mach, IPCC WGII TSU)	Added sections for crop and livestock and fisheries.Perhaps.
131	36422	7	5	12	5	13	Where are these changes described? (Adrian Muller, Research Institute of Organic Agriculture FiBL)	We have reworded this sentence to "These changes were primarily the result of factors other than atmospheric CO2 or climate, such as cultivar improvement and increased use of synthetic fertilizers, herbicides, and irrigation." find ref.
132	52489	7	5	12	5	16	Also evapotranspiration is crucial, the importance of water access and irrigation system, water harvesting, etc. (Ursula Oswald-Spring, Centro Regional de Investigaciones Multidisciplinarias (CRIM) UNAM)	Changes in evapotranspiration are one of the effects of changing climate. The mechanisms are discussed in section 7.3
133	35662	7	5	13	5	16	There are for recent years other opinions, stating that the effects of weather in the recent past cannot be viewed as noise anymore, see, e.g. Coumou and Rahmsdorf (2012) or Mastrandrea et al (2011); full references: Coumou, D, Rahmsdorf, S (2012) A decade of weather extremes. Nature Climate Change, 2(6), doi:10.1038/nclimate1452. and Mastrandrea, MD, Tebaldi, C, Snyder, CW, Schneider, SH (2011) Current and future impacts of extreme events in California. Climatic Change 109, (Suppl): S43-S70. (Reimund Rötter, MTT Agrifood Research Finland)	Thank you for the references. The point here is that, from the perspective of trying to understand genetic gains in crop varieties, weather or climate changes are viewed as noise that obscures the signal. this sentence has been reworded to clarify.
134	46976	7	5	18	0	29	Heavy use of fertilizers and chemicals have resulted in high incidence of Cancer in Punjab,india, after green Revolution (RAIS AKHTAR, ALIGARH MUSLIM UNIVERSITY)	Not relevant to chapter.
135	41081	7	5	18	5	18	I disagree with the statement "crop models indicate that this warming has had significant negative impacts on crop yield trends" as I do not think crop models deal with trends in yields just snap shots at a point in time. So how do you see effects on trends? (Bruce McCarl, Texas A&M University)	Wrong page number, but I found it. Reworded to clarify: "In particular, global temperature trends over the past few decades are attributable to human activity (WG 1, Chapter x), and the studies discussed above indicate that this warming has had significant impacts on yield trends of some crops."
136	42423	7	5	29	0	0	Add the following at the end of this paragraph: "However, the continual rise in India's yields for rice and other grains indicates that, notwithstanding fluctuations, India's food production is today less at the mercy of weather than in times past (FAOSTAT 2012)." (Indur Goklany, Independent)	This statement is not substantiated (faostat is just a statistical database) nor is it very relevant to a chapter on climate change and not weather.
137	45208	7	5	31	5	37	This paragraph is difficult to understand without reading the reference of Hegerl et al. (2010). Is it possible to give a little bit more explanation here in the text about the discussion of Hegerl et al. (2010)? (Eline Vanuytrecht, KU Leuven)	Have added reference to ch. 18 for readers. Fuller description here would take too much space
138	45209	7	5	41	5	41	"...in response TO climate..."? (Eline Vanuytrecht, KU Leuven)	Yes, thanks, corrected
139	35329	7	5	43	5	45	Related to this sentence, the statistically-estimated time change in relationship between climate and crop productivity is reported for maize and soybean in United States, China, and Brazil (Sakurai et al., 2011). This paper concludes that the effects of climatic factors on crop yield changed over time for the last 3 decades and, especially for maize, the negative effect of high temperatures has intensified in Brazil, northern China, and the southern United States. I Sakurai, G., T. Iizumi, and M. Yokozawa, 2011. Varying temporal and spatial effects of climate on maize and soybean affect yield prediction. Climate Research, 49, 143-154. (Toshichika Iizumi, National Institute for Agro-Environmental Sciences)	Have added reference but not additional text.
140	46977	7	5	47	0	0	Famers' behaviour is an important factor in changing cropping patters. For gaining more money. Wheat and rice being replaced for cotton and sugarcane in northern India. (RAIS AKHTAR, ALIGARH MUSLIM UNIVERSITY)	Ok but not clear how this is relevant to text
141	43076	7	5	47	4	53	Specify to what extend these results are based on model calculations or empirical observations. (Andreas Meyer-Aurich, Leibniz-Institute for Agricultural Engineering Potsdam-Bornim)	The sentence references figure 7-3 which depicts the type of studies used. Most are based on statistical models.
142	41616	7	5	47	5	50	References are missing. (Lourdes Tibig, The Manila Observatory)	References provided in figure caption
143	41617	7	5	49	0	0	which regions? (Lines 50-53 cite at least two cold regions where warming benefitted crop production.) (Lourdes Tibig, The Manila Observatory)	Two regions are mentioned - North China and England
144	45210	7	5	49	5	49	What about rice (besides wheat and maize)? There is also information available for rice, also an important food crop. (Eline Vanuytrecht, KU Leuven)	Have added a sentence about rice and soybean, which are also shown in figure 7-3
145	45238	7	5	51	5	52	write "temperate regions" instead of "cold regions" (Marcus Kaplan, German Development Institute)	Temperate is too broad, since some temperate regions like the US have not gained from warming

#	ID	Ch	From Page	From Line	To Page	To Line	Comment	Response
146	50410	7	6	13	6	13	"likely" -- If this term is being used per the uncertainties guidance for authors (reflecting a probabilistic basis for its assignment), it should be italicized. Casual usage of this reserved likelihood term should be avoided. (Katharine Mach, IPCC WGII TSU)	Removed word
147	50411	7	6	13	6	18	The author team should ensure full referencing to the chapters of the working group 1 contribution. (Katharine Mach, IPCC WGII TSU)	References updated
148	45483	7	6	15	6	17	A number of studies have also tried to link climate variability to food security indicators, including production, for example in Nepal and Mali. Suggested references include: IRI and WFP (forthcoming) Climate risk and food security in Mali. IRI/WFP: New York/Rome. WFP, NPC, and CCAFS (forthcoming) Climate risk and food security in Nepal: Analysis of climate impacts on food security and livelihoods. NPC/WFP: Kathmandu. (Carlo Scaramella, World Food Programme)	Ok, but the focus here is on impacts of climate trends, not variability
149	37096	7	6	19	0	0	This statement seems at odds with the statements on p6, line 51 - I appreciate that this paragraph is trying to refer to a global trend rather than regional effect - and maybe this should read "...negative impacts on global crop yield trends." (Robert Norton, International Plant Nutrition Institute)	Text reworded based on this and other reviewer comment
150	41618	7	6	24	6	26	How does one distinguish that any major cropping region has not experienced significant climate trends in the past few decades as indicated in Figure 7-4 (Example cited is the United States.)? (Lourdes Tibig, The Manila Observatory)	Regions without trends are in lower left-hand corner. We have added this to text for clarity
151	45212	7	6	24	6	26	Is this conclusion right here? You seem to draw a strong conclusion based on the selection of a limited number of studies for figure 7-4. (Eline Vanuytrecht, KU Leuven)	Not clear exactly which sentence the reviewer means. But figure 7-4 is not intended to reflect individual studies, but rather an assessment of overall evidence
152	35896	7	6	35	6	36	None crop food production system should also include bushmeat and Non Timber Forest Products - If accepted, I could make contributions on this. (Precillia Ijang Tata épouse Ngome, Institute of Agricultural Research for Development)	If there is information on climate impacts in these areas, we would welcome contributions
153	43077	7	6	35	6	36	To my understanding livestock production systems are also food production systems. (Andreas Meyer-Aurich, Leibniz-Institute for Agricultural Engineering Potsdam-Bornim)	Yes. The distinction here is between crop and non-crop
154	52490	7	6	35	6	36	recollection and hunting are also non-crop food production systems (Ursula Oswald-Spring, Centro Regional de Investigaciones Multidisciplinarias (CRIM) UNAM)	We have modified the sentence to be clear that no literature exists for wild food collection or hunting, in terms of observed impacts of recent climate trends
155	52491	7	6	35	6	48	The ENSO phenomenon is crucial for fish migration, especially in the Southern Pacific (Ursula Oswald-Spring, Centro Regional de Investigaciones Multidisciplinarias (CRIM) UNAM)	Agreed, but no changes made because it is not directly related to the paragraph's topic.
156	36411	7	6	35	7	53	1. Considering the statement here about the scarcity of published work on "non-crop food production.....livestock...", it would seem a mention of work done by H. Wayne Polley and his group in Texas on the effects of increasing CO2 concentrations since the industrial revolution on Texas grasslands would be relevant to cite at the bottom of p 7 (lines 47-53) where the discussion is about the effects of past increases of CO2 on crops. Perhaps this overall section is more concerned with analyses of actual recent climatic trends and consequences for agriculture that manipulative experimentation (Section title "Observed Impacts"), in which case please ignore. Nevertheless, I think Polley's work in Texas is some of the best documentation of plant responses to CO2 concentrations since the beginning of the industrial revolution (the closest thing we have to a recent historical analysis regarding the effect of past increases in CO2). A recent publication is Polley, H.W., V.L. Jin, and P.A. Fay. 2012. CO2-caused change in plant species composition rivals the shift in vegetation between mid-grass and tallgrass prairies. Global Change Biology 18:700-710. From this paper you'll find relevant citations of related earlier work of this group. In short, their work shows both production increases and potential plant species shifts due to rising CO2. Also, the conclusion here (bottom of page 7) that while CO2 affects plant yield, it has not been a major factor enhancing yield trends has considerably less relevance to rangelands, where the food product is forage production in native plant communities, not grain yield. (Jack Morgan, USDA Agricultural Research Service)	Good suggestion - a paper with Polley is included.
157	50412	7	6	37	6	38	The author team might consider indicating more specifically what is meant by "short to medium term," for example indicating the approximate duration of relevant modes of variability. (Katharine Mach, IPCC WGII TSU)	Have reworded to be more specific we are talking about up to decadal time scale
158	35456	7	6	40	6	40	To add before of (Brander, 2007) the following references: (Pearson and Dawson, 2003; Perry et al., 2005; ...). (M. Dolores Garza-Gil, University of Vigo)	Perry et al. 2005 and Cheung et al. 2010 added as two of the more significant papers on the topic. Also cross references to Chapters 6 and 30.
159	35457	7	6	40	6	40	To add after of (Brander, 2007; ...) the following references: (...; Hannesson, 2007; Garza et al., 2011). (M. Dolores Garza-Gil, University of Vigo)	As for previous comment
160	50413	7	6	43	6	43	"High confidence," as calibrated uncertainty language, should be italicized. Additionally, it would be preferable to provide this author team's evaluation of confidence for the increase, rather than simply reporting the judgment of the authors of the study. (Katharine Mach, IPCC WGII TSU)	Reworded to reflect the evidence and arguments presented by the authors.
161	50414	7	6	50	7	5	For these statements, the author team should consider and cross-reference chapters 5, 6, and 30. Additionally, it would be preferable to indicate more specifically what is meant by "immediately threatened" on line 51. (Katharine Mach, IPCC WGII TSU)	Cross referencing has been introduced in several places
162	41619	7	6	53	6	54	Lacking confidence statements in detection and attribution (Lourdes Tibig, The Manila Observatory)	A new reference has been added and wording has been changed to reflect conflicting opinions
163	50415	7	7	1	7	45	"likely" on lines 1, 21, 31, 45 -- If this term is being used per the uncertainties guidance for authors (reflecting a probabilistic basis for its assignment), it should be italicized. Casual usage of this reserved likelihood term should be avoided. (Katharine Mach, IPCC WGII TSU)	Have removed use of likely for these four cases.
164	41620	7	7	2	7	5	one single study on declines in coral reef cover? (Lourdes Tibig, The Manila Observatory)	Comment incorrect - statement refers to impact of declining coral cover on dependent species.

#	ID	Ch	From Page	From Line	To Page	To Line	Comment	Response
165	52492	7	7	7	7	7	also aquaculture (Ursula Oswald-Spring, Centro Regional de Investigaciones Multidisciplinarias (CRIM) UNAM)	Despite a search no reliable references on aquaculture to expand this statement could be found.
166	41622	7	7	7	7	9	Lacking confidence statements in detection and attribution (Lourdes Tibig, The Manila Observatory)	Further information is being sought for this paragraph as a whole which will be amended as required.
167	41623	7	7	9	7	11	not observed impacts (Lourdes Tibig, The Manila Observatory)	The current wording expresses sufficient uncertainty
168	41624	7	7	14	7	16	limited evidence? (Lourdes Tibig, The Manila Observatory)	As above
169	45482	7	7	18	7	37	We suggest including more recent references highlighting the potential impact of extreme events on food security and nutrition. Suggested references include: WFP and UK Met Office (2012) Climate impacts on food security and nutrition. WFP/UK Met Office: Rome/Exeter. (Carlo Scaramella, World Food Programme)	Was not able to find this reference. The organizations produced a map of hotspots, but cannot find document. Also, the map does not appear to be focused on impact of past trends
170	41625	7	7	21	7	23	Isn't this a contradiction to lines 18-19? (Lourdes Tibig, The Manila Observatory)	No. previous statement was about past work on impacts attribution. Here we are talking about climate attribution
171	41626	7	7	24	7	27	How affected? (Lourdes Tibig, The Manila Observatory)	Sentence has been removed to shorten section
172	50416	7	7	30	7	31	For this statement, the author team should cross-reference the findings of the special report on extremes (chapter 3) and the working group 1 contribution to the 5th assessment report. (Katharine Mach, IPCC WGII TSU)	References added
173	35330	7	7	31	7	32	In addition to rice yield, increased frequency of hot night (represented by daily minimum temperature) negatively affects rice eating quality that directly worsen rice price and anticipated farm income as concluded in Okada et al. (2009;2011). I Okada, M., T. Iizumi, Y. Hayashi, and M. Yokozawa, 2009. A Climatological analysis on the recent declining trend of rice quality in Japan. Journal of Agricultural Meteorology, 65, 327-337. I Okada, M., T. Iizumi, Y. Hayashi, and M. Yokozawa, 2011. Modeling the multiple effects of temperature and radiation on rice quality. Environmental Research Letters, 6, 034031. (Toshichika Iizumi, National Institute for Agro-Environmental Sciences)	Excellent point, reference added
174	41628	7	7	31	7	32	likely damaging? Not appropriate language for detected impacts (Lourdes Tibig, The Manila Observatory)	Reworded
175	41630	7	7	32	7	33	What are the observed impacts? (Lourdes Tibig, The Manila Observatory)	Unclear. No changes made
176	41632	7	7	33	7	37	It is suggested that the second part of the sentence in lines 32-35 be part of the last sentence in lines 36-37 to adequately describe attribution of observed trends. (Lourdes Tibig, The Manila Observatory)	Suggestion unclear. We have left sentence structure the same
177	50417	7	7	40	7	40	This cross-reference should be completed. (Katharine Mach, IPCC WGII TSU)	Will complete once Ch 18 table numbers are set.
178	52485	7	7	42	7	44	Model of food system (Ursula Oswald-Spring, Centro Regional de Investigaciones Multidisciplinarias (CRIM) UNAM)	Unclear. No changes made
179	50418	7	7	48	7	48	The summary terms for evidence and agreement on this line should be italicized. Additionally, the author team could consider leaving them out here, given the assignment of very high confidence as well. (Katharine Mach, IPCC WGII TSU)	Terms removed
180	45213	7	7	49	7	49	"...yield growth and enhanced water relations...". I think it is essential to add this to emphasize that it is not only a production benefit that matters, especially for C4 crops. (Eline Vanuytrecht, KU Leuven)	Thanks, good point. sentence reworded
181	41633	7	7	50	7	53	Not observed impacts (Lourdes Tibig, The Manila Observatory)	Reworded to be clear this refers to past co2 changes
182	50419	7	8	2	8	3	The summary terms for evidence and agreement here should be italicized. Additionally, the author team could consider leaving them out, given the assignment of high confidence. (Katharine Mach, IPCC WGII TSU)	Terms removed.
183	41082	7	8	3	8	3	to me the statements about declines in production are misleading for example if one read "O3 has suppressed global production of	Good point, reworded for clarity
184	45214	7	8	4	8	4	There are more papers available describing the effect of ozone on crops, also crops not yet mentioned in this paragraph. (Eline Vanuytrecht, KU Leuven)	We have referred to later section which discusses the evidence on ozone impacts on crops. This section is focused on the effects of past changes. Further suggestions for references on this particular issue are welcome.
185	37091	7	8	8	0	0	some notes could also be said about trends on cropping input (for instance fertilizers, fuel etc) prices and availability (Antti Hannukkala, Agrifood Research Finland)	Unclear. No changes made
186	52493	7	8	10	8	43	Food safety is part of food security and includes the handling, preparation, and storage of food in ways to avoid foodborne illnesses, preventing health hazards. Food can transmit diseases from person to person as well as serve as a growth medium for bacteria that can cause food poisoning. (Ursula Oswald-Spring, Centro Regional de Investigaciones Multidisciplinarias (CRIM) UNAM)	Definitions of food security are in introduction
187	46978	7	8	16	0	25	Declining food output in some areas , poor storage facilities and emphasis on food crop export to earn foreign exchange are important causes of food insecurity in developing countries including India. (RAIS AKHTAR, ALIGARH MUSLIM UNIVERSITY)	Ok, but the focus here is on impacts of climate trends
188	41634	7	8	16	8	25	Not at all related to climate (Lourdes Tibig, The Manila Observatory)	Good point, this section has been reworded to focus on climate factors
189	45239	7	8	16	8	43	I understand that the first paragraph of this section explains how important it is to look at non-climate factors that interact with climate change and thus influence food security; however, the direct link between food prices and climate change is rather weak (at least as food prices are discussed here), thus I would not spend so many words on this non-climate issue; the report should be concise and clearly focus on climate change, otherwise nobody will read it if it becomes too long (Marcus Kaplan, German Development Institute)	Very good point. reworded to shorten discussion of non-climate factors
190	49068	7	8	21	8	22	Which role play, besides the increased demand for biofuels, the increased demand for meat for the global prices of cereals, etc and the food security for poor consumers. (Oyvind Christophersen, Climate and Pollution Agency)	See previous response

#	ID	Ch	From Page	From Line	To Page	To Line	Comment	Response
191	37568	7	8	22	7	22	Add following reference to references Robert and Schenkler, 2010; Wrights; 2011): Mueller, S.A. Anderson, J. E., Wallington, T.J. (2011). Impact of biofuel production and other supply and demand factors on food price increases in 2008. Biomass and bioenergy 35: 1623-1632: Full citation: 5. Conclusions The prices of key food commodities (corn, soybeans, and wheat) more than doubled and the global price index for food increased 45% from March 2007 to March 2008. The economic impact was greater in developing nations than in developed nations because unprocessed grains comprise a large fraction of the daily diet in developing nations and commodity food prices account for a substantial fraction of the total cost of food and are a larger percentage of personal expenditures. Many factors contributed to the increase in commodity food prices over this period, including increased energy and fertilizer costs, increased financial speculation in commodity markets, export restrictions, depreciation of the US dollar, increased biofuel production, poor harvests, smaller world grain reserves, increased foreign exchange holdings by foodimporting countries, and increasing world population and affluence. Disentangling these factors and quantifying their contributions is a difficult, perhaps impossible, task. As listed in Table 1, four publicly-available analyses attempted to quantify the contribution of biofuel production to increased global commodity food prices in the period leading up to the peak in 2008. Three out of four studies concluded that biofuel production had a modest (3e30%) contribution. In sharp contrast, an analysis published by Mitchell in 2008 concluded that biofuel production was responsible for 70e75% of the increase in food prices. While it is beyond the scope of the present work to review in detail the methodology used in each study, we note that the method used in the Mitchell report appears to be inappropriate and overly simplistic. Excluding this analysis, the available analyses are in reasonable agreement and suggest that biofuel production had a modest (3e30%) contribution to the increase in commodity food pricesobserved in 2007/2008. (John Sumelius, University of Helsinki, Faculty of Agriculture and Forestry)	Thanks, reference added
192	41635	7	8	27	8	33	It is suggested that there is a need to reformulate the paragraph to establish possible link between global prices and changing frequency of weather extremes because of climate change, although there is limited evidence that unambiguously links climate change to impacts on food security. (Lourdes Tibig, The Manila Observatory)	Section reworded
193	41083	7	8	28	8	28	Biofuel poicy and exchange rates have also been important. Abbott et al has been updated to 2011 (Bruce McCarl, Texas A&M University)	Reference was removed based on suggestions above to shorten this section.
194	41084	7	8	43	8	43	a number of studies have tried to incorporate measures of extremes like drought, el nino events, high temperatures and some other factors on both the level of yields and the variability of yields. Some of this may be needed. For example McCarl, B.A., X. Villavicencio, and X.M. Wu, "Climate Change and Future Analysis: Is Stationarity Dying", American Journal of Agricultural Economics, Volume 90, Issue 5, 1242-1247, 2008. did some of this and there have been followups by devadoss and khanna plus several have been submitted to climatic change recently. (Bruce McCarl, Texas A&M University)	This is an interesting reference, but not one that makes an obvious statement related to the observed impacts of climate trends on food prices, as it deals mainly with projections
195	45480	7	8	46	0	0	We suggest revising this section to better link issues of rainfed agriculture, agriculture in general, drylands as drivers of food insecurity. (Carlo Scaramella, World Food Programme)	Thanks. The author team will look into it (MMI).
196	45484	7	8	46	0	0	We suggest mentioning some of the anlyses carried by WFP and partners to understand climate impacts on food security. These analyses propose methods to assess which populations are most vulnerable to climate change, and in what ways for example, by examining climate-sensitivities of food and income sources. Using this information, it is then possible to prioritise interventions to support the most food insecure and vulnerable populations. IRI and WFP (forthcoming) Climate risk and food security in Mali. IRI/WFP: New York/Rome. WFP, NPC and CCAFS (forthcoming) Climate risk and food security in Nepal: Analysis of climate impacts on food security and livelihoods. NPC/WFP: Kathmandu. WFP, ANACIM, and CCAFS (in preparation) Climate risk and food security in Senegal: Analysis of climate impacts on food security and livelihoods. ANACIM/WFP: Dakar. WFP, DRMFSS, AAU, and CCAFS (in preparation) Climate risk and food security in Ethiopia: Analysis of climate impacts on food security and livelihoods. DRMFSS/WFP: Addis Ababa. (Carlo Scaramella, World Food Programme)	Thanks. The author team will look into it (MMI).
197	35663	7	8	53	8	54	a whole lot of publications has been recently produced (e.g. Under COST 734) on historical empirical evidence between climate and food production - add references (see, e.g. Olesen, J.E., Trnka, M., Kersebaum, K.C., Skjelvåg, A.O., Seguin, B, Peltonen-Saino, P., Rossi, F., Kozyra, J., Micale, F., 2011. Impacts and adaptation of European crop production systems to climate change. European Journal of Agronomy 34, 96-112.) (Reimund Rötter, MTT Agrifood Research Finland)	Thanks. The identified papers will be reviewed (MMI).
198	37097	7	9	10	0	0	Grammar (Robert Norton, International Plant Nutrition Institute)	Not able to spot a grammatical error
199	45215	7	9	11	9	11	Shouldn't there be a comment that models also have a drawback, namely that interaction effects are not yet completly understood and thus difficult to implement in models, which compromises their simulations to some extent. (Eline Vanuytrecht, KU Leuven)	The drawbacks are listed later: lines 46-47
200	43220	7	9	14	9	20	This is a long sentence containing several ideas. What is the evidence that crop models have fostered communication between scientists, managers, policymakers and planners? Is a crop model capable of speaking to the divergent needs of these communities? (Peter Gregory, University of Reading)	The sentence contains a list rather than being a set of ideas. Crop models have been used, for example, as part of workshops with breeders. Other examples exist - too many to cite. The point here is that crop models have a role; we are not saying that they have a pivotal role.

#	ID	Ch	From Page	From Line	To Page	To Line	Comment	Response
201	35664	7	9	22	9	31	This one paragraph on novel developments since AR4 in the methodologies could be quite much expanded as a lot of new useful concepts and approaches have been recently published and/or are currently in the making: I just add here an excerpt of some recent publications on quantifying and reporting uncertainties (a longer list follows on my comments on the Reference section (page 37 ff); ongoing relevant works from AgMIP (www.agmip.org) e.g. the wheat pilot (Asseng et al in prep) and FACCE MACSUR (www.macsur.eu ; Soussana et al., Global Change Biology, in press) are also very relevant - one should put at least a placeholder here for referring AgMIP and FACCE MACSUR in the 2nd order draft; Børgesen CD, Olesen JE (2011) A probabilistic assessment of climate change impacts on yield and Nitrogen leaching from winter wheat in Europe. Nat. Hazards Earth Syst. Sci. 11, 2541-2553. Lobell, D et al., 2012. Extreme heat effects on wheat senescence in India. Nature Climate Change, published online: 29 January 2012. doi:10.1038/nclimate1356. Mastrandrea, MD, Tebaldi, C, Snyder, CW, Schneider, SH (2011) Current and future impacts of extreme events in California. Climatic Change 109, (Suppl): S43-S70. van Oort, PAJ, Timmermans, BGH, Meinke, H, van Ittersum, MK (2012) Key weather extremes affecting potato production in the Netherlands. European Journal of Agronomy 37 (2012) 11–22. Palosuo, T, Kersebaum, KC, Angulo, C et al (2011) Simulation of winter wheat yields and yield variability in different climates of Europe. A comparison of eight crop growth models. European Journal of Agronomy, 35, 103-114. doi: 10.1016/j.eja.2011.05.001. Rötter, RP, Carter, TR, Olesen, JE, Porter, JR (2011a) Crop-climate models need an overhaul. Nature Climate Change, 1, 175-177. Rötter, RP, Palosuo, T, Pirttioja, NK et al (2011b) What would happen to barley production in Finland if global warming exceeded 4°C? A model-based assessment. European Journal of Agronomy 35, 205-214. doi: 0.1016/j.eja.2011.06.003. Rötter, RP, Palosuo, T, Kersebaum, KC et al (2012) Simulation of spring barley yield in different climatic zones of Northern and Central Europe. A comparison of nine crop models. Field Crops Research 133, 23-36. Semenov, MA, Shewry, PR, (2011) Modelling predicts that heat stress, not drought, will increase vulnerability of wheat in Europe. Scientific Reports, 1, 66; DOI:10.1038/srep00066. Teixeira, EI, Fischer, G, van Velthuizen, H, Walter, C, Ewert, F., in press. Global hot-spots of heat stress on agricultural crops due to climate change. Agricultural and Forest Meteorology (2011), doi:10.1016/j.agrformet.2011.09.002. (Reimund Rötter, MTT Agrifood Research Finland)	We will review these references for the next draft, though this paragraph is not necessarily the place for many of them.
202	35331	7	9	26	9	28	Related to this, Iizumi et al. (2011) demonstrates an impact assessment that accounts for physical, bio-physical, and socioeconomic drivers through an ensemble approach and suggests that the uncertainty of impact on rice yield in Japan induced by biophysical factors (represented by crop model parameter value) could be comparable to or larger than the uncertainties of impact from physical and socioeconomic factors in some areas. I Iizumi, T., M. Yokozawa, and M. Nishimori, 2011. Probabilistic evaluation of climate change impacts on paddy rice productivity in Japan. Climatic Change, 107, 391-415. (Toshichika Iizumi, National Institute for Agro-Environmental Sciences)	The references in this paragraph are examples. We will look at including this citation where the chapter discusses the relative contributions of uncertainties.
203	52494	7	9	31	9	31	Why not introduce a models of food production? (Ursula Oswald-Spring, Centro Regional de Investigaciones Multidisciplinarias (CRIM) UNAM)	This comment is insufficiently detailed to enable us to follow up.
204	35333	7	9	33	9	33	The idea that the quantification of uncertainty does not necessarily lead to less robust statements regarding climate impacts is well demonstrated in Iizumi et al. (2011) that displays the projected rice yield change in Japan from FAR to AR4 and highlights the usefulness of ensemble-based probabilistic assessment approach. I Iizumi, T., M. Yokozawa, and M. Nishimori, 2011. Probabilistic evaluation of climate change impacts on paddy rice productivity in Japan. Climatic Change, 107, 391-415. (Toshichika Iizumi, National Institute for Agro-Environmental Sciences)	We will consider this reference along with all the other relevant references
205	43799	7	9	43	10	7	A new methodology to investigate typical patterns of vulnerability and adaptation options has evolved since AR4 (Jäger et al. 2007, Kok et al. 2010, Sietz et al. 2011a, Sietz et al. 2011b). These analyses categorise the multiple dimensions of vulnerability in a set of socio-ecological systems. The proposed cluster approach presents one way of dealing with the complex vulnerability-creating mechanisms to multiple exposures. It abstracts recurrent conditions from a multitude of observations to highlight typical vulnerability-creating mechanisms. Therefore the pattern approach provides an alternative to modelling approaches with high data and computational demands. This approach is useful to understand functional similarities and differences from a broader perspective, however reflecting sub-national processes. The studies characterise vulnerability at global scale, for example identifying hotspots of vulnerability in global drylands (Sietz et al. 2011a) as well as at local scale, for example considering smallholder production systems in southern Peru (Sietz et al. 2011b). Thereby, the global dryland analysis is the first attempt to quantitatively analyse dryland vulnerability sub-nationally and with global coverage. The results are validated by selected case studies reflecting the cluster-specific mechanisms and their spatial distribution. REFERENCES: Jäger, J., Kok, M., Mohamed-Katerere, JC., Karlsson, SI., Lüdeke, MKB., Dabelko, GD., Thomalla, F., de Soysa, I., Chenje, M., Filcak, R., Koshy, L., Long Martello, M., Mathur, V., Moreno, AR., Narain, V. and Sietz, D. (2007) Vulnerability of people and the environment: Challenges and opportunities. In: Global Environment Outlook: Environment for development (GEO-4). UNEP, Progress Press, Valletta, Malta, pp. 301-360. ----- Kok, M., Lüdeke, MKB., Sterzel, T., Lucas, PL., Walther, C., Janssen, P., de Soysa, I., Tekelenburg, T., Sietz, D. and Brighenti, J. (2010) Quantitative analysis of patterns of vulnerability to global environmental change. Netherlands Environmental Assessment Agency, Potsdam Institute for Climate Impact Research, Norwegian University of Science and Technology. ----- Sietz, D., Lüdeke, MKB. and Walther, C. (2011a) Categorisation of typical vulnerability patterns in global drylands. Glob. Environ. Chang. 21: 431-440. ----- Sietz, D., Mamani Choque, SE. and Lüdeke, MKB. (2011b) Typical patterns of smallholder vulnerability to weather extremes with regard to food security in the Peruvian Altiplano. Reg. Environ. Chang., Published online: 15 November 2011, DOI: 10.1007/s10113-011-0246-5. (diana sietz, Wageningen University)	If space permits we will include a few paragraphs on vulnerability approaches, using these references and others such as Fraser.
206	45216	7	10	2	10	2	Moreover, statistical models can only assume future trends by extrapolation. (Eline Vanuytrecht, KU Leuven)	Added to text.

#	ID	Ch	From Page	From Line	To Page	To Line	Comment	Response
207	43221	7	10	9	10	18	I found this paragraph very difficult to understand (Peter Gregory, University of Reading)	Paragraph rephrased, shorter sentences used.
208	37098	7	10	23	0	0	Research at the AGFACE demonstrate there are genotypic differences even within the current germplasm to a character such as response to CO2 as well as transpiration - by Tausz M, Posch S, Norton R, Fitzgerald G, Nicolas ME, Seneweera S. (2011) Understanding crop physiology to select breeding targets and improve crop management under increasing atmospheric CO2 concentrations. http://dx.doi.org/10.1016/j.envepxbot.2011.12.005 . (Robert Norton, International Plant Nutrition Institute)	The abstract states: "Yield increases per 100 µL L-1 increase in [CO2] varied between none and over 30% among varieties of important crops." This has been paraphrased and cited in the chapter text.
209	40602	7	10	30	0	0	Section 7.3.2. This section has been structured in a way that has led to numerous duplications and to at least one significant gap (see my following comments for details). The authors need to re-think the structure of section 7.3.2. Given that there appears to be next to no literature on IVR in mixed farming, and the material on hand in the draft, I suggest that they take an explicitly land/sea-use-based approach, e.g. (i) broadacre crops, (ii) pastures, rangelands & livestock, (iii) horticulture, (iv) fisheries and aquaculture, (v) land use change and autonomous adaptation in land use. Issues of pests, weeds, diseases, product quality & human health should be distributed across the land uses, especially since the relevant sub-section drafts make no attempt to draw any conclusions across land uses. This would also allow the authors to match the structure of section 7.5.1.1 more closely to that of section 7.3.2. (Andrew Moore, CSIRO)	Section restructured. The content on adaptation is also now more prominent
210	40603	7	10	30	0	0	Section 7.3.2. The material concerning plants in this section has been divided into one sub-section on "crops and pastures" (i.e. a set of land uses), and a second on "perennials" (i.e. a life form). This set of sub-sections does not properly partition the space. Material on perennial pastures has gone into the "crops and pastures" section, and the "perennials" section is devoted to perennial horticulture and (somewhat oddly, in my view) to sugar cane. The most serious consequence of this way of structuring the sub-sections is that non-tree horticulture (in particular vegetable production) appears to have received next to no consideration - I found one reference to potato diseases. This seems to me to be a major gap in the coverage of the chapter. (Andrew Moore, CSIRO)	Section restructured
211	40604	7	10	30	0	0	Section 7.3.2. Section 7.3.2.6, although titled "livestock", is actually about "forage and livestock". It contains material on pasture/rangeland production that has already been covered in section 7.3.2.1 (e.g. compare page 12 lines 31-37 with page 19 lines 39-48) and also a section on host-pathogen interactions which should (but doesn't) overlap with section 7.3.2.2. It is always difficult to decide whether to consider forage plants alongside crop plants or in conjunction with the animals that eat them, but trying to do both is not a solution. (Andrew Moore, CSIRO)	Section restructured
212	50420	7	10	34	10	42	As these findings are developed further, the author team should consider using calibrated uncertainty language to indicate its degree of certainty in the conclusions. One option would be to present calibrated uncertainty language here, along with line-of-sight references to where assessment is developed in the chapter for each finding. Alternatively, the author team's degree of certainty in the findings could be indicated in the subsequent sections of the chapter where assessment supporting the conclusions is completed. (Katharine Mach, IPCC WGII TSU)	Ok. As in the FD.
213	36412	7	10	36	10	37	1. See Morgan et al. 2011. C4 grasses prosper as carbon dioxide eliminates desiccation in warmed semi-arid grassland. Nature 476:202-206. for recent results from a combined FACE and warming experiment which suggest a very strong role of water relations in explaining the CO2 productivity responses of semi-arid grasslands. It also features results from one of the very few two-factor (CO2 and warming) field manipulative experiments (see also Hovenden M. J. et al. 2008. Influence of warming on soil water potential controls seedling mortality in perennial but not annual species in a temperate grassland. New Phytol. 180, 143-152.) Additional information on the consequences of CO2 and warming on N cycling (e.g. Dijkstra et al. 2010. Contrasting effects of elevated CO2 and warming on nitrogen cycling in a semiarid grassland. New Phytologist 187:426-437; Carrillo et al. 2012. Controls over soil nitrogen pools in a semiarid grassland under elevated CO2 and warming ecosystems. Ecosystems DOI: 10.1007/s10021-012-9544-0) suggest that it is the indirect effects of CO2 and warming on water which largely determines N cycling responses, which is another critical aspect of grassland ecology and functioning. So, while it may be true that this water relations response is not as important in more intensively managed cropped agro-ecosystems, it is a critical/dominant matter in dry grasslands/rangelands which comprise somewhere in the neighborhood of 25-30% of the terrestrial surface of the planet, and where most of the world's large livestock spend much of their time. (Jack Morgan, USDA Agricultural Research Service)	References reviewed and included as appropriate
214	40605	7	10	39	10	41	Results from recently-completed work (Moore & Ghahramani in prep.) for sheep & cattle production across southern Australia indicate strongly that precipitation effects are much more important than temperature effects in this setting. (Andrew Moore, CSIRO)	Can be included if we can read the text
215	43222	7	10	42	10	42	Where is the evidence that pests, weeds and diseases are more fully included in assessments of climate change since AR4? Their effects are almost completely ignored in section 7.3 of this report and the research effort in these fields since 2006/7 has been very poor. See Gregory et al 2009, J Exp Bot 60, 2827-2838 and Newton et al 2011 Euphytica 179, 3-18 for discussion. (Peter Gregory, University of Reading)	Bullet deleted
216	35332	7	11	18	11	21	In case of rice in Japan, increased temperature shortens the length of reproductive growth period and reduces accumulated solar radiation for the period and anticipated yield and rice eating quality (Uno et al. 2012): these changes are projected to appear in future climate condition (Okada et al. 2011). Okada, M., T. Iizumi, Y. Hayashi, and M. Yokozawa, 2011. Projecting climate change impacts both on rice quality and yield in Japan. Journal of Agricultural Meteorology, 67, 285-295. Uno, F., T. Iizumi, M. Nishimori, and Y. Hayashi, 2012. Time trend and variation in mean and accumulated solar radiations for the ripening period of paddy rice in Kyushu for 1979-2007. Journal of Agricultural Meteorology, 68, 69-76. (Toshichika Iizumi, National Institute for Agro-Environmental Sciences)	This process is well understood and specific reference to rice in Japan is not required.

#	ID	Ch	From Page	From Line	To Page	To Line	Comment	Response
217	50421	7	11	18	11	33	For several statements on these lines (for example, on lines 18-19, 28-30, and 31-33), the author team might consider further specifying the relevant time frame for the observations. (Katharine Mach, IPCC WGII TSU)	This section is about the processes and biophysical relationships that cause change - to include a timeframe temperature projections would be needed. Projections are covered in a later section.
218	41085	7	11	26	11	26	this discussion of crops and temperature neglects a pretty important factor and that is yields in some areas are depressed because temperatures are too low whereas other areas are stressed by too hot of conditions. Thus ambiguous effects of temperature should be expected. (Bruce McCarl, Texas A&M University)	Text and citations on low temperatures added.
219	35337	7	11	42	11	52	While this sentence focuses on the effects of precipitation on yield, it is found that typhoon damage (including heavy precipitation) affects harvested area rather than yield (Masutomi et al., 2012). I Masutomi, Y., T. Iizumi, K. Takahashi, and M. Yokozawa, 2012. Estimation of the damage area due to tropical cyclones using fragility curves for paddy rice in Japan. Environmental Research Letters, 7, 014020. I Jongejans, E., Kroon, H.d., Tuljapurkar, S., & Shea, K. (2010) Plant populations track rather than buffer climate fluctuations. Ecology Letters, 13, 736-743. (Toshichika Iizumi, National Institute for Agro-Environmental Sciences)	Thank you for another reference to one of your papers. This chapter considers food production globally; typhoon damage, whilst important in some areas, is not significant enough globally to be included here. Hopefully you commented also on the Asia chapter.
220	50422	7	11	48	11	48	The author team should clarify the introduction of this figure. Even though precipitation is described here, the figure focuses on temperature. (Katharine Mach, IPCC WGII TSU)	Two figures are described, one for temp, one for precip. Text fine as is.
221	48278	7	12	0	0	0	There are specific studies about agricultural operations being affected in India. Some work with Infocrop in Tamil Nadu Agricultural University, Coimbatore, while N H Ravindranath et al in Vulnerability of North East India talks about effect of agriculture, forestry, water, in the short-term scenario and long-term scenario (Malini Nair, Indian Institute of Science)	Relevant to the Asia chapter. We have limited space here for specific countries.
222	41086	7	12	15	12	15	I believe more can be said about rangeland. There are 2 papers by the society for rangemanagement team that reviews the state of the art. One is Polley, W.R., K.W. Pulwarty, D.W. Bailey, D. Briske, J. Brown, J.A. Morgan, and L. Joyce, "Climate Change and North American Rangelands: Synthesis and Assessment of Mitigation and Adaptation Strategies", 2010. and there is another Climate Change and North American Rangelands: Evidence, Trends, and Implications H. Wayne Polley,1 David D. Briske,2 Jack A. Morgan,3 Klaus Wolter,4 Derek W. Bailey,5 and Joel R. Brown6 Both were commissioned and are under way at the journal rangelands ecology. This includes comments on changes in forage quality G64G49 (Bruce McCarl, Texas A&M University)	Paragraph revised in the light of these references
223	40606	7	12	17	12	19	Results from recently-completed work (Moore & Ghahramani in prep.) for sheep & cattle production across southern Australia project the opposite: higher temperatures and lower precipitation shorten the forage production season, increasing the need for supplementary feeding (Andrew Moore, CSIRO)	Work in prep cannot be cited.
224	50423	7	12	24	12	24	As appropriate, it would be helpful to indicate which climate/socio-economic scenarios are meant here. (Katharine Mach, IPCC WGII TSU)	Needs addressing by whoever wrote pastures paragraphs - chapter 4.
225	36413	7	12	27	12	28	All dry rangelands (which constitute the vast majority of rangelands) are strongly dependent on water. (Jack Morgan, USDA Agricultural Research Service)	Needs addressing by whoever wrote pastures paragraphs - chapter 4.
226	36414	7	12	33	12	37	1. Interesting. These modeling results are somewhat similar to the compensating effects we saw of CO2 and warming on water relations in semi-arid grasslands of the western Great Plains (Morgan et al. 2011. Nature 476:202-206). (Jack Morgan, USDA Agricultural Research Service)	Needs addressing by whoever wrote pastures paragraphs - chapter 4.
227	50424	7	12	34	12	34	"likely" -- If this term is being used per the uncertainties guidance for authors (reflecting a probabilistic basis for its assignment), it should be italicized. Casual usage of this reserved likelihood term should be avoided. (Katharine Mach, IPCC WGII TSU)	See previous responses.
228	35665	7	12	42	12	54	first of all, why only impact of CO2 and ozone - why not UVB ? Second, most of what is presented in the first paragraph (lines 42-47) is known for a long time (see, e.g. Reilly et al., Rötter & van de Geijn, 1999); full ref: Rötter, RP, van de Geijn, SC (1999) Climate change effects on plant growth, crop yield and livestock. Climatic Change 43, 651-681. Then, what the statements made in the second para (lines 49-54) are questionable to some extent; under mild water stress most what is said might be true; however, if water stress becomes severe, the CO2 fertilization effect will be reduced considerably (see, forthcoming AgMIP wheat pilot results) (Reimund Rötter, MTT Agrifood Research Finland)	1. UVB literature reviewed and included as appropriate. 2. Agreed that the first paragraph introduces the issue. We await publication of the AgMIP results so that we can include them. UVB is not a central climate issue - more an ozone issue,
229	37099	7	13	4	0	0	Posch S, Norton R, Seneweera S, Fitzgerald G, Tausz M (2012) Will intra-specific differences in transpiration efficiency in wheat be maintained in a high CO2 world? – A FACE study. Field Crops Research 133, 160-166. (Robert Norton, International Plant Nutrition Institute)	We do not discuss intra-species differences here.
230	45217	7	13	5	13	5	It is the first time that the effect of CO2 on stomatal aperture is mentioned. Shouldn't this come earlier in the text? (Eline Vanuytrecht, KU Leuven)	No; this is the section on CO2 responses
231	46289	7	13	5	13	5	The saying "water stress....stomatal apertures" may be supported by reference (Arif Goheer, Global Change Impact Studies Centre (GCISC))	This is fundamental physiology - no reference needed
232	36415	7	13	7	13	16	1. We found that the results from two field CO2-enrichment experiments, one using OTCs, the other FACE, could be used to derive a single relationship relating the relative CO2-induced enhancement of plant biomass to soil water potential (Fig. 3 from Morgan et al. Nature 476:202-206). This is particularly interesting as the two similar grasslands (a shortgrass steppe and mixed-grass prairie) are only 40 miles apart from one another. This would seem to indicate that at least in these dry grasslands of the western Great Plains, similar results are obtained in FACE and chamber technologies. It also supports the comment in this section that comparisons between different techniques take into account differences in water stress levels. I can provide more details if useful. (Jack Morgan, USDA Agricultural Research Service)	Very relevant to chapter 4, but not sufficiently relevant for crops for us to use here.

#	ID	Ch	From Page	From Line	To Page	To Line	Comment	Response
233	45218	7	13	10	13	11	There are much more reasons mentioned (by other authors) for the disparity between FACE and non-FACE experiment results. It is strange to mention only one here. (Eline Vanuytrecht, KU Leuven)	We would welcome other suggestions for inclusion
234	41087	7	13	16	13	16	we recently did a pooled face/observed yield analysis in us finding the c3 c4 effects but also effects on c3 under drought plus effects of co2 on technical progress. Attavanich, W., and B.A. McCarl, "How is CO2 Affecting Yields and Technological Progress? A Statistical Analysis", 2012. or Attavanich, W., and B.A. McCarl, "The Effect of Climate Change, CO2 Fertilization, and Crop Production Technology on Crop Yields and Its Economic Implications on Market Outcomes and Welfare Distribution", Selected paper presented at the 2011 Annual Meetings of the Agricultural and Applied Economics Association, Pittsburgh, July, 2011. (Bruce McCarl, Texas A&M University)	Thanks. The identified papers will be reviewed.
235	45219	7	13	16	13	16	Moreover, there is a strong bias towards C3 crops, and to 'important' crops like wheat and rice. (Eline Vanuytrecht, KU Leuven)	Thanks. The learned reviewer is probably referring to Page 12, line 42-43.
236	35666	7	13	18	13	39	What is written here about ozone is a little bit out of date -- there are a couple of more recent papers in: Global Change Biology (2012) 18, 1489–1490, doi: 10.1111/j.1365-2486.2012.02676.x (Virtual Special Issue on food security) (Reimund Rötter, MTT Agrifood Research Finland)	Thanks. The identified papers and other latest papers will be reviewed.
237	50425	7	13	35	13	53	"likely" on lines 35 and 53 -- If this term is being used per the uncertainties guidance for authors (reflecting a probabilistic basis for its assignment), it should be italicized. Casual usage of this reserved likelihood term should be avoided. (Katharine Mach, IPCC WGII TSU)	Thanks. The term 'likely' will be italicized.
238	52495	7	13	46	13	47	There are missing temperature, run-off and precipitation change as another subchapter related to sensitivity of food production to weather and climate (Ursula Oswald-Spring, Centro Regional de Investigaciones Multidisciplinarias (CRIM) UNAM)	Thanks. The author team will look into it - but the comment is vague.
239	41088	7	13	51	13	51	We just did two studies on adaptaion and land use change that go beyond what is said here. One shows crop mix is being altered by recent climate change and looks at the effect of climate on crop mix using US agricultural acreage data. It shows a change in crops as climate warms with corn replacing wheat, cotton replacing corn, rice replacing cotton (JIYUN PARK "ESSAYS ON IMPACTS OF CLIMATE CHANGE ON AGRICULTURAL SECTOR IN THE U.S." Unpublished PhD Dissertation, Department of agricultural economics, texas A&M University, July, 2012 in the essay therein "THE EFFECTS OF CLIMATE ON CROP MIX AND CLIMATE CHANGE ADAPTATION". this was based on US agricultural census data observed over last 30 years. we also examined the effects of climate on land allocation between crops and livestock finding hotter and drier switches land to livestock and also decreases livestock stocking rates. this was also based on US agricultural census data observed over last 30 years. Mu, J.E., B.A. McCarl, and A. Wein, "Climate Influences on Livestock and Crop Land Use", Mitigation and Adaptation of Strategies for Global Change, forthcoming, 2012. (Bruce McCarl, Texas A&M University)	Looks interesting, but the work is not published, so we cannot include at present.
240	43223	7	13	51	13	54	It is notable that such studies almost always ignore any effects on pests and diseases. (Peter Gregory, University of Reading)	It is indeed. Text amended.
241	45220	7	13	52	13	54	This sentence is unclear. (Eline Vanuytrecht, KU Leuven)	Amended
242	41089	7	13	54	13	54	Seo and colleagues have done a number of adaptaion studies on how climate affects crop vs livestock land and livestock mix in africa, south america and austrailia. Two recent ones are Seo, S.N. 2012. Adaptation Behaviors across Ecosystems under Global Warming: A Spatial Micro-econometric Model of the Rural Economy in South America. Papers in Regional Science. Regional Science Association International. (Available as EarlyView). -Seo, S.N. 2012. Adapting Natural Resource Enterprises under Global Warming in South America: A Mixed Logit Analysis. Economia: Journal ofthe Latin American and Caribbean Economic Association. Spring 2012. Brookings Institution Press (Bruce McCarl, Texas A&M University)	References included as appropriate
243	50426	7	13	54	13	54	The summary terms for evidence and agreement on this line should be italicized. (Katharine Mach, IPCC WGII TSU)	Amended
244	37569	7	14	2	0	0	"... variability in crop suitability." Add the following sentence "A study carried agricultural crop production in Finland indicated that increases in precipitation in August an September might caused by be harmful counteracting the beneficial effects of a longer vegetation period" (Growing season precipitation in Finland under recent and projected climate by J. S. Ylhäisi, H. Tietavainen, P. Peltonen-Sainio, A. Venalainen, J. Eklund, J. Raisanen and K. Jylhä 2010. Nat. Hazards Earth Syst. Sci., 10, 1563–1574, 2010 (Abstract. The past and projected future precipitation sum in May–September for two areas in Finland, one located in the south-west (SW) and the other in the north-east (NE), is studied using 13 regional climate simulations and three observational datasets. The conditions in the present-day climate for agricultural crop production are far more favourable in the south-western part of the country than the more continental north-eastern Finland. Based on a new high-resolution observational precipitation dataset for Finland (FMI grid), with a resolution of 10×10 km, the only statistically significant past long-term (1908–2008) precipitation tendencies in the two study regions are positive. Differences between FMI grid and two other observational datasets during 1961–2000 are rather large in the NE, whereas in the SW the datasets agree better. Observational uncertainties stem from the interpolation and sampling errors. The projected increases in precipitation in the early stage of the growing season would be most favourable for agricultural productivity, but the projected increases in August and September might be harmful. Model projections for the future indicate a statistically significant increase in precipitation for most of the growing season by 2100, but the distribution of precipitation within the growing season is not necessarily the most optimal.) (John Sumelius, University of Helsinki, Faculty of Agriculture and Forestry)	This chapter deals with global food production; we do not have room to cite all regional studies - but we do have a regional box now.
245	50427	7	14	6	14	6	The summary terms for evidence and agreement on this line should be italicized. (Katharine Mach, IPCC WGII TSU)	Amended
246	50429	7	14	7	14	10	As appropriate for these statements, it would be helpful to indicate the relevant climate/socio-economic scenarios. (Katharine Mach, IPCC WGII TSU)	Amended

#	ID	Ch	From Page	From Line	To Page	To Line	Comment	Response
247	50428	7	14	8	14	18	"likely" on lines 8 and 18 -- If this term is being used per the uncertainties guidance for authors (reflecting a probabilistic basis for its assignment), it should be italicized. Casual usage of this reserved likelihood term should be avoided. (Katharine Mach, IPCC WGII TSU)	See earlier responses.
248	52496	7	14	27	14	28	big dams built on geological faults have also produced and increased earthquakes (see 2 articles in Sciences 2012) (Ursula Oswald-Spring, Centro Regional de Investigaciones Multidisciplinarias (CRIM) UNAM)	This comment falls outside the domain of Ch. 7.
249	41090	7	14	40	14	40	I have no idea why this para on biofuels is in section under land use and adaptation. It is more a point on mitigation and food security in general that should move to elsewhere (Bruce McCarl, Texas A&M University)	Cropland that is used for biofuels is not used for food, hence this is a point about land use. Text changed to clarify the relevance.
250	44837	7	14	40	14	52	The links between biofuel production and food (in)security could be explained more fully. Chapter 19 has a short discussion on the connection between biofuels and food prices but I think it is important to also include it here, along with questions of national food security (does producing more biofuels for export mean relying more on food imports?), farmer risk (do farmers who produce biofuel crops give up subsistence crops and/or other cash crops to do so? How does this affect their ability to produce or purchase food?), and differentiated impacts of food price increases on the ability of people in different situations to access food. (Carol Hunsberger, Institute of Social Studies)	Agreed. Text amended. See also comment #249
251	43078	7	14	48	14	48	Refer to Ch. 19 where risks associated with bioenergy are mentioned as well. (Andreas Meyer-Aurich, Leibniz-Institute for Agricultural Engineering Potsdam-Bornim)	Text amended
252	52498	7	15	1	21	3	Interlinks between physical changes, food items and socioeconomics should be taken into account. There is a crucial adaptation measure called virtual water, but also migration, subsistence crops, etc. are ways to deal with climate change and variability, hunger, disasters and desertification. Other factors are trade and production related monopolies, which can increase with lack of food production do to climate change and producing price spikes and speculation. (Ursula Oswald-Spring, Centro Regional de Investigaciones Multidisciplinarias (CRIM) UNAM)	This section is entitled 'sensitivity of food production to weather and climate' - adaptation comes later
253	41091	7	15	3	15	3	this adaptation section is not effective and would be best left to the adaptation chapters where the topic is better handled. (Bruce McCarl, Texas A&M University)	Adaptation cannot be omitted from a chapter about food production and food security - it would be highly unrealistic. Specific comments on improving this section are welcome.
254	52497	7	15	3	15	3	by a range of actors and regions (Ursula Oswald-Spring, Centro Regional de Investigaciones Multidisciplinarias (CRIM) UNAM)	Regions' implicit in the range of actors
255	35667	7	15	3	15	9	also in this paragraph, there could be some reference to recent work; e.g. Ref supporting statement in lines 3-4: Sacks, J, Kucharik, CJ, (2011) Crop management and phenology trends in the U.S. Corn Belt: Impacts on yields, evapotranspiration and energy balance. Agricultural and Forest Meteorology 151, 882-894. (Reimund Rötter, MTT Agrifood Research Finland)	This is an introductory paragraph with introductory concepts. References and further details are in the adaptation section.
256	40607	7	15	7	15	9	This point has already been made (with the same citation) at page 14 line 18 (Andrew Moore, CSIRO)	Thanks. Sentence removed.
257	40610	7	15	12	0	0	Section 7.3.2.2. This section commences with several paragraphs on the effects of climate change on pests, weeds and diseases, and then proceeds to a sub-section titled "climate change effects on pests, weeds and diseases". If Section 7.3.2. is to retain its current structure (see my comments on ch 7 page 10 line 30), then this sub-section needs to be structured more carefully - perhaps into weeds, plant pests & diseases and animal pests & diseases. (Andrew Moore, CSIRO)	There is a missing section title 73221 that clarifies. 73221 deals with climate and weather, 73222 deals with climate change. All section titles and numbering have been revised for the FD.
258	40608	7	15	14	15	14	This sentence is (at best) ambiguous: the current potential loss from pests & pathogens is 100%. Do the authors mean "estimated current actual loss", or do they mean potential extra loss under some climate change scenario? (Andrew Moore, CSIRO)	Potential loss is defined as estimated actual current loss in the absence of any physical, biological or chemical crop protection. Text amended.
259	50430	7	15	14	15	15	For this statement, the author team should clarify the relevant time frame--is this an observed or projected outcome? To what ranges of years does it pertain? (Katharine Mach, IPCC WGII TSU)	Current. See #258
260	40609	7	15	25	15	27	We have here a statement that "knowledge is being synthesised" with a citation to a 2006 paper. Surely, if such a synthesis is worth mentioning, it would have produced some specific results after 6+ years of work? (Andrew Moore, CSIRO)	Reference removed
261	40611	7	15	47	15	48	What does "climate stability" mean here? The default assumption would be that a stable climate would lead to no effect, contra the second part of this sentence. (Andrew Moore, CSIRO)	"climate stability with respect to" replaced with "changes in" .."are"
262	50431	7	15	47	15	51	"likely" on lines 47 and 51 -- If this term is being used per the uncertainties guidance for authors (reflecting a probabilistic basis for its assignment), it should be italicized. Casual usage of this reserved likelihood term should be avoided. (Katharine Mach, IPCC WGII TSU)	Likely' removed
263	40612	7	15	52	15	52	If there is evidence, then it should be cited... (Andrew Moore, CSIRO)	Sentence deleted
264	49069	7	15	52	15	52	Check language: delete "While" (Oyvind Christophersen, Climate and Pollution Agency)	Sentence deleted
265	50432	7	16	39	0	0	Section 7.3.2.2.2. The author team may wish to consider if this section would be better merged with the previous. (Katharine Mach, IPCC WGII TSU)	See responses to comments 210, 211, 257
266	35668	7	16	39	16	39	I wonder where is the previous sub-sub...section 7.3.2.2.1 ? (Reimund Rötter, MTT Agrifood Research Finland)	See #257
267	41092	7	16	40	16	40	there are some studies that have been done that show climate change increases pest treatment cost a recent reference is Koleva, N.G., U.A. Schneider, and B.A. McCarl, "Pesticide and greenhouse gas externalities from US agriculture - The impact of their internalization and climate change", Climate Change Economics, forthcoming, 2012. and Koleva, N.G., U.A. Schneider, and B.A. McCarl, "US agricultural sector analysis on pesticide externalities - The impact of climate change and a Pigovian tax", Climatic Change, forthcoming, 2012. (Bruce McCarl, Texas A&M University)	We deal here with impacts, not their subsequent cost implications

#	ID	Ch	From Page	From Line	To Page	To Line	Comment	Response
268	41093	7	16	40	16	40	You mention diseases but say little on them. We recently looked at avian influenza and find climate change is contributing to its spread. Mu, J.E., B.A. McCarl, X.M. Wu, and M.A. Ward, "Is Climate Change contributing to Avian Influenza Outbreaks", 2012, under second review at climate research. (Bruce McCarl, Texas A&M University)	Impacts on food production difficult to quantify
269	35334	7	16	41	16	41	Related to pests and weeds, some literatures are available: (1) Increased temperature for the last 30 years had a little effect on the dynamics of H. cunea population change in Japan (Yamanaka et al., 2008); (2) it is expected that increasing climate variability increases population fluctuations and extinction risks (Jongejans et al., 2010); and (3) the observed number of light-trap catches of C. suppressalis and N. cincticeps in summer increases with increasing temperatures in the previous winter and the influence of temperature is not carried over to the next year (Yamamura et al., 2006). I Yamamura, K., M. Yokozawa, M. Nishimori, Y. Ueda, and T. Yokosuka, 2006. How to analyze long-term insect population dynamics under climate change: 50-year data of three insect pests in paddy fields. Population Ecology 48: 31-48. I Yamanaka, T., S. Tatsuki, and M. Shimada, 2008. Adaptation to the new land or effect of global warming? - An age-structured model for rapid voltinism change in an alien lepidopteran pest. Journal of Animal Ecology 77, 585-596. I Jongejans, E., Kroon, H.d., Tuljapurkar, S., & Shea, K. (2010) Plant populations track rather than buffer climate fluctuations. Ecology Letters, 13, 736-743. (Toshichika Iizumi, National Institute for Agro-Environmental Sciences)	Refs 1 and 3 are too geographically or species specific for this section. Reference 2 makes no mention of weeds.
270	40613	7	17	5	0	0	I was surprised to see no mention of effects on grapevines in this section (see e.g. chapter 25, page 25, line 53). (Andrew Moore, CSIRO)	Will be included in the new version
271	42332	7	17	5	0	0	Section 7.3.2.3. Perennials I propose that following sentences are inserted in this section: To produce high quality fruits, apple trees are cultivated in narrow temperature zone in Japan. The current main apple producing districts are 6-14°C on annual mean temperature and 13-21°C on mean temperature from April to October, respectively. Many parts of these apple producing districts will be possibly unfavorable regions to cultivate apples by 2060's (Sugiura, et al., 2005). Reference Sugiura, T., H.Kuroda, H.Sugiura, and H.Honjo. 2005: Prediction of effects of global warming on C in Japan. Phytion-Annales Rei Botanicae, 45(4), 419-422. (I have sent PDF of this paper. The file name is "apple production regions in Japan.pdf".) (Toshihiko Sugiura, National Agriculture and Food Research Organization, Institute of Fruit Tree Science)	The paper will be reviewed and included if appropriate
272	50433	7	17	11	17	17	For these statements, it would be helpful to clarify the climate/socio-economic scenarios used for the projections. (Katharine Mach, IPCC WGII TSU)	Text amended
273	40614	7	17	26	0	0	Section 7.2.3.4. This section is extremely thin. It contains only 3 citations directly relevant to the topic (De Matta et al 2010, Pikki et al 2007 and Aggarwal 2007). Critique of the remainder of the section is given in the following comments. The paucity of information - if it is due to a genuine lack of studies (see page 22 lines 41-44) - further strengthens my argument that section 7.3.2 needs to be re-structured. (Andrew Moore, CSIRO)	The learned reviewer is probably referring to Sectio 7.3.2.4. The comment will be taken into account.
274	37100	7	17	28	0	0	Micronutrient malnutrition is already recognised as a significant component of food security - see WHO (2007). Preventing and controlling micronutrient deficiencies in populations effected by an emergency. Joint Statement by the World Health Organization, The World Food Programme and the United Nations Children's Fund. Online citation: UNICEFstatement.pd">http://www.who.int/nutrition/publications/WHO_WFP_?tul=0?>UNICEFstatement.pd . fThere have been several papers published on micronutrient levels in grain - and most recently Fernando N, Panozzo J, Tausz M, Norton R, Fitzgerald and G, Seneweera S. (2012) Rising atmospheric CO2 concentration affects mineral nutrient and protein concentration of wheat grain. Food Chemistry, 133, 1307-1311. This paper also summarises some work from Erbs et al (Erbs, M., Manderscheid, R., Jansen, G., Seddig, S., Pacholski, A., & Weigel, H. J. (2010). Effects of free-air CO2 enrichment and nitrogen supply on grain quality parameters and elemental composition of wheat and barley grown in a crop rotation. Agriculture, Ecosystems and Environment, 136, 59-68.) and Höggy (Höggy, P., Wieser, H., Kohler, P., Schwadorf, K., Breuer, J., Franzaring, J., et al. (2009). Effects of elevated CO2 on grain yield and quality of wheat: Results from a 3-year free-air CO2 enrichment experiment. Plant Biology, 11, 60-69). The issue of micrnutrients for those on grains based diets is likely to become more significant as Zn contents decline in response to eCO2. Current interventions of improved Zn nutrition and more Zn efficient cultivars will continue to be important to deal with this problem. (Robert Norton, International Plant Nutrition Institute)	The identified paper and other latest papers will be reviewed.
275	40615	7	17	30	17	30	The cited paper by Caracelli et al 2010 (actually Ceccarelli et al) is a review that contains only one reference to food quality. The point relating to food quality by Ceccarelli et al is not supported by the the citation they provide (Atkinson et al 2008, J Agric Sci 148:2008, which is about grain quality varibility under historic, not future climate) (Andrew Moore, CSIRO)	The identified paper will be reviewed.
276	40616	7	17	32	17	33	Effects of soil degradation on micronutrient deficiency are no doubt real, but the text makes no link between climate change and any alteration in the current situation. It may be that such an argument can be found in Lal (2009) but as the section stands, the point about soil degradation & food quality seems out of scope to me. (Andrew Moore, CSIRO)	it will be looked onto whether a link can be established between soil degradation and food quality.
277	40617	7	17	33	17	37	This part of the section is about effects on rice yield, not rice quality & so does not belong in this section (the point is already made at ch 7 page 11 line 33). (Andrew Moore, CSIRO)	Thanks for the comment.
278	35335	7	17	35	17	37	High night-time temperature causes a decrease in rice eating quality as well as yield (Okada et al. 2009; 2011). I Okada, M., T. Iizumi, Y. Hayashi, and M. Yokozawa, 2009. A Climatological analysis on the recent declining trend of rice quality in Japan. Journal of Agricultural Meteorology, 65, 327-337. I Okada, M., T. Iizumi, Y. Hayashi, and M. Yokozawa, 2011. Modeling the multiple effects of temperature and radiation on rice quality. Environmental Research Letters, 6, 034031. (Toshichika Iizumi, National Institute for Agro-Environmental Sciences)	Thanks. The identified paprs will be reviewed.
279	40618	7	17	37	17	38	***What*** impacts of ozone on crop quality were reported by Aggarwal 2007? (Andrew Moore, CSIRO)	Tkanks. The impacts will be specified.

#	ID	Ch	From Page	From Line	To Page	To Line	Comment	Response
280	40619	7	17	38	17	40	No link is made between the severity of crown rot and food quality or human health. This point does not belong in the section. (Andrew Moore, CSIRO)	Thanks for the comment.
281	40620	7	17	40	17	40	Susceptibility of maize plants to drought stress near anthesis: No link is made to food quality or human health. This point does not belong in the section. (Andrew Moore, CSIRO)	Thanks for the comment.
282	40621	7	17	40	17	43	The two sentences here about soil degradation partly repeat points made earlier in the section, and wholly consist of assertions unsubstantiated by refereed literature. If these points are to be retained, then (i) the meaning of "allied impact of climate change" needs to be clarified - do the authors mean that climate change impacts are exacerbated by climate change, or that climate change will accelerate soil degradation, or both? (ii) citations need to be provided for the propositions in point (i); (iii) citations (from the primary literature or a properly relevant review) need to be provided for the impacts of soil degradation *** on food quality and human health***, not on crop yield; and (iv) the structure of the sub-section needs to be tightened so that it doesn't jump in & out of the question of soil degradation impacts. (Andrew Moore, CSIRO)	Thanks. The comment will be taken into account.
283	41094	7	17	43	17	43	this section is all negative. I believe there are cases where climate change to date has increased regional production and quality. (Bruce McCarl, Texas A&M University)	Thanks for the comment.
284	39476	7	17	45	19	16	Check the QUEST-fish literature for recent research. (Sarah Cornell, Stockholm Resilience Centre)	Merino et al. 2012 used and cited.
285	50434	7	17	46	0	0	Section 7.3.2.5. The author team should consider further addressing aquaculture in this section. (Katharine Mach, IPCC WGII TSU)	There is very little information available. The relevant and reliable information that could be found is used.
286	52499	7	18	1	18	4	Sea level rise and storm surges produce salinization of coastal areas and erosion in the highly fertile areas of the deltas, often with intrusion of salty water to the aquifers affecting drinking water and irrigation potential. (Ursula Oswald-Spring, Centro Regional de Investigaciones Multidisciplinarias (CRIM) UNAM)	This comment is presumably referring to impacts of salinization on agriculture - needs consideration by others in Ch7 team and possible reference in appropriate section.
287	41095	7	18	3	18	3	I believe there have been some effects on aquaculture with changes in parasites and water temperatures increasing costs or stimulating movement of production facilities. I think you could add some of that (Bruce McCarl, Texas A&M University)	Has been referred to with reference to Da Silva and Soto.
288	50435	7	18	8	18	8	"High confidence," as calibrated uncertainty language, should be italicized. (Katharine Mach, IPCC WGII TSU)	Language has been changed.
289	50436	7	18	9	18	11	The author team should additionally consider cross-referencing the findings of chapter 30. (Katharine Mach, IPCC WGII TSU)	Cross references included where appropriate.
290	36504	7	18	14	18	19	The quality of such projections is discussed (rather inconsistently) in chapter 6 and several of the comments I have written there are relevant here. The general point is that this is an important conclusion and it needs to be dealt with consistently across all the chapters where it appears. (Keith Brander, DTU)	Agreed. Common sources are being used and there should be consistency.
291	50437	7	18	18	18	18	"likely" -- If this term is being used per the uncertainties guidance for authors (reflecting a probabilistic basis for its assignment), it should be italicized. Casual usage of this reserved likelihood term should be avoided. (Katharine Mach, IPCC WGII TSU)	Deleted
292	52500	7	18	21	18	25	The destruction of the traditional food chain (plankton) may create enormous effects on wild marine species. (Ursula Oswald-Spring, Centro Regional de Investigaciones Multidisciplinarias (CRIM) UNAM)	A very general statement that would need to be substantiated by references
293	35458	7	18	34	18	34	To add after of the word impacts the following comment: A study on populations in the Portuguese coast, under A2 and b2 scenarios, concluded that a commercial opportunity for fisheries may arise due to new tropical species emerge in the two scenarios (Vinagre et al., 2011). (M. Dolores Garza-Gil, University of Vigo)	Included.
294	45221	7	18	45	19	14	Early sowing implies the adaptation of a whole agricultural system. This may be much more complicated than can be modelled by a model with only one crop. Temperature change has also impact on winter cereals, for which the sowing data will be postponed, as will be the maturity, which can cause problems due to water stress. (Eline Vanuytrecht, KU Leuven)	This is not relevant to the text in the FOD. There must be a problem with page and line references.
295	50438	7	18	47	18	47	The author team might also consider explicit reference to chapter 6 and 30 here. (Katharine Mach, IPCC WGII TSU)	Section now based on cross-reference to cross-chapter box
296	41326	7	19	0	20	0	There has rightly been a focus on the feedbase in understanding impacts of climate change on livestock. However, there is a gap in our knowledge of the impacts on the animals themselves and this research need could be addressed in 7.3.2.6. Some studies have examined intensive production systems e.g. housed cattle, large-scale piggeries and caged poultry production, particularly in terms of susceptibility to disease and pathogens, heat stress and water resource limitations. More complex and difficult to quantify are the impacts on animal behaviour, including interactions within groups or herds and reproductive behaviour and efficiency, especially in extensive grazing systems. One reference that touches on this issue in the Australian context is: Henry B., Charmley E., Eckard R., Gaughan J. and Hegarty R. (2011), Livestock production in a changing climate. Crop and Pasture Science 63: 191-202. (Beverley Henry, Queensland University of Technology)	Papers reviewed and included as necessary
297	50439	7	19	3	19	7	The author team should consider providing citations for the statements, cross-references to other chapters, and potentially calibrated uncertainty language for indicating the author team's degree of certainty in the statements. (Katharine Mach, IPCC WGII TSU)	Agreed. Needs tightening up and will be addressed.
298	40622	7	19	15	19	16	These "four dimensions" appear in Figure 7.1, but the language used in the Figure is somewhat different. The authors should try to harmonize the two. (Andrew Moore, CSIRO)	This will be addressed.
299	41096	7	19	20	19	20	the first 2 paragraphs here are somewhat contradictory and it would be desirable to reconcile them (Bruce McCarl, Texas A&M University)	Text revised

#	ID	Ch	From Page	From Line	To Page	To Line	Comment	Response
300	36416	7	19	21	19	27	1. The matter of global change and forage quality is extremely complex. The fairly recent paper of Craine et al. 2010 is fascinating, but there is other information that is somewhat contradictory. For instance, warmer temperature often speeds up the N cycling, making N more available for plants (Rustad et al. 2001. A meta-analysis of the response of soil respiration, net nitrogen mineralization, and aboveground plant growth to experimental ecosystem warming. <i>Oecologia</i> 126:543-562; Dijkstra et al. 2010. <i>New Phytologist</i> 187:426-437). I'm not sure what to make of this apparent contradiction. Craine et al. 2010, which uses actual field data from across the USA is compelling, but it mixes different ecosystems and management. The two papers I cite above on warming and N cycling seem solid, but they are based on manipulative, mostly short-term experiments. Bottom line for me is, I don't think we know yet exactly how these effects of temperature and precipitation will affect forage quality. And they are likely to be further confounded by species changes which are sure to happen (e.g. Polley, H.W., P.A. Fay, V.L. Jin, and G.F. Combs, Jr. 2011. CO2 enrichment increases element concentrations in grass mixtures by changing species abundances. <i>Plant Ecology</i> 212:945-957; Morgan et al. 2007. <i>PNAS</i> 104:14724-14729). (Jack Morgan, USDA Agricultural Research Service)	Text revised.
301	50440	7	19	25	19	42	"likely" on lines 25, 26, 42 -- If this term is being used per the uncertainties guidance for authors (reflecting a probabilistic basis for its assignment), it should be italicized. Casual usage of this reserved likelihood term should be avoided. (Katharine Mach, IPCC WGII TSU)	Text amended, 'likely' not used
302	40623	7	19	29	19	48	Much of this material is duplicated in section 7.2.3.1. (Andrew Moore, CSIRO)	Duplication found with section 7.3.2.1.1. Text amended, pastures now dealt with in 73211 and referenced in the livestock section. Section numbers and titles revised in FD.
303	40624	7	19	30	19	30	All else being equal, "advanced development" should act to shorten the growing season, not lengthen it. Earlier commencement of the phenological cycle and/or a later end to growth by frosts are not quite the same thing. (Andrew Moore, CSIRO)	Text amended to clarify
304	50441	7	19	39	19	39	For the described projected changes, it would be helpful to indicate if this result is relevant over all time frames and scenarios of climate change. (Katharine Mach, IPCC WGII TSU)	Text amended
305	36417	7	20	4	20	11	1. Yep. Again, see citations made in previous comments (above) that cover these very interactions of CO2, warming, water, and nutrient cycling. For interactions of management with CO2, see Paul Newton and his groups who have, I think, the only FACE experiment with livestock (e.g. Tobias Rütting, Tim J. Clough, Christoph Müller, Mark Lieffering and Paul C. D. Newton (2010). Ten years of elevated atmospheric CO2 alters soil N transformations in a sheep-grazed pasture. <i>Global Change Biology</i> 16, 2530-2542. This work by Newton's group is especially good at examining livestock involvement in CO2 effects on N cycling. (Jack Morgan, USDA Agricultural Research Service)	Text and citation added as needed.
306	37101	7	20	5	0	0	The data from Stokes et al refers particularly to savannah grasslands and should not - I believe - be extended to all grassland and so the qualification of Soussana is important. The work of Hovenden et al (<i>Aust. J. Botany</i> 55, 780-794,) indicates changes in C4 grasses more a response to elevated temperature than elevated carbon dioxide. Also there should really be a reference to the temperate pastures systems studied by Newton in New Zealand at the Pasture FACE (Newton, PCD, V Allard, RA Carran, M Lieffering (2006) in <i>Managed Ecosystems and CO2: Case Studies, Processes and Perspectives</i> , Ed. Nösberger J. et al. (Springer Verlag, Germany)) showing changes in forage quality that can significantly impact on grazing animal performance. (Robert Norton, International Plant Nutrition Institute)	References included as appropriate.
307	40625	7	20	8	20	10	The text currently does not address the important question of how changes to supply of forage under climate change will affect the production of food and fibre from pasture & rangeland ecosystems. I read these lines as suggesting that the literature is not available. Recently-completed work (Moore & Ghahramani in prep.) for sheep & cattle production across southern Australia has addressed the pasture-> livestock production nexus, changes to the water cycle and the mediating effects of management. Key outcomes include: (a) livestock production is more sensitive to changing climate than pasture NPP. Since some NPP must be left unconsumed in order to preserve the soil, a proportional reduction in forage growth translates into a larger proportional reduction in safely-consumable NPP (b) livestock production systems in lower-rainfall environments are more vulnerable to climate change in the absence of adaptation, because of a combination of differing precipitation trends & because they are starting from a more-vulnerable state (c) combinations of existing technologies (changes to the feedbase, livestock genetics & changes to stocking rates & supplementary feeding) should, if adopted, be sufficient to maintain economic viability to 2030; in drier environments in particular, vulnerability increases over time (Andrew Moore, CSIRO)	Cannot include this work until it is available
308	40626	7	20	14	20	15	Selection for fleece weight in sheep is a likely exception, as it will tend to insulate the animals... (Andrew Moore, CSIRO)	Text amended as needed
309	41097	7	20	15	20	15	why is the following true "Over the long term, single-trait selection for productivity will therefore result in animals with lower heat tolerance" one could select for other traits (Bruce McCarl, Texas A&M University)	See #308
310	50442	7	20	19	20	21	If appropriate, the author team might consider indicating the magnitude of this effect for time frames and climate/socio-economic scenarios considered. (Katharine Mach, IPCC WGII TSU)	Text amended
311	40627	7	20	21	20	22	I am out of my expertise here, but does the existence of a GxE interaction automatically enforce a link between genetic improvement for productivity & reduced heat tolerance? I would have thought that some kind of genetic correlation would be required to assert this. (Andrew Moore, CSIRO)	Unclear comment. What is the point being made?
312	40628	7	20	29	20	29	"Species diversity" is unclear here. Species diversity of pathogens? Hosts? (Andrew Moore, CSIRO)	OK - good point.
313	50444	7	20	29	20	42	As appropriate, the author team should increase specificity for these statements, indicating where possible relevant time frames, geographic areas, climate/socio-economic stereotypes, etc. Additionally, it would be preferable on line 38 to indicate more specifically which "extreme weather events" are most relevant. (Katharine Mach, IPCC WGII TSU)	Text amended

#	ID	Ch	From Page	From Line	To Page	To Line	Comment	Response
314	50443	7	20	29	20	52	"likely" on lines 29, 34, 37, 38, 50, 52 -- If this term is being used per the uncertainties guidance for authors (reflecting a probabilistic basis for its assignment), it should be italicized. Casual usage of this reserved likelihood term should be avoided. (Katharine Mach, IPCC WGII TSU)	Instances of 'likely' removed
315	49070	7	20	48	20	48	Check language: delete "and keeping" (Oyvind Christophersen, Climate and Pollution Agency)	Text amended
316	50445	7	20	48	20	50	For this statement, it would be preferable to indicate the relevant climate/socio-economic scenario for the projection. (Katharine Mach, IPCC WGII TSU)	Amended
317	41098	7	21	3	21	3	Livestock water requirements are generally pretty small. Larger requirements are to grow feeds that require irrigation . Livestock waste disposal issues are also influenced by water mainly precipitation (Bruce McCarl, Texas A&M University)	Unclear implication for food security.
318	52501	7	21	6	21	52	In this part a gender perspective is crucial. (Ursula Oswald-Spring, Centro Regional de Investigaciones Multidisciplinarias (CRIM) UNAM)	We are trying to find relevant literature for the SOD.
319	42424	7	21	10	21	18	See comments on page 0. (Indur Goklany, Independent)	Unclear.
320	42425	7	21	21	21	48	Please note that by far the largest category of people that desire food security, particularly in the future, is likely to be households that produce little or no food and are net consumers. For this, as well as other categories, economic development is a critical factor affecting food security, since it allows people to purchase food (e.g., Goklany 1995, 2007c, and references therein.) (Indur Goklany, Independent)	The comment is relevant with the following response/action: we have included a summary of papers that make this point in section 7.3.3.1 citing Goklany and Parry et. al. 2009
321	49071	7	21	31	21	33	"This to is a relatively small group" is used "23 % of all households". The expression doesn't seem to be consistent with the figure 23 % (Oyvind Christophersen, Climate and Pollution Agency)	The comment is relevant with the following response/action: we have revised this section and made a correction about relative size of the group
322	41099	7	21	40	21	40	the rural landless and urban poor also often depend on the marketable surplus in the region and if that is greatly reduced by an adverse event then issues arise (Bruce McCarl, Texas A&M University)	The comment is relevant with the following response/action: we added material on this in relevant categories in table
323	50446	7	22	1	22	1	The author team must further qualify the statement here, as not all climate extremes will become more frequent. Please carefully consider and cross-reference the findings of chapter 3 of the special report on extremes, as well as of the working group 1 contribution to the 5th assessment report. (Katharine Mach, IPCC WGII TSU)	The comment is relevant with the following response/action:Thanks to the reviewer for pointing it out -we have revised the text to note that SREX found only some types of extremes will increase.
324	49072	7	22	2	22	2	The meaning of "In terms of availability" in the sentence seems unclear. (Oyvind Christophersen, Climate and Pollution Agency)	Good point - we edited to text to reflect it.
325	49073	7	22	9	22	9	The sentence states "All of these responses generally lead to both lower current and future farm profits". I assume that not only the farm profits will be lower, but also the food production, which is important in the context of food security. Suggest to add "and food production" after the sentence. (Oyvind Christophersen, Climate and Pollution Agency)	We added text as suggested.
326	50447	7	22	12	22	12	"likely" -- If this term is being used per the uncertainties guidance for authors (reflecting a probabilistic basis for its assignment), it should be italicized. Casual usage of this reserved likelihood term should be avoided. (Katharine Mach, IPCC WGII TSU)	We changed to say "can be expected" since we have no estimate of probability.
327	45240	7	22	27	22	28	I don't see why households currently vulnerable to climate shocks have limited opportunities to smooth these shocks through informal networks; please explain (Marcus Kaplan, German Development Institute)	We added text responding to this comment - essentially informal networks are not capable of providing the level of insurance needed, given the highly co-variate nature of impacts from climate shock.
328	40629	7	22	41	22	44	This material should be placed with the (few) seful pieces of information in section 7.2.3.4. (Andrew Moore, CSIRO)	The comment is not relevant - no section 7.2.3.4
329	35669	7	23	1	23	17	yes,there have been quite a number of studeis showing that increases of freuency of climate extremes may lower crop yield beyond mean changes....(lines 1-3), e.g. Porter, JR, Semenov, MA (2005) Crop responses to climatic variation. Philos. T. Roy. Soc. B 360, 2021-2035. Rötter, RP, Palosuo, T, Pirttioja, NK et al (2011b) What would happen to barley production in Finland if global warming exceeded 4oC? A model-based assessment. European Journal of Agronomy 35, 205-214. doi: 0.1016/j.eja.2011.06.003. Semenov, MA, Shewry, PR, (2011) Modelling predicts that heat stress, not drought, will increase vulnerability of wheat in Europe. Scientific Reports, 1, 66; DOI:10.1038/srep00066. and on the issue that quantification of uncertainty results in more robust statements (see, extra references given above --- and forthcoming papers from AgMIP wheat pilot (Reimund Rötter, MTT Agrifood Research Finland)	Some refs pre-AR4 but useful point.
330	45485	7	23	5	23	17	We suggest including a reference to increasing knowledge on climate impacts on food security beyond changes in production. (Carlo Scaramella, World Food Programme)	Which reference?
331	42426	7	23	18	0	0	Add a new bullet: "Impact asesments have a tendency to overestimate negative impacts while underestimating positive impacts of climate change (Goklany 2012a)" See also comments on Chapter 0. (Indur Goklany, Independent)	Is this a reviewed paper?
332	42427	7	23	19	0	0	Add a new bullet: "Mitigation measures that would advertently or inadvertently increase the cost of energy or divert crop produce, food, feed, land or water away from food production could add to poverty, hunger and associated consequences to health (Erisman et al. 2008; Pelletier et al.2008; De Hoyos and Medvedev 2009; Arnell 2004; Alcamo et al. 2007; Oki and Kanae 2006; van Vuuren et al. 2011; Arnell et al. 2011; Goklany 2009a, 2009b, 2012a, 2011)." (Indur Goklany, Independent)	Not relevant to chapter. WG3.
333	45658	7	23	20	0	0	Section 7.4 is not well balanced. A sub-section is devoted to fisheries but there are no subsections for cropping nor livestock. (Hideki Kanamaru, FAO)	Revised.
334	50448	7	23	47	23	47	The author team should further clarify which autonomous adaptations are meant here by the word "these." (Katharine Mach, IPCC WGII TSU)	See earlier responses.

#	ID	Ch	From Page	From Line	To Page	To Line	Comment	Response
335	50449	7	24	5	24	10	For the 1st statement in this paragraph, the author team should clarify the relevant climate/ socio-economic scenarios (or perhaps simply that this is a result across all scenarios considered, if that is the case). Also, if "likely" is being used on line 8 per the uncertainties guidance for authors (reflecting a probabilistic basis for its assignment), it should be italicized; casual usage of this reserved likelihood term should be avoided. (Katharine Mach, IPCC WGII TSU)	Possible to include but extra complexity and little extra value. Change 'likely'
336	52502	7	24	13	24	49	several repetitions (Ursula Oswald-Spring, Centro Regional de Investigaciones Multidisciplinarias (CRIM) UNAM)	Has been rationalised as far as possible.
337	50450	7	24	15	0	0	Section 7.4.2.1. For this section, the author team should consider and coordinate assessment with chapter 6 and 30, reducing redundancy and increasing cross-referencing of findings. (Katharine Mach, IPCC WGII TSU)	Cross-references inserted where appropriate/
338	50451	7	24	23	24	24	It would be helpful to specify what is meant here by "their outcomes." Additionally, the summary terms for evidence and agreement used on line 24 should be italicized. (Katharine Mach, IPCC WGII TSU)	This sentence was unnecessary and has been deleted
339	50452	7	24	30	24	31	It would be beneficial to clarify what is meant here by "lower confidence in these results than for other scenarios"--which other scenarios, how do confidence levels compare? (Katharine Mach, IPCC WGII TSU)	Additional information has been added from the paper to clarify the differences in confidence.
340	50453	7	24	36	24	39	The author team should clarify the citations supporting these statements. (Katharine Mach, IPCC WGII TSU)	Reference inserted. Is Bell et al 2011.
341	50454	7	24	43	24	44	Is it possible to indicate more specifically how "low" and "moderate" were defined, quantified, or determined? (Katharine Mach, IPCC WGII TSU)	Vulnerabilities are estimated through a complex and, to some extent, subjective framework. The reference to the framework has been provided.
342	50455	7	24	47	24	53	As possible, the author team should consider specifying relevant time frame and climate/socio-economic scenarios here. (Katharine Mach, IPCC WGII TSU)	The necessary information is already provided for lines 47-49. Missing information included for the Australian example
343	50456	7	25	2	25	2	"likely" -- If this term is being used per the uncertainties guidance for authors (reflecting a probabilistic basis for its assignment), it should be italicized. Casual usage of this reserved likelihood term should be avoided. (Katharine Mach, IPCC WGII TSU)	Amended
344	50457	7	25	22	25	25	The author team might consider specifying the relevant time frame for this analysis. (Katharine Mach, IPCC WGII TSU)	Information added
345	36505	7	25	29	25	38	Also presented at length in ch6.4.1.1.2 and briefly in AR4 WG2 ch5.4.6.2 (Keith Brander, DTU)	Noted but the work by Allison et al. is directly relevant to Ch. 7 and should be reported here.
346	50458	7	25	41	0	0	Section 7.4.3. By the 2nd-order draft, the author team should ensure full development of this section, supported by a comprehensive consideration of relevant literature, with citations provided accordingly. (Katharine Mach, IPCC WGII TSU)	Revise and provide citations.
347	41100	7	25	43	25	43	I think this section on reduced food production option should be discussed in terms of regional changes as the implication of it as now written is a global one. This will happen in regions but other regions may have expanded options (Bruce McCarl, Texas A&M University)	Suggestion to regionalise - but this will potentially duplicate regional chapter material. Perhaps synthesise regional chapter material and cross-refer.
348	41101	7	25	43	25	43	Food price spikes in the 21st century are not so related to climate change. They are more related to bioenergy, trade policy, exchange rates, extreme events see abbot tyner and hurt or a review (Bruce McCarl, Texas A&M University)	Actually line 49. Revise text. Include recent OXFAM report ? Now a figure in the FD.
349	41102	7	25	43	25	43	I really have some reservations about what figure 7-7 purports to show and doubt the veracity of the underlying work. I am unfamiliar with such findings and think they should be written up much more carefully. We do not want to be unnecessarily negative ie "mean crop yields are [hopefully use calibrated language here] likely to fall by at least X% by the year 20XX" (Bruce McCarl, Texas A&M University)	Need to revise the language. See Figure 7-7 in the FD and in the SPM.
350	50459	7	25	43	25	43	The author team should consider the statement made on this line, enhancing its specificity and clarifying the intended meaning. (Katharine Mach, IPCC WGII TSU)	Revise text
351	37104	7	26	0	0	0	I would propose that another section under adaptation be added to address the implications of climate change on plant nutrition - especially N - It is surprising that there is no mention of studies of the effects of e[CO2] on soil N processes, which have indicated that the increased level of plant demand is not always able to be met by soil processes and as a result, over time N becomes more limiting, an effect termed progressive nitrogen limitation. Progressive N limitation (PNL) is closely linked to potential C sequestration under e[CO2] (Schlesinger WH, J Lichter (2001) Limited carbon storage in soil and litter of experimental forest plots under increased atmospheric CO2. Nature, 411, 466-469; Gill et al. 2002) and this occurs when the availability of mineral N declines over time at e[CO2] in comparison to ambient [CO2] (a[CO2]) and if there is no new N input or higher N losses. The result is a gradual decrease in the [CO2]-induced increment in ecosystem C storage Luo Y, B Su, WS Currie et al. (2004) Progressive nitrogen limitation of ecosystem responses to rising atmospheric carbon dioxide. Bioscience, 54, 731-739.) so that the actual response of these systems based on carbon dioxide response is significantly less than if N was not limiting. PNL has been observed in woodland Hungate BA, DW Johnson, P Dijkstra et al. (2006) Nitrogen cycling during seven years of atmospheric CO2 enrichment in a scrub oak woodland. Ecology, 87, 26-40.) and grassland ecosystems where the stimulation of biomass accumulation by e[CO2] was constrained by N limitation (Newton et al. 2006, Reich PB, SE Hobbie, TLee et al. (2006) Nitrogen limitation constrains sustainability of ecosystem response to CO2. Nature, 440, 922-925., Hovenden et al. 2008), but there are few studies reported for cropping systems despite the implications for rates of N fertilizer application as well as the incorporation of legumes into crop rotations. A paper that is in print on the effects of N dynamics is Lam, S.K., Chen, D., Norton, R., Armstrong, R. and Mosier, A.R. Nitrogen dynamics in grain crop and legume pasture systems under elevated CO2: A meta-analysis. Global Change Biology (2012), doi: 10.1111/j.1365-2486.2012.02758.x which indicates that there will be a need to adapt N management for cropping systems in response to elevated carbon dioxide as the increased N demand will not be met by increased N fixation. (Robert Norton, International Plant Nutrition Institute)	This is largely an impact not an adaptation issue. Perhaps needs a couple of lines on this, perhaps cross-referring to another chapter that might cover this.

#	ID	Ch	From Page	From Line	To Page	To Line	Comment	Response
352	50460	7	26	1	26	29	"likely" on lines 1, 9, 10, 13, 23, 29 -- If this term is being used per the uncertainties guidance for authors (reflecting a probabilistic basis for its assignment), it should be italicized. Casual usage of this reserved likelihood term should be avoided. (Katharine Mach, IPCC WGII TSU)	Fix.
353	37102	7	26	9	0	0	without access to the figure or the paper referred to, is this figure of potential decline conditional on adaptation and relocation - or is it just with the current main crops remaining in the current agroecological zones. It is important to remember the work of Howden et al (cited in main text) that indicates that adaptation will help but ultimately some industries will restructure. This may be movement of current low-moderate rainfed cropping systems moving to more favourable places as environments dry. This will be largely economically driven for more developed countries - as yields decline growers will move to other industries or other places. It would seem unlikely they would stay in the same place doing the same thing - but this may be the fate of the less developed countries that are not able to shift or change. (Robert Norton, International Plant Nutrition Institute)	Need more clarity on the Figure
354	50461	7	26	23	26	29	The author team should coordinate this paragraph with 7.3.2.2. Additionally, on line 29, it would be helpful to clarify the mechanism through which adverse effects would occur--why would chemical control be decreased in efficacy or other attributes? (Katharine Mach, IPCC WGII TSU)	OK.
355	37103	7	26	26	0	0	The studies referred to here seem to focus on glyphosate, but this is only one herbicide (albiet the largest selling one globally), and the extension of these data to other herbicides with different modes of action seems an oversimplification. Other herbicides (eg auxin types) may be expected to have a more significant effect as they moderate growth hormonally - no data on this but my point is that I think the extension of data on one mode of action to all herbicides is simplistic. (Robert Norton, International Plant Nutrition Institute)	insert 'by glyphosate'
356	50462	7	26	31	26	33	For these projections, the author team should indicate the relevant climate/socio-economic scenarios for the analysis. Additionally, it would be helpful to clarify the described stunting--of crops? (Katharine Mach, IPCC WGII TSU)	Clarify??
357	41558	7	26	35	0	0	The implications for global and large-region food security. This section is too brief and it is not clear what the overall message is for the reader or how it differs (if it does differ) from the messages in AR4 2007. It is recommended that authors summarise for the reader the key conclusions of AR4 (see ch 5 p 298), and then update these. They were: 1) CC is likely to increase the number of people at risk of hunger by 5-15%; but 2) the CC effect is smaller than the effects of differing development; and c) the main negative effects of CC are projected to be in Africa; while 4) much uncertainty remained due to unclear effects of CO2, and 5) the effects of CC mitigations may have a delayed alleviating effect, putting a burden on adaptation in the intervening period. On 1) the magnitude of effect on global or large-region figures for risk of hunger: The AR4 assessment is based on work using DSSAT/BLS by Rosenzweig and Parry and using AEZ/BLS by Fischer. The more recent work is by Rosegrant and Nelson, and is reported as changes in child malnutrition rather than risk of hunger to all ages, but the measures (child malnutrition vs all ages risk of hunger) can be compared. Mark Rosegrant and I compared the two sets and concluded that the recent research broadly confirms the previous conclusions concerning magnitude and distribution. The comparisons are made in 'Climate change and hunger: Responding to the Challenge' by Parry, Evans, Rosegrant and Wheeler, World food Programme 2009. see http://www.wfp.org/content/climate-change-and-hunger-responding-challenge . AR5 authors could make their own comparisons :On 2) socio-economic trends are more powerful than climate: The IFPRI studies confirm this; ie ' smart development' can be an effective adaptation. On 3): the main potential increase in malnutrition/hunger is in sub-saharan Africa: the post AR4 studies confirm this but add more regional detail On 4): the uncertainty due to CO2 effects: the more recent work has helped to clarify this, the overall magnitudes of projected effects being broadly confirmed. On 5) that mitigation may not avoid the mid-term stress. This is a general point that still holds, I believe...but see the nelson work on effects under differing forcing. (Martin Parry, Imperial College)	Very useful comment. However much of the comments is focussed on the availability aspect of food security and authors working on those sections of the chapter should include material comparing to results from AR4. We will add material in our sections that compares our analysis/results with that of AR4 on CC impacts on non-availability dimensions of food security. However there is relatively little material on these aspects in AR4 so one of the main differences is just that these non-availability dimensions are given more importance in the AR5 analysis. We have now included more discussion of points 2 and 3 which are relevant to this sub-section on non-availability dimensions of food security and included relevant cites. See regional box in FD.
358	50463	7	27	11	27	13	For this statement, it would be helpful to indicate the relevant timeframe and climate/socioeconomic scenario. (Katharine Mach, IPCC WGII TSU)	We added the relevant time frame (by 2100 end of 21st century).
359	50464	7	27	18	0	0	Section 7.4.5. The author team should ensure full development of this section by the 2nd-order draft. The author team, in further developing complex findings, should use calibrated uncertainty language to characterize its degree of certainty in the conclusions. References to supporting subsections of the chapter should also be provided. (Katharine Mach, IPCC WGII TSU)	See the FD.
360	50465	7	27	25	27	25	"Medium evidence," as calibrated uncertainty language, should be italicized. (Katharine Mach, IPCC WGII TSU)	Change.
361	54261	7	28	1	0	0	Section 7.5: As noted in my comment on the Executive Summary, some statements in this section are assigned a level of confidence (with agreement/evidence terms also provided as the basis for the confidence assignment), while some are only assigned agreement/evidence terms. The distinction between these cases is not clear, and in general, I suggest using the agreement/evidence assignments as a basis for confidence wherever possible (e.g., unless limited evidence and/or low agreement prevent an assignment of confidence, which could then be explained). (Michael Mastrandrea, IPCC WGII TSU)	Systematically addressed throughout the section.
362	43224	7	28	1	35	52	This section on adaptation is much easier to read than section 7.3 and there is much good information/evidence in it. One issue that is not dealt with is the time required to develop new genotypes adapted to different environments. The text gives the impression that this is a time-free option and does not give any idea of the time required to move from a trial result to widespread adoption. (Peter Gregory, University of Reading)	Good point. Insert.

#	ID	Ch	From Page	From Line	To Page	To Line	Comment	Response
363	35670	7	28	1	36	11	The examples presented on adaptation and managing risks in agriculture are still fairly selective /not exhaustive at all; requires substantial additions in the next draft (Reimund Rötter, MTT Agrifood Research Finland)	Can try, but the literature is huge. This type of comment would be more useful if they provided guidance. Done as much as seems reasonable but the literature is huge. This type of comment would be more useful if they provided guidance
364	41103	7	28	7	28	7	I think the adaptation section should be cross referenced and maybe shortened as the other chapters handle this better and have more space devoted to the topic (Bruce McCarl, Texas A&M University)	Conflicting demands. Need to check. Will require exploration of cross-linkages post SOD
365	41104	7	28	7	28	7	as said above there is US evidence on crop mix and crop/livestock adaptaion plus seo in africa and south america (Bruce McCarl, Texas A&M University)	Search for his examples above.Seo (2011) already in section.
366	52134	7	28	10	28	25	In introducing the terms "adaptation," "autonomous adaptation," and "planned adaptation" here, the chapter team could also consider cross-referencing the entry for "adaptation" in the report glossary, which contains sub entries for "autonomous" and "planned" adaptation. (Katharine Mach, IPCC WGII TSU)	Good point.
367	37092	7	28	21	0	22	The daylength adaption of plants can make them unsuitable to poleareas although growing conditions would otherwise become favourable (Antti Hannukkala, Agrifood Research Finland)	Need to insert this caveat.
368	36426	7	28	43	28	43	Add a sentence emphasizing the need to take a systemic view: e.g. "Given the importance of food security and livelihood aspects, adaptation strategies should not only focus on single practices or combinations thereof, but also account for the potential of systemic approaches where such practices are embedded in a wider context, such as in agroecology or organic agriculture (e.g. Muller, A., Osman-Elasha, B. and Andreassen, L., 2012, The potential of organic agriculture for contributing to climate change adaptation, in: Halberg, N. and Muller (Eds), Organic Agriculture for Sustainable Livelihoods, Earthscan Publishers; (El-Hage Scialabba, N., Müller-Lindenlauf, M., 2010. Organic agriculture and climate change. Renewable Agriculture and Food Systems 25, 11.) (Adrian Muller, Research Institute of Organic Agriculture FiBL)	Need to discuss this with the Chapter writing team. The general idea is OK but the specifics need to be agreed on as to importance. Not all reviewed papers.
369	50466	7	29	8	29	8	Calibrated uncertainty language used on this line (medium confidence, high agreement, medium evidence) should be italicized. (Katharine Mach, IPCC WGII TSU)	Fixed systematically throughout the section
370	35671	7	29	36	29	36	the reference IAASTD 2010 does not exist to my knowledge (Reimund Rötter, MTT Agrifood Research Finland)	The reference is: IAASTD (2009) Agriculture at a Crossroads: Global Report. International Assessment of Agricultural Knowledge, Science and Technology for Development. Island Press, Washington D.C., U.S.A.
371	36423	7	29	44	29	44	Increasing soil carbon levels should be mentioned as a key aspect of improved water management (absorption and retention capacity) in soils. This can be brought about by using crop rotations with deep rooting legume leys or organic fertilizers such as compost, for example. Suggestion: insert the following sentence after "...Piao et al. 2010." and before "There is medium confidence...": "Increasing soil organic carbon levels plays an important role for improved water retention and absorption capacity of soils (El-Hage Scialabba, N., Müller-Lindenlauf, M., 2010. Organic agriculture and climate change. Renewable Agriculture and Food Systems 25, 11., Mäder, P., Fließbach, A., D, D., L. G., Jossi, W., Widmer, F., Oberson, A., Frossard, E., Oehl, F., Wiemken, A., Gattinger, A., Niggli, U., 2006. The DOK experiment (Switzerland). In: Raupp, J., Pekrun, C., Oltmanns, M., Köpke, U. (Eds.), ISOFAR Scientific Series. University of Bonn, Germany. Smith, P. & Olesen, J.E. (2010). Synergies between mitigation of, and adaptation to, climate change in agriculture. Journal of Agricultural Science 148, 543-552.). Several agricultural practices support increased soil carbon levels, such as use of organic fertilizers (compost, farm yard manure), crop rotations with deep rooting forage legumes or mulching of crop residues (e.g. Freibauer A, Rounsevell MDA, Smith P, Verhagen J (2004) Carbon sequestration in the agricultural soils of Europe. Geoderma 122:1-23. 5. Diacono M, Montemurro F (2010): Long-term effects of organic amendments on soil fertility. A review. Agron Sustain Dev 30:401-422.Smith, P. & Olesen, J.E. (2010). Synergies between mitigation of, and adaptation to, climate change in agriculture. Journal of Agricultural Science 148, 543-552.). Increasing soil carbon levels also exhibits synergies to climate change mitigation, as it is the biggest mitigation potential in agriculture (REF to AR5 WG III, chapter XX agriculture, Smith, P. & Olesen, J.E. (2010). Synergies between mitigation of, and adaptation to, climate change in agriculture. Journal of Agricultural Science 148, 543-552.) (Adrian Muller, Research Institute of Organic Agriculture FiBL)	This has been addressed in the revised section and cross-referenced to other chapters in WG 2 and WG 3
372	50467	7	29	44	29	44	"Medium confidence," as calibrated uncertainty language, should be italicized. (Katharine Mach, IPCC WGII TSU)	See earlier responses.
373	41327	7	30	0	31	0	Many adaptation strategies also result in mitigation as noted in 7.5.1.2.2. However, this is not also the case and less attention has been given to the impacts of climate change on the capacity of food production systems (agriculture and natural production systems) to contribute to mitigation through either abatement or sequestration. In particular, adaptive options in extensive livestock production in poorer communities are more limited and it is likely that reduced feed quality resulting from increased heat and water stress will result in lower productivity (measured as daily weight gain or milk production) in ruminants. This will result in higher emissions in absolute (kg CH4 per animal at slaughter or at end of productive life) and efficiency (kg CH4 per kg milk or meat) terms. In addition for pastures or crops the benefits of elevated atmospheric CO2 concentrations on growth may only be realised through higher nutrient inputs, particularly nitrogen) with the risk of consequent higher N2O emissions. These challenges to meeting goals for increased productivity for food security while reducing emissions could be expanded in Chapter 7. (Beverly Henry, Queensland University of Technology)	Good point but does it need to be dealt with here or elsewhere or cross-referenced ? Requires discussion as to whether this belongs in the adaptation section or in the Impacts section.

#	ID	Ch	From Page	From Line	To Page	To Line	Comment	Response
374	52503	7	30	11	30	15	crop system is not a food system (Ursula Oswald-Spring, Centro Regional de Investigaciones Multidisciplinarias (CRIM) UNAM)	There is no mention of food systems here. The figure is explicitly a meta-analysis of the literature which in this case looks at crop systems. The distinction between farm systems (where there tends to be lots of literature) and food systems (where there is little) is explicitly addressed elsewhere in the Chapter. Crop production is absolutely a crucial part of food systems - but is also absolutely only part of these.
375	50468	7	30	29	30	29	"High confidence," as calibrated uncertainty language, should be italicized. (Katharine Mach, IPCC WGII TSU)	Fixed systematically throughout the section
376	40630	7	31	1	31	4	There is potential for confusion here when comparing this text with that starting at page 29 line 51, in which a trend toward more mixed crop-livestock farms is projected. I can see that the two statements are not necessarily inconsistent but I think that care with wording is required to make things as easy as possible for the reader to understand (Andrew Moore, CSIRO)	Clarify - perhaps adding a few words about mixed farming here.
377	40631	7	31	16	31	17	This is either unclear or wrong. In climates that are warmer at the present day, there is already no need for winter housing or feed stocks for housed animals (and warmer conditions may tend to increase the requirement for feeding in summer). In cooler climates at the present day, the point may stand - surely someone has looked at this somewhere (Europe, Canada, China)? (Andrew Moore, CSIRO)	Good point. Change 'warmer' to 'cooler'. Seek out a reference. Text added to clarify. Done.
378	50469	7	31	19	0	0	Section 7.5.1.1.3. For this section, the author team should consider and cross-reference chapter 6 and 30, also reducing overlap. Additionally, assessment should be coordinated further with section 7.3.2.5. (Katharine Mach, IPCC WGII TSU)	Agreed, see earlier comments on coordination with these chapters. Chapters 6 and 30 checked and cross-referenced. There was very limited overlap with those chapters having very little on adaptation in them.
379	48279	7	32	0	0	0	Indigenous Knowledge - Housing in Stilts to cope with increased flooding in North-East India, Mukhopadhyay 2009 IOP conference Series Earth and Environmental Sciences 6 (2009) (Malini Nair, Indian Institute of Science)	Not sure that this quite fits here. We have an adaptation section and are limited for space. This specific example may be better placed in a regional chapter.
380	48280	7	32	0	0	0	Another reference: Pareekh and Trivedi PC " Cultural Values and indigenous knowledge of climate change and disaster prediction in Rajasthan India" Indian Journal of Traditional Knowledge Vol 10 (1): pp 183-189 (Malini Nair, Indian Institute of Science)	Not sure that this quite fits here. We have an adaptation section and are limited for space. This may be better placed in the relevant regional chapter.
381	35280	7	32	26	32	28	I think that the paper "Weatherhead, E., S. Gearheard, and R.G. Barry, 2010: Changes in weather persistence: Insight from Inuit knowledge. Global Environmental Change, 20(3), 523-528." should be added in this Inuit's part. (Hiromitsu Kanno, NARO Tohoku Agricultural Research Center)	Several papers relating to indigenous knowledge have been included.
382	47212	7	32	39	32	39	see also the following excerpt from Weathering Uncertainty (Nakashima et al., 2012), in particular the reference to the case study in British Columbia. Rocheleau (1991) comments that 'half or more of indigenous ecological science has been obscured by the prevailing 'invisibility' of women, their work, their interests and especially their knowledge.' In her documentation of knowledge of indigenous men and women, Helen Clifton, an Elder of the Gitgathen Nation, British Columbia, Canada, notes that women's tasks may be weather-dependent including the cutting and drying of halibut and the processing of edible seaweed (Turner and Clifton, 2009). Turner, N.J. and Clifton, H. 2009. "It's so different today": climate change and indigenous lifeways in British Columbia, Canada. Global Environmental Change, 19: 180-90. (Jennifer Rubis, United Nations Educational, Scientific and Cultural Organization (UNESCO))	Check these papers and potentially add a reference.
383	47198	7	32	48	0	0	Now peer-reviewed and published as (Nakashima et al 2012): Nakashima, D.J., Galloway McLean, K., Thulstrup, H.D., Ramos Castillo, A. and Rubis, J.T. 2012. Weathering Uncertainty: Traditional Knowledge for Climate Change Assessment and Adaptation. Paris, UNESCO, and Darwin, UNU, 120 pp. (Douglas Nakashima, UNESCO)	Indigenous knowledge in 7.5 now.
384	47935	7	32	48	0	0	Nakashima et al. 2011 incorrectly referenced. Reference should be: Nakashima, D et al. (2012) "Weathering Uncertainty: Traditional Knowledge for Climate Change Assessment and Adaptation" Paris, UNESCO and Darwin, UNU, 120p. (Ameyali Ramos Castillo, United Nations University - Institute of Advanced Studies)	Indigenous knowledge in 7.5 now.
385	35336	7	32	51	32	51	Related to practical adaptation measures that is already performed in apple farming in Japan, Fujisawa and Kobayashi (2011) reports a good ground truth. I Fujisawa, M. and K. Kobayashi, 2011. Climate change adaptation practices of apple growers in Nagano, Japan. Mitigation and Adaptation Strategies for Global Change, 16, 865-877. (Toshichika Iizumi, National Institute for Agro-Environmental Sciences)	See 7.5 now.
386	52504	7	33	6	33	7	There exists a complexity of adaptation activities beside farming or fishing in the rural and coastal areas. (Ursula Oswald-Spring, Centro Regional de Investigaciones Multidisciplinarias (CRIM) UNAM)	Not sure of the relevance of this comment to this text. This point has now been made elsewhere in the section.
387	41105	7	33	10	33	10	a lot of this adaptation discussion is covered in other chapters (Bruce McCarl, Texas A&M University)	Check options to cross-reference. There is a tension here between being sufficiently stand-alone and reducing duplication. The text has now been cross-referenced and this will be re-visited post SOD.
388	45241	7	33	12	33	12	for the factors add political and cultural (Marcus Kaplan, German Development Institute)	Good point if possible to find refs. These and more are addressed in Chapter 16 which is cross-referenced here.
389	42428	7	33	12	33	29	There should be a discussion of the fact that, despite the potential of genetically modified crops, their lack of acceptance in many parts of the world, particularly, in Europe is a barrier not only for Europe but also for other countries (Goklany 2007b, Chapter 9; Paarlberg 2008). (Indur Goklany, Independent)	Addressed briefly. Too policy prescriptive.

#	ID	Ch	From Page	From Line	To Page	To Line	Comment	Response
390	50470	7	33	13	33	14	The summary terms for evidence and agreement on this line should be italicized (once fully assigned). (Katharine Mach, IPCC WGII TSU)	Fixed systematically throughout the section
391	36424	7	33	42	33	42	add the following between "...measures for" and "conserving soil moisture...": increasing soil carbon sequestration, " (Adrian Muller, Research Institute of Organic Agriculture FiBL)	Not included. The text relates to adaptations that may reduce net emissions - whereas the suggested insertion is one of the emission-reduction activities.
392	52505	7	33	48	33	49	Not only farmers and policymakers, but the whole society, linking up with health issues, changes in food intake, exercises and reduction e.g. from meat to vegetarian calories and proteins. (Ursula Oswald-Spring, Centro Regional de Investigaciones Multidisciplinarias (CRIM) UNAM)	Discuss how broad to make this and similar points. Too policy prescriptive for the chapter. Text included to broaden out the discussion slightly.
393	45486	7	34	16	0	0	We suggest including a reference to MERET, an example of a WFP-supported intervention in Ethiopia aimed at enhancing food security and building resilience. Suggested text includes: (Carlo Scaramella, World Food Programme)	Check this paper. The program looks like a worthwhile one - but not sure how to differentiate it from lots of others and why CCAFS did not select it. Perhaps needs broader discussion as to inclusion.
394	44889	7	34	18	35	29	Section 7.5.2. Food System Case Studies – Examples of Successful and Unsuccessful Adaptation Another Case: Spatial Resilience in the neighbourhoods of Mozambique Historically, the people of Mozambique have faced long periods of hardship and responded in a way that has reinforced rather than dismantled their traditional values. The population's strategy for escaping from environmental and foreign political disruption has been to reinvent tradition, based on the principles of resilience, resistance and self-reliance. The development of decentralised human settlements, involving the appropriation of land for domestic space and the self-organisation of neighbourhoods, were strategies to protect communities from adversity and secure collective self-reliance. The variable climate, involving periods of heavy rain followed by periods of drought, is a natural phenomenon in Mozambique. People have learned to cope with nature's lifecycles and the severity of extreme weather conditions by intercropping combined with flexible and diverse production modes – domestic farming combined with urban-based income strategies through a modified use of Outdoor Domestic Space. In Mozambique the important agricultural sector is affected by the climate, involving major economic impacts, whilst the dependence of the population on natural resources and agriculture, the general poverty, poor infrastructures, low capital, limited municipal resources and environmental degradation are also factors that increase the country's vulnerability to climate change. This is the reason why attention must be paid to emergent resilient sustainable practices, since they are better equipped to deal with severe and unexpected catastrophes. (Celine Verissimo, University College London)	The case studies were reduced in number and this one was not included.
395	46693	7	35	1	35	16	The Care experience came from their project titled "Reducing Vulnerability to Climate Change (RVCC)". However, the project has actually not just carried out gender analysis based assessments taking mens' and womens' needs seperately but also looking into a whole set of issues that are associated to their perceived climatic risks which may have a severe implications for their future adaptation and adaptive decisions at local and household food security level. (Atiq Kainan Ahmed, Asian Disaster Preparedness Center (ADPC))	May need to assess this item. MARK and MARIA
396	46962	7	35	1	35	16	I am not sure that the Case 3 should be worth to mention here as it is only shows a planning process of adaptation rather implementation of it. I dont have any clear idea about the out come of this donar founded project. Often, in Bangladesh, many organization funde by intenational donars, conducted study which actually not able to bring significant changes to the community (A K M Saiful Islam, Bangladesh University of Engineering and Technology)	May need to assess this item. The examples were selected by the CGIAR. This example raises a series of points about effective adaptation planning processes which are reasonable to report in this context.
397	37105	7	35	28	0	0	CSIRO is only one of many agencies working to transform agriculture - others are the state and federal government agricultural agencies, universities and grower funded research and development corporations. This statement was probably suggested by someone from CSIRO! But there are others! (Robert Norton, International Plant Nutrition Institute)	Change CSIRO to 'researchers'. Offending text deleted.
398	48281	7	35	32	0	0	The key findings section has to be rewritten (Malini Nair, Indian Institute of Science)	Sounds like a re-write of this section. Text modified.
399	50471	7	35	32	0	0	Section 7.5.3. In further revision of this chapter, the author team should aim to develop compelling, complex, and nuanced findings in this section, with cross-references to supporting subsections of the chapter. Additionally, the author team should use calibrated uncertainty language to indicate its degree of certainty in these findings. (Katharine Mach, IPCC WGII TSU)	Sounds like a re-write of this section. Text modified.
400	50472	7	35	36	35	43	"likely" on lines 36 and 43 -- If this term is being used per the uncertainties guidance for authors (reflecting a probabilistic basis for its assignment), it should be italicized. Casual usage of this reserved likelihood term should be avoided. (Katharine Mach, IPCC WGII TSU)	Fixed systematically throughout the section
401	47936	7	35	51	0	0	Reconsider use of 'past tense' in the first part of this sentence - given evidence in literature (and the large number of subsistence and local farmers that are still relying on IK for food security). (Ameyali Ramos Castillo, United Nations University - Institute of Advanced Studies)	Fixed systematically throughout the section
402	52506	7	35	51	35	52	Too simple; analyze the impact of indigenous knowledge for adaptation (Ursula Oswald-Spring, Centro Regional de Investigaciones Multidisciplinarias (CRIM) UNAM)	Address as part of re-write.

#	ID	Ch	From Page	From Line	To Page	To Line	Comment	Response
403	45488	7	36	0	0	0	Section on FAQs We suggest including a question on climate extremes and food security: "What type of climate extremes matter for food security and nutrition?" Suggested text for the answer: "Climate-related disasters are among the main drivers of food insecurity, both in the aftermath of a disaster and in the long run. For example, studies from Bangladesh show increased wasting and stunting rates among preschool children after floods, due to reduced access to food, increased difficulties in providing proper care and greater exposure to contaminants. "Drought is a major driver of food insecurity, and contributes to a negative impact on nutrition. In Ethiopia, for example, children born during a drought are 35.5% more likely to be malnourished and 41% more likely to be stunted. "Floods and tropical storms also affect food security by destroying livelihood assets: for example, after cyclone Nargis in Myanmar, communities and regions 40 kilometres inland were inundated; soil salinisation made 50,000 acres of rice cropland unfit for planting, and rice seeds, fertilisers, farm machinery and valuable land were lost, thereby affecting the food security of millions of people in the region." Suggested references: Del Ninno, C., Dorosh, P.A. and Smith, L.C. (2003) Public policy, markets and household coping strategies in Bangladesh: Avoiding a food security crisis following the 1008 floods. World Development. 31(7): 1221-1238. Fuentes, R. and Seck, P. (2007) The short-term and long-term human development effects of climate-related shocks. New York: UNDP. WFP and UK Met Office Hadley Centre (in press) Climate impacts on food security and nutrition. Rome: WFP. (Carlo Scaramella, World Food Programme)	Accept with many thanks.
404	45489	7	36	0	0	0	Section on FAQs We suggest including a question on adaptation actions to enhance food security: "How could adaptation actions enhance food security and nutrition?" Suggested text for the answer: "Over 70 per cent of agriculture is rain-fed. This suggests that agriculture, food security and nutrition are all highly sensitive to changes in rainfall associated with climate change. "All of the National Adaptation Programmes of Action submitted to the UNFCCC so far mention food security and/or agriculture as one of the most vulnerable sectors to climate change, and suggest that climate change adaptation outcomes focusing on ensuring food security under a changing climate could have the most direct benefits on livelihoods. "Climate change adaptation can have multiple benefits for food security, including: enhancing food production, access to markets and resources, and reduced disaster risk. "The MERET (Managing Environmental Resources to Enable Transitions) programme illustrates how climate change adaptation outcomes can also improve food security. A joint venture between the Ethiopian government and WFP, the MERET programme gets chronically food-insecure communities involved in environmental rehabilitation and sustainable income-generating activities that improve livelihoods. Under MERET, chronically food-insecure communities participate in environmental rehabilitation and income-generating activities designed to improve livelihoods through the sustainable use of natural resources. Its primary objective is to build resilience to the kind of shocks that struck Ethiopia in 2008. Some of those shocks were economic, such as high food and fuel prices, while others were environmental, like the prolonged drought that was related to climate change, according to experts. Among the programme's many activities are measures to build and rehabilitate feeder roads, reforest barren hillsides, restore springs and rainwater ponds, and reconstruct and refurbish agricultural terraces - all of which contribute to lower environmental degradation and climate change adaptation as well as food security and livelihood enhancement." (Carlo Scaramella, World Food Programme)	accept with many thanks
405	46291	7	36	0	36	0	In 7.6 section the statement on need for the research efforts for assessing the impact of climate change on pests and diseases also be mentioned (Arif Goheer, Global Change Impact Studies Centre (GCISC))	Included in SOD.
406	46292	7	36	0	36	0	Ongoing efforts on the platform of CCAFS and AgMIP also need to be mentioned in the Section 7.6 (Arif Goheer, Global Change Impact Studies Centre (GCISC))	Publications from these organisations have been referred to in multiple places in the chapter.
407	35672	7	36	14	36	24	These two paragraphs are very rudimentary and could be considerably enriched by drawing from recent literature (e.g. Lobell et al 2012, Rötter et al 2011) and preliminary assessments and results from AgMIP and FACCE MACSUR (see, e.g. Soussana et al, in press, Global Change Biology) (Reimund Rötter, MTT Agrifood Research Finland)	Revised in SOD and FD.
408	46290	7	36	17	36	20	A lot of studies describe that much work needs to be done on other components of food security besides production. References may be given in support of this statement. (Arif Goheer, Global Change Impact Studies Centre (GCISC))	Revised in SOD and FD.
409	43225	7	36	17	37	27	While agreeing with the sentiments expressed in lines 22-24, this chapter, with its predominant content focussed on production, also lacks a critique of current research efforts. It would be very instructive to compare / contrast the research being done with the questions that the policy community actually want answers/information to answer. For example, what confidence do the current models of production and climate change provide when changes in other aspects of the biological system (e.g. insect vectors of disease) are allowed for? (Peter Gregory, University of Reading)	Revised in SOD and FD.
410	42433	7	36	29	36	33	Rewrite this to indicate that this depends on the magnitude of changes in temperature and precipitation, as well as technological changes that may occur in the future (e.g., changes in cultivars, farming practices, etc.) Trade and economic growth should buffer the impact of any adverse consequences from changing climate and weather, like they have always done (Goklany 1995, 1998, 2007c, 2007d). (Indur Goklany, Independent)	This point is made. Refs pre-AR4.

#	ID	Ch	From Page	From Line	To Page	To Line	Comment	Response
411	42429	7	36	29	37	37	For the most part these FAQs focus on food production, rather than food security. This is a major flaw. I would recommend either adding to, or replacing, the current set of FAQs with the following questions: (a) How does the concept of food security differ from that of food production? Does low food production necessarily lead to food insecurity? (B) What factors determine food security? (C) Has food security increased or decreased over the past several decades? Has climate change contributed significantly to those trends and, if so, how? (D) How much credence can be given to impacts assessments, considering the accumulation of uncertainties in emission scenarios, climate models, biophysical models, and socioeconomic models? (E) Considering food insecurity is a consequence of poverty but the world should be much wealthier in the future according to assumptions incorporated into emission scenarios, how sensitive would food security be to future climate change? (F) How might mitigation affect food security? The various comments on page 0 and page 2 can help formulate the necessary responses to most of these questions. Also, I would add the following FAQ to parallel the current FAQ 7.1: "How could climate change increase food production?" The response to this FAQ should include, but not be limited to, the current FAQ 7.2. Specifically, it should address not only effects from CO2 and nitrogen fertilization, but also temperature and precipitation effects. (Indur Goklany, Independent)	The FAQs give a balanced response to these points.thank you detailed coments. it could not add to FAQs more for limited space, but we could accept your ideas into new FAQs.
412	41106	7	36	30	36	30	I do not care for the faq. It misses the fundamental fact that crop models show inverted u shape functions that differ across crops and that increasing temperatures increase some crop and livestock yields in some places. Thus the overall food production issue involves adaptation to adopt crops/livestock favored by climate conditions. us studeis since one i did with adams that is in nature 1980 show potential for more fofod production with northward migration in crop mixes and we are seeing this happen. the discussion needs to be more realistic and nuanced with the word regional appearing. also one should not omit livestock. (Bruce McCarl, Texas A&M University)	For space limitation, no more FAQs could be added,but "crop models" and "livestock" should be considered in new FAQs
413	41107	7	36	50	36	50	wehave been doing statistical studies on yields and find low and high temperatures as you state but also drought, el nino, fertilizer, rainfall intensity exert major influences. The paper Attavanich, W., and B.A. McCarl, "The Effect of Climate Change, CO2 Fertilization, and Crop Production Technology on Crop Yields and Its Economic Implications on Market Outcomes and Welfare Distribution", Selected paper presented at the 2011 Annual Meetings of the Agricultural and Applied Economics Association, Pittsburgh, July, 2011. has this as does the underlying phd thesis plus one just completed by park on effects on skeyness and kurtosis (Bruce McCarl, Texas A&M University)	Your references (whole paper) are welcomed,but I think your commnets are consistent with this FAQ.
414	50473	7	36	51	36	51	Casual usage of the term "likely" should be avoided, as it is a reserved likelihood term. (Katharine Mach, IPCC WGII TSU)	Accept with many thanks
415	42430	7	37	4	37	13	Modify the FAQ to read: "How could adaptation actions avoid the loss of OR INCREASE food production?" In the response, note that adaptations include (a) crops developed to take advantage of, or withstand, situations that exist today but might be enhanced under climate change, e.g., drought, salinity, higher CO2, higher temperatures, water logging and (b) precision agriculture (for a fuller list: see, Goklany 2007b, Section 4.2). This should also be worked into the sub-sections of this chapter dealing with adaptation. (Indur Goklany, Independent)	Accept with many thanks
416	41108	7	37	13	37	13	one can also alter livestock breeds, move crop land to livestock and alter livestock species papers have looked at thes adaptations as they exist and are projected (Seo work, Zhang, W., A. d. Hagerman, and B.A. McCarl, "How climate factors influence the spatial distribution of Texas cattle breeds", Climatic Change, in second review, 2012., Mu, J.E., B.A. McCarl, and A. Wein, "Climate Influences on Livestock and Crop Land Use", Mitigation and Adaptation of Strategies for Global Change, forthcoming, 2012.) (Bruce McCarl, Texas A&M University)	accept with many thanks
417	47937	7	37	15	0	0	Inadequate response to "Where do the food insecure live?" - response gives impression that only small island nations are vulnerable to climate change . Consider rephrasing question and/or providing response that includes mention of food insecure in different regions (including marginalized communities). (Ameyali Ramos Castillo, United Nations University - Institute of Advanced Studies)	Agreed, we need to add information - FAO (and probably others e.g. World Bank, UNDP) publishes maps of food insecurity. I can add some information from a fisheries perspective from a published global analysis. Should we change this faq to "Where do the most vulnerable [to climate change impacts] live"?comments 417-423 are on FAQ 5.yes, this question is not necessary and the answer is not accurate, so this FAQ should deleted.
418	41109	7	37	15	37	15	I think the question "Where do the food insecure live?" is the wrong one. I would address where is food security likely to be worsened by climate change. The framing you have has been addressed by fao and your answer is not totally on point. I would talk some about dry areas in subtropics and perhaps asia (Bruce McCarl, Texas A&M University)	See earlier responses.
419	42431	7	37	15	37	17	This FAQ should be replaced by the one in (B) identified in the comment on page 36, line 29 to page 37, line 37. (Indur Goklany, Independent)	See earlier responses.
420	46293	7	37	15	37	17	Accordin to FAO South Asia, Africa and Small Islands the world's most food insecure regions. This needs to be added in FAQ 7.5. (Arif Goheer, Global Change Impact Studies Centre (GCISC))	OK - good point.
421	52507	7	37	15	37	17	Africa and Asia have the highest number of undernourished people, not small islands. (Ursula Oswald-Spring, Centro Regional de Investigaciones Multidisciplinarias (CRIM) UNAM)	OK - good point.
422	40818	7	37	16	37	17	This phrasing looks strange, at least to a non English reader. (Michel Petit, CGIET rue de Bercy)	See FD.

#	ID	Ch	From Page	From Line	To Page	To Line	Comment	Response
423	45487	7	37	16	37	17	We suggest replacing this text with: "The most food insecure people live in the poorest and most marginal areas of Asia, Africa and Latin America, where environmental degradation and climate change will likely exacerbate current threats to food security. The majority of food insecure people live in Asia, where high poverty rates and high disaster magnitudes affect food security. In Sub-Saharan Africa, the most food insecure communities live in highly degraded environments where climate change could increase degradation rates. In Latin America, the most food insecure generally live in poor urban and rural settings where climate-related disasters affect poverty and food insecurity trends." Initial analysis by the United Nations World Food Programme and the UK Met Office Hadley Centre (2010) shows that current climate risks and food insecurity intersect in the most vulnerable areas of the world: West Africa, East Africa, Southern Africa, and South Asia. This is due to a combination of exposure to climate risks such as floods, droughts, and storms, as well as high poverty rates, and high sensitivity to climate change." Suggested source: UK Met Office Hadley Centre and WFP (2010) Food insecurity and climate change. [Poster] Available from http://documents.wfp.org/stellent/groups/public/documents/newsroom/wfp229182.pdf (Carlo Scaramella, World Food Programme)	See regional box and Table 7-2.
424	42432	7	37	19	0	0	Replace "declining" with "changes in". Rationale: The text on lines 21-23 indicates that some fisheries may be enhanced. (Indur Goklany, Independent)	Agreed. accept with many thanks
425	41110	7	37	20	37	20	I might talk some about aquaculture and stresses raised by warming waters and pest/disease issues (Bruce McCarl, Texas A&M University)	Provided reliable information can be found to support this statement, it could be included in the FAQ but space is limited and it will have to be as part of a general statement on adaptation in aquaculture.
426	52508	7	37	28	37	28	Another question could be: How is a food system with climate change adaptation functioning? (Ursula Oswald-Spring, Centro Regional de Investigaciones Multidisciplinarias (CRIM) UNAM)	See comment and response 404
427	35673	7	37	30	56	31	References: it is very difficult to check what important Refs are missing -- but apart from what I have given in previous comments - here is a list of further Refs to be added: Asseng, S, Foster, IAN, Turner NC, (2011) The impact of temperature variability on wheat yields. <i>Global Change Biology</i> , 17, 997-1012. Bindi, M, Olesen, JE (2011) The responses of agriculture in Europe to climate change. <i>Regional Environmental Change</i> , 11 (Suppl 1), S151-S150. Børgesen CD, Olesen JE (2011) A probabilistic assessment of climate change impacts on yield and Nitrogen leaching from winter wheat in Europe. <i>Nat. Hazards Earth Syst. Sci.</i> 11, 2541-2553. Carter, TR (2010) Assessing impacts of climate change: an editorial essay. <i>Wiley Interdisciplinary Reviews, WIREs Climate Change</i> , 1, 479-482. Challinor, AJ (2011) Agriculture: forecasting food. <i>Nature Climate Change</i> , 1, 103-104. Challinor, AJ, Ewert, F, Arnold, S, Simelton, E, van Fraser, E, (2009) Crops and climate change: progress, trends, and challenges in simulating impacts and informing adaptation. <i>Journal of Experimental Botany</i> , 60(10), 2775-2789. Ewert, F, Rounsevell, MDA, Reginster, I, Metzger, MJ, Leemans, R (2005) I. Estimating changes in crop productivity. <i>Agriculture, Ecosystems & Environment</i> , 107, 101-116. Hakala, K, Jauhainen, L., Himanen, SJ et al (2012) Sensitivity of barley varieties to weather. <i>The Journal of Agricultural Science, Cambridge</i> , 150, 145-160. doi:10.1017/S0021859611000694. Kaukoranta, T, Hakala, K (2008) Impact of spring warming on sowing times of cereal, potato and sugar beet in Finland. <i>Agricultural and Food Science</i> 17, 165-176. Wallach, D, Makowski, D, Jones, JW (Eds.) (2006) Working with dynamic models. Evaluation, analysis, parameterization, and applications. 462 pp., Elsevier, Amsterdam, The Netherlands. White JW, Hoogenboom, G, Kimball, BA, Wall, GW (2011) Methodologies for simulating impacts of climate change on crop production. <i>Field Crops Research</i> doi:10.1016/j.fcr.2011.07.001. (Reimund Rötter, MTT Agrifood Research Finland)	Thank you. Some included.
428	46294	7	40	28	40	29	The Reference "Humaira, S, N. Ali. ..." may be corrected as "Sultana, H., N. Ali....." (Arif Goheer, Global Change Impact Studies Centre (GCISC))	Thanks. The reference will be corrected.
429	35459	7	50	14	50	14	To include the reference: Garza-Gil, M.D, J. Torralba-Cano, and M. Varela-Lafuente, 2011: Evaluating the economic effects of climate change on the European sardine fishery. <i>Regional Environmental Change</i> , 11, 87-95. (M. Dolores Garza-Gil, University of Vigo)	Thank you for the reference. I will read it and include it if it contains important information for this chapter on food security and food production.
430	35460	7	50	18	50	18	To include the reference: Hannesson, R., 2007: Geographical distribution of fish catches and temperature variations on the northeast Atlantic since 1945. <i>Marine Policy</i> , 31, 32-39. (M. Dolores Garza-Gil, University of Vigo)	Thank you for the reference.
431	35461	7	50	37	50	37	To include the reference: Pearson, R.G., and T.P. Dawson, 2003: Predicting the impacts of climate change in the distribution of species: are bioclimate envelope models useful? <i>Global Ecology Biogeography</i> , 12, 361-371. (M. Dolores Garza-Gil, University of Vigo)	Thank you for the reference.
432	35462	7	50	37	50	37	To include the reference: Perry, A.L., P.L., Low, J.R., and J.D., Reynolds, 2005: Climate change and distribution shifts in marine fisheries. <i>Science</i> , 308, 1912-1915. (M. Dolores Garza-Gil, University of Vigo)	Thank you for the reference.
433	35463	7	50	46	50	46	To include the reference: Vinagre, C., F. Duarte Santos, H. Cabral, and M.J. Costa, 2011: Impact of climate warming upon the fish assemblages of the Portuguese coast under different scenarios. <i>Regional Environmental Change</i> , 11, 779-789. (M. Dolores Garza-Gil, University of Vigo)	Thank you for the reference.
434	47199	7	55	16	55	19	Now peer-reviewed and published as: Nakashima, D.J., Galloway McLean, K., Thulstrup, H.D., Ramos Castillo, A. and Rubis, J.T. 2012. Weathering Uncertainty: Traditional Knowledge for Climate Change Assessment and Adaptation. Paris, UNESCO, and Darwin, UNU, 120 pp. (Douglas Nakashima, UNESCO)	Reference corrected.

#	ID	Ch	From Page	From Line	To Page	To Line	Comment	Response
435	52509	7	57	0	0	0	A dynamic systemic approach is missing, where the dissipative, open and self-regulating systems could improve Figure7-1. This figure is still very simple missing processes' feedbacks. If you would design a system with subsystems (dynamic interrelation between food utilization; food access; food availability), surrounding conditions of entrance such as markets, inputs, availability of natural resources (soil, water, fertility, seeds, fertilizers pesticides), institutional support, food conservation, etc. and output flows such as food items, nitrogen and phosphorous leaching, migration of young people, food culture, etc. and surrounding conditions between subsystems (at lower level) you could then use the different phases of the food system activities and interrelate them regionally with climate change impacts. The immaterial values of the food culture are completely missing in the figure and they are key factors of cohesion and identity patterns for indigenous societies. (Ursula Oswald-Spring, Centro Regional de Investigaciones Multidisciplinarias (CRIM) UNAM)	Figure 7-1 is designed to illustrate the main elements of the food system, and adding all the nuances indicated (correct though they are) would make the figure over-complicated. Certainly the social function of food s critically important, and very often missing in food security debates, thus the specific inclusion of the social function "button" under Utilisation in Figure 7-1. The dynamic nature of the interactions is given in Figure 7-2, where feedbacks to socioeconomic systems are indicated. We have refined this figure in the FD.
436	53922	7	57	0	0	0	Figure 7-1: It may be more effective to recreate this figure to highlight the key concepts assessed/discussed in the chapter instead of extracting exactly from the source. The information presented here can be reorganized and presented in a simpler schematic diagram. For example, it may not be necessary to list all Food System Activities (or presented in a separate table). (Yuka Estrada, IPCC WGII TSU)	The aim is to identify the main activities (and hence areas of literature) along the whole food "chain"; and also to show how a change in any of these Activities (ie adaptation by any actor along the food chain) affects the food security Outcomes.
437	37004	7	57	0	58	0	Figures 7-1 and 7-2: Delete 7-1 as it is redundant, keep 7-2 as it gives more information. I suggest you rework the figure and include details from 7-1. Please also give the meaning of GEC in the figure caption and make sure there is no direct feedback from GEC drivers to socioeconomic drivers. (Joachim Rock, Johann Heinrich von Thuenen-Institute, Federal Research Institute for Rural Areas, Forestry and Fisheries)	Fig 7.1 and 7.2 will be combined.The aim of 7-1 is to list both the food system Activities and Outcomes in sufficient detail to show both the range of activities in the food chain and the range of important considerations relating to food security outcomes. While it would be possible to add the richness of Figure 7-1 to 7-2, it would result in an over-complicated figure which would need a large size to be legible.
438	45205	7	57	0	58	0	Figure 7-1 and 7-2. Can both figures not be combined. They both contain useful information, but overlap a bit if not combined. (Eline Vanuytrecht, KU Leuven)	Yes.See above re 437
439	41636	7	58	0	0	0	In Figure 7-3b) which shows boxplots of studies separated by modelling approach, whether CO2 effects were included and crop, how are the estimates of the impacts of recent climate trends on yields read or interpreted from the figure (e.g., for rice, 0 to -2+ 5/decade)? (Lourdes Tibig, The Manila Observatory)	Caption reworded to clarify
440	45211	7	58	0	0	0	Figure 7-3. Does it make sense to show a graph here including studies that do not take into account the effect of CO2 (whether positive or negative)? Which are the "four major crops" mentioned in the figure caption? Was the information used for this graph exhaustive (all available studies included)? If not, how did you select the studies that are included? (Eline Vanuytrecht, KU Leuven)	Caption reworded to clarify
441	50474	7	58	0	0	0	Figure 7-2. Where the author team notes that this figure may be removed, another option to consider is combining it with figure 7-1, potentially as a figure with 2 panels or with a slightly different balance between text in the figure and figure caption. For example, for both figures, the author team should provide further explanation of how to interpret the figures in the figure captions, and these explanations could potentially displace some text from the figures themselves. (Katharine Mach, IPCC WGII TSU)	Will be combined with 7.1.
442	53923	7	58	0	0	0	Figure 7-2: As Figure 7-1, it could be useful if this figure is recreated or possibly combined with Figure 7-1. (Yuka Estrada, IPCC WGII TSU)	Will be combined with 7.1.
443	53924	7	58	0	0	0	Figure 7-3: This is an effective way to illustrate summary of the studies assessed. It could be useful to elaborate a little more on the methods of its construction and analysis (which also can be provided in supplemental material for the chapter). It could be also useful for readers to have further clarification. For instance, what are the different colors indicating? The left chart needs a clear x-axis label. (Yuka Estrada, IPCC WGII TSU)	Caption expanded to clarify
444	37005	7	58	0	58	0	Figure 7-3: The right panel needs clarification. The boxplots of the "yes-CO2" and "no-CO2" are very similar to the "process models" and "statistical models", respectively. If there are no statistical models that incorporate CO2 effects the message of the picture is completely different! As it is including CO2 effects shows that yields are bound to decrease. If only physiological models include CO2 this inclusion shows higher yields (still lower than today, but ...). But with only 2 observations that included CO2 - how high can your confidence be, after all? (Joachim Rock, Johann Heinrich von Thuenen-Institute, Federal Research Institute for Rural Areas, Forestry and Fisheries)	Sample size is admittedly small. Will try to add more studies as they become available, but we feel including the breakdown is useful as long as the number of studies are clearly shown
445	46295	7	58	0	58	0	The source of the Fig.7.2 may be mentioned (Arif Goheer, Global Change Impact Studies Centre (GCISC))	Caption reworded to clarify
446	41111	7	58	1	58	1	I would drop figure 7-1 as it is not on point about climate change 7-2 is in the right ball park although I think could be enhanced with some notion of adaptation (Bruce McCarl, Texas A&M University)	Will be combined with 7.1.
447	50475	7	59	0	0	0	Figure 7-4. The chapter team could clarify whether attribution here is to climate change (presumably) or to anthropogenic climate change. (Katharine Mach, IPCC WGII TSU)	Caption reworded to clarify
448	53925	7	59	0	0	0	Figure 7-4: The legend needs to be outside of the chat pane. Instead of using the different markers, it may be easier for readers if the numbers or letters are used (e.g., W= wheat, 0=global... etc) and use different colors to illustrate yield impacts (e.g., red=negative yield impacts). (Yuka Estrada, IPCC WGII TSU)	Agreed, formatting got messed up in original conversion. Will change symbols
449	50476	7	60	0	0	0	Figure 7-5. The author team should further clarify the source of information plotted here--what database was used? Additionally, these are results that are forward-looking projections, correct? It would be helpful to clarify the baseline for temperature changes considered. (Katharine Mach, IPCC WGII TSU)	Figure and caption revised

#	ID	Ch	From Page	From Line	To Page	To Line	Comment	Response
450	53926	7	60	0	0	0	Figure 7-5: The visibility of this figure should be improved, especially for the printed version. It may be interesting to analyze the new data separately from the AR4 studies and if any new trends are emerging, highlight new data (e.g., open circles and dotted line for AR4 data, and closed circles and solid line for new data). (Yuka Estrada, IPCC WGII TSU)	Figure and caption revised
451	50477	7	61	0	0	0	Figure 7-6. The figure caption should provide more information on the data being plotted. What is the baseline for changes in precipitation, what is the range of crops included in "all crops," etc.? (Katharine Mach, IPCC WGII TSU)	Figure and caption revised
452	50478	7	62	0	0	0	Figure 7-7. Where "likely" is used in the figure caption, is it being used as a likelihood term from the uncertainties guidance for authors? If so, it should be italicized for clarity; casual usage of this reserved likelihood term should be avoided. (Katharine Mach, IPCC WGII TSU)	Figure and caption revised
453	50479	7	62	0	0	0	Figure 7-8. The source of information presented in this figure should be clarified. (Katharine Mach, IPCC WGII TSU)	Figure and caption revised
454	53927	7	62	0	0	0	Figure 7-7: If it is decided that this figure is to be used, the visibility of this figure should be improved by use of bigger fonts and a legend should be provided. However, I am not sure if this is the most effective way to present the data. I found it hard to read and understand what the individual boxes are representing. (Yuka Estrada, IPCC WGII TSU)	Figure and caption revised
455	50480	7	63	0	0	0	Figures 7-9 and 7-10. The sources of information and data in these figures should be clarified. (Katharine Mach, IPCC WGII TSU)	Figure and caption revised