



**IPCC WGII
Fourth Assessment Report
Climate Change Impacts, Adaptation and Vulnerability**
Expert Review of First Order Draft

Specific Comments

Chapter 5

December 5, 2005

Discussion of expert review comments and record keeping

IT IS RECOMMENDED THAT:

- AUTHORS BEGIN WORK ON THE COMMENTS IMMEDIATELY. SUBSTANTIVE COMMENTS NEED TO BE SEPARATED FROM NON-SUBSTANTIVE, AND THE TWO SHOULD BE TREATED DIFFERENTLY
- CONTACT IS MADE BETWEEN AUTHORS AND THEIR REVIEW EDITORS IN DECEMBER

Substantive comments

- The chapter writing team should discuss all substantive expert review comments, by email and/or at Merida.
- Substantive comments require full and proper consideration. The *Principles Governing IPCC Work* state that:
 - genuine controversies should be reflected adequately in the text of the Report and
 - it is the role of the Review Editors to advise the lead authors on how to handle contentious/controversial issues
- You must record the outcome of these discussions in this document, under the column 'Notes of the Writing Team'.

Non-substantive comments

- For non-substantive comments, a very brief entry should be made in the column 'Notes of the Writing Team'. The following terms are acceptable:
 - Addressed
 - Not applicable
 - Text removed
 - A tick to denote a comment has been addressed (somewhere on the document this should be stated)

General

- The record can be kept electronically, or with pen-and-paper.
- The document becomes part of the traceable account of the Working Group II Fourth Assessment. When completed to the satisfaction of the Review Editors, a copy should be returned to the TSU by the **28th February 2006**.

IPCC WGII AR4 FOD Expert Review Comments

Chapter-Comment	Batch	From Page	From Line	To Page	To line	Comments	Notes of the writing team
5-0	A	0				<p>Co-chair and TSU comments</p> <p>From being in quite good shape last December in the ZOD, I think that this has not tightened up as a chapter to the extent we had hoped: a) the messages new since TAR are not clearly spelled out; b) length, which was 50% in excess in ZOD, is now 100% in excess; c) the structure is sometimes confusing; d) there are no outstanding summary figures or tables that shout out to be used in a Summary for Policymakers.</p> <p>I recommend the authors consider following the example of ch 4 in creating an effective summary of findings, thus:</p> <p>a) a table summarising impacts by increments of T change (table 4.5)</p> <p>b) a summary map of projected impacts, worldwide (fig 4.9)</p> <p>c) a burning embers diagram for each FFF type to show key vulnerabilities (fig 4.10)</p> <p>Length is an increasing problem. In ZOD Word text was 58pp (in excess by 24); in FOD it is 70 (in excess by 35).</p> <p>Asssuming refs will be 7 printed pages (i.e. half the Word number), then text needs to maximum 23 printed pages,that is 35 Word pages.</p> <p>Tables and figures could summarise much of current text and make the latter redundant.</p>	<p>We recognize that the chapter needs improved assessment and synthesis. Figures have been prepared that plot crop yields v. temperature change for three crops, two major zones (tropical and temperate), and with and without adaptation. Similar summary figures are planned for forestry.</p> <p>We will consider the feasibility of an impacts map for crops, livestock, forestry, and fisheries.</p> <p>Will do.</p> <p>Under consideration.</p> <p>Under consideration.</p> <p>Comment has been accepted as fair and incorporated into redraft.</p> <p>Comment has been accepted as fair and incorporated into redraft.</p> <p>Comment has been accepted as fair and incorporated into redraft.</p>

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						<p>For example, Boxes 5.2 and 5.3 and Table 5.3 summarise the new knowledge . IF CONCLUSIONS WERE ATTACHED TO THESE (and I suggest that each para in the boxes and each part of the table have a clear conclusion/summary/message of the state of current knowledge), then these are the essential core of the chapter. The rest could be cut to half the current amount. It is imperative the chapter meets its target length in FOD.</p> <p>Key conclusions are not clear, viz a) is global agric production projection potential expected to increase? How different is this conclusion from TAR? B) is this consistent with more recent findings that CO2 effects may previously have been over-estimated (NB the global assessments prior to 2005 generally assume CO2 effects that have NOT YET BEEN REVISED DOWN in tune with 2005 findings). What is the new message and its confidence level?</p> <p>I do not think it works to separate Exec Sumary statement by confidence levels, if this means separating out topics: eg there are some aspects of food production that come under different sections: better to bring topics together, e.g. with one para on food production, but different parts of this (maybe) having different confidences attached to them.</p> <p>The structure adopted has not helped the authors: a) why not bring all adaptation (except acclimation eg of trees and fish) into section 6, thus enabling considerable condensing of current text b) bring all socio-economic components into section 5 (eg production, security, livelihood; and c) cover only effects on primary potential in section 4.</p> <p>There seems to be a lot to do; and, as before, I think you need to</p>	<p>We will revisit the boxes and table to make them more centrally part of the section.</p> <p>A new section dealing with the Long CO2 postulates will be inserted.</p> <p>Confidence levels will be removed.</p> <p>The entire chapter has been revised to restructure according to this comment.</p>

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						<p>start with deciding what your key conclusions must be and be clear how these differ or confirm TAR); then you can decide what space to devote to the key areas. You simply cannot cover all the ground, and no one expects you to.</p> <p>Please use the reduced-form section headings that have been recommended, as other chapters have.</p> <p>The conclusions do not include a matrix, which was requested, which summarises effects under different amounts of climate change, and under SRES futures and stabilisation (where this information allows)</p> <p>These, below, are a copy of comments on ZERO-ORDER DRAFT IN JAN 2005 made by Martin Parry, [with responses in FOD indicated in square brackets]</p> <p>This chapter appears to represent a lot of early work by the authors, which has led to a draft that is in fair shape. In particular you seem to have found a persuasive balance between the sections, giving over (we think correctly) half the pages to section 5.4 and covering topics crop/forestry/fisheries etc in an easy-to-follow manner. [I now think that, as the chapter has grown, it has lost shape and message]</p> <p>But one problem is length. The current is xxx times the target length (which would be xx pages in this format; this draft is 73). [You have not addressed this is and it is now much more of a problem].</p> <p>Some solutions would be: 1) judicious use of tables to summarise text eg could there not be updates of tables in TAR [such as TAR table 5.4, but much shorter than in TAR] and updates of summary</p>	<p>We will go back to the reduced-form headings.</p> <p>We will attempt this if the literature bears it.</p> <p>Comment now redundant or irrelevant as section has been revised.</p> <p>Comment has been accepted as fair and Incorporated into redraft.</p>

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						<p>figures [such as TAR figure 5.20]. 2) Concentrate on the emerging new knowledge eg where AR4 reinforces or revises TAR, and do not repeat the rest. 3) illustrate the main points by example, but no need to list every finding that leads to the conclusion (and use collected sources to cover the references eg AIACC summary report might be used as 'meta' reference source? [the core boxes and table I refer to above have helped, but the text has not been cut accordingly; you do not need both]</p> <p>What case studies do you plan to use? [boxes are helpful] Unrelenting text needs to be broken up by friendly figures and tables. [Summary tables and figures, as suggested above, would be really helpful] But first task probably needs to be for writing team to consider what are the emerging key conclusions (global, regional and local), and then to consider how best to address these, eg give them more attention than non-key findings. [these not clear]</p> <p>No assessment of 'key' impacts (in the sense of thresholds) in section 4 that could lead ch19 and 20 to draw together. Is this planned? [A table illustrating the effects estimated for increment of T and P change would be helpful, as I have suggest in my FOD comments] Also missing is assessment of 1)effects under different development pathways: eg under SRES futures; 2) effects under stabilisation scenarios (where such information exists). [These are still missing] (Martin Parry)</p> <p>Chapter 5 FOD is well written; however, being still incomplete, it is too long. The estimated FOD printed pages are around 60 while the</p>	<p>Done.</p> <p>Yes.</p> <p>Comment has been accepted as fair and incorporated into redraft.</p> <p>Comment now redundant or irrelevant as section has been revised.</p>

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						<p>allocated number is 30. It looks like an excellent scientific assessment, including some valuable advice, particularly on what concerns adaptation actions in countries having a complete or quasi complete knowledge of their current resources, including climate and water resources (hydrographic systems). However, as mentioned in the specific comments, a more focused advice for developing country’s decision makers is necessary. This includes actions to be taken before any effort is developed to deal with the climate change effects (both adverse and beneficial). In this regard some basic components in the multifarious complexity of FFF, should be considered as very basic elements. Suggestions will be included in the specific comments.</p> <p>Further, FOD does not contain conclusions valid for decision making. For instance, many decision makers request information to act in closer time-horizons (i.e. 2020 or nearer), It is suggested to add some comments in this respect. FOD includes a large number of references on developed countries FFF activities and research and few on developing countries. However, since a good amount of research work developed by developing country scientists is available, these should be mentioned. Maybe the recommendation for improved cross-referencing with regional and, even, with other sectoral chapters, will improve the chapter scope and permit to reduce its length.</p> <p>Regarding adaptation, major emphasis is put on climate variability effects, although some are missing, like the changes in oceanic circulation in the case of climate variability (i.e. the important economic effect on fisheries due to the deflection of the Humboldt current, in the eastern Pacific Ocean). Regarding adaptation to climate change, the relocation of crops, already applied in South America, is not offered as an adaptation strategy. Further, some simple suggestions, like the value of redesigning frost tables</p>	<p>We hope to array impacts and adaptation by time horizons and temperature slices.</p> <p>I contacted Osvaldo Canziani for further information and added appropriate text on fisheries impact.</p>

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						(intensity and duration, in autumn, winter and spring) is a suggested feasible adaptation action. (Osvaldo Canziani)	
5-1	A	0				<p>The scope is clear and well framed and the chapter seems very comprehensive in it's coverage and appears to contain most of the recent, relevant research from the primary literature of the last six years. The amount and detail of some of the information makes for a quite a 'dense' read. If it were possible to synthesise some of the work and present it in the form of graphs, diagrams and tables, this might make the whole more digestible. I have some concerns with the structure, with there being scope for overlap or splitting of information in different sub-sections within sections (e.g. within 5.4.1 to 5 and 5.4.6) and overlap or gaps between sections (e.g. 5.4 and 5.5 - impacts, vulnerabilities, costs - might it not be easier to integrate these, so there are not widely separated sub-sections on 'regional impacts' and 'regional vulnerabilty' and 'regional costs', or similar for trade..?)</p> <p>Although I have read all the chapter, I have confined my comments mostly to the sections on fisheries and aquaculture, as this is the area of my expertise, assuming that other referees will address the technical details and presentation of evidence in other sectors. Overall, I think the fishery contributions are useful and appropriate, although perhaps biased towards marine temperate systems (admittedly more primary literature is available for these). There is also a concentration on the impacts of climate on fish production, and less of an overview on the impacts on fishery systems (perhaps this is covered in other chapters?). Hence, there is little on the impacts and costs of sea level rise and increased stormines sor extreme rainfall events on fishery and aquaculture installations and infrastructure - fishing ports, coastal aquaculture ponds, sea cages, losses of boats at sea etc. There is also rather less on impacts and adaptation of small-scale fisherfolk - when the fishery (as opposed to the fish) is mentioned, it is the capacity of trade and enterprise, rather than boats, households, and people. (Edward Allison, University of East Anglia)</p>	<p>See above for synthesis strategies.</p> <p>Comment has been accepted as fair and incorporated into redraft Chapter 6 deals with effects of sea rise and extreme events on coastal communities and livelihood.</p>
5-2	A	0				<p>Generally, as per progress from the ZOD, this chapter is improved - but still has problems with flow. There are still bits of text that seem out of place (this was a major problem with the ZOD); and there is still repetition. I have tried to flag the repetition where it is obvious, but I may have missed elements. Lastly, the</p>	Will address repetition

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						authors need to be quite sure that there are not sections that are contradicting each other. The later sections of the chapter get rather fluffy, and need a good edit for comprehension, coherency and repeats. (Emma Archer, University of the Witwatersrand)	
5-3	A	0				In general, the authors have done a good job in synthesizing the information on forests, although there are some gaps in references and in reporting of some of the biological issues, especially in a North American Context. Again, few mentions of Asia and Africa. (Pierre Bernier, Natural Resources Canada)	Comment considered valid but on balance it is felt due consideration has been given to the point.
5-4	A	0				General comments on the chapter: a) the length of the chapter could be reduced matching the planned 60 pages deleting descriptive illustrations of several tasks that are well known (see comments below); b) impact and adaptation tasks should be reported in separate sections c) results or references already reported in the TAR should be removed in the SOD d) the references are often incomplete (e.g. without years) or are not reported in the list of reference. (Marco Bindi, Dept. of Agronomy and Land Management)	Comment now redundant or irrelevant as section has been revised. Comment has been accepted as fair and incorporated into redraft.
	A	0				Please find the following references cited in my review: Ainsworth EA, Davey PA, Bernacchi CJ, Dermody OC, Heaton EA, Moore DJ, Morgan PB, Naidu SL, Ra H-SY, Zhu X-G, Curtis PS, Long SP. 2002. A meta-analysis of elevated [CO ₂] effects on soybean (Glycine max) physiology, growth and yield. <i>Global Change Biology</i> 8, 695-709. Booker FL, Fiscus EL, Miller JE. 2004. Combined effects of elevated atmospheric carbon dioxide and ozone on soybean whole-plant water use. <i>Environmental Management</i> 33, S355-S362. Booker FL, Miller JE, Fiscus EL, Pursley WA, Stefanski LA. 2005. Comparative responses of container- versus ground-grown soybean to elevated CO ₂ and O ₃ . <i>Crop Science</i> 45, 883-895. Fiscus EL, Miller JE, Booker FL, Heagle AS, Reid CD. 2002. The impact of ozone and other limitations on the crop productivity response to CO ₂ . <i>Technology</i> 8, 181-192. Fiscus EL, Booker FL, Burkey KO. 2005. Crop responses to ozone: uptake, modes of action, carbon assimilation and partitioning. <i>Plant, Cell and Environment</i> 28, 997-1011. Fuhrer J, Booker FL. 2003. Ecological issues related to ozone: agricultural issues. <i>Environment International</i> 29, 141-154.	Will consider.

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						<p>Heagle AS, Miller JE, Pursley WA. 1998. Influence of ozone stress on soybean response to carbon dioxide enrichment. III. Yield and seed quality. <i>Crop Science</i> 38, 128-134.</p> <p>Heagle AS, Miller JE, Booker FL, Pursley WA. 1999. Ozone stress, carbon dioxide enrichment, and nitrogen fertility interactions in cotton. <i>Crop Science</i> 39, 731-741.</p> <p>Jablonski LM, Wang X, Curtis PS. 2002. Plant reproduction under elevated CO2 conditions: a meta-analysis of reports on 79 crop and wild species. <i>New Phytologist</i> 156, 9-26.</p> <p>Kimball BA, Pinter J, P.J., Wall GW, Garcia RL, Lamorte RL, Jak PMC, Frumau KFA, Vugts HF. 1997. Comparisons of responses of vegetation to elevated carbon dioxide in free-air and open-top chamber facilities. In: Allen LH Kirkham MB Olszyk DM, Whitman CE, eds. <i>Advances in Carbon Dioxide Effects Research</i>. Madison, WI: ASA Special Publication No. 61, American Society of Agronomy, Crop Science Society of America, and Soil Science Society of America, 113-130.</p> <p>Long SP, Ainsworth EA, Rogers A, Ort DR. 2004. Rising atmospheric carbon dioxide: plants FACE the future. <i>Annual Review of Plant Biology</i> 55, 591-628.</p> <p>McKee IF, Eiblmeier M, Polle A. 1997. Enhanced ozone-tolerance in wheat grown at an elevated CO2 concentration: ozone exclusion and detoxification. <i>New Phytologist</i> 137, 275-284.</p> <p>Pielke RA, Sr., Adegoke JO, Chase TN, Marshall CH, Toshihisa M, Niyogi D. In press. A new paradigm for assessing the role of agriculture in the climate system and in climate change. <i>Agricultural and Forest Meteorology</i>.</p> <p>Polley HW. 2002. Implications of atmospheric and climatic change for crop yield and water use efficiency. <i>Crop Science</i> 42, 131-140. (Fitzgerald Booker, USDA-ARS Plant Science Research Unit)</p>	
5-6	A	0				<p>General Comment #5: While the Chapter correctly calls attention to the fact that populations dependent on a poorly endowed natural resource base (variable climate and marginal soils) will have the greatest difficulty in adapting to climate change, the text provides little scientific substance to back up this claim. To correct this deficiency, more information is needed on the relationships between crop yields and yield stability in semi-arid regions with highly variable climate and soil fertility problems. These studies show clearly that farmers that rely on soils of low fertility have many fewer options to deal with drought. Specific comments about this point are made below in reference to various locations in the text.</p> <p>General Comment #6: The Chapter is already outdated in its discussion of the role of biofuel production from crops and this must be addressed in the next draft.</p>	<p>Will use the new tropical crop yields graphs to make this case.</p> <p>Comment has been accepted as fair and incorporated into redraft.</p>

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						<p>Current text is clearly based on fossil fuel prices equivalent to \$30 per barrel of oil, which is no longer the case! Specific comments about this point are made in reference to the text where it is mentioned.</p> <p>General Comment #7. Box 5.6 on the role of Biotechnology is very one-sided in its optimistic notion that biotechnology can provide a "quantum leap" in food production capacity, which by inference suggests that it can overcome limitations from climate change. In fact, such views are mostly expressed by plant molecular biologists, economists, and seed company professionals while a number of highly regarded plant physiologists have a much less optimistic view of the potential for biotech solutions to impact key crop traits such as yield potential, drought tolerance, nitrogen use efficiency, and heat tolerance. I do not have these references on hand, but the authors of key papers on the subject are R. Ford and Thomas Sinclair, among others. I will send citations shortly, but there is a need to tone down the tenor of Box 5.6 and to provide coverage of the opposing viewpoint that biotech is one tool among many, and is not a silver bullet. (Kenneth Cassman, University of Nebraska)</p>	<p>Will look over Ford and Sinclair articles and decide whether or not to add.</p>
5-7	A	0				<p>General Comment #1: The following general and specific comments focus on food security, crop productivity, and farmer adaptations to climate change because these are the areas for which I am most qualified to comment.</p> <p>General Comment #2: This Chapter does not come out very clearly about the effects of climate change on global and regional food security based on new knowledge. From my view much stronger statements could be made as follows: While there is still far too much uncertainty about the net impact of climate change on global food security, new knowledge has strengthened the prognosis that food production capacity in developing countries will be reduced by climate change. The former point underscores the need for further research on global food security issues, while the latter point raises concern about alleviation of poverty and malnourishment and economic development in developing countries with large rural populations. These statements are consistent with the text and information provided in the report, and they crystallize the issues more clearly for policy makers. Moreover, the last comment in the first bullet of the Executive Summary under Food Crops and Livestock that "Medium and longer term (2050 and beyond) impacts are uniformly stressful to crop yields globally" is a very diffuse way of saying that longer-term climate change impact will likely be NEGATIVE on global food security.</p> <p>General Comment #3: The Chapter is far too optimistic about the prognosis for meeting human food needs in the coming decades--with or without climate</p>	<p>Comment now redundant or irrelevant as section has been revised.</p> <p>Comment now redundant or irrelevant as section has been revised.</p>

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						<p>change. It relies far too heavily on the projections of food supply and demand from FAO and IFPRI (as given in the IMPACT model). At the same time, it ignores biophysical evidence that actual trends in crop yields and land area devoted to the major food crops are not following these FAO and IFPRI projections. For the sake of balance, it is essential that this chapter provide a more balanced view of current trends and projections for meeting food demand that would include some of the less optimistic scenarios are indicated in the following papers: (1) Cassman, K.G., Dobermann, A., Walters, D.T., Yang, H. 2003. Meeting cereal demand while protecting natural resources and improving environmental quality. <i>Annu. Rev. Environ. Resour.</i> 28: 315-358; (2) Cassman, K.G. 1999. Ecological intensification of cereal production systems: Yield potential, soil quality, and precision agriculture. <i>Proc. National Acad. Sci. (USA)</i> 96: 5952-5959; (3) Tillman, D., Cassman, K.G., Matson, P.A., Naylor, R. and Polasky, S. 2002. Agricultural sustainability and intensive production practices. <i>Nature</i> 418: 671-677. Also see recent papers by economists Luther Tweeten and others by Vern Ruttan who both have less optimistic views than seem to pervade Chapter 5 as presently written.</p> <p>General Comment #4: There is too much emphasis given to the separate effects of increasing CO₂ on crop yields and net primary productivity, which are very positive, as opposed to the combined effects of increasing CO₂ and higher temperatures that together represent the foundation of climate change. If there is a high degree of certainty that temperatures will rise, then the length of this chapter can be greatly reduced by eliminating or reducing large sections of text that focus only on the separate effect of CO₂. For example, Boxes 5.2 (separate effect of CO₂) could easily be combined with Box 5.3 (integrated effects of temperature increase and CO₂ increase). The danger of following the current format of first discussing in great detail the separate, positive impact of increased CO₂ is that the reader is ultimately left with the feeling that climate change will be good for crop production--which is clearly not the case when the combined effects of temp and CO₂ are considered.</p> <p>(Kenneth Cassman, University of Nebraska)</p>	<p>Included now is the first cassman et al., 2003 reference in 5.4.2., in the context of studies assessing global demand vis a vis poorly endowed regions.</p> <p>Box 5.2 and 5.3 have indeed been combined. In addition, text in now replacing boxes in 5.4.1. Emphasis on co₂ alone is given only to discuss recent findings that responses in the field may be lower than previously thought.</p>
5-8	A	0				<p>The findings of chapters 3 &4 are not always reflected in the write up of Chapter-5 . For example one of the main findings in chapter-3 page-3 line 43-46 states "Climate change is one of multiple pressures on water resources..... exacerbate the situation". This finding needs to be appropriately reflected in the draft (chapter-5)</p> <p>(Subhash Chander, TERI)</p>	<p>Will coordinate with Chapter 3 and 4. Linkages to water resources and irrigation are now made in 5.4.2</p>

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5-9	A	0				<p>The Chapter is very long, with 70 pages of text and 15 pages of references. In the Chapter are utilized in excess different very long Boxes, that enlarge their volume.</p> <p>I have the impression that the text has many references and explanations related with TAR. I think that AR4 has to analyze which are the advances from TAR to AR4.</p> <p>The LAs would try to avoid the repetitions in different parts of the Chapter. Still exist many "holes " to be filled.</p> <p>It is necessary to include a list of Acronyms with the meaning of many abbreviations in the text.</p> <p>The Chapter has a valious information, but it is necessary to organize and synthesize it.</p> <p>(Cristobal Felix Diaz Morejon, Ministry of Science, Technology and the Environment)</p>	<p>Comment now redundant or irrelevant as section has been revised.</p> <p>Comment now redundant or irrelevant as section has been revised.</p> <p>Accepted.</p> <p>Will consider.</p> <p>Comment now redundant or irrelevant as section has been revised.</p>
5-10	A	0				<p>a) This chapter is 85p, almost 3 times the recommended max, so I suggest the authors consider dropping many of the introductory, sub-section paragraphs (e.g. P8 L26-29). Readers can just read the following sub-headings to get the crux of this paragraph. p9 L50-p10 L4 is largely redundant and provides little guide to what follows. p17 L5-12 Could be condensed into 1-2 sentences.</p> <p>b) Many citations in the text appear only as the authors names, or, in many cases, don't appear at all in the list of references. This makes it difficult to judge the degree of reliance on "grey literature", but there are a number of places where the authors cite this literature rather than referring to primary, peer-reviewed, scientific literature.</p> <p>There are a number of terms (weather, climate vulnerability, FACE, adaptability, resilience.....) that are used throughout. Useful to have a Glossary for the Report as a whole (if there is one I didn't find it) so these definitions aren't redefined in each chapt.</p> <p>c) chpt 5 needs a major re-organisation so that the litany of CO2 & temp effects are constantly being repeated for every possible sub-division of agric & forestry practice. The chpt struggles to answer the ? In the back of every reader's mind: "what does it all mean?". According to the authors, there seems to be nothing substantially new since TAR. No qualitatively new & potentially dominant processes have been uncovered? Progress since TAR has largely been in better quantifying the effects. I don't agree with this (partly because of some of my own work, referenced above, & also because of what I know of others' work). Maybe the authors of this chpt don't agree with this either, but this chpt, as written,</p>	<p>Addressed above.</p> <p>Will fix.</p> <p>Will include glossary is room permits.</p> <p>Will edit to make all CO2 effects appear in one section. 5.4.2, for instance, has been re-written precisely to highlight what's new since the TAR.</p>

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						<p>doesn't make that clear.</p> <p>d) This chapter still needs a lot of work. It needs to be substantially reduced in size. It is already 85p with many references missing, many more still to be added, & section 5.8.2 still undrafted. I have recommended many places where the authors could look at shortening the chpt, but I think the authors will have to do much more on their own.</p> <p>e) I have pointed to a number of places where I think the authors could produce a more comprehensive account. I did not find an insightful assessment of the state of knowledge. Rather, the chpt in its present form seems like a shopping list of almost all possible impacts. I expect the insight & added value to develop with the authors start to organise, re-sort, & prioritize their shopping list, pull out common threads in the different sections on fish, ag & forest.</p> <p>f) Chpt follows appropriate heading structure.</p> <p>g) I found no specific evaluations for the 3 time slices: 2030s, 2050s, or 2080s. (Richard Fleming, Great Lakes Forest Research Centre)</p>	<p>Addressed above.</p> <p>Addressed above.</p> <p>Comment has been accepted as fair and incorporated into redraft.</p>
5-11	A	0				<p>This Draft is a first collection of topics related to climate sensitivity, climate change impacts, and adaptation in the agricultural, forest and fishery sectors. At this stage, the quality of the text is variable, as is the level of detail in the different chapters and the style. There is great need for better harmonization.</p> <p>Several of the chapters are not sufficiently clear, and they fail to convey a clear message. Sev-eral issues are treated in a non-consistent form, e.g. the effect of elevated CO2 on crop yield and forest growth. Several times the report mentions that effects may be smaller than previ-ously expected, but at the end yield projections are made with models which fully consider a strong positive stimulation.</p> <p>The text is lengthy and could be shortened considerably. This could be achieved by simply avoiding the many overlaps (in some cases the same information appears in more than one place with exactly the same words!). Condensation of the text would be facilitated by im-proving the structure of the chapter. For instance, the separation of chapters 5.2. and 5.4 is fuzzy, which leads to repetitions, and in some cases diverging information on the same sub-ject. Assessment of the information is made difficult due to missing complete references.</p> <p>(Juerg Fuhrer, Federal AgroEcological)</p>	<p>Addressed above.</p> <p>A discussion on measured vs. simulated co2 effects has been inserted in 5.4.1.</p> <p>Comment now redundant or irrelevant as section has been revised.</p>
5-12	A	0				Rosse et al., 2004 is missing in the list of references	Done.

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						(Juerg Fuhrer, Federal AgroEcological)	
5-13	A	0				The chapter is well documented and quite comprehensive. It is a very good idea to include a section on key conclusion and their uncertainties, confidence levels and research gaps, which contribute to better understand implication for sustainable development, especially in Asia where development will be overwhelming in the next decades. However, cautions should be put on changes in trade, ie. scientific evidences or bases should be emphasized. (Savitri Garivait, The Joint Graduate School of Energy and Environment (JGSEE))	
5-14	A	0				All the acronyms and abreviation should be define and porbably not used in the exective summary (FACE, NPP, etc) I felt that many of the statement in the conclusion or in the summary were too strong when compared to the text that they come from. For instance see p 22lines 21- 34 (Sylvie Gauthier, Laurentian Forestry Center, Canadian Forestry Service)	All authors are to respond to this—findings and conclusions likely to change at LA3, but stronger case to be made for all major conclusions.
5-15	A	0				Overall the chapter is quite complete and in reasonable shape. There are still a number of repetitions which must be eliminated (e.g. problems with transfer of coffee from Africa to Asia mentioned four times; CO2 increase and salinization). A more serious problem, in my opinion, is the rather vague and sometimes anecdotal evidence provided. There is very little quantification provided of the socio-economic dimensions of vulnerability. There should be a careful screening of text to avoid too many common places. (Fischer Günther, International Institute for Applied Systems Analysis)	More quantification of socio-economic dimensions included in 5.4.2. Comment has been accepted as fair and incorporated into redraft.
5-16	A	0				This chapter still has many gaps and a poor, confusing structure with section and sub-section headings that are unclear. Many statements are not backed by recent references. This makes it difficult to review in detail. (Paula Harrison, University of Oxford)	Addressed above.
5-17	A	0				There is significant variation in the quality of content between sections which should be reduced in the editing for the 2OD. The key findings need to be closely linked to the content of the chapter. Some of these were not clear to me from having read the earlier material. Content that is not referenced to literature should be removed or fully referenced if the guidelines for writing are to be adhered to. I suggest to bring the chapter closer to the recommended length that all the sections that are (I) speculative, (II) poorly referenced, (III) text-book like and (IV) overly detailed with little of general concequence be removed. I have	Once major findings and conclusions established at LA3, will work backwards to shore up the foundation. Comment has been accepted as fair and incorporated into redraft. Comment has been accepted as fair and incorporated into redraft. Comment raises broader issues than is feasible to discuss within the limitations of space provided.

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						indicated a number of these sections in my specific points listed above. If there is nothing to say under a pre-selected heading, say nothing! The three time slices 2030 2050 and 2080 are not clearly deliniated in the presentation of the chapter. Maybe this is not possible, but some effort should perhaps be made to identify these time periods in the tables of results. (Nicholas Holden, University College Dublin)	Comment now redundant or irrelevant as section has been revised.
5-18	A	0				Comparing Chapter 5 with parts in chapters 1, 3 and 12 related to agriculture and soil water resources (have not comments about these), chapter 5 was relatively harder to read (weaker logical interrelation, too long sentences in some places) (Jüri Kadaja, Estonian Research Institute of Agriculture)	Editing should fix.
5-19	A	0				One minor comment on the title of Chapter 5: Food, Fiber, Forestry, and Fisheries. In the Chapter 5, however, the title is written as 'Food, Fiber and Forest Products', and there is no content on fisheries in some sections. For example, in sub-subsection '5.3.2 Balancing future global supply and demand in agriculture and forestry', there were only two sub-sub-subsections: '5.3.2.1 Agriculture' (page 17) and '5.3.2.2 Forestry' (page 18). They should create a sub-sub-subsection of '5.3.2.3 Fisheries'. Though we have a space limitation, some important or urgent issue which is related to environmental changes should be added somewhere. My thought on this issue is the inclusion of more comprehensive explanation in AR4 including Chapter 10. Five items are suggested: (a) Three Gorges Dam effects on terrestrial and marine ecosystems, (b) Construction of early warning system due to climate change and disaster, (c) Some beneficial effects of climate change, (d) Ecosystem-based resources management, and (e) Development on capacity building and outreach program. (Suam Kim, Pukyong National University)	Comment has been accepted as fair and incorporated into redraft See chapter 6 on this.
5-20	A	0				Drought in Bulgaria, A Contemporary Analog for Climate Change (2004; eds. C. G. Knight, I. Raev, M. P. Staneva), Aldershot, UK: Ashgate) may be useful to the authors as an example of using a contemporary period of drought to suggest concerns about plausible future climate impacts, especially on water, but in sectors including agriculture and forestry. (C. Gregory Knight, Pennsylvania State University)	Will consider.
5-21	A	0				The chapter is not very convincing as a whole. Many statements are quite vague and not well substantiated with references. The overall length is exceeding the target twofold. The structure of summerizing TAR results and then reviewing knowledge gained since TAR is not well implemented. Many recent papers are	Chapter to be restructured to shorten and focus on major findings since the TAR. Comment has been accepted as fair and

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						still missing in the review, which is also reflecting a strong bias towards US conditions, at least in the forest section. (Marcus Lindner, European Forest Institute)	incorporated into redraft.
5-22	A	0				<p>The current text on environmental consequences is extremely sparse. It needs to be supplemented by effects of climate change on C-losses/sequestration, N₂O emissions, nitrate leaching, P-losses, soil degradation (including soil erosion). Many of these secondary effects are becoming increasingly important in terms of sustainability of food production systems, resulting in governmental regulations on agricultural systems and their impacts on environment. There is also an increasing literature on the possible effects of climate change on these secondary effects, which should be reflected in this chapter.</p> <p>Section 5.1.1 describes current trends in production of food, fibre and forest products. However, this is not really followed up in the later sections in terms of what this implies in terms of climate change impacts on these trends. There are studies reported that touch upon this and these should be mentioned with reference to these trends and with reference to the respective SRES scenarios. Much of the presentation of climate change impacts mentioned in the chapter does not make specific reference to which SRES scenarios and which time slices these impacts refer to, which makes it difficult to evaluate these impacts in correspondence to the respective socio-economic scenarios, where the underlying trends in population, economic growth and technology in general will also impact greatly upon food and fibre production and demands for all these products. (Jørgen E. Olesen, Danish Institute of Agricultural Sciences)</p>	<p>Environmental effects revised to include soils and a pollution, but other stresses left for chapters 3 and 4.</p> <p>All authors: this is an excellent point and one that could help us with organization for the SOD.</p>
5-23	A	0				<p>Many of my comments for the ZOD still hold, and I will just repeat them here and in some of my other general comments. It is still a lengthy chapter (too long). Much of the text can be reduced substantially through editing out repetitions and by focusing on those issues where new knowledge has been presented since the TAR. I would also suggest to reduce the focus in the chapter on CO₂ and temperature effects on various crops, since much of this knowledge has not changed substantially since the TAR, even though new references have come out. Some of the new studies that have come out since the TAR focus on the importance of extreme events. I suggest that this is given a higher emphasis in the chapter. Extreme events include high temperature events, extended droughts, floodings etc and their effect on the food production and related services of the food production systems. A recent example (of course) is the 2003 heat wave and drought in Europe, which had large consequences for European food production and for income in agriculture, but also for other services such as soil carbon</p>	<p>Length addressed above. Discussion on CO₂ has been merged in 5.4.1 to address a) issues of measurements vs modelling, and b) highlight interactions with temperature and precip.</p> <p>More discussion of socio-economic and technological drivers alongside climate change has been included in 5.4.2. One suggested reference (ewert et al., 2005) has been included therein. Need to make a better case for what was learned about extreme events by synthesizing from</p>

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						<p>storage. There are also severe socio-economic effects of extreme events in the food, fibre and timber industry, which needs consideration.</p> <p>For the discussion of CO2 effects on crops, I would find it more useful to concentrate the chapter on the interactions of CO2 with other limiting factors in crop production, in particular water and nutrients. It would also be helpful to discuss how this interacts with management and improved technologies, such as better irrigation and improved fertilisation strategies (including low-input versus high-input systems). It would also be useful to emphasise the agreements and disagreements between experiments and modelling when it comes to CO2 and temperature effects on crops.</p> <p>The chapter contains very little information on how trends in technology (e.g. improved varieties, GMO crops, better fertilisation, improved irrigation etc) will affect food and fibre production. There are some studies showing these effects also in relation to SRES scenarios, which are crucial when evaluating impacts of climate change on food production. Important references are: Ewert, F., Rounsevell, M.D.A., Reginster, I., Metzger, M.J., Leemans, R., 2005. Future scenarios of European agricultural land use. I. Estimating changes in crop productivity. <i>Agriculture, Ecosystems and Environment</i> 107, 101-116. and: Rounsevell, M.D.A., Ewert, F., Reginster, I., Leemans, R., Carter, T.R., 2005. Future scenarios of European agricultural land use. II. Projecting changes in cropland and grassland. <i>Agriculture, Ecosystems and Environment</i> 107, 117-135. However, it is equally important to consider how improved technologies will interact with climate change and increased CO2 concentration. I am sure there must be some references out there on this issue.</p> <p>(Jørgen E. Olesen, Danish Institute of Agricultural Sciences)</p>	<p>several studies to make a few major points.</p> <p>Comment has been accepted as fair and incorporated into redraft.</p> <p>Easterling will look at Ewert et al study for possible addition to biotech box.</p> <p>Will consider.</p>
5-24	A	0				<p>This chapter is informative and presents a balanced view of the potential benefits and costs from climate change. The conclusions reported in the Executive summary are sound and well-supported. My comments relate only to instances where additional emphasis might be placed.</p> <p>(Kevin Percy, Canadian Forest Service)</p>	
5-25	A	0				<p>The general impression of chapter 5 is that it needs a lot of further work to make it in any way presentable for IPCC. The main problems are that it is disjointed in how it is written and it is clear that there have been many contributors to it. It lacks an overall focus and overview - for example animal diseases are included but plant diseases not so. There are missing sections in the index (ie 5.3.3) and there are too many vague statements of the sort that 'such and such will have an effect' without saying what the effect is. There are also many pre-2001 references</p>	<p>Focusing on what is new since the TAR is likely to fix the overall complaint.</p> <p>Comment now redundant or irrelevant as section has been revised.</p>

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						<p>cited and a predominance of N American sources for information. I suggest that a better method would have been to search international forestry, agronomy, agricultural systems, fisheries and climate change etc journals since 2001 with relevant words and then base the review on the publications that are found. This would have given a much more solid base to the work. In fact, as it stands, Chapter 5 presents little that is new post-2001 and this may be either because the authors have not found it or it does not exist and I suspect the latter. I have also restricted my comments to those topics in the chapter that fit my expertise.</p> <p>Finally, it is crucial that the impacts sections of the FAR are very solid as these are likely to be the sections that will have the highest impact when the FAR is released - so the questions that have to be asked of each part of the presented evidence are: 1) how far is an impact the consequence of climate change or some other cause? 2) is this something new ie post the TAR?</p> <p>Other general points are that information that is reported as being known with high, medium or low confidence is a bit haphazard - for example some abiotic effects are known with high confidence yet others are only known with medium confidence but there does not seem to be much reasoning behind such gradations. I strongly suggest that considerable attention is given to this part of the Chapter as the degree of certainty of impacts is one of the most important conclusions to come out of the IPCC process.</p> <p>Actually I do not think that much has really happened since the TAR in the ag and forest etc areas. I would name the effects of extreme events; more integrated modelling; less validation of models, not much increase in the range of crops covered and that adaptation and mitigation have a higher profile than impacts. I think these are the major advances since the TAR. As I say above the chapter should have been much more focussed in its process of assemble - ie find the papers post-2001 and then use them as the basis of the chapter.</p> <p>The authors have to decide whether to use an American English style or a British one - ie 'impact' is a noun and not a verb in UK English - but the authors of the whole IPCC need to take a position on this issue.</p> <p>(John R Porter, KVL)</p>	<p>Comment now redundant or irrelevant as section has been revised.</p> <p>While we obviously will need to cut the length of the chapter, we will insert reasoning behind the level of uncertainty attached to major conclusions.</p> <p>Highlighted point is very good guidance.</p> <p>Accepted.</p>
5-26	A	0				<p>Do you really mean TAR when you have references after 2001? (Goetz M Richter, Rothamsted Research)</p>	Will check and fix.
5-27	A	0				<p>This chapter gives me the impression of an early first draft: several key references are missing in the reference list; some references (eg Fisher 2002, Leff et al 2004) I was unable to track down using CABI suggesting they may be 'grey' literature or confidential reports. Perhaps serious refereeing should be undertaken when a</p>	Will fix.

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						more complete draft is available. (Kim Ritman, Bureau of Rural Sciences)	
5-28	A	0				The Chapter presents some very interesting information. Overall it needs to be organized more logically. The writing is too discursive; it needs to be much more succinct. (Cynthia Rosenzweig, NASA/Goddard Institute For Space Studies at Columbia University)	Addressed above.
5-29	A	0				A general comment- the chapter needs to be better linked to other chapters in WGII, as well as relevant information in WGI. A second general comment- the chapter seems in my view to be lacking in marine fisheries information. Some of my comments are an attempt to include fisheries material, but a more complete effort is needed. Another general comment- Another important aspect of climate change is shifts in seasonal timing, which can impact biological production and growth for populations whose migration, reproduction, etc. cycles are tightly timed to seasonal cycles. (Franklin Schwing, NOAA Fisheries Service)	A lot of this is probably handled best in Chapt. 4. Space is limited for more marine fisheries information. I have inserted a reference to chapter 18 in 5.4.2
5-30	A	0				First, I should say that I have appreciated the opportunity to look at this chapter. The comments below concentrate on the agricultural (crops-livestock) aspects (my area of expertise), rather than forestry and fish. There is a great deal of highly useful information in the chapter, and my comments below concentrate on what I perceive to be omissions and areas that could do with strengthening -- so they are meant in a spirit of being constructive, not merely carping. In general, I think the chapter needs better organisation -- there are currently pieces scattered throughout that need to be pulled together into the relevant sections. I found the chapter quite hard to read and make sense of, in places -- it does not yet "flow" (there are a few specific comments and examples below). The chapter contains more elements of a review than of an assessment -- in places, I felt that more critical synthesis is needed. Again, a few specifics follow below. The chapter as a whole treats the household and systems level rather weakly, I felt. It may well be that (for example) the global trade system is able to mitigate impacts of climate change (page 3, line 45), but in terms of focuses on R&D for development and poverty alleviation, this picture obscures enormous variation and heterogeneity that only really "surfaces" at much higher resolutions. I think more is needed in the chapter on household-level impacts and vulnerability. Again, there are great continental-level differences, and the outlook for Africa (say) is	Flow issue addressed above. Comment has been accepted as fair and incorporated into redraft.

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						very different from LAC or Asia, in general. (Philip Thornton, International Livestock Research Institute (ILRI))	
5-31	A	0				<p>Chapter “Food, Fibre and Forest Products” has been written by distinguished scientists some changes have been made in the text, following general comments on the chapter may help for further improvements.</p> <ol style="list-style-type: none"> 1. There is the need to make a uniform system of describing the impact of global climate change on food crops, forests and live stocks. Description is unceremoniously mixed and needs to be systematically grouped. 2. There is a general requirement of improvement regarding the linkages in sentences. Lot of grammatically unacceptable words have been corrected in the corrected document. 3. South Asian, European, and Australian studies published in refereed Journals, reports and books related to the impacts of elevated CO2, temperature on crops are not highlighted. 4. Current approaches like selection of responsive cultivars and other organisms, identification of genes linked with adaptations manipulation of genetic engineering for the development of such plant types and live stocks is ignored and need to be emphasized. 5. Uncertainties in various changes have been highlighted, however, their impact has been side tracked making the conclusions questionable and shaky. These needs to be carefully understood and written. 6. More emphasis has been made in general description to quantitatively increase the size of the documents. There is an overall requirement of the impact assessment analysis on crops forests and live stock productivity. 7. Repetition of the sentences and description is very much existing which reduces the quality of the document. 8. Acronyms should be spelled out at least once so that reader need not look to ATR-3 as suggested by the authors 9. References are neither given properly in the text nor in the bibliography. There are serious mistakes and required to be revisited by the authors. <p>(Dinesh Chandra Uprety, Indian Agricultural Research Institute)</p>	<p>Addressed above.</p> <p>Comment has been accepted as fair and incorporated into redraft.</p> <p>Comment considered valid but on balance it is felt due consideration has been given to the point.</p> <p>Comment raises broader issues than is feasible to discuss within the limitations of space provided.</p> <p>Addressed above.</p> <p>Comment has been accepted as fair and incorporated into redraft.</p> <p>Comment has been accepted as fair and incorporated into redraft.</p> <p>Comment has been accepted as fair and incorporated into redraft.</p>
5-32	A	0				<p>In general the chapter has a strong biophysical focus which allows for descriptions of impacts on individual species of crops etc.. The chapter however tries to move beyond the species level to farming systems and farm household. But as no clear framework is presented this remains an attempt. Suggestion is to link to the work of the FAO on farming systems (Dixon et al) to give the reader a framework to</p>	<p>Comment has been accepted as fair and incorporated into redraft.</p>

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						handle farm level adaptation strategies. (Jan Verhagen, Wageningen-UR)	
5-33	A	1	0			Two refs for consideration: Denison R.F. 2003. Darwinian agriculture: When can humans find solutions beyond the reach of natural selection? <i>The Quarterly Review of Biology</i> 78:145-168. Sinclair T.R., Purcell L.R., Sneller C.H. 2004. Crop transformation and the challenge to increase yield potential. <i>Trends in Plant Sci.</i> 2:71-75. (Kenneth Cassman, University of Nebraska)	OK – will consider.
5-34	A	1	0			Following are eleven references alluded to in the comments. Most of these are also available from my home page. Alternatively, I can mail them, if asked. 1. Goklany, IM. 1995. “Strategies to Enhance Adaptability: Technological Change, Economic Growth and Free Trade.” <i>Climatic Change</i> 30: 427-449. 2. Goklany, IM. 1998. “Saving Habitat and Conserving Biodiversity on a Crowded Planet.” <i>BioScience</i> 48 : 941-953. 3. Goklany, IM. 1999a. “The Future of the Industrial System.” Invited Paper. International Conference on Industrial Ecology and Sustainability, University of Technology of Troyes, Troyes, France, September 22-25, 1999. Also available in: D. Bourg and S. Erkman (eds). 2003. <i>Perspectives on Industrial Ecology</i> (Sheffield, UK: Greenleaf Publishing), pp. 194-222. 4. Goklany, IM. 2000. “Potential Consequences of Increasing Atmospheric CO2 Concentration Compared to Other Environmental Problems.” <i>Technology</i> 7S: 189-213. 5. Goklany, IM. 2001. <i>The Precautionary Principle: A Critical Appraisal of Environmental Risk Assessment</i> (Cato Institute, Washington, DC). 6. Goklany, IM. 2001a. <i>Economic Growth and the State of Humanity</i> . Political Economy Research Center, Policy Study 21. March 2001. 7. Goklany, IM. 2003. “Relative Contributions of Global Warming to Various Climate Sensitive Risks, and Their Implications for Adaptation and Mitigation,” <i>Energy & Environment</i> 14: 797-822. 8. Goklany, IM 2003a. “Agricultural Technology and the Precautionary Principle.” In R. Meiners and B. Yandle, eds., <i>Agricultural Policy and the Environment</i> (Lanham, MD: Rowman and Littlefield, 2003), pp. 107-133. 9. Goklany, IM. 2005. “A Climate Policy for the Short and Medium Term: Stabilization or Adaptation?” <i>Energy & Environment</i> 16: 667-680. 10. Goklany, IM. 2005a. “Is a Richer-but-warmer World Better than Poorer-but-cooler Worlds?” 25th Annual North American Conference of the US Association	Will consider.

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						for Energy Economics/International Association of Energy Economics, September 21-23, 2005. 11. Goklany, IM. 2005b. "Integrated Strategies to Reduce Vulnerability and Advance Adaptation, Mitigation, and Sustainable Development," accepted by Mitigation and Adaptation Strategies for Global Change. . (Indur Goklany, Office of Policy Analysis, Department of the Interior)	
5-35	A	1	0			There is much confusion in the chapter about two concepts. 1. productivity and production: productivity is the amount produced per unit area (ie tonnes per ha.) and is mostly the result of biophysical processes, production on the other hand is a larger scale issue (ie the wheat production of China). This is the result of many other drivers than the biophysical ones. You have to be sure whether you are mainly talking about productivity or production. 2. Enormous confusion over extreme events - they seem to be defined in two ways - one based on their frequency and the other based on their intensity. If one makes a 2x2 grid of intensity x rarity then you have have the following combinations 1. high intensity and rare; 2. low intensity and rare; 3. not rare but intense; 4. not rare and not intense. I would only classify 1 and 3 as extreme events. In some places in the chapter carbon is used as in the term 'carbon fertilisation enhancing forest growth' (p. 42, l. 45). In other places you talk about CO2. You need to be consistent and use either one or the other as it is confusing to use both. This should also apply to the whole IPCC report. (John R Porter, KVL)	There is no confusion about these terms, but will check to make sure. Interesting approach but space will preclude. Eliminated the term "fertilization" when referring to co2 impacts, in 5.4.2 and 5.4.1
5-36	A	3	0			The bullet on P.3 implies that the major response of marine fisheries to climatic change will be "selection of tolerant strains". (Cristobal Felix Diaz Morejon, Ministry of Science, Technology and the Environment)	Comment has been accepted as fair and incorporated into redraft. A new bullet will be drafted.
5-37	A	3	0	6		The relation between the important findings and the conclusions is not clear. (Jan Verhagen, Wageningen-UR)	Addressed above.
5-38	A	3	1			The "Executive Summary" section was not reviewed since CLAs reported that this is only a cut and past of the conclusions. The one page final version will be provided in the SOD (Marco Bindi, Dept. of Agronomy and Land Management)	Comment has been accepted as fair and incorporated into redraft.
5-39	A	3	5			Adverse effects are prevailing. Major benefits because of extension of agricultural land, productivity gains, lengthening of growing seasons, CO2 fertilization, etc. resulting in increase of production potential, have been understated. (Hans H.J. Labohm, Netherlands Institute of International Relations 'Clingendael')	Section rearranged. Possible benefits are added. Note that the benefits from CO2 fertilization expressed in the TAR are reconsidered towards a lower effect if any.

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5-40	A	3	7	3	11	This of course depends on the socio-economic scenario taken onboard. However, I believe that equally important to the factors mentioned, is the role of technology (also driven by socio-economics) and how the technology interacts with climate change. Technology in agriculture includes plant breeding (GMO), fertilisation, pesticides, irrigation, tillage etc. All of these technologies can be greatly improved leading to higher yields at lower costs and less labour, but the efficiency of some of them depends strongly on the climate. I miss some considerations on this in the chapter ad in the conclusions. (Jørgen E. Olesen, Danish Institute of Agricultural Sciences)	Comment raises broader issues than is feasible to discuss within the limitations of space provided.
5-41	A	3	7	3	7	Replace seen with judged or evaluated (Surinder Sagggar, Landcare Research)	Done.
5-42	A	3	11	3	11	Included the importance of traditional agriculture in South Asian countries which cannot be ignored (Dinesh Chandra Uprety, Indian Agricultural Research Institute)	
5-43	A	3	15	3	16	Although the likely adoption rate of adaptations may be uncertain, one could say the the likelihood of adoption should increase along with the magnitude of impacts. (Indur Goklany, Office of Policy Analysis, Department of the Interior)	Comment now redundant or irrelevant as section has been revised.
5-44	A	3	16	3	16	Role of genetic engineering for developing plants responsive to climate change has been included. (Dinesh Chandra Uprety, Indian Agricultural Research Institute)	
5-45	A	3	17		17	This senetence is not very clear. I suggest rewriting it to give the required meaning. Is the intended menaing the role of fibre crops in rural ecomonies? As is, the sentence implies that reserach on fibre crops, which are grown in rural areas, is lacking. I think this is not wholly true.Kindly remove the confusion. (Mohamed El Mahdi Beshir, Independent scholar and consultant)	Comment now redundant or irrelevant as section has been revised.
5-46	A	3	17			Hard to imagine why increased research on fiber crops such as jute and kenaf justifies inclusion in the executive summary. Seems to be a rather insignificant point. (Kenneth Cassman, University of Nebraska)	Comment now redundant or irrelevant as section has been revised.
5-47	A	3	18	3	19	Here is the first among many statements about the separate effect of increased CO2 on crop yields or cropping system performance. Because the impact of increased temperature often reduces or eliminates the positive impact of higher CO2, I don't believe that the Chapter should spend much time on or highlight such separate effects. Similar comments made elsewhere will simply state "CO2 x Temp interaction needs to be emphasized rather than separate CO2 effect" (Kenneth Cassman, University of Nebraska)	Comment considered valid but on balance it is felt due consideration has been given to the point.

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5-48	A	3	18	3	19	This is not very informative. Also I do believe that this is not a new finding. (Jørgen E. Olesen, Danish Institute of Agricultural Sciences)	Accepted.
5-49	A	3	20	3	22	It is evident that the current practice regarding planted forests does not involve reforestation with many of the hardwood and precious wood species which have tended to disappear from the wood markets. It would be appropriate to report on the loss of such species. In fact, as the same bullet mentions, ongoing activities are directed towards assist natural processes in restructuring forest composition, meaning that.. (Osvaldo Canziani, IPCC WG2 Co-chair)	The question of species loss is more appropriate to chapter 4 and is exported to Chapter 4.
5-50	A	3	20	3	22	Is it true that forestry is mostly using plantation? Currently? (Nicholas Holden, University College Dublin)	Plantations take ~5% of the entire area; however producing 35% of global roundwood (projected to increase to 44% by 2020).
5-51	A	3	23	3	23	Does the selection here imply natural selection or does it imply some human interventions? (Jørgen E. Olesen, Danish Institute of Agricultural Sciences)	Comment now redundant or irrelevant as section has been revised.
5-52	A	3	26			If you want to call this rather vague bullet an important finding then several other factors must be listed as well, e.g., better education, off-farm employment opportunities, risk-spreading schemes. (Fischer Günther, International Institute for Applied Systems Analysis)	Comment now redundant or irrelevant as section has been revised.
5-53	A	3	26	3	30	While in general it is right to put more stress on the capacity enhancement of small holders in the present picture for building resilience to climate change, it is equally important to bring large land holders in this capacity enhancement net. It is due to highly skewed distribution of agricultural land in these less developed economies (for instance, Pakistan), large land holders operate big chunk of the available agricultural land and provide huge surpluses of food and fibre crops for consumption to the local population. Their inability to react timely to the future climate change would quickly be translated into food insecurity. (Mudasser Muhammad, Global Change Impact Studies Centre (GCISC))	Comment now redundant or irrelevant as section has been revised.
5-54	A	3	29		30	Suggest you add the word (land) so that the sentence reads ... more secure land propoerty rights.This same concept is mentioned in chapter 9 on page 6, line 12. Here the authors chose the word inequitable land distribution. I think the word inequitable carries an element of certainty and judgement, which need not be there. The report I think should be partial. It will be useful if reference to such sensitive issues such as land tenure could be unified throughout the report. (Mohamed El Mahdi Beshir, Independent scholar and consultant)	Comment now redundant or irrelevant as section has been revised.
5-55	A	3	32			I would add that threshold temperatures for different crop processes and for a variety of major crops are known with high confidence.	Will consider.

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						(John R Porter, KVL)	
5-56	A	3	35	3	50	The more continued development of more severe natural disasters as hurricanes, earthquakes, tsunamis and others, will provoke large losses in the food crops and livestock, and severe decreases in yield and availability of products. (Cristobal Felix Diaz Morejon, Ministry of Science, Technology and the Environment)	Comment does not appear to be supported by the preponderance of literature sources consulted.
5-57	A	3	35	3	39	Almost all the third world agriculture based economies can be characterised as becoming increasingly food insecure and with a poor resource base. It would therefore be more useful to mention clearly which are those "several regions" which are under threat and when this threat is more critical (short, medium, or long term). Moreover, food insecurity might be due to low production or poor distribution. this conclusion seems to be based on production side only which is expected to be declining due to poor future yields. (Mudasser Muhammad, Global Change Impact Studies Centre (GCISC))	Comment raises broader issues than is feasible to discuss within the limitations of space provided.
5-58	A	3	38	33	39	I am not sure that there is a solid basis for "high confidence" in the claim that "Medium and longer term (2050 and beyond) impacts are uniformly stressful to crop yields globally" because it is unclear whether studies have indeed considered the full range of potential technological (and management) options that might be available in the future, particularly if, per the SRES scenarios, societies become wealthier and have greater human and social capital -- all against a backdrop of (continued) secular technological change. For example, Parry et al. (2004: 57) acknowledges that their adaptive responses are based on currently available technologies, not on technologies that would be available in the future or any technologies developed to specifically cope with the negative impacts of climate change. However, the potential for future technologies to cope with climate change is large, especially if one considers bioengineered crops (Goklany, 2003, 2001). (Indur Goklany, Office of Policy Analysis, Department of the Interior)	Will clarify our point in the revision.
5-59	A	3	38	3	39	In my terminology, stressful implies a negative impact. However, I certainly do not believe that crop yields are going to be negatively impacted uniformly on a global scale, even (or especially) beyond 2050. Also, I cannot recall any literature describing this. This sentence should be rephrased. (Jørgen E. Olesen, Danish Institute of Agricultural Sciences)	Disagree.
5-60	A	3	40	3	45	The 'high confidence' conclusion that "more economic equilibrium analyses with explicit account of trade, show that inter-regional and international trade generally mitigate impacts of climate change" needs justification, as well as some re-writing for clarity. Also, is the use of the word 'mitigate' correct here? My understanding	Comment has been accepted as fair and incorporated into redraft.

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						was that in the IPCC context, it is used to refer to mitigation of warming through various carbon sequestration options. My first thoughts reading this statement is that whether or not a country facing reduction in food supplies can make up any deficit by increased trade depends on the relative purchasing power of the affected countries and on whether its GNP is dependent on exports of climate-affected primary produce (in which case it will suffer a 'double whammy' of decreased production and decreased. This is evident in the case of West African countries such as Mauritania and Senegal, where climate change could negatively affect both domestic grain production, necessitating greater imports, and the production of the main revenue-generating export - fish and international fishing agreements. In these cases, this adaptation through increased trade seems unlikely. Pierre Failler, at CEMARE, Portsmouth, is working on these issues and may be worth contacting. His work remains in the 'grey' literature for now, but I understand he has intentions to publish it in 'Food Policy' (Edward Allison, University of East Anglia)	
5-61	A	3	40		45	Inter-regional and international trade could mitigate impacts of climate change. It seems to me that there is an assumption here. It would be useful to state the assumption. I am inclined to think that mitigation could take place under healthy economies of the tropical countries which would permit them to import food commodities. Should third world economies continue to have poor economies, climate change could possibly be cause of political instability as hunger prevails. Regional and international security issues could then result. (Mohamed El Mahdi Beshir, Independent scholar and consultant)	Comment raises broader issues than is feasible to discuss within the limitations of space provided.
5-62	A	3	40	3	45	I suggest to add from the temperate countries to tropical countries, AND A SMALLER FLOW OF TROPICAL FRUITS, VEGETABLES AND RAW MATERIALS IN THE CONTRARY WAY. (Cristobal Felix Diaz Morejon, Ministry of Science, Technology and the Environment)	Will consider.
5-63	A	3	40			Recommend modifying the start of the first sentence as follows: "In keeping with recent trends, international agricultural trade flows..." (Indur Goklany, Office of Policy Analysis, Department of the Interior)	Comment now redundant or irrelevant as section has been revised.
5-64	A	3	40			International agricultural trade flows are expected to rise substantially in the next decades due to demographic and socio-economic trends (even in the absence of further trade liberalization). The impacts of climate change will lead to additional increases in flows of temperate products ... (Fischer Günther, International Institute for Applied Systems Analysis)	Comment has been accepted as fair and incorporated into redraft.
5-65	A	3	41	3	43	Does climate change here also include the impacts of CO2 itself on crops. If so,	Done.

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						this should be stated explicitly. (Jørgen E. Olesen, Danish Institute of Agricultural Sciences)	
5-66	A	3	43			Tropical and subtropical (Mahi Tabet-Aoul, Association pour la Recherche pour le climat et l'environnement (ARCE))	Disagree.
5-67	A	3	44			Mitigate is used in a confusing way - mitigation can be used to mean measures that reduce the levels of GHGs in the atmosphere. Is it a good idea to use it with the meaning of 'reducing the impacts of' climate change. I think this can be confusing. (John R Porter, KVL)	Comment now redundant or irrelevant as section has been revised.
5-68	A	3	46	3	47	"CO2 x Temp interaction needs to be emphasized rather than separate CO2 effect" (Kenneth Cassman, University of Nebraska)	Comment now redundant or irrelevant as section has been revised.
5-69	A	4	1	4	3	species life history will be critical, rising background levels of tropospheric ozone and increasing cloudiness (lowered max PAR) will also be limiting factors to maximizing the CO2 fertilization effect as has been shown since TAR in FACE experiments and summarized in state of science reviews (supporting references given later) (Kevin Percy, Canadian Forest Service)	Comment now redundant or irrelevant as section has been revised.
5-70	A	4	2	4	2	To add - In the fields many factors such as soils and water QUANTITY AND quality; pests..... (Cristobal Felix Diaz Morejon, Ministry of Science, Technology and the Environment)	Disagree.
5-71	A	4	2	4	3	I agree that many factors influence CO2 effects in experimental settings. But this will not always lead to reductions. There will also be cases where it may lead to increased gains, because the control may be more severely affected by the limiting factors than the increased CO2 treatment. (Jørgen E. Olesen, Danish Institute of Agricultural Sciences)	Agree, but don't know supporting publications.
5-72	A	4	3	4	4	I do not agree that pest and disease interactions with crops under climate change is known with high - or even medium - confidence. If the assertion on p.4 is correct then there should be a corresponding body of research on this issue in the chapter and there ain't. (John R Porter, KVL)	Comment has been accepted as fair and incorporated into redraft.
5-73	A	4	4	4	4	"Elevated CO2 levels will alter food quality to grazers..." It may be useful to indicate whether these alterations are deemed beneficial or not in terms of digestibility and food conversion efficiency. (Edward Allison, University of East Anglia)	Comment raises broader issues than is feasible to discuss within the limitations of space provided.
5-74	A	4	4	4	6	I do not understand the concept of scale here (fine and coarse). The fine-scale	Comment now redundant or irrelevant as

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						seems to be associate with nutrient contents of crops, where as the coarse-scale is associated with differences between crop types. This is not at all the same thing and thus very difficult to attach to a concept of scale. (Jørgen E. Olesen, Danish Institute of Agricultural Sciences)	section has been revised.
5-75	A	4	4	4	6	Quality changes are known with high confidence on p4 ln 4-6 but with medium confidence on p5 ln 13-17. (John R Porter, KVL)	Comment has been accepted as fair and incorporated into redraft.
5-76	A	4	6	4	6	Needs a table showing +and- responsive effects from the existing literature. (Dinesh Chandra Uprety, Indian Agricultural Research Institute)	Disagree.
5-77	A	4	10	4	10	Sentence reconstructed (Dinesh Chandra Uprety, Indian Agricultural Research Institute)	OK
5-78	A	4	12			How confident can one be that variability will increase? There should be a statement regarding the level of confidence in that outcome, as opposed to a statement that if variability increases then we have confidence that effects will be greater. (Indur Goklany, Office of Policy Analysis, Department of the Interior)	Comment does not appear to be supported by the preponderance of literature sources consulted.
5-79	A	4	16	4	18	To add heat stress to livestock, THE NEGATIVE EFFECTS OVER THE GRASSLAND AND THEW RISING OF DROUGHTS MORE PROLONGATED (Cristobal Felix Diaz Morejon, Ministry of Science, Technology and the Environment)	Not sure what is meant here.
5-80	A	4	18			... to suffer losses through water scarcity and heat stress to livestock; (Fischer Günther, International Institute for Applied Systems Analysis)	Will consider.
5-81	A	4	20	4	24	moderate temperature increase is likely to positively affect global forest growig stock volume, should be followed by decreased rainfall does not result in water stress to become limitation. (Shirong Liu, Institute of Forest Ecology, Environment and Protection, Chinese Academy of Forestry)	Agree – section changed.
5-82	A	4	20	4	25	It is proposed to include also impacts from extreme weather events (draught, storm) as well as diseases as this is also relevant in many regions. (Klaus Radunsky, Umweltbundesamt GmbH)	Agree – section changed.
5-83	A	4	20	4	25	It is noted that no information of impacts on forestry for the period up to 2100 is provided although such long time periods are relevant e.g. for boreal forests. (Klaus Radunsky, Umweltbundesamt GmbH)	
5-84	A	4	21	4	24	This statement does not take into account the possible interaction with other factors such as N limitation or disturbance regime change that may limit the potential growth increase predicted by the change of temperature only.	Agree – section changed.

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Chapter-Comment	Batch	From Page	From Line	To Page	To line	Comments	Notes of the writing team
						(Kenneth Cassman, University of Nebraska)	
5-85	A	4	21	5	24	making forests to a global carbon sink under these conditions. (Reinhold Glauner, Inst. for World Forestry)	More relevant for WG3 Chapter 12.
5-86	A	4	21	4	24	This is an example of the vagueness that pervades many of the statements in the Chapter. To say that forest species composition and productivity are 'altered' by climate change says nothing useful. This is because climate change is a suite of changes (GHG level, T, water and nutrient levels) and thus what is known needs to be stated more incisively. This applies to many statements in the Chapter. Be more positive when you know things and state clearly when you do not. It is vital that the Executive Summary is consistent and completely defensible as this may be the only part that some people read. You need to make sure that later statements of confidence levels in the Chapter are consistent with those stated in the Executive Summary. (John R Porter, KVL)	This point might have been poorly worded, indeed, as the reviewers tend to misread it. I agree that there are many factors that need to be included, but this section is for HIGH CONFIDENCE. Section changed.
5-87	A	4	22	4	24	Appears to contradict p5 L20-22 (Richard Fleming, Great Lakes Forest Research Centre)	I see no contradiction (p4 discusses T increase; p5 – CO2 enrichment), but I changed both sections to improve the style..
5-88	A	4	23	4	25	However I find the bullet on important findings (P.4 l.23-25) to be unconnected to the general text and, in fact, to be completely at odds with the main points. (Apart from grammatical errors) (David Price, Northern Forestry Centre)	Disagree. See previous. Not having a privilege of being a native English speaker, I can't evaluate the grammar-related remark.
5-89	A	4	25			but the intensification of the forest fires due to heat waves can be a limiting factor of this growth (Mahi Tabet-Aoul, Association pour la Recherche pour le climat et l'environnement (ARCE))	The section is adjusted.
5-90	A	4	26	4	39	To add this point: THE INCREASING OF TEMPERATURE IN SEAWATERS WILL AFFECT THE COLONIES OF CORAL REEFS IN TROPICAL REGIONS, SPECIALLY IN THE ISLANDS, WHERE THE FISH, SHRIMPS, LOBSTERS, MOLLUSCS AND OTHERS HAVE THEIR HABITATS, DECREASING THE FISHERIES AND POSSIBILITIES OF CAPTURE (Cristobal Felix Diaz Morejon, Ministry of Science, Technology and the Environment)	Comment has been accepted as fair and incorporated into redraft.
5-91	A	4	27	4	28	No compelling evidence' - a recent paper in 'Nature' proposed that the Persian Gulf's fisheries would increase under climate change due to increased upwelling-induced productivity, driven by projected increases in monsoon winds over the region. I don't have the paper to hand, but can find it if required. (Edward Allison, University of East Anglia)	Will make clear that there are regional gains as well as losses.

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5-92	A	4	27	4	28	The significant implication – absent in the bullet – is that overall production may neither increase or decrease (P.4 I.27-28), but local or regional fisheries for particular species may be adversely (or positively) affected. Of course freshwater fisheries and aquaculture that are geographically constrained will be more affected, as pointed out in the main text. My impression is that trying to squeeze all the fish text into three lines has misrepresented the message about fisheries. There need to be 2-3 bullets on fisheries (John Steele, Woods Hole Oceanographic Institution)	Comment has been accepted as fair and incorporated into redraft. “and fisheries” has been added to a number of general points, where appropriate.
5-93	A	4	32	4	35	But the main conclusion (P.4 I.32-35) is that “fish distributions have rapid poleward shifts” that can cause changes in production of these species at their northern and southern boundaries (In other words, instead of species having to adapt to the temperature change in situ, as terrestrial plants may do, these species can change their geographic location). (John Steele, Woods Hole Oceanographic Institution)	Yes.
5-94	A	4	32			The increasing occurrence of the heat waves will induce a greater occurrence of forest fires, particularly in the arid and semi arid regions. (Mahi Tabet-Aoul, Association pour la Recherche pour le climat et l'environnement (ARCE))	Comment does not appear to be supported by the preponderance of literature sources consulted.
5-95	A	4	36	4	39	The first sentence implies that these local extinctions are due to climate change. How much confidence can be ascribed to this, considering all the other non-CC activities that affect these fish, e.g, water diversion, dam building, overfishing, etc.? (Indur Goklany, Office of Policy Analysis, Department of the Interior)	This is the attribution problem. Will alter 2 nd sentence to include other activities.
5-96	A	4	37	4	39	consider changing the sentence "Fishing impacts...exploitation rates" to "Fishing impacts are particularly harmful where, climate induced decline in productivity occurs without corresponding reduction in exploitation rates" Human influences on biological systems intensify these impacts" (Subhash Chander, TERI)	Comment has been accepted as fair and incorporated into redraft.
5-97	A	4	44	5	49	The impacts of temperature extremes and increased mean temperature are different, the mean temperature is good, and the temperature extreme is harmful. (Xie Liyong, Insititute of Agro-Environment and Sustainable Development)	Comment does not appear to be supported by the preponderance of literature sources consulted.
5-98	A	5	2	5	4	The chapter is slightly optimistic about the extent to which intensive farming systems have management flexibility. The relationships here should not be assumed. (Emma Archer, University of the Witwatersrand)	Comment considered valid but on balance it is felt due consideration has been given to the point.
5-99	A	5	5	5	9	Do these studies consider the increases in water use efficiency of crops under	Yes.

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						higher CO2 conditions and changes in crops and crop management that would reduce agricultural water demand? (Indur Goklany, Office of Policy Analysis, Department of the Interior)	
5-100	A	5	5	5	9	Elevated CO2 should increase water use efficiency. This should be taking into consideration. (Xie Liyong, Insitute of Agro-Environment and Sustainable Development)	Discussed in 5.4.1 yet mainly a TAR issue.
5-101	A	5	5	5	9	Though this statement seems valid, It would be useful to mention when reduction in water availability is most probably be a crucial bottlenect (in shor term or medium or long term) and for which regions. As far as South Asia is concerned it is expected that water availability might be increasing in the short run due to enhanced snow and ice melting (deglaciation) while it would be decreasing in the long run. (Mudasser Muhammad, Global Change Impact Studies Centre (GCISC))	Included details in 5.4.2.
5-102	A	5	5	5	17	I think that the irrigation impacts of climate change are known with high and not medium confidence as increased population pressure and competing demands for water from the industrial, household and tourist sectors increase. You need to mention that elevated CO2 improves WUE in mainly C3 crops. (John R Porter, KVL)	Included in 5.4.2. Yet irrigation impacts are not known with high confidence, given that the underlining projected socio-economic trends are somewhat uncertain.
5-103	A	5	8			It is better to say “water demand would decrease, etc” (Osvaldo Canziani, IPCC WG2 Co-chair)	Comment now redundant or irrelevant as section has been revised.
5-104	A	5	8			In a few regions, water demand may decrease, partly as a result of managment changes taking advantage of the possibility to shift crop calendars within the extended thermal growing seasons. (Fischer Günther, International Institute for Applied Systems Analysis)	Comment has been accepted as fair and incorporated into redraft.
5-105	A	5	11			Sentence is unclear; some words are missing. (Fischer Günther, International Institute for Applied Systems Analysis)	OK.
5-106	A	5	13	5	16	“Grain protein” may be reduced by CO2, but soybean seed protein was not significantly affected by elevated CO2 (Heagle et al., 1998). Suggest revising sentence to read: “. . . nutrient quality of some food grown under elevated CO2 Grain protein, but not legume seed protein, was reduced under elevated CO2” (Fitzgerald Booker, USDA-ARS Plant Science Research Unit)	Comment now redundant or irrelevant as section has been revised.
5-107	A	5	13	5	14	It is not clear what is meant by nutrients here. Usually nutrients imply various minerals. However, nutrients in this context must imply much more (including carbohydrates, proteins etc.). This needs to be more explicitly mentioned. (Jørgen E. Olesen, Danish Institute of Agricultural Sciences)	Comment now redundant or irrelevant as section has been revised.
5-108	A	5	20	5	22	This sentence is somewhat in contradiction with the sentence on page 4 line 21-	Will resolve.

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						24; please reconcile (Sylvie Gauthier, Laurentian Forestry Center, Canadian Forestry Service)	
5-109	A	5	20	5	31	those statements should be linked together. NPP may not increase so much due to CO2 fertilization when N limitation are considered . The change of insect, if it results in more frequent and severe damage, may also limit that potential increase in productivity. If forest is replaced by grasslands, I have trouble to think that overall the global wood supply will increase (Mudasser Muhammad, Global Change Impact Studies Centre (GCISC))	Changed. Limits are now discussed in 5.4.1
5-110	A	5	20	5	22	the authors here and later in the text have not taken into consideration key findings from the largest FACE, Aspen FACE; some 40 papers have been published since 1998 when exposure to 1.4X ambient ozone and 550 ppm CO2 was initiated with ecosystem scale communities of North America's most widely (26 M ha) tree species trembling aspen (5 genotypes), paper birch and sugar maple; summary papers provide a synthesis of the work (Nature 2002 420: 403-407; Functional Ecology 2003 17:289-314; and Plant Cell and Environment 2005 28:965-981). Ozone is predicted to occur at damaging levels (Water Air and Soil Pollution 1999 116: 5-32; Plant Cell and Environment as previously cited) over much of the world's forest in the future and the messages from co-exposure at Aspen FACE are clear on the potential of ozone to offset or negate the benefits from rising CO2 (Kevin Percy, Canadian Forest Service)	Included. In revision. Comment considered valid but on balance it is felt due consideration has been given to the point.
5-111	A	5	23			This sentence could be phrased better. (Cynthia Rosenzweig, NASA/Goddard Institute For Space Studies at Columbia University)	Will change.
5-112	A	5	26	5	31	A better balance between the two bullets included in these lines suggests to say would instead of will, in both cases, in line 26. (Osvaldo Canziani, IPCC WG2 Co-chair)	Agree.
5-113	A	5	26			Check comment regarding nature of species changes later in the document. Such changes are likely to be saltatory and related to disturbance events. (Norman Christensen, Duke University)	Corrected.
5-114	A	5	26			".... Will be replaced by ecosystems? better" (Richard Fleming, Great Lakes Forest Research Centre)	Replaced.
5-115	A	5	26	5	28	Especially in areas where natural (broadleaf) species forest has been replaced by plantation-like (conifer) forests, this might lead to undesired die-backs. (Reinhold Glauner, Inst. for World Forestry)	Reorganized.
5-116	A	5	26	5	27	[1] Modify line 26 as follows: "The composition of many forests will change as many tree species, unable to adjust to warming, will be replaced by species	Done.

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						better..." [2] Insert "will over time" after "species" on line 28. (Indur Goklany, Office of Policy Analysis, Department of the Interior)	
5-117	A	5	26			Is this across all regions? See other comment. (Cynthia Rosenzweig, NASA/Goddard Institute For Space Studies at Columbia University)	Comment now redundant or irrelevant as section has been revised.
5-118	A	5	27	5	28	At the tree line, soils will often not be ready to accept tree establishment when climate first gets warm enough (Richard Fleming, Great Lakes Forest Research Centre)	Done.
5-119	A	5	29			Again, in line 29 use would instead of will. (Osvaldo Canziani, IPCC WG2 Co-chair)	To tech editors.
5-120	A	5	30	5	31	Demand may increase due to economic development in developing world (e.g. China) & property destruction due to weather extremes (Richard Fleming, Great Lakes Forest Research Centre)	The sentence is revised.
5-121	A	5	34		37	SSAP households have already responded to cycles of drought in Sudan since the 1984 famine. Changes had been introduced in herd composition to suit the available grazing. Some nomads chose to settle when they have been left with numbers of livestock not economical for the nomadic mode of production. You have given examples to show that livelihoods in the drylands are adaptations to variability of climate. Perhaps you could allude to this in the executive summary for the benefit of such readers as politicians or decision-makers. More recent adaptations and resilience data was presented by Zaki-Eldeen, S and Hanafi, A.(2004) from the community-based rangeland rehabilitation for carbon sequestration at Gireigikh rural council in Sudan. The Gireigikh project(SUD/93/G31UNDP/GEF) was designed specifically to promote adaptation and mitigation actions through biodiversity conservation. Natural resource management actions such as revegetation of degraded or vulnerable lands together with the promotion of sustainable agricultural practices are seen as important components of an adaptation strategy. (Mohamed El Mahdi Beshir, Independent scholar and consultant)	Comment considered valid but on balance it is felt due consideration has been given to the point.
5-122	A	5	35			What is governance-related vulnerability? (Hans H.J. Labohm, Netherlands Institute of International Relations 'Clingendael')	Will define.
5-123	A	5	38	5	41	This part says everything and nothing and needs to be sharpened. Also how can something that suffers 'hard to predict' impacts be included in the medium confidence section - seems more appropriate in the low level category. (John R Porter, KVL)	Comment now redundant or irrelevant as section has been revised.
5-124	A	5	41			Snow-pack decrease will cause negative impacts only in very specific regions, e.g. Himalayas, northwest China, etc. A more general limitation will be enhanced	OK.

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						overall or seasonal water scarcity. (Fischer Günther, International Institute for Applied Systems Analysis)	
5-125	A	5	42	5	44	This statement is rather too deterministic - i.e. 'WILL accelerate land degradation and endanger biodiversity' (Emma Archer, University of the Witwatersrand)	Comment now redundant or irrelevant as section has been revised
5-126	A	5	49	5	50	This statement in the Executive Summary is a good example of the "optimistic bias" of this chapter with regard to the impact of climate change on food security. If there is a low confidence on the impact of climate change of agricultural production potential, why not simply say that current understanding does not allow reliable projections about the impact of climate change on food production-- which from my view should be one of the first bullets given in the executive summary. Note also that this bullet does not seem consistent with the earlier bullet that "Medium and longer term (2050 and beyond) impacts are uniformly stressful to crop yields globally". (Kenneth Cassman, University of Nebraska)	The tone will be adjusted, but we stand by our assessment of the state of production potential – we do know something!
5-127	A	5	49	5	50	But in china, the crops production will decrease without CO2 fertilization. (Xie Liyong, Insitute of Agro-Environment and Sustainable Development)	Comment now redundant or irrelevant as section has been revised
5-128	A	5	49	5	50	An almost ignored theme in the report is the effect of combinations of gases - such as raised atmospheric O3 plus CO2 - on crops. See papers by Ewert et al and others In the European Journal of Agronomy. Climate change is more than just elevated CO2 as this chapter seems to think. (John R Porter, KVL)	Revision emphasizes multiple stresses.
5-129	A	6	3	6	6	Most crops (maize wheat rice) should be also included. (Xie Liyong, Insitute of Agro-Environment and Sustainable Development)	OK.
5-130	A	6	3	6	6	If long-term experiments have just concluded that plantation tree crops show declines ... why is this known with low confidence?? What is the basis for your evaluation of the confidence level of conclusions? (John R Porter, KVL)	Will provide foundation.
5-131	A	6	5		5	It would be helpful to explain the meaning of down-regulation. (Mohamed El Mahdi Beshir, Independent scholar and consultant)	OK.
5-132	A	6	5			What is down-regulation. (Hans H.J. Labohm, Netherlands Institute of International Relations 'Clingendael')	OK.
5-133	A	6	5	6	5	Avoid or define jargon terms like 'down regulation'. There are many such terms in the chapter. (John R Porter, KVL)	OK.
5-134	A	6	5			Following on from point above, is this really a conclusion and what does it mean by 'down regulation'.	OK.

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Chapter-Comment	Batch	From Page	From Line	To Page	To line	Comments	Notes of the writing team
						(Kim Ritman, Bureau of Rural Sciences)	
5-135	A	6	9	6	10	Increased fire risk is considered low confidence. I would disagree with this . See the notes below - numbers 4 &6 (Mike Flannigan, Canadian Forest Service)	Changed.
5-136	A	6	9	6	10	Also interaction with insects (e.g. spruce budworm in N.A. boreal (forest). See Fleming, R.A., J-N. Candau, & R.S McAlpine, 2002. Landscape-scale analysis of interactions between insect defoliation and forest fire in central Canada. Cliamte Change 55 (1): 251-272. (Richard Fleming, Great Lakes Forest Research Centre)	Changed.
5-137	A	6	9	6	10	May be this statement should be more balanced, as increase temperature does not necessarily means altered precipitation. Studies such as Bergeron et al. 2001 (CJFR) and Lefort et al. 2003 (Forest science) tend to suggest that although temperature is increasing the precipitation regime may become less conducive to fire. So variability in the change will also occur (Sylvie Gauthier, Laurentian Forestry Center, Canadian Forestry Service)	Changed.
5-138	A	6	9	6	9	Altered precipitation extremes should be omitted as it does not indicate a clear meaning, or replaced by decreased rainfall will increase fire risk. (Shirong Liu, Institute of Forest Ecology, Environment and Protection, Chinese Academy of Forestry)	Changed.
5-139	A	6	10			cancel the word 'commercial' (Reinhold Glauner, Inst. for World Forestry)	Done.
5-140	A	6	12	6	16	The reason given for freshwater fisheries greater sensitivity seems unlikely - geographic discreteness. It might be more useful to stress that many of the most productive freshwater fisheries are dependent on either floodplains or on shallow lakes, where small changes in rainfall and evapotranspiration can lead to drying out (e.g. Lake Chad, the inland Niger delta and similar 'wetlands in drylands'). There is a considerable body of work on these wetlands, and others in Africa (summarised in Talling and Lemoalle's book in 1998 or 1999?) and in a more recent FAO book. See also Sarch, Birkett and Neiland, as well as work on Bangladesh by Halls and Welcomme. (Edward Allison, University of East Anglia)	Comment has been accepted as fair and incorporated into redraft. Will include extra refs.
5-141	A	6	15			But will it increase local fish stocks elsewhere? (Hans H.J. Labohm, Netherlands Institute of International Relations 'Clingendael')	Yes, will mention range expansion. (Brander)
5-142	A	6	19			General comments on section 5.1: The section is rather fine, even if more references should be added to support the information reported, and some sub-sections should be completed in SOD (Marco Bindi, Dept. of Agronomy and Land Management)	

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5-143	A	6	19			Section 5.1. This would be clearer if it included only a summary of knowledge in the TAR and section 5.1.1 which describes current trends in non-climate factors was moved to section 5.2. Section 5.1.2 is not really necessary, so could be summarised in a short paragraph after line 26 on page 6 to decrease the length of the chapter. (Paula Harrison, University of Oxford)	Comment has been accepted as fair and incorporated into redraft. (Brander)
5-144	A	6	22	6	26	Remove. Title of section 5.1 suggests this section should only summarise where TAR left us. It should not be summarising progress since TAR. (Richard Fleming, Great Lakes Forest Research Centre)	Comment now redundant or irrelevant as section has been revised.
5-145	A	6	22	6	22	At this point and many throughout the term variation or variability is used. I feel its use is ambiguous unless clearly defined. Does it refer to variation in space or time or both? Sometimes I get the sense that it refers to unpredictability and other times to climate change. (Nicholas Holden, University College Dublin)	Will clarify.
5-146	A	6	22	7	3	This is not true with south Asian studies (Dinesh Chandra Uprety, Indian Agricultural Research Institute)	Will reconsider.
5-147	A	6	29			Section 5.1.1. You might mention that agriculture is the largest global employer and is even more important for humans than simply primary production if you consider that it forms the basis of the food industry (processing, supply, retail). (John R Porter, KVL)	Comment considered valid but on balance it is felt due consideration has been given to the point.
5-148	A	6	29			Section 5.1.1, there are other figures that estimate numbers of poor livestock keepers that may be useful here (Thornton et al (2003). Livestock and poverty maps for research and development targeting in the developing world. Land Use Policy 20, 311-322) (Philip Thornton, International Livestock Research Institute (ILRI))	Comment considered valid but on balance it is felt due consideration has been given to the point.
5-149	A	6	31	6	39	Clarify if all the numbers reported in this paragraph come from the same reference FAO, 2001 or from different references. (Marco Bindi, Dept. of Agronomy and Land Management)	Comment now redundant or irrelevant as section has been revised.
5-150	A	6	31			"Ice-free" all year or any part of the year - needs a definition. (Richard Fleming, Great Lakes Forest Research Centre)	Disagree.
5-151	A	6	31		34	Using FAO data, total land excluding Antarctica and Greenland is about 13.2 B ha. Taking (as suggested) 35% of this, the land managed for agriculture should be 4.6 B ha. Cultivated land accounts for 1.5 - 1.6 B ha; hence, using these figures would result in 3.1 B ha for managed pastures. While uncertainties and discrepancies in various land estimates have been pointed out many times, the consistency of values presented in this paragraph needs to be improved! (Fischer Günther, International Institute for Applied Systems Analysis)	Comment has been accepted as fair and incorporated into redraft.

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5-152	A	6	31		34	The quoted area for pastures (4.5 B ha) is not well established. The world total of permanent pastures listed in FAOSTAT for year 2000 is 3.475 B ha and I would argue that not even all of this is 'managed'. Similarly, I question the number given for 'managed' forest (200 M ha), which appears too low given that FAOSTAT industrial roundwood production in 2000 is about 1 B m3. (Fischer Günther, International Institute for Applied Systems Analysis)	Comment has been accepted as fair and incorporated into redraft.
5-153	A	6	31	6	50	be consistent with abbreviations of million (Mha) and billion (Bha) hectares; Lubchenco (20??) incomplete, see also citations (Goetz M Richter, Rothamsted Research)	Done.
5-154	A	6	31	6	34	The percent and aerial data is confusing. If 10% = 1.5 billion ha, then 25% should =3.75 billion ha (not 4.5 B ha). Similarly 30% should be 4.5 B ha not 3.9. These values need to be corrected and matched with the values reported in other chapters. (Surinder Saggar, Landcare Research)	Done.
5-155	A	6	32	6	34	This chapter summarizes key findings of TAR. While observations related to climate and CO2 effects are summarized in a clear and condensed way, statements about methods and uncertainty are much more general. This information could be shortened and more directly related to the scientific findings. What was concluded, by which method and what is the source of uncertainty. Specific points: - Units should be used consistently. E.g. pg 6/lines 32-34: once it is B ha and then bil-lion ha (likewise for million or M) (Juerg Fuhrer, Federal AgroEcological)	Done. Done.
5-156	A	6	32	5	33	There must be something wrong with the area figures here. If 25% of for pastures corresponds to 4.5 B ha, how can 30% for forest correspond to a lower figure (3.9 B ha)? (Jørgen E. Olesen, Danish Institute of Agricultural Sciences)	Done.
5-157	A	6	33			The area of managed forest is too small. Canada's "managed" forest covers about 200 M km2. Is that a problem of definition? (Pierre Bernier, Natural Resources Canada)	Definition changed.
5-158	A	6	33	6	34	Define "managed for forestry". In Canada, some forest receives fire protection only - no insect control, no fertilisation, thinning etc. (Richard Fleming, Great Lakes Forest Research Centre)	Definition changed.
5-159	A	6	34			Latin America is a developing region, having the world largest percentage of urban population (See Chapters 13 and 7). So, the sentence after the bracket should better read: "In some developing countries nearly 70 %, etc" (Osvaldo Canziani, IPCC WG2 Co-chair)	OK.

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Chapter-Comment	Batch	From Page	From Line	To Page	To line	Comments	Notes of the writing team
5-160	A	6	34	6	34	To change the expression - "In developing countries nearly of 70% of people live in rural areas by " IN MANY DEVELOPING COUNTRIES, SPECIALLY IN ASIA AND AFRICA REGIONS, MORE AND LESS 60% OF PEOPLE LIVE IN RURAL AREAS "(because in Latin America and the Caribbean the proportion of people living in rural areas was in 2003 year of 23%, and in the Middle East and North Africa 41%(reference: The World Bank Group, 2005 - "World Development Indicators 2005 ", Environment, Table 3.10 Urbanization http://www.worldbank.org/data/wdi2005/wditext/Table3_10.htm (Cristobal Felix Diaz Morejon, Ministry of Science, Technology and the Environment)	OK.
5-161	A	6	38			cancel the word 'managed' (Reinhold Glauner, Inst. for World Forestry)	Disagree.
5-162	A	6	41	6	48	Clarify the sources of the reported numbers (only form FAO, 2001 ?) (Marco Bindi, Dept. of Agronomy and Land Management)	Done.
5-163	A	6	41	6	50	Remove. Put any necessary points in sub-section 5.1.3. (Richard Fleming, Great Lakes Forest Research Centre)	Disagree.
5-164	A	6	42	6	45	This statement does not leave room for alternative hypotheses about why the rate of growth in food production is slowing, and again reinforces the optimistic bias. For the major food crops such as rice, wheat, and maize, another reason that the rate production is slowing is because: (1) there has been no increase in the genetic yield ceiling for rice and maize for more than 30 years, which means that average farm yields are approaching this genetic yield ceiling in many of the most productive cereal growing areas (at least for rice), (2) land area devoted to all cereal crops has been decreasing at about 2 million ha per year since 1980, and (3) that new land that can be placed into crop production is of poorer quality than the large amount of higher quality arable land that is being lost to urbanization/industrialization. Note how this latter point connects with the capacity to respond to climate change, if an increasing proportion of global agriculture is practiced on marginal land. Citations for the above points include: (i) Young, A. 1999. Is there really spare land for agriculture? Environment, Development, Sustainability 1:3-18; (ii) Tillman, D., Cassman, K.G., Matson, P.A., Naylor, R. and Polasky, S. 2002. Agricultural sustainability and intensive production practices. Nature 418: 671-677, (iii) Cassman, K.G., Dobermann, A., Walters, D.T., Yang, H. 2003. Meeting cereal demand while protecting natural resources and improving environmental quality. Annu. Rev. Environ. Resour. 28: 315-358; (iv) Duvick, D.N. and K.G. Cassman. 1999. Post-green-revolution trends in yield potential of temperate maize in the north-central United States.	Comment now redundant or irrelevant as section has been revised, although a balance of views on future productivity trends and associated resource use will be inserted.

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						Crop Sci. 39:1622-1630; (v) Peng, S., K.G. Cassman, S.S. Virmani, J. Sheehy, and G.S. Khush. 1999. Yield potential trends of tropical rice since the release of IR8 and the challenge of increasing rice yield potential. Crop Sci. 39:1552-1559. (Kenneth Cassman, University of Nebraska)	
5-165	A	6	42	6	44	Surely this is a slowing in the rate of demand increase rather than a decrease in demand (Jo Hossell, ADAS)	Comment now redundant or irrelevant as section has been revised.
5-166	A	6	45			To what degree is undernourishment a problem of food distribution rather than food production? (Richard Fleming, Great Lakes Forest Research Centre)	Comment raises broader issues than is feasible to discuss within the limitations of space provided.
5-167	A	6	46			the net global change in forest area between 1990 and 2000 was estimated as -9.4 million hectares per year: the sum of -14.6 million hectares of deforestation and 5.2 million hectares of gain in forest cover. The global change (-0.22 percent per year) represents an area about the size of Portugal. The estimated net loss of forests for the 1990s as a whole was 94 million hectares – an area larger than Venezuela. (FAO FRA 200) (Reinhold Glauner, Inst. for World Forestry)	Changed.
5-168	A	6	48	6	48	No change in % fisheries over-fished since 1997? Get current reference. (Richard Fleming, Great Lakes Forest Research Centre)	Comment has been accepted as fair and incorporated into redraft.
5-169	A	6	48	6	49	This is not a good source. A more reliable and up to date reference is FAO 2005: The State of World Fisheries and Aquaculture 2004. FAO, Rome. According to this, "...it is estimated that in 2003 about one quarter of the stocks monitored were unexploited or moderately exploited (...). About half the stocks (52 per cent) were fully exploited (...) and approximately one quarter were overexploited, depleted, or recovering from depletion" (page 32). (Alf Håkon Hoel, University of Tromsø)	Comment has been accepted as fair and incorporated into redraft.
5-170	A	6	49	6	49	Vitousek's 1997 reference is out of date - FAO have published much more recent reviews of the state of fish stocks - e.g. see work by Serge Garcia, or in the 'SOFIA' reports (Edward Allison, University of East Anglia)	Comment has been accepted as fair and incorporated into redraft.
5-171	A	7	1	7	3	This statement is confusingly written; and should be rewritten. (Emma Archer, University of the Witwatersrand)	Comment now redundant or irrelevant as section has been revised.
5-172	A	7	1			It is suggested to change the verb "to force" by "to take advantage of". Then the sentence should read: "are used to take advantage of models to estimate variables which would lead to certain assumed/foreseen impacts" (Osvaldo Canziani, IPCC WG2 Co-chair)	Done.

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5-173	A	7	6		33	I would find it more logical to move this after the Summary of findings of TAR. I was first confused to what this scope chapter referred. Placing it after the TAR summary it would be possible to express better how the focus has shifted and knowledge evolved. (Marcus Lindner, European Forest Institute)	Disagree.
5-174	A	7	6			Section 5.1.2, the last two major questions to be addressed do not get much treatment in the chapter, in my view (distributional differences, and variability impacts). (Philip Thornton, International Livestock Research Institute (ILRI))	Comment has been accepted as fair and incorporated into redraft.
5-175	A	7	7	7	8	The sentence in these two lines would be better located at the end of line 3. This statement indicates from the start, the limitation of the mock data obtained from models and, for the last section of this chapter (section 5.8.2), provides support for the urgent need to have observational data. (Osvaldo Canziani, IPCC WG2 Co-chair)	Comment now redundant or irrelevant as section has been revised.
5-176	A	7	9	7	21	Remove. Only repeats main headings in 'Contents' on p 1-2. (Richard Fleming, Great Lakes Forest Research Centre)	Not sure what is meant.
5-177	A	7	14	7	17	What is the difference between the two types of adaptation? Another example of jargon. (John R Porter, KVL)	Comment has been accepted as fair and incorporated into redraft.
5-178	A	7	22	7	33	Please be sure that these major questions are addressed in chapter 5. (John R Porter, KVL)	OK.
5-179	A	7	23	7	24	Why answering only for cropping/managed forest? Also fisheries and agricultural crops are sensitive to current climate variability (Marco Bindi, Dept. of Agronomy and Land Management)	True and is mentioned in text.
5-180	A	7	28	7	33	What does this mean? What is the "global situation" "from" which things can differ? (Nicholas Holden, University College Dublin)	Comment now redundant or irrelevant as section has been revised.
5-181	A	7	41			agriculture/food crops/food crops and livestock the categories are confusing. It seems that agriculture is a container which is not well defined. (Jan Verhagen, Wageningen-UR)	Will better define in introduction.
5-182	A	7	43	7	43	But elevated CO2 will shift current photosynthetic optima towards higher temperature. (Page 3, L 50) (Xie Liyong, Institute of Agro-Environment and Sustainable Development)	Disagree.
5-183	A	7	46	7	48	But the result from china is somewhat different to this. (Xie Liyong, Institute of Agro-Environment and Sustainable Development)	Not sure how to respond.
5-184	A	7	49		49	It would be helpful to explain the meaning of regional resource endowments. It would be more helpful if an example is cited.	Comment considered valid but on balance it is felt due consideration has been given to the

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						(Mohamed El Mahdi Beshir, Independent scholar and consultant)	point.
5-185	A	7	49			Insert "more" after "are" and before "likely" (Norman Christensen, Duke University)	OK.
5-186	A	7	49	7	49	"regional resource endowments" is jargon and ambiguous (Nicholas Holden, University College Dublin)	Disagree.
5-187	A	7	49	7	49	What the hell is a 'greater regional resource endowment'? (John R Porter, KVL)	Seems self-explanatory to us.
5-188	A	8	0	9		To suggest that the two types models (5.1.4.2 and 5.1.4.3) should be successes in agriculture meteorology study only when they are conjunct. (Xie Liyong, Insitute of Agro-Environment and Sustainable Development)	We do not understand.
5-189	A	8	0			the role of the section on Methods and uncertainty is not clear. How uncertainty is related to methods is not worked out. Suggest to described uncertainty ranges as adopted by the IPCC and try to link it to the various methodologies. Provide some critical comments on the limitations of upscaling detailed (physiological) models and experiments. (Jan Verhagen, Wageningen-UR)	Comment now redundant or irrelevant as section has been revised.
5-190	A	8	3			FACE experiments figure prominently in this report. They have some useful things to say about the effects of increasing GHGs on some aspects of forest biology. However, they also have some severe limitations which have been almost entirely glossed over in this chapter, at least as far as forestry is concerned. Their duration is often too short to be certain that observed effects are persistent and not just transient. This short duration also excludes the effects of processes (e.g. natural selection) which develop slowly but often incrementally over time. Their spatial scale is too limited to observe large scale effects. Temperature, at least in the forest FACE experiments, is not controlled so the experiments do not, in fact simulate future climate change environments in which both climate and GHG concentrations change simultaneously. (Richard Fleming, Great Lakes Forest Research Centre)	Are discussed in 5.4.1.
5-191	A	8	3	8	6	This statement should be combined with Page 5, Line 20-22 (Xie Liyong, Insitute of Agro-Environment and Sustainable Development)	Comment now redundant or irrelevant as section has been revised.
5-192	A	8	3	8	21	Sentence reconstructed for clarity (Dinesh Chandra Uprety, Indian Agricultural Research Institute)	
5-193	A	8	6	8	6	Moreover Liebig's Law-of-Minimum states that the factor in minimum determines growth and carrying capacity. In many forests stands it is N that determines growth and not factors like temperature or rainfall. (Reinhold Glauner, Inst. for World Forestry)	Comment raises broader issues than is feasible to discuss within the limitations of space provided.
5-194	A	8	7	8	8	Much work shows this sensitivity of boreal forests to CC is because of fire &	OK.

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						insect disturbances. See work by Mike Apps. (Richard Fleming, Great Lakes Forest Research Centre)	
5-195	A	8	9	8	11	The discussion of market trends is confusing because the general trend is that markets are flat or increasing only at the margins (Norman Christensen, Duke University)	Comment now redundant or irrelevant as section has been revised.
5-196	A	8	14	8	14	delete "will" and insert "may" (Alf Håkon Hoel, University of Tromsø)	OK.
5-197	A	8	21	8	21	aren't there positive effects as well, such as enhanced growth of fish farmed in cold waters? (Alf Håkon Hoel, University of Tromsø)	Comment has been accepted as fair and incorporated into redraft.
5-198	A	8	22	8	22	Include a bullet point on the species richness. (Surinder Sagggar, Landcare Research)	Comment raises broader issues than is feasible to discuss within the limitations of space provided.
5-199	A	8	24			Section 5.1.4. Are these methods and uncertainty from the TAR or FAR? (John R Porter, KVL)	Are of general relevance.
5-200	A	8	28	8	28	The "social-scientific research" is not mentioned in the following sections unlike the other issues listed before (Nicholas Holden, University College Dublin)	Comment now redundant or irrelevant as section has been revised.
5-201	A	8	32	8	46	Many publications are available narating the adaptation statergy for plants to meet the global climate changes (Dinesh Chandra Uprety, Indian Agricultural Research Institute)	OK.
5-202	A	8	33	8	33	"necessary" - I don't think so. There are other proven ways to advance. "Useful" is more appropriate. (Richard Fleming, Great Lakes Forest Research Centre)	Will consider.
5-203	A	8	33			Section 5.1.4.1 should mention different results between models and experiments for same crop as cited in p25 ln 10 (Jo Hossell, ADAS)	Comment now redundant or irrelevant as section has been revised.
5-204	A	8	33	8	46	All of the questions mentioned here are important to experimentation study; they are worthy of paying more attention. (Xie Liyong, Insititute of Agro-Environment and Sustainable Development)	Comment now redundant or irrelevant as section has been revised.
5-205	A	8	34	8	46	Terminology and treatment methods could be clarified. Instead of "In situ manipulative experiments," I suggest: "Experiments utilizing field chambers apply climate change factors to small land areas (ca. 7 m2 per chamber). Larger areas (ca. 700 m2 per ring) can be treated with elevated CO2 by adopting free-air methods (e.g. Free Air Carbon Dioxide Enrichment, FACE), although some MiniFACE systems encompass smaller areas (ca. 3 m2). While I agree that most recent experiments strive to achieve field-like conditions, FACE technology does	This section was greatly condensed to save space – no details of this level can be discussed.

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						not supplant the utility of open-top and other types of field chambers. Each technology has advantages and disadvantages. For example, ambient air pollutant effects are present in FACE systems whereas some open-top chamber systems utilize charcoal-filtered air (clean air) in control treatments, thus improving the ability to evaluate individual environmental effects more clearly. Variability in gas concentrations is reduced in chambers compared with FACE systems, although sunlight, boundary layer conductances and temperature in chambers may be altered from ambient conditions while this is less of a factor in FACE systems. I encourage a balanced evaluation of elevated CO ₂ treatment methods that recognizes that while none completely simulate future climate conditions, the general tendencies in plant responses are similar among methodologies used in field experiments (Kimball et al., 1997; Long et al., 2004). The sentence about key factors that remain understudied should include mention of air pollutants, mainly tropospheric ozone (Fiscus et al., 2005). In addition, we have combined various factors involved in global change (CO ₂ , ozone, and N availability) in experiments with cotton (Heagle et al., 1999), which may deserve mention alongside a reference to an arid grassland system (e.g., Shaw et al. 2003). Otherwise, the points made in this section adequately summarize the situation. (Fitzgerald Booker, USDA-ARS Plant Science Research Unit)	
5-206	A	8	37	8	37	Add reference after (e.g. Free Air) (Marco Bindi, Dept. of Agronomy and Land Management)	OK.
5-207	A	8	37			Something is missing at the end of this line. (Paul J. Hanson, Oak Ridge National Laboratory)	Comment now redundant or irrelevant as section has been revised.
5-208	A	8	42	8	42	The reference Shaw et al, 2003 was not reported in the list of references (Marco Bindi, Dept. of Agronomy and Land Management)	Done.
5-209	A	8	46	8	46	Add a reference at the end of the sentence (Marco Bindi, Dept. of Agronomy and Land Management)	Will consider.
5-210	A	8	50	9	14	These models provide way to make use of large scale survey data in a GIS context in a holistic approach (e.g. Candau, J-N & R A Fleming 2005 Landscape scale spatial distribution of spruce budworm defoliation in relation to bioclimatic conditions. Can. J. For. Res. 35: 2218-2232). (Richard Fleming, Great Lakes Forest Research Centre)	Comment now redundant or irrelevant as section has been revised.
5-211	A	9	0			Subchapter 5.1.4.4. This paragraph seems out of place. (Juerg Fuhrer, Federal AgroEcological)	Comment now redundant or irrelevant as section has been revised.
5-212	A	9	7	9	9	Out of context (Dinesh Chandra Uprety, Indian Agricultural Research Institute)	Comment now redundant or irrelevant as section has been revised.
5-213	A	9	9	9	14	See Hogg and Bernier 2005 (Forestry Chronicle 81: 675-682) for an example of	Comment now redundant or irrelevant as

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						an application of a simple climate index to the analysis of potential shift in the southern limit of forests at the prairie-forest interface in Canada. (Pierre Bernier, Natural Resources Canada)	section has been revised.
5-214	A	9	9		14	The AEZ methodology developed by FAO and IIASA (Fischer et al., 2000a) provides various agro-climatic indicators specifically used for agricultural resource appraisals and crop suitability assessments. These indicators were calculated both for current climate and several future SRES-based climates projected by GCMs (e.g., changes in length of growing period discussed in Fischer et al., 2000b).[Fischer, G., van Velthuizen, H., Shah, M., and Nachtergaele, F.O., 2002a. Global Agro-ecological Assessment for Agriculture in the 21st Century: Methodology and Results. Research Report RR-02-02. ISBN 3-7045-0141-7. International Institute for Applied Systems Analysis, Laxenburg, Austria. pp 119 + CD-ROM. Fischer, G., Shah, M., and van Velthuizen, H., 2002b. Climate Change and Agricultural Vulnerability, Special Report as contribution to the World Summit on Sustainable Development, Johannesburg 2002. International Institute for Applied Systems Analysis, Laxenburg, Austria. pp 152.]. (Fischer Günther, International Institute for Applied Systems Analysis)	Comment is a welcome suggestion but there is not the space to discuss individual projects in the revision.
5-215	A	9	11	9	14	This section is rather out of place - is this one particular example ? (Emma Archer, University of the Witwatersrand)	Comment now redundant or irrelevant as section has been revised.
5-216	A	9	11		13	Holden ... sentence not important. I suggest to delete it. (Marcus Lindner, European Forest Institute)	Not sure which one.
5-217	A	9	11	9	14	Out of context and needs to be deleted (Dinesh Chandra Uprety, Indian Agricultural Research Institute)	Comment now redundant or irrelevant as section has been revised.
5-218	A	9	13			What are examples of complex ecosystems? For which systems can the indices mentioned above be used, and where are the problems? The authors should be more specific. (Juerg Fuhrer, Federal AgroEcological)	Comment now redundant or irrelevant as section has been revised.
5-219	A	9	16			General comment on section 5.1.4.3: Add some references of the physiological models used in climate change analyses (Marco Bindi, Dept. of Agronomy and Land Management)	Comment now redundant or irrelevant as section has been revised.
5-220	A	9	16			Retitle: physiological modelling is a subset of process modelling which includes predator/prey dynamics in ecological food web models, for example. (Richard Fleming, Great Lakes Forest Research Centre)	Comment now redundant or irrelevant as section has been revised.
5-221	A	9	16			Section 5.1.4.3. The end of this section would be easier to read as sentences backed by references, rather than bullets. (Paula Harrison, University of Oxford)	Comment has been accepted as fair and incorporated into redraft.

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5-222	A	9	16	9	32	Some references would be nice here. The sequence of papers by Holden and Brereton discuss a number of these issues as do others (Nicholas Holden, University College Dublin)	Comment has been accepted as fair and incorporated into redraft.
5-223	A	9	16			Section 5.1.4.3. This section is full of jargon - eg. Critical-variable-process relations etc. The points with models are that they have generally captured the main effects, they have suggested areas of research (the importance of extreme events being a good example) and they are now being used at more regional scales. (John R Porter, KVL)	Comment has been accepted as fair and incorporated into redraft.
5-224	A	9	18	9	32	A discussion of completed model intercomparison studies could be included in this section. For example: VEMAP Members. 1995. Vegetation/ecosystem modeling and analysis project: comparing biogeography and biogeochemistry models in a continental-scale study of terrestrial ecosystem responses to climate change and CO2 doubling. <i>Global Biogeochemical Cycles</i> 9:407-437. Ryan, M.G., E.R. Hunt Jr., R.E. McMurtrie, G.I. Ågren, J.D. Aber, A.D. Friend, E.B. Rastetter, W.M. Pulliam, R.J. Raison, and S. Linder. 1996a. Comparing models of ecosystem function for temperate conifer forests. I. Model description and validation, pp. 313-362 in A.I. Breymeyer, D.O. Hall, J.M. Melillo, and G.I. Agren, editors. <i>Global Change: Effects on coniferous forests and grasslands</i> , John Wiley & Sons, New York. Ryan, M.G., R.E. McMurtrie, G.I. Ågren, E.R. Hunt Jr., J.D. Aber, A.D. Friend, E.B. Rastetter, and W.M. Pulliam. 1996b. Comparing models of ecosystem function for temperate conifer forests. II. Simulation of the effect of climate change, pp. 363-387. in A.I. Breymeyer, D.O. Hall, J.M. Melillo, and G.I. Agren, editors. <i>Global Change: Effects on coniferous forests and grasslands</i> , John Wiley & Sons, New York. Amthor, J.S., J.M. Chen, J.S. Clein, S.E. Froking, M.L. Goulden, R.F. Grant, J.S. Kimball, A.W. King, A.D. McGuire, N.T. Nikolov, C.S. Potter, S. Wang, and S.C. Wofsy. 2001. Boreal forest CO2 exchange and evapotranspiration predicted by nine ecosystem process models: intermodel comparisons and relationships to field measurements. <i>Journal of Geophysical Research</i> 106: 33,623-33,648. Hanson PJ, Amthor JS, Wullschleger SD, Wilson KB, Grant RF, Hartley A, Hui D, Hunt ER Jr., Johnson DW, Kimball JS, King AW, Luo Y, McNulty SG, Sun G., Thornton PE, Wang S, Williams M, Baldocchi DD, Cushman RM (2004) Oak forest carbon and water simulations: model intercomparisons and evaluations against independent data. <i>Ecological Monographs</i> 74(3):443-489.	Comment raises broader issues than is feasible to discuss within the limitations of space provided.

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						(Paul J. Hanson, Oak Ridge National Laboratory)	
5-225	A	9	21	9	24	Physiological modelling and biotechnological approaches needs to be included (Dinesh Chandra Uprety, Indian Agricultural Research Institute)	Comment now redundant or irrelevant as section has been revised.
5-226	A	9	24	9	32	One uncertainty not mentioned is: High sensitivity of crop models to variables (i.e., precipitation) that are poorly simulated by climate models: Takle, E. S., and Z. Pan, 2003: Climate Change and Crop Production: Challenges to Modeling Future Scenarios. In Lal, R., J. Duxbury, B. A. Stewart, and D. O. Hansen, 2003; ed., Climate Change and Global Food Security. Marcel Dekker. (Eugene Takle, Iowa State University)	Comment now redundant or irrelevant as section has been revised.
5-227	A	9	24	9	45	Uncertainties give less confidence on the data base resulting shakiness of conclusions It is nessary to explain uncertainties and their impacts on the productivity of crops, forests and livestock (Dinesh Chandra Uprety, Indian Agricultural Research Institute)	Comment has been accepted as fair and incorporated into redraft.
5-228	A	9	25	9	32	Uncertainties also form from error propagation & enhancement. Turning effectively converts process model into a stat model by 'fudging' parameter values to ensure fit of overall patterns. This often results in compensating errors in different model components which may not longer compensate in novel (e.g. CC) environments (Fleming, R.A, and Shoemaker, C.A.S, 1992. Evaluating models for spruce budworm-forest management: Comparing output with regional field data. Ecological Applications 2(4): 460-477). (Richard Fleming, Great Lakes Forest Research Centre)	Comment has been accepted as fair and incorporated into redraft.
5-229	A	9	30	9	32	Suggest adding "effects of air pollutants" to the list . (Fitzgerald Booker, USDA-ARS Plant Science Research Unit)	Comment has been accepted as fair and incorporated into redraft.
5-230	A	9	33			Omitted structural modelling ~ typically, but not exclusively performed with simple analytic models. Typically, the parameters of analytic models of simplified ecosystems are allowed to change in direction that might be expected under climate change. The modeller studies how this change affects the presistence/stability of the model ecosystem. This approach is the best at revealing how non-linear interactions might lead to ecosystem re-structuring (as might happen along ecotones) under climate change. Examples used for climate change and forest insects are Antonovsky, M.Y., R.A.Fleming, Y.A.Kuznetsov, and W.C.Clark, 1990. Forest-pest interaction dynamics: the simplest mathematical models. Theor. Popul. Biol. 37: 343-367 and Fleming, R.A. 1996. A mechanistic perspective e of possible influences of climate change on defoliating insects in North America's boreal forests. Silva Fennica 30: 281-294. (Richard Fleming, Great Lakes Forest Research Centre)	Comment now redundant or irrelevant as section has been revised.
5-231	A	9	34			Section 5.1.4.4 "characterizing uncertainty": this section was not reviewed since it	OK.

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						will be introduced in the SOD (Marco Bindi, Dept. of Agronomy and Land Management)	
5-232	A	9	34	9	44	Comment on Section 5.1.4.4. As a viewer I don't have a good idea as to how the different confidence levels were arrived at. And frankly I don't have the time to sort through all the details. Accordingly I would recommend that there be a statement that the confidence levels are based on the collective judgement of the CLAs and lead authors and not necessarily of anyone else, nor does it represent a consensus view of the scientific community." Finally, I note that as a reviewer, since I do not know exactly how the levels were arrived in each case, I certainly can't endorse them lock, stock and barrel. (Indur Goklany, Office of Policy Analysis, Department of the Interior)	Comment has been accepted as fair and incorporated into redraft.
5-233	A	9	36	9	44	chpt 5 p9 L36-44 ~ This pgh, or something like it, belongs in intro to whole report, not in each chapter. Remove. Specific uncertainties for this chpt go in 5.8. (Richard Fleming, Great Lakes Forest Research Centre)	What is pgh?
5-234	A	9	38	9	44	Can this paragraph be omitted? I am not sure what it adds (Nicholas Holden, University College Dublin)	Comment now redundant or irrelevant as section has been revised.
5-235	A	9	47	9	48	This title is overlong & rather confusing (Emma Archer, University of the Witwatersrand)	OK.
5-236	A	9	47			General comments on section 5.2: This section should reduced in length removing descriptive illustrations of different aspects (climate variability, extreme events, multiple stress, etc.) that are well known and are more adapt for a book than for an IPCC report. Only examples of current sensitivity and vulnerability should reported in this section like those reported in Box 5.1 (Marco Bindi, Dept. of Agronomy and Land Management)	Accepted.
5-237	A	9	47	9	48	Long, awkward section title. (Richard Fleming, Great Lakes Forest Research Centre)	OK.
5-238	A	9	47			Section 5.2. Rename heading as Current sensitivity/vulnerability then have subsection 5.2.1 on Climatic factors and trends and 5.2.2 on Non-climatic factors and trends? This section is generally weak on post 1999 references. (Paula Harrison, University of Oxford)	Accepted.
5-239	A	9	50	15	42	Same as first pont. The term variability is ambiguous. The distinction between short-term variability leading to risk management and long-term variability leading to adaptation is not clearly made. Spatial and temporal issues are also unclear (Nicholas Holden, University College Dublin)	Will clarify.
5-240	A	9	50	10	4	Is this necessary here as it only refers to climate variability and not to degradation	Comment now redundant or irrelevant as

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Chapter-Comment	Batch	From Page	From Line	To Page	To line	Comments	Notes of the writing team
						of resources or loss of biodiversity which are also included in section 5.2 (Jo Hossell, ADAS)	section has been revised.
5-241	A	9	50			There are two critical factors to establish models. One is basic data, the another is input data. Otherwise, any models are not being trusted. (Xie Liyong, Insititute of Agro-Environment and Sustainable Development)	Disagree.
5-242	A	9				Chapter 5.2 This chapter on current sensitivity/vulnerability is a mix of a selection of very different issues, of which each is very complicated and the short overviews are not providing sufficiently clear messages. Moreover, there is no clear separation of climate and climate variability. In this chapter, emphasis should be on climate variability, incl. extremes. (Juerg Fuhrer, Federal AgroEcological)	Comment has been accepted as fair and incorporated into redraft.
5-243	A	10	0			Extreme events are handled from a biophysical perspective. Possible structural damage to buildings, crops etc is not included. Also the social aspects are not included later you move to farming systems/povert and households. The link between the social and biophysical context in agriculture has to be made clear from the beginning. (Jan Verhagen, Wageningen-UR)	Comment has been accepted as fair and incorporated into redraft.
5-244	A	10	1	10	3	The two sentences embedded in these lines are correct; however they refer to climate variability. The planning for sustainable development also requires – already at this stage in its development –for this chapter to produce some information on the potential effects of the possible new climate system, or better new regional climate systems. This referencing would enable a simpler approach to adaptation strategies calling for (as is mentioned below, in respect of certain crops) planning for re-zoning of crops. (Osvaldo Canziani, IPCC WG2 Co-chair)	Comment has been accepted as fair and incorporated into redraft.
5-245	A	10	1	10	3	"Threatening human influences on biological systems such as habitat conversion, overexploitation and pollution intensify these impacts" This requires to be introduced between the sentence ending with "in the literature' and the sentence starting with 'Production systems.." The reference for this finding is;" Walther,G.R.,2003: Plants in a warmer world. Perspectives in plant Ecology, Evolution and Systematics(Urban & Fischer Verlag),Vol.6/3,169-185". (Subhash Chander, TERI)	Thank you.
5-246	A	10	1	10	5	This implies that forestry is in the same league as crops... I think very little has been done to actively mitigate impacts of climate variability in forests. Or can you provide a reference to support this statement? To some extent this is because trees may not be as sensitive. It is also because breeding trees for a trait such as drought tolerance takes time.	Will look into this further.

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						(David Price, Northern Forestry Centre)	
5-247	A	10	2	10	2	Add reference after "..... literature" (Marco Bindi, Dept. of Agronomy and Land Management)	OK.
5-248	A	10	9	10	18	Again, this paragraph is rather bitty and confusingly written. (Emma Archer, University of the Witwatersrand)	Comment now redundant or irrelevant as section has been revised.
5-249	A	10	9			Climate on an hourly time scale? (Richard Fleming, Great Lakes Forest Research Centre)	Comment now redundant or irrelevant as section has been revised.
5-250	A	10	9			..., seasonal and hourly distribution ... This sounds odd; why not mention monthly or daily, or simply refer to a range of relevant temporal scales. (Fischer Günther, International Institute for Applied Systems Analysis)	Comment now redundant or irrelevant as section has been revised.
5-251	A	10	11	10	50	Corrections are made in the corrected manuscript (Dinesh Chandra Uprety, Indian Agricultural Research Institute)	OK.
5-252	A	10	14			There are two critical factors to establish models. One is basic data, the another is input data. Otherwise, any models are not being trusted. (Xie Liyong, Insitute of Agro-Environment and Sustainable Development)	OK.
5-253	A	10	17	10	18	Cross referencing to Chapters 3, 4 and regional chapters is suggested (Osvaldo Canziani, IPCC WG2 Co-chair)	Done.
5-254	A	10	20			5.2.1.1 Not a very useful chapter! Again, what is the key message? How important are cultivar differences? The chapter should address yield rather than photosynthesis. In crops, photosynthesis is not directly related to yield. (Juerg Fuhrer, Federal AgroEcological)	Comment has been accepted as fair and incorporated into redraft.
5-255	A	10	20			5.2.1.1 It should be clarified that extreme events can be defined in a statistical sense (as mentioned), but also on the basis of impacts (e.g. exceedance of ecological thresholds). (Juerg Fuhrer, Federal AgroEcological)	Comment has been accepted as fair and incorporated into redraft.
5-256	A	10	20			Section 5.2.1.1. Much of this section is a repeat from other sections and needs to be trimmed. It is surprising that the the main extreme event drivers such El Nino or the NAO are not included. There has been a series of analyses since 2001 on the correlation of effects of these systems with African maize yields etc (Nature). The NAO has been analysed for its effects on wheat quality (Kettlewell et al.) (John R Porter, KVL)	Revision greatly condenses and focuses on <u>current</u> climate.
5-257	A	10	22	10	36	I suggest to include in lines 26-27: cyclones and hurricanes, tsunamis, earthquakes (Cristobal Felix Diaz Morejon, Ministry of Science, Technology and the Environment)	Comment raises broader issues than is feasible to discuss within the limitations of space provided.
5-258	A	10	22	10	25	omit? (Paula Harrison, University of Oxford)	Disagree.
5-259	A	10	22	10	25	I know this is referenced, and I am not a meteorologist, but this definition of	Comment now redundant or irrelevant as

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						extreme event is counter-intuitive (Nicholas Holden, University College Dublin)	section has been revised.
5-260	A	10	23		25	Very undefined concept for extreme climate event. Does it be better to define this concept statistically? E.g. as deviation more than two standard deviations from mean value. Reference 'IPCC, 2001b' does not exist in the references list. (Jüri Kadaja, Estonian Research Institute of Agriculture)	Comment now redundant or irrelevant as section has been revised.
5-261	A	10	26			Change to "Extreme events relevant to agriculture, forestry and fisheries include:..." (Paula Harrison, University of Oxford)	Comment now redundant or irrelevant as section has been revised.
5-262	A	10	26			Do not include : after a verb. (Cynthia Rosenzweig, NASA/Goddard Institute For Space Studies at Columbia University)	Comment has been accepted as fair and incorporated into redraft.
5-263	A	10	27			wildfire is not an extreme weather event, although it strongly interacts with extreme weather conditions. (Pierre Bernier, Natural Resources Canada)	Comment has been accepted as fair and incorporated into redraft.
5-264	A	10	27	10	29	Introduce "Changes in climate variability at annual and decadal scales under the influence of climate change are still uncertain. It is not clear yet whether, the strong droughts and floods related to ENSO will intensify with climate change.between the sentences starting with "Both frequency... and The importance of extreme events". (Subhash Chander, TERI)	Comment now redundant or irrelevant as section has been revised.
5-265	A	10	27			Strictly speaking, a wildfire is not an extreme climatic event but the possible impact of an extreme climatic event. (Fischer Günther, International Institute for Applied Systems Analysis)	Good point! Done.
5-266	A	10	28	10	29	If it is well-established, why are there no references listed? (Paula Harrison, University of Oxford)	Comment has been accepted as fair and incorporated into redraft.
5-267	A	10	29	10	32	Add references at the end of the two sentences (Marco Bindi, Dept. of Agronomy and Land Management)	Comment has been accepted as fair and incorporated into redraft.
5-268	A	10	29			The importance of extreme events and climate thresholds for crop production is well established. The thresholds for specific crops, unfortunately, are not so well established and are extremely hard to find in the literature. A consolidated database of these would be highly valuable. (Fischer Günther, International Institute for Applied Systems Analysis)	Comment has been accepted as fair and incorporated into redraft.
5-269	A	10	32			Is 2005 a reference? (Juerg Fuhrer, Federal AgroEcological)	Comment has been accepted as fair and incorporated into redraft.
5-270	A	10	32			author missing on 2005 reference (Paula Harrison, University of Oxford)	OK.

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5-271	A	10	32			Reference??? (Marcus Lindner, European Forest Institute)	Comment has been accepted as fair and incorporated into redraft.
5-272	A	10	35	10	36	See the work of Fleming, R.A., J.N. Candau and R.S. McAlpine, 2002. (Landscape-scale analysis of interactions between insect defoliation and forest fire in Central Canada. Climatic Change 55: 251-272) on fire-insect interactions. (Pierre Bernier, Natural Resources Canada)	Added Harrington et al.
5-273	A	10	36			Possible REF which applies to both agric & forestry = Harrington, R, RA Fleming, and IP Woiwod 2001. Climate change impacts on insect management and conservation in temperate regions: can they be predicted? Agricultural and Forest Entomology 3(4): 233-240. (Richard Fleming, Great Lakes Forest Research Centre)	Added.
5-274	A	10	38			Section 5.2.1.2. Some temperature responses of plants are linear such as developmental responses. Figure 5.1 shows no clear response except for Greenland and the N sea. No data for the Irish sea are presented as far sa can be seen. The points are in generally in a cloud. The latitudinal distribution of crops is as likely to be a result of photoperiod response as much as temperature and climate. An important point is that there seem to be absolute and not relative threshold temperature responses for annual crops (see Porter and Gawith 1999, EJA). Perennial crops can be influenced by previous temperature regimens. (John R Porter, KVL)	Comment has been accepted as fair and incorporated into redraft.
5-275	A	10	38			should "plant-climate" be organism-climate", based on the text that follows? (Franklin Schwing, NOAA Fisheries Service)	Comment now redundant or irrelevant as section has been revised.
5-276	A	10	40	11	5	This entire section is rather out of place - it is not sufficiently linked into the rest of the chapter. (Emma Archer, University of the Witwatersrand)	Comment now redundant or irrelevant as section has been revised.
5-277	A	10	42	10	46	Why is this material present if this section is on plant-climate thresholds (as stated in the title) ? (Emma Archer, University of the Witwatersrand)	Comment now redundant or irrelevant as section has been revised.
5-278	A	10	44	11	31	Much of the information provided in this section relies on the Fisher et al 2002 citation. However, no information is provided in the reference list about how to access this publication, and it is not clear if this is a refereed scientific publication or, instead, part of the "grey" literature. The guidelines we received said the IPCC chapters would attempt to utilize refereed literature in preference to grey literature. (Kenneth Cassman, University of Nebraska)	Comment now redundant or irrelevant as section has been revised.
5-279	A	10	44			... Fischer et al., 2002a ... [Fischer, G., van Velthuisen, H., Shah, M., and Nachtergaele, F.O., 2002. Global Agro-ecological Assessment for Agriculture in	Comment now redundant or irrelevant as section has been revised.

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Chapter-Comment	Batch	From Page	From Line	To Page	To line	Comments	Notes of the writing team
						the 21st Century: Methodology and Results. Research Report RR-02-02. ISBN 3-7045-0141-7. International Institute for Applied Systems Analysis, Laxenburg, Austria. pp 119 + CD-ROM.] (Fischer Günther, International Institute for Applied Systems Analysis)	
5-280	A	10	45	10	50	This section is really awkward. Not sure how to interpret phrases like "clear envelopes" (Norman Christensen, Duke University)	Comment now redundant or irrelevant as section has been revised.
5-281	A	10	46			Remove "variability". (Richard Fleming, Great Lakes Forest Research Centre)	Comment now redundant or irrelevant as section has been revised.
5-282	A	11	0	12		The argument that production had to keep pace with demand and productivity increase also resulted in land saving for nature is lacking. ref. Wood, D. and Lenné J.M., 2005. 'Received wisdom' in agriculture land use policy: 10 years on from Rio. Land use Policy. Volume 22, Issue 2, Pages 129-144 (Jan Verhagen, Wageningen-UR)	Comment now redundant or irrelevant as section has been revised.
5-283	A	11	1	11	5	Lines position has been changed and corrections are incorporated (Dinesh Chandra Uprety, Indian Agricultural Research Institute)	Comment now redundant or irrelevant as section has been revised.
5-284	A	11	3	11	5	Substitute the reference Hanninen, 1991 with more recent ones (Marco Bindi, Dept. of Agronomy and Land Management)	
5-285	A	11	7	11	22	I am not that convinced by this graph! The thermal tolerance of cod ranges from winter temperatures just above zero to just over 10 degrees. The inverted U is fitted through a dataset which shows that there are no cod in areas where the winter temperature is less than 0.3 oC and, once you start getting over 9.5, they also start to get scarce. If you took out these extremes, would an inverted U still provide the best fit? Is there evidence that a temperature change of a few degrees would have any impact on juvenile cod density? At 4.8 C density varies between 10 and 98, at 6.8 degrees it varies between 10 and 99 per ha, while at 9 degrees it varies 5 to 85 per ha - its only above 9 degrees that it begins to fall off... Is there more statistically compelling data on the likely negative consequences of warming for future cod fisheries? (Edward Allison, University of East Anglia)	Comment now redundant as section has been revised. Comment now redundant or irrelevant as section has been revised.
5-286	A	11	8	11	20	The consideration of a clearer understanding of Figure 5.1, brings back the IPCC principle that, in spite of the necessary scientific background on which its products shall be based/supported, its products shall be aimed to stakeholders's decision making. The reference between brackets (i.e weeks 14 – 26) calls for clarification. (Osvaldo Canziani, IPCC WG2 Co-chair)	Comment now redundant as section has been revised.
5-287	A	11	19			Importance/relevance of this figure is not made clear.	Comment now redundant as section has been

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						(Cynthia Rosenzweig, NASA/Goddard Institute For Space Studies at Columbia University)	revised.
5-288	A	11	22			Figure 5.1 - this is not very convincing! Is there a source? (Paula Harrison, University of Oxford)	Comment now redundant as section has been revised.
5-289	A	11	22			Figure 5.1 Reference? (Jo Hossell, ADAS)	Comment now redundant as section has been revised.
5-290	A	11	25	11	42	There is a great deal of repetition here (e.g. lines 37-39). The entire section needs a good edit for coherence & flow. (Emma Archer, University of the Witwatersrand)	Comment now redundant or irrelevant as section has been revised.
5-291	A	11	25	11		Section 5.2.1.3, pg. 11: It could be mentioned in this section that the biological effects of elevated CO2 have potential feedback effects on water vapor fluxes to the atmosphere through increased biomass production. Increases in water vapor flux can influence temperatures and cloudiness (Pielke et al., In press) (Fitzgerald Booker, USDA-ARS Plant Science Research Unit)	Comment now redundant or irrelevant as section has been revised.
5-292	A	11	25			5.2.1.3 This is a key issue for ecosystems. Unfortunately, the message here is not clear, and the text mixes current water issues with issues arising from climate change. There is vast literature about the importance of water, current limitations and trends, which is not used here. (Juerg Fuhrer, Federal AgroEcological)	Comment now redundant or irrelevant as section has been revised.
5-293	A	11	25			Section 5.2.1.3. Repeats earlier and later material about water. Some statements are stunningly obvious - such that water balance is affected by rainfall etc. What are you really trying to say? Much of the chapter is just space filling. (John R Porter, KVL)	Comment now redundant or irrelevant as section has been revised.
5-294	A	11	27	11	41	It is important to take in consideration not only available water in quantity, but in quality too. Irrigation with saline waters produce negative effects over the crops and pastures, and of course in the soils. The irrigation with polluted waters of a river, lake may produce negative effects over the crops and over the human, that eat these crops (Cristobal Felix Diaz Morejon, Ministry of Science, Technology and the Environment)	Comment now redundant or irrelevant as section has been revised.
5-295	A	11	31	11	31	Specify the area? (Dinesh Chandra Uprety, Indian Agricultural Research Institute)	Comment now redundant or irrelevant as section has been revised.
5-296	A	11	32	11	35	Sentences starting "Further runoff reduction..." is essentially repeated on p 11 ln 37-39 (Jo Hossell, ADAS)	Comment now redundant or irrelevant as section has been revised.
5-297	A	11	35	11	39	Should also note that, on the other hand, higher CO2 may reduce water demand for crops.	Comment now redundant or irrelevant as section has been revised.

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						(Indur Goklany, Office of Policy Analysis, Department of the Interior)	
5-298	A	11	35	11	35	corrections are made in this line kindly see the corrected manuscript (Dinesh Chandra Uprety, Indian Agricultural Research Institute)	Comment now redundant or irrelevant as section has been revised.
5-299	A	11	40	11	40	Replace the word Pattern with temporal structure (reference Jian Ni et.al,2005: Impact of climate Variability on Present and Holocene Vegetation: a model-based study, Ecological Modelling, (Article in Press)) (Subhash Chander, TERI)	Comment now redundant or irrelevant as section has been revised.
5-300	A	11	43			Add sub-section heading on Non-climatic factors and trends here? - see comment on row 39 (Paula Harrison, University of Oxford)	Comment now redundant or irrelevant as section has been revised.
5-301	A	11	44			5.2.2. I also find the discussion of biodiversity in relations to sensitivity too simplistic, and I would question that high biodiversity (in terms of species diversity) would ensure high resilience in all cases. (Juerg Fuhrer, Federal AgroEcological)	Comment now redundant or irrelevant as section has been revised.
5-302	A	11	44	13	28	These sections make little reference to climate. It is not clear why they should be included in the report at such length if they are just for scene setting. I would prefer to see some discussion of how the factors listed interact with climate (Nicholas Holden, University College Dublin)	Disagree.
5-303	A	11	44	13	28	Section 5.2.2. I cannot see that this section is relevant to the IPCC report on climate change. Cut it out. It is merely vague generalities and handwaving. (John R Porter, KVL)	Has been revised for focus on climate.
5-304	A	11	44			Section 5.2.2, this section could contain discussions on other issues related to natural resource degradation -- e.g. water, and access to water, which are going to become even more critical. (Philip Thornton, International Livestock Research Institute (ILRI))	Comment has been accepted as fair and incorporated into redraft.
5-305	A	11	46			First phrase redundant ... "the degradation of natural land... includes land degradation." (Norman Christensen, Duke University)	Comment has been accepted as fair and incorporated into redraft.
5-306	A	11	46			Sentence 'The degradation of natural land resources ... Includes land degradation' sounds weird. (Fischer Günther, International Institute for Applied Systems Analysis)	Comment has been accepted as fair and incorporated into redraft.
5-307	A	11	47			"groundwater" rather than "underground water" (Jo Hossell, ADAS)	Comment has been accepted as fair and incorporated into redraft.
5-308	A	11	50	12	4	There is also environmental pressure from intensive livestock manure nutrients and dry-land degradation from overgrazing. (Fischer Günther, International Institute for Applied Systems Analysis)	Comment has been accepted as fair and incorporated into redraft.
5-309	A	11				Fig. 5 needs explanation for many readers. Why do most observations lie well	Comment now redundant or irrelevant as

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						under line - looks like a biased fit. There is no indication that the density of parent fish is controlled for so this fig doesn't appear to make the point of p10 L45-48. (Richard Fleming, Great Lakes Forest Research Centre)	section has been revised.
5-310	A	12	2	12	2	To add Leaching of nitrate and PHOSPHOROUS into water bodies(pollution, eutrophication),.... (Cristobal Felix Diaz Morejon, Ministry of Science, Technology and the Environment)	Comment raises broader issues than is feasible to discuss within the limitations of space provided.
5-311	A	12	4	12	7	How does this section tie in with the introduction to the chapter, which seemed a little more optimistic? (Emma Archer, University of the Witwatersrand)	Comment has been accepted as fair and incorporated into redraft.
5-312	A	12	4	12	7	Text related to Figure 5.2 is not consistent with the trends shown in Fig 5.2. As I read the figure, the impact from agriculture has been constant over time, whereas the greatest impact has come from the increasing impact of energy use and forestry. This text needs clarification. (Kenneth Cassman, University of Nebraska)	Comment now redundant or irrelevant as section has been revised.
5-313	A	12	4	12	28	There are problems associated with the figure from Wackernagel et al. and the associated discussion. First, there is a conceptual problem in that Wackernagel et al. assume that so far (at least to 1999, per the figure) additional CO2 emissions from fossil fuel combustion imply an equivalent amount of land should be set aside as compensation. But, in fact, higher CO2 means higher photosynthetic capacity in managed and "unmanaged" lands. This increase in unmanaged lands is not accounted for in the construction of this diagram (nor is any increase in such areas due to nitrogen fertilization of human activities elsewhere). It is possible that, in the future, as temperatures rise the increase in productivity due to higher CO2 may be more than offset by the resulting higher temperatures, but are we at that point yet? In fact, increases in CO2 concentration and nitrogen inputs have been advanced as reasons why the sink strength of ecosystems in the northern latitudes has increased in past decades (Schimel et al. 2001). It also contradicts the notion that for small temperature increases there would be net benefit to society because of higher forest and agricultural productivity (see this chapter, for instance). Second, the ecological footprint calculation assumes that the entire biological product of land that is or would be physically occupied by a human activity is required for that activity. But, in fact, one parcel of land can and does support a multiplicity of ecological functions and uses. For instance, much of Europe's biodiversity is associated with its farmland areas (COE & UNEP 2002: Section 2.2). This is ignored in the Wackernagel analysis which assumes that CO2	Comment now redundant or irrelevant as section has been revised.

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						emissions are detrimental from the get go. That hasn't yet been proven. Third, Wackernagel et al. assumes that nuclear power has the same footprint as a fossil fuel plant of the same capacity. This assumption seems to contradict the central role that CO2 emissions were accorded in developing the footprint for fossil fuel consumption. [References: [1] Schimel, D. S. et al. 2001. Recent patterns and mechanisms of carbon exchange by terrestrial ecosystems. Nature 414: 169-172. [2] Council of Europe & United Nations Environment Program [COE & UNEP]. 2002. Agriculture and biodiversity in Europe. Working Group on Agriculture and Environment, 5th meeting, Strasbourg, 19 March 2002.] (Indur Goklany, Office of Policy Analysis, Department of the Interior)	
5-314	A	12	6		27	The meaning of Fig 5.2 in the context is not clear. Impact on the agriculture sector (text before Fig) or impact of agriculture sector on the environment (Fig's legend)? In addition the Fig 5.2 is poorly readable. (Jüri Kadaja, Estonian Research Institute of Agriculture)	Comment now redundant or irrelevant as section has been revised.
5-315	A	12	10			Figure 5.2 This needs more explanation... use of land equivalents is confusing (Norman Christensen, Duke University)	Comment now redundant or irrelevant as section has been revised.
5-316	A	12	25			Figure 5.2 and text are very unclear. Drop or try to explain concept. Why is cropland around 3 B global hectares and staying constant over time? (Fischer Günther, International Institute for Applied Systems Analysis)	Comment now redundant or irrelevant as section has been revised.
5-317	A	12	25			Add 'ecosystem.' Pressures on ECOSYSTEM primary productivity in land equivalents (Cynthia Rosenzweig, NASA/Goddard Institute For Space Studies at Columbia University)	Comment has been accepted as fair and incorporated into redraft.
5-318	A	12	30	12	40	These lines shall include reference to the critical conditions arising from wild deforestation. The soybean boom is annihilating the few remains of tropical, subtropical and temperate forests and woods still left in many producers' countries, in developing regions. (Osvaldo Canziani, IPCC WG2 Co-chair)	Comment raises broader issues than is feasible to discuss within the limitations of space provided.
5-319	A	12	30			5.2.2.1 Here, a link is made to climate change. However, the Chapter deals with current sensitivity, and aspects of future changes come later. Also, the argument is not convincing that dryland areas are more sensitive. Agriculture is likely already adapted to dry conditions, unlike agriculture in currently not water-limited regions. (Juerg Fuhrer, Federal AgroEcological)	Comment has been accepted as fair and incorporated into redraft.
5-320	A	12	30	30	40	Unclear. Will climate change increase grazing pressure or decrease it? (Surinder Saggarr, Landcare Research)	Comment now redundant or irrelevant as section has been revised.
5-321	A	12	33	12	33	To add in the causes that produces soil degradation.....AND BAD	Comment has been accepted as fair and

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						AGRICULTURAL TILLAGE (Cristobal Felix Diaz Morejon, Ministry of Science, Technology and the Environment)	incorporated into redraft.
5-322	A	12	36	12	40	How does this statement tie in with disequilibrium theory and 'new ecology' thinking on grazing and rangeland management? In fact, more broadly, this literature is really missing from this chapter. Even a brief reference, to provide caution in this type of statement, would be an improvement. We simply cannot always assume that these relationships will hold ! (Emma Archer, University of the Witwatersrand)	Comment raises broader issues than is feasible to discuss within the limitations of space provided.
5-323	A	12	36			Good section. (Cynthia Rosenzweig, NASA/Goddard Institute For Space Studies at Columbia University)	Thanks!
5-324	A	12	38			... Grasslands could sequester approximately 45 Tg C yr-1. Over what time? Grassland rehabilitation could certainly sequester a certain (fixed) amount of carbon, but could not sustain carbon sequestration (at the given or any other rate) for ever. (Fischer Günther, International Institute for Applied Systems Analysis)	Comment has been accepted as fair and incorporated into redraft.
5-325	A	12	38	12	38	super script correction in year (Dinesh Chandra Uprety, Indian Agricultural Research Institute)	Comment has been accepted as fair and incorporated into redraft.
5-326	A	12	42	12	50	No references have reported for supporting the number reported in this paragraph (Marco Bindi, Dept. of Agronomy and Land Management)	Comment has been accepted as fair and incorporated into redraft.
5-327	A	12	42	12	50	Move to section 5.2.1.3? (Paula Harrison, University of Oxford)	Disagree.
5-328	A	12	44	12	47	Reference? Clarify the the definition (Emma Archer, University of the Witwatersrand)	Comment has been accepted as fair and incorporated into redraft.
5-329	A	12	47			Is 2005 a reference? (Juerg Fuhrer, Federal AgroEcological)	Comment has been accepted as fair and incorporated into redraft.
5-330	A	12	49	12	50	This statement needs supporting with reference to modelled climate projections. (Edward Allison, University of East Anglia)	Comment has been accepted as fair and incorporated into redraft.
5-331	A	12	50			Cross-reference to the regional chapters is necessary (Osvaldo Canziani, IPCC WG2 Co-chair)	Comment has been accepted as fair and incorporated into redraft.
5-332	A	13	2			Section 5.2.2.2: as well as for the rest of section 5.2 this sub-section is too descriptive and only an example on how to reduce biodiversity vulnerability is reported (Zhu et al., 2000) (Marco Bindi, Dept. of Agronomy and Land Management)	Comment has been accepted as fair and incorporated into redraft.
5-333	A	13	2			Section 5.2.2.2. Needs more and recent references to support statements (Paula Harrison, University of Oxford)	Comment has been accepted as fair and incorporated into redraft.

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5-334	A	13	4	13	4	Include aquatic or freshwater, as well as/instead of just marine (Edward Allison, University of East Anglia)	Comment now redundant or irrelevant as section has been revised.
5-335	A	13	4	13	28	Comment: The alien species has a negative impact over genetic resources of autoctonous plants, and, of course, over diversity losses (Cristobal Felix Diaz Morejon, Ministry of Science, Technology and the Environment)	Comment now redundant or irrelevant as section has been revised.
5-336	A	13	4	13	15	Why isn't Tillman's work cited here. The idea that monoculture increases susceptibility to insects & disease has been around since at least the 1950s. In fact, it has been practiced with what in N.A. since then. The dates of some citations in this pgh give the erroneous impression to the uninformed reader that this idea has only been put in practice since TAR. I realise a goal of this report is to highlight new research since TAR, but failing to to the initiating literature for key concepts could be interpreted as filing to give due acknowledgement or that our science is wasting lots of research \$ by "forever re-inventing the wheel". (Richard Fleming, Great Lakes Forest Research Centre)	Comment now redundant or irrelevant as section has been revised.
5-337	A	13	4			resilience ~ cite Holling (Richard Fleming, Great Lakes Forest Research Centre)	Comment now redundant or irrelevant as section has been revised.
5-338	A	13	7			insert "communities" after "plant" (Norman Christensen, Duke University)	Comment now redundant or irrelevant as section has been revised.
5-339	A	13	7	13	7	plants (David Price, Northern Forestry Centre)	Comment now redundant or irrelevant as section has been revised.
5-340	A	13	7			Evidence is accumulating ... is supported with one reference dated 1998 which is not a strong argument. (Jan Verhagen, Wageningen-UR)	Comment now redundant or irrelevant as section has been revised.
5-341	A	13	11			Key citation--Mortimer & Adams (2001) not fully referenced in reference section. (Kenneth Cassman, University of Nebraska)	Comment now redundant or irrelevant as section has been revised.
5-342	A	13	13			The sentence on rice vulnerability to pathogens is out of place here (Norman Christensen, Duke University)	Comment now redundant or irrelevant as section has been revised.
5-343	A	13	13	13	15	replace "the decline in the" with "decreased" (David Price, Northern Forestry Centre)	Comment now redundant or irrelevant as section has been revised.
5-344	A	13	17	13	17	This paragraph seems speculative and unsupported. It should be shortened and reference to an example or review should be made (Edward Allison, University of East Anglia)	Comment has been accepted as fair and incorporated into redraft.
5-345	A	13	18	13	21	Pops at upper edge of temp rate in Fig 5.1 likely to become more resil (assuming fishing pressure doesn't shift accordingly - an unlikely assumption). (Richard Fleming, Great Lakes Forest Research Centre)	Don't understand this comment.
5-346	A	13	20	13	21	Replace (see the inverted U curve) with (Fig. 5.1)	Comment now redundant as section has been

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						(Surinder Saggar, Landcare Research)	revised.
5-347	A	13	21	13	25	These sentences could be more clear. (Cynthia Rosenzweig, NASA/Goddard Institute For Space Studies at Columbia University)	Comment has been accepted as fair and incorporated into redraft.
5-348	A	13	21			should read ...curve) and therefore more vulnerable to the cobined effects of fishing and changes in ocean conditions. (Franklin Schwing, NOAA Fisheries Service)	Comment has been accepted as fair and incorporated into redraft.
5-349	A	13	25	13	28	This sentence is out of place. (Cynthia Rosenzweig, NASA/Goddard Institute For Space Studies at Columbia University)	Don't understand why?
5-350	A	13	26	13	28	Key citation--Eakin (2003) not fully referenced in reference section. (Kenneth Cassman, University of Nebraska)	Comment now redundant as section has been revised.
5-351	A	13	26			Ecological fungibility of what? Clarify (Norman Christensen, Duke University)	Comment now redundant as section has been revised.
5-352	A	13	26			define "fungilbility" (Richard Fleming, Great Lakes Forest Research Centre)	Comment now redundant as section has been revised.
5-353	A	13	28	13	29	Lines are deleted for making it meaningful (Dinesh Chandra Uprety, Indian Agricultural Research Institute)	Disagree.
5-354	A	13	29			What about other socio-economic factors such as trends in population, GDP, demand and other relevant economic and political changes? (Paula Harrison, University of Oxford)	Line 29 is blank in my text and I don't know what this refers to.
5-355	A	13	31	15	19	The section on current coping has a lot of detail on pastoralists, but nothing on fishers. There has been quite a lot of work on fisherfolk's coping and adaptive strategies (e.g. see Allison & Ellis, 2001, Marine Policy Vol 25, for a review) that might be mentioned - they paralled the strategies of dryland livelihoods systems and therefore help to generalise the arguments (Edward Allison, University of East Anglia)	Comment has been accepted as fair and incorporated into redraft.)
5-356	A	13	31			Sub-section 5.2.3 refers to strategies vis à vis climate variability, this is correct. However, considerations on measures to cope with the ongoing climate trend, already causing different stresses for some marginal agricultural, forestry and fishing activities, should be mentioned. Also reference to innovative irrigation procedures would be important for decision making. (Osvaldo Canziani, IPCC WG2 Co-chair)	Comment has been accepted as fair and incorporated into redraft.
5-357	A	13	31			5.2.3 deals exclusively with agriculture. What about forests and fisheries? 5.2.3.1 addresses the issue of coping with climate variability and uses a single example. The example is ok, but I would like to see a more comprehensive coverage of different coping strategies.	Comment has been accepted as fair and incorporated into redraft.

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						(Juerg Fuhrer, Federal AgroEcological)	
5-358	A	13	31	13	42	in general we can say that enhancing the input use efficiency would be necessary for coping the negative impact of climate variability/change. Keeping in view of the inter and intra regional (location) variation in crop productivities, several studies estimating the technical efficiencies across agricultural farms conclude that increasing the input use efficiencies in crop production would raise productivity and production. this could be done by putting more efforts on farming communities for more precision agriculture which undoubtedly is not an easy task. However, increasing the technical efficiency would help in achieving significant increase in yield even without introducing any alternation in cropping patterns, etc. (Mudasser Muhammad, Global Change Impact Studies Centre (GCISC))	Will consider.
5-359	A	13	31	14	36	This section is weak, no clear framework is presented. Most strategies will not only focus on climate variability but will have a economic (market) and social (labour/family) components. What happened to the adaptive capacity concept? (Jan Verhagen, Wageningen-UR)	Comment raises broader issues than is feasible to discuss within the limitations of space provided.
5-360	A	13	33			Sentence should read "A number of strategies are currently used to avoid..." (Norman Christensen, Duke University)	Comment has been accepted as fair and incorporated into redraft.
5-361	A	13	33	13	42	To add: THE USE OF EARLY WARNING SYSTEMS IN ORDER TO FORECAST THE DROUGHT, NATURALPHENOMENUMS, TROPOSPHERIC OZONE(O3) THAT IS A SUBSTANCE VERY DANGEROUS FOR CROPS. (Cristobal Felix Diaz Morejon, Ministry of Science, Technology and the Environment)	We do not understand the point of this comment.
5-362	A	13	33	13	42	The necessity of a more use of strategic planning, for example, in the foresight and supply of water, in the case of a prolonged drought, the use of harvested rain, and others. (Cristobal Felix Diaz Morejon, Ministry of Science, Technology and the Environment)	Comment raises broader issues than is feasible to discuss within the limitations of space provided.
5-363	A	13	33	13	42	Combine with intro to section 5.2 (p9 L50-p10 L4). Pgh says almost nothing for fish, forests. (Richard Fleming, Great Lakes Forest Research Centre)	Comment has been accepted as fair and incorporated into redraft.
5-364	A	13	33			avoidance strategies? What are these? (Jan Verhagen, Wageningen-UR)	Comment has been accepted as fair and incorporated into redraft.
5-365	A	13	35	13	35	Replace "avoid" by "mitigate the impacts of" (Subhash Chander, TERI)	Comment has been accepted as fair and incorporated into redraft.
5-366	A	13	39			Here again, the Mathus 2004 citation is a key reference for how farmers adapt to	Comment has been accepted as fair and

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						climate variability, yet there is no information provided about this citation in the reference list. Furthermore, the discussion of key adaptations is fuzzy and could be strengthened by noting the most important adaptations first, followed by secondary adaptations. For example, the most widely used adaptations to climate uncertainty is to modify crop planting dates and variety maturities to better take advantage of non-stress temperatures and rainfall, changing to more stress tolerant crops from more sensitive crops, using no-till practices to conserve soil moisture. Other adaptations are of secondary importance. (Kenneth Cassman, University of Nebraska)	incorporated into redraft.
5-367	A	13	39	13	40	insert citation for drought resistance of sugar beet after "resistant cultivars (Ober et al., 2004; Ober et al., 2005)" Ober, E.S., Clark, C.J.A., LeBloa, M. et al., 2004. Assessing the genetic resources to improve drought tolerance in sugar beet: agronomic traits of diverse genotypes under droughted and irrigated conditions. Field Crops Research, 90(2-3): 213-234. Ober, E.S., LeBloa, M., Clark, C.J.A. et al., 2005. Evaluation of physiological traits as indirect selection criteria for drought tolerance in sugar beet. Field Crops Research, 91(2-3): 231-249. (Goetz M Richter, Rothamsted Research)	Comment raises broader issues than is feasible to discuss within the limitations of space provided.
5-368	A	13	40			insert after "and adapting planting and sowing dates. Avoiding late sowing dates would minimize the risk of drought-affected yield loss of winter wheat in England (Richter et al., 2004; Richter and Semenov, 2005). Richter G M, Glendining M, Coleman K., Jaggard KW, Qi A. and Semenov M A 2004. Re-Assessing drought risks for UK crops using UKCIP02 climate change scenarios. DEFRA Project CC0368, Final Report; Richter, G. M. and Semenov, M. A., 2005. Modelling impacts of climate change on wheat yields in England and Wales - assessing drought risks. Agricultural Systems 84(1): 77-97. (Goetz M Richter, Rothamsted Research)	Will consider.
5-369	A	13	44			Section 5.2.3.1. Seem to be delving deep in the weeds here by providing detailed, specific examples. Given the already excessive length of this chpt, I suggest aiming for a higher level in which you make more general observations that apply to most types of agriculture, fisheries, & forestry. Paper by Baskerville & Regier. (Richard Fleming, Great Lakes Forest Research Centre)	Comment has been accepted as fair and incorporated into redraft.
5-370	A	13	44	15	19	Section 5.2.3.1. Not relevant to report. Cut it out. (John R Porter, KVL)	Comment now redundant or irrelevant as section has been revised.
5-371	A	13	47	13	47	Words deleted, kindly see the corrected manuscript (Dinesh Chandra Uprety, Indian Agricultural Research Institute)	Comment now redundant or irrelevant as section has been revised.
5-372	A	13	48	13	50	Make mention of livestock production here as well (Emma Archer, University of the Witwatersrand)	Comment now redundant or irrelevant as section has been revised.

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5-373	A	13	50	13	50	Sustainable agriculture concept needs to be followed (Dinesh Chandra Uprety, Indian Agricultural Research Institute)	Comment now redundant or irrelevant as section has been revised.
5-374	A	14	4	14	5	Unwanted words are deleted (Dinesh Chandra Uprety, Indian Agricultural Research Institute)	Comment now redundant or irrelevant as section has been revised.
5-375	A	14	6	14	9	these lines are not required and are deleted (Dinesh Chandra Uprety, Indian Agricultural Research Institute)	Comment now redundant or irrelevant as section has been revised.
5-376	A	14	10		20	Suggest you link with above on page 5.... Dryland livelihoods are adaptive strategies to climate variability. (Mohamed El Mahdi Beshir, Independent scholar and consultant)	Comment now redundant or irrelevant as section has been revised.
5-377	A	14	18	14	20	These lines should be clearly explained (Dinesh Chandra Uprety, Indian Agricultural Research Institute)	Comment now redundant or irrelevant as section has been revised.
5-378	A	14	24	14	24	Legumes are more susceptible to drought than cereals. Please check. (Dinesh Chandra Uprety, Indian Agricultural Research Institute)	Comment now redundant or irrelevant as section has been revised.
5-379	A	14	27	14	27	variability NO COMMA (Cynthia Rosenzweig, NASA/Goddard Institute For Space Studies at Columbia University)	Comment now redundant or irrelevant as section has been revised.
5-380	A	14	31	14	31	This line position should be changed and written after line 36. (Dinesh Chandra Uprety, Indian Agricultural Research Institute)	Comment now redundant or irrelevant as section has been revised.
5-381	A	14	32	14	36	Are there not more recent references that can be used here? (Emma Archer, University of the Witwatersrand)	Comment now redundant or irrelevant as section has been revised.
5-382	A	14	35			What kind of networks? (Jüri Kadaja, Estonian Research Institute of Agriculture)	Comment now redundant or irrelevant as section has been revised.
5-383	A	14	39			Box 5.1 Since there are also coping strategies in other regions, a reference to the regional chapters would provide a wider perspective for decision making 's action (Osvaldo Canziani, IPCC WG2 Co-chair)	Comment now redundant or irrelevant as section has been revised.
5-384	A	15	21	15	34	The concepts reported in the first paragraph are well known and already reported in TAR-IPCC (Marco Bindi, Dept. of Agronomy and Land Management)	Comment has been accepted as fair and incorporated into redraft.
5-385	A	15	21	15	23	As said in italics, between brackets, it is not only possible but also rather crucial to make broad statements regarding vulnerability, very particularly at the regional scale (see below) (Osvaldo Canziani, IPCC WG2 Co-chair)	Comment has been accepted as fair and incorporated into redraft.
5-386	A	15	21			Section on Vulnerability: A key point that is not well developed here is the relationship between soil quality and the capacity to adapt to climate variability. There is a body of research that has shown that soil P deficiency is a much greater limitation to crop yields and yield stability in the most arid regions of the Sahel	Comment has been accepted as fair and incorporated into redraft.

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						than is water limitation (C.T. de Wit Science paper from 1982--I don't have the specific reference). Likewise, there is a body of literature that shows crops are more sensitive to drought when they are potassium deficient. Here again, I don't have the citations on hand, but the authors of this chapter should find this information and include it in this section because it is a key point about vulnerability and adaptation opportunities to climate change. Likewise, it has implications for subsistence farmers on marginal soils who do not have access or cannot afford commercial fertilizers--another key point that is mentioned briefly but would seem to deserve more recognition. (Kenneth Cassman, University of Nebraska)	
5-387	A	15	21			5.2.4 should be up front as it makes some general statements about vulnerability, after which factors could be discussed which are relevant to the biophysical sensitivity and the socioeconomic components of this term. (Juerg Fuhrer, Federal AgroEcological)	Comment has been accepted as fair and incorporated into redraft.
5-388	A	15	21			I find section 5.2.4 too vague to be useful. (Fischer Günther, International Institute for Applied Systems Analysis)	Comment has been accepted as fair and incorporated into redraft.
5-389	A	15	21	15	42	Section 5.2.4. The second paragraph essentially repeats the first one in this section. Reduce the section. (John R Porter, KVL)	Comment has been accepted as fair and incorporated into redraft.
5-390	A	15	21			Section 5.2.4, this is rather vague, and I think some statements are needed here on current vulnerability in particular areas, and how this may change in the future -- and what about the effects of key drivers such as population, globalisation, socio-cultural change etc. There are various refs that could be knitted in here (e.g. "Coping with global change, vulnerability and adaptation in Indian agriculture", TERI 2003) (Philip Thornton, International Livestock Research Institute (ILRI))	Comment has been accepted as fair and incorporated into redraft.
5-391	A	15	25			What does it mean: long term changes in climate when the accelerated retreat of glaciers is already crucial for snowmelt fed agricultural economies (see chapter 1 and 13). (Osvaldo Canziani, IPCC WG2 Co-chair)	Comment now redundant or irrelevant as section has been revised.
5-392	A	15	25	14	25	Gramatical errors are corrected kindly see the corrected manuscript. (Dinesh Chandra Uprety, Indian Agricultural Research Institute)	OK
5-393	A	15	26	15	26	To add:social, economic, ENVIRONMENTAL, and institutional context (Cristobal Felix Diaz Morejon, Ministry of Science, Technology and the Environment)	OK
5-394	A	15	27	15	29	Is this correct? In Africa, there would be a lot of overlap, I suspect. (Philip Thornton, International Livestock Research Institute (ILRI))	Comment has been accepted as fair and incorporated into redraft.

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5-395	A	15	29	15	3	Assuming that the term 'communities' involved national communities, countries with sufficient territorial expanse and a range of elevations may re-distribute internal groups or regional communities to cope with the adverse effects and reap the benefits of climate change. In fact, internal migrations does that. Further, in spite of any argument on the contrary, the foresaw small island and low coastal areas inundation will have to be solved with massive people dislocation to other regions. Then, why not assume that this is an adaptation action to be adopted at national scale? (Osvaldo Canziani, IPCC WG2 Co-chair)	Comment has been accepted as fair and incorporated into redraft.
5-396	A	15	30	15	31	To add:depending of economic wealth, social structures, FORMATION OF HUMAN RESOURCES, INDIGENOUS EXPERIENCES, and previous..... (Cristobal Felix Diaz Morejon, Ministry of Science, Technology and the Environment)	OK
5-397	A	15	33	14	33	Ref. Year is missing kindly (Dinesh Chandra Uprety, Indian Agricultural Research Institute)	OK
5-398	A	15	34			This paragraph is redundant to the preceding one (Norman Christensen, Duke University)	Comment has been accepted as fair and incorporated into redraft.
5-399	A	15	38			"whereas others may have more limited capacities" : this statement is too general. Why different from before? (Marcus Lindner, European Forest Institute)	Comment now redundant or irrelevant as section has been revised.
5-400	A	15	40			Add to the end of sentence ending on line 40 the following: "...conditions change AND TECHNOLOGIES EVOLVE." (Indur Goklany, Office of Policy Analysis, Department of the Interior)	Comment now redundant or irrelevant as section has been revised.
5-401	A	15	45	20	50	Section 5.3 contains no reference to fisheries (e.g. the WorldFish/IFPRI study projecting future production, demand and trade flows - 'Fish to 2020', should be cited) (Edward Allison, University of East Anglia)	Valid comment, still to be incorporated.
5-402	A	15	45			Chapter 5.3 This chapter describing several future trends is generally ok. However, there are some important issues missing with respect to agriculture: Technology: Any projection of future trends in agricultural production and responses to climate change depends on the technological development. This can be illustrated by the comparison between the projected increase in crop yield due to CO2 fertilization of 10-15% sometime between 2050 and 2100 (2xCO2), which is much smaller than the past yield increase achieved through breeding and improved management, including fertilization. Technological advances are difficult to project, but the issue should e stated in this report. Pollution: The trend in air pollution particularly in SE Asia could become an	Comment raises broader issues than is feasible to discuss within the limitations of space provided.

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						important constraint for agricultural production, and also for forest development. Shifts in consumer preferences: There is a great shift in progress towards more meat consumption in the developing world. This will strongly affect production as well as environmental impacts in the next decades. In turn, this will be relevant for impacts of climate change, and for GHG emissions form the sector. (Juerg Fuhrer, Federal AgroEcological)	
5-403	A	15	45			Section 5.3 -- in general, I did not think that this section was very well linked to the rest of the chapter, and as a survey there are some omissions here (Philip Thornton, International Livestock Research Institute (ILRI))	Valid comment, still to be incorporated.
5-404	A	15	48	16	1	[1] Add Goklany (1995) to the reference to the sentence ending on line 1, and [2] add the following new sentence after that sentence, as follows: "Moreover there are likely to be significant, if not dramatic, changes in technology which should mean a broader range of technological options for coping with climate change (Goklany 2001, 2005b). (Indur Goklany, Office of Policy Analysis, Department of the Interior)	Valid comment, still to be incorporated.
5-405	A	15	49	15	50	I am very reluctant about the statement on less dependency on natural resources. To my knowledge the needs of natural resources such as water, air, environment, land for production of biomass and food will not decline, sooner the opposite. (Mats Olsson, SLU)	The text does not say this.
5-406	A	16	0			function of section climate is unclear. (Jan Verhagen, Wageningen-UR)	We do not understand the point being made in this comment and therefore cannot respond.
5-407	A	16	6			Section 5.3.1 was not reviewed since it will be available in the SOD (Marco Bindi, Dept. of Agronomy and Land Management)	
5-408	A	16	6			Section 5.3.1 Climate. Since this section is under construction, its drafting offers the opportunity to remark the urgent need for more and better meteorological, climatic, hydrological, phenological information. Many of the adaptation measures call for an effective knowledge of the current climate, including appropriate information on meso-climatic regions and even the values of topographic effects on climate. In different regions of the world ancient civilizations even used topoclimates to grow their staple. Therefore, appropriate reference on the need to know their climate well before embarking on climate change adaptation strategies will bring a useful step forward in the idea of development with equity. (Osvaldo Canziani, IPCC WG2 Co-chair)	Comment now redundant or irrelevant as section has been revised.
5-409	A	16	6			I appreciate the attempt to provide information on ranges of climate change expected in major agricultural production regions. I fail to understand why you	Comment now redundant or irrelevant as section has been revised.

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						want to overlay the IPCC sub-regions with FAO's 17 regions; it seems that in almost all cases the IPCC regions are a subset of the FAO regions, so what will you gain? In the work at IIASA similar calculations have been done for 14 SRES-based GCM projections. We used administrative maps, a GIS data set of downscaled cultivated land of year 2000, as well as spatial data sets of current and projected climate to calculate ranges of expected changes for agricultural areas by country and about 20 regions. (see Annex 2.1 in Fischer et al., 2000b). (Fischer Günther, International Institute for Applied Systems Analysis)	
5-410	A	16	6	17	1	I know this section is not finished, but it should attempt to derive a reliability for the map produced and explain some detail of its derivation. The proposed map is potentially very interesting if it can be made (Nicholas Holden, University College Dublin)	Comment now redundant or irrelevant as section has been revised.
5-411	A	16	8	16	12	GOOD IDEA! (Richard Fleming, Great Lakes Forest Research Centre)	
5-412	A	16	10	16	12	How will the differences among climate models be accounted for? Are you proposing to average the projected changes? How can this be done? Or would it be better to provide two maps, one for minimum change and one for maximum change? (David Price, Northern Forestry Centre)	Comment now redundant or irrelevant as section has been revised.
5-413	A	16	13	16	30	It is necessary to put the meaning of each colour in the map (Cristobal Felix Diaz Morejon, Ministry of Science, Technology and the Environment)	Comment now redundant or irrelevant as section has been revised.
5-414	A	17	2			Add sub-section heading on Non-climate trends? This section should also include reference to the IPCC SRES scenarios and describe socio-economic trends in relation to them - see ch. 12, section 12.3.2. (Paula Harrison, University of Oxford)	Comment raises broader issues than is feasible to discuss within the limitations of space provided.
5-415	A	17	3	19	26	Point 5.3.2 maybe smaller, because talk a lot of things that not are in the main lines of the Chapter. Lack the analysis of fisheries. (Cristobal Felix Diaz Morejon, Ministry of Science, Technology and the Environment)	Valid comment, still to be incorporated.
5-416	A	17	3			Section 5.3.2 - I realise that it is not possible here to look in any details at different scenarios of the future, but this section would benefit greatly from some discussion of the different futures that have been constructed elsewhere and what this may mean for balancing future global supply and demand. The implications for agriculture (for instance) are enormously variable, depending on the assumptions that are made, and a nod (at least) should be made to these. (Philip Thornton, International Livestock Research Institute (ILRI))	Comment raises broader issues than is feasible to discuss within the limitations of space provided.

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5-417	A	17	5	17	12	Taking account of the extension already shown in the FOD, appropriate cross reference with chapter 7 may serve to cut even this small segment of this draft. (Osvaldo Canziani, IPCC WG2 Co-chair)	Valid comment, still to be incorporated.
5-418	A	17	10			How meaningful are projections to 2300? Projections elsewhere in the chapter are more time-constrained (Norman Christensen, Duke University)	Disagree.
5-419	A	17	11	17	11	Is 2300 correct ? (Marco Bindi, Dept. of Agronomy and Land Management)	YES.
5-420	A	17	11			The reference to population in 2300 is very speculative and not required for the main arguments in this paragraph. I would drop it; it is well known that a very wide range of population outcomes is possible for 2300 with only minor changes in projection assumptions. (Fischer Günther, International Institute for Applied Systems Analysis)	Disagree.
5-421	A	17	12	17	12	Presentation in the graph form will be better (Dinesh Chandra Uprety, Indian Agricultural Research Institute)	Noted, but unclear how to deal with.
5-422	A	17	14			Section 5.3.2.1. What about trends in technology? (Paula Harrison, University of Oxford)	Valid comment, still to be incorporated.
5-423	A	17	14	18	8	This section makes no reference to climate or climate change; it is an abbreviated paraphrase of various FAO reports. I cannot see the point in including it in its current form. I would have thought that in the context of an IPCC report that it should indicate whether studies have suggested these projections coming true in light of climate change scenarios. (Nicholas Holden, University College Dublin)	Noted, but unclear how to deal with.
5-424	A	17	14			Section 5.3.2.1 - there's a lot of IFPRI work on projected trends in livestock in developing countries in the coming decades (the Delgado work is cited later in the chapter, but it should be discussed here). Similarly, there is IFPRI work on trends on fisheries that could be referred to (also Delgado and others). It's also rather imbalanced -- half a page on agricultural trends, and a page and a half on forestry trends? (Philip Thornton, International Livestock Research Institute (ILRI))	Noted, but unclear how to deal with.
5-425	A	17	16	17	21	The meaning of the paragraph is not clear, since the deceleration of the world demand for food is consistent with slowing population growth but not with the increase in daily energy supply per person. Moreover, a reference to these numbers should be added. (Marco Bindi, Dept. of Agronomy and Land Management)	Disagree.
5-426	A	17	16	17	21	The statistics on energy supply per person is not really relevant here unless the energy losses during the production process is also considered. Among these	Comment considered valid but on balance it is felt due consideration has been given to the

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						energy losses are losses during storage (will climate change affect these), wastes during food processing, and in particular the energy losses that occurs during conversion of plant to animal products. The diet (proportion of meat in the diet) is thus of critical importance in determining how large an energy content is needed in the primary products. (Jørgen E. Olesen, Danish Institute of Agricultural Sciences)	point.
5-427	A	17	25	17	30	The text in this section is again biased towards an optimistic scenario for food security because it does not acknowledge actual trends in crop area or the fact that the uncultivated land in Latin America and Subsaharan Africa is of marginal quality with severe soil fertility and often acidity constraints. See earlier comment with citations provided that give a different view of the potential for expansion of agriculture--especially onto marginal land. Note that if opportunities for expansion of agriculture are limited, then the <u>rate of gain in crop yields on existing farmland must be accelerated well above current rates of gain</u> , which is a formidable task even without climate change (here again see citations given in previous comments that document these points). Note also that a projection for an increase in irrigated area of 60M ha also seems highly optimistic given the projections elsewhere in this chapter for increased irrigation water requirements per unit area irrigated due to climate change, and the increasing competition for water from non-agricultural uses. How does this reconcile? (Kenneth Cassman, University of Nebraska)	Comment does not appear to be supported by the preponderance of literature sources consulted. Disagree.
5-428	A	17	28			Fischer et al. 2002b (p. 99) estimate net increase of cultivated land in developing countries for the four SRES development path for the period 1990 to 2080. For 1990 to 2050 the range is from an additional 136 M ha (for B1) to 237 M ha (for A2). (Fischer Günther, International Institute for Applied Systems Analysis)	Valid comment, still to be incorporated.
5-429	A	17	32	17	40	Could provide some more specific examples here. (Emma Archer, University of the Witwatersrand)	Not feasible to discuss within the limitations of space provided.
5-430	A	17	32	18	3	It appears that the FAO estimates of undernourishment 2050 are base case, i.e., without climate change. If this is the case, it should be clearly stated in the paragraph. If the FAO estimate includes climate change, the assumptions about climate change to 2050 should be stated. (Lenny Bernstein, IPIECA)	Valid comment, still to be incorporated.
5-431	A	17	32			Fischer et al. 2002b (p. 100) estimate number of people at risk of hunger in developing countries for the four SRES development path for the period 1990 to 2080. For 2050 the possible range is quite large, from 208 M (for A1) to 721 M (for A2), and 239 M for B1 and 348 M for B2.	Valid comment, still to be incorporated.

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Chapter-Comment	Batch	From Page	From Line	To Page	To line	Comments	Notes of the writing team
						(Fischer Günther, International Institute for Applied Systems Analysis)	
5-432	A	17	34	17	34	Delete "to prevail." (Cynthia Rosenzweig, NASA/Goddard Institute For Space Studies at Columbia University)	Valid comment, still to be incorporated.
5-433	A	18	1	18	3	Access issues should be taken into account here - this is mentioned later on in the chapter, but should be mentioned here as well. This was also raised strongly in the review of the ZOD. (Emma Archer, University of the Witwatersrand)	Valid comment, still to be incorporated.
5-434	A	18	2			Insert "... -- unless economic growth picks up significantly in the region -- ..." between "that" and "they". Reference: Goklany (2002b). (Indur Goklany, Office of Policy Analysis, Department of the Interior)	Valid comment, still to be incorporated.
5-435	A	18	5	18	8	Add reference to this information (Marco Bindi, Dept. of Agronomy and Land Management)	Valid comment, still to be incorporated.
5-436	A	18	5	18	8	The part on international trade in agriculture seems extremely brief for such an important topic. This could be expanded. (John R Porter, KVL)	It is not feasible to discuss within the limitations of space provided.
5-437	A	18	10			Section 5.3.2.2. One of few aspects of forestry in this chapt where the authors show a passable familiarity with the literature - but even here there's a heavy reliance on "grey literature". This section goes deep into the weeds. I suggest removing all but the last paragraph & bolstering it with necessary, primary literature. (Richard Fleming, Great Lakes Forest Research Centre)	Roger, I would suggest just the opposite: moving some of the 5.4.4 text on industry to this section. Projections of future supply and demand are often part of the "grey" literature. However, several of the studies cited are in the mainstream of peer reviewed literature.
5-438	A	18	10	6	26	too lengthy and off the focus of climate change. Include ideas on increased prices of fossile fuels and implications for fuelwood - also or particularly in temperate regions (Reinhold Glauner, Inst. for World Forestry)	Beyond the scope of this chapter.
5-439	A	18	10	19	25	As for previous point. How will climate change influence these projections? Did they account for climate change? (Nicholas Holden, University College Dublin)	In 5.4.4 section.
5-440	A	18	12	18	16	This is rather clumsily written (Emma Archer, University of the Witwatersrand)	Debatable.
5-441	A	18	12	19	25	I am surprised that the wood demand scenario discussion does not place more attention on the trends in bio-energy use and market developments driven by energy prices. In a study commissioned for the European Environment Agency we have made scenario studies with the forest sector model EFI-GTM, which clearly indicated that major shifts in wood use could be anticipated until 2030 if energy	The focus here on industrial wood. Bioenergy, beyond fuelwood, is outside the focus of this chapter.

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						prices and CO2 emission credits according to storyline assumptions were taken into account (study still unpublished). I have heard several experts stating the expectation that future wood prices may be mainly driven by energy prices. (Marcus Lindner, European Forest Institute)	
5-442	A	18	12	19	25	The aim of this section 5.3.2 .2 is to balance future global supplies and demand in forestry. However, only info on harvest/supply is presented and not anything on supplies in terms of growth. Thus it is difficult to balance and to have any opinion on deforestation vs afforestation. This is in contrast to the section on agriculture where both production and needs are quantified (Mats Olsson, SLU)	The studies cited related supply and demand for industrial wood into the future and include considerations of afforestation (planting) and deforestation. Most deforestation is due to land use change and not commercial forestry.
5-443	A	18	14	18	15	this sentence refers to a projected shift from natural forest harvest to plantation. The summary p. 5 line 20 to 31, is more talking like if this was a fact. (Sylvie Gauthier, Laurentian Forestry Center, Canadian Forestry Service)	It is fact. The FAO reports that about 34% of commercial harvest in 2000 came from planted forests. See line 18.
5-444	A	18	15			Incomplete references (Juerg Fuhrer, Federal AgroEcological)	Need to correct and complete reference.
5-445	A	18	15			References incomplete. (Paula Harrison, University of Oxford)	Ditto.
5-446	A	18	17	18	17	20% and 40% of what? (John R Porter, KVL)	This is percent of industrial wood supply as reflected in 5 of harvests.
5-447	A	18	17	18	20	Can you explain why there is such a discrepancy between Hagler and FAI for 2000. Why is Hagler's estimate relevant in the circumstances? (David Price, Northern Forestry Centre)	Perhaps we should drop Hagler.
5-448	A	18	20	18	20	Replace 205 with 2050 (Marco Bindi, Dept. of Agronomy and Land Management)	OK.
5-449	A	18	20			"205" to "2050" (Norman Christensen, Duke University)	OK.
5-450	A	18	20			2050 not 205 (Paula Harrison, University of Oxford)	OK.
5-451	A	18	20			205 ? - 2005? 2050? (Jüri Kadaja, Estonian Research Institute of Agriculture)	OK.
5-452	A	18	20	18	20	205 should read 2050. (John R Porter, KVL)	OK.
5-453	A	18	20	18	20	205? Should be 2050 (Surinder Saggar, Landcare Research)	OK.
5-454	A	18	21	18	22	Could you explain the reasons of a shift in industrial supply from the Northern to the Southern Hemisphere ? (Marco Bindi, Dept. of Agronomy and Land Management)	Limited space, Done elsewhere in Chapter?

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5-455	A	18	26	19	15	may be this could be summarized if a table was presented. Also it is not clear why are those data presented (Sylvie Gauthier, Laurentian Forestry Center, Canadian Forestry Service)	Limited space.
5-456	A	18	26	18	26	First sentence appears to contradict the following sentence. (Surinder Saggar, Landcare Research)	Actual is different from forecast.
5-457	A	18	27	18	30	Is this relatively small increase in demand partially due to declines (or softening) demand for pulp and paper products, as compared to roundwood? My understanding is that P&P demand has declined in Canada over the last few years, for a number of reasons. (David Price, Northern Forestry Centre)	Yes.
5-458	A	18	28	18	28	Changed, kindly see in corrected manuscript (Dinesh Chandra Uprety, Indian Agricultural Research Institute)	OK.
5-459	A	18	29	18	29	use dry matter instead of cubic metres - or give the conversion between the two. (John R Porter, KVL)	Cubic meters are standard in most of forest. See FAO reporting.
5-460	A	18	32			year missing from references - same on line 48 (Paula Harrison, University of Oxford)	From above. But should add.
5-461	A	18	32	18	49	Is this level of detail necessary - It could all be summarised by p19 ln1-4 with appropriate references included. (Jo Hossell, ADAS)	Some want detail.
5-462	A	18	32	18	37	Words deleted kindly see the corrected manuscript (Dinesh Chandra Uprety, Indian Agricultural Research Institute)	OK.
5-463	A	18	32	18	32	This line is corrected and attached with line 33 (Dinesh Chandra Uprety, Indian Agricultural Research Institute)	OK.
5-464	A	18	33	18	34	What proportion of standing forest biomass does this 1.8 b cu. m represent? (John R Porter, KVL)	Far less than 1%.
5-465	A	18	40			delete "anticipation of" (Norman Christensen, Duke University)	OK.
5-466	A	18	46	18	46	1.9 is not 'well below' 2.1. Is this paragraph needed?? (John R Porter, KVL)	OK, drop para.
5-467	A	19	0	20	0	The discussion on the future of subsistence and smallholder agriculture and pastoralism on pages 19-20 deserves The discussion on subsistence and smallholder agriculture and pastoralism deserves to be complemented by a short discussion on the future of the gum Arabic belt across Africa. The commodity is one one of the most important commodities as it has high demand in the world market. The producers are typically subsistence and smallholder farmers. In the last two decades the belt had been subjected to the impacts of droughts and changing economic policies beginning with impacts of structural adjustment to	Comment raises broader issues than is feasible to discuss within the limitations of space provided.

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						complete liberalization of trade. Gum Arabic qualifies in my view for a special treatment. (Mohamed El Mahdi Beshir, Independent scholar and consultant)	
5-468	A	19	2			through not thru (Paula Harrison, University of Oxford)	Changed.
5-469	A	19	10			This result is also noted in the 2005.' Sentence incomplete! (Fischer Günther, International Institute for Applied Systems Analysis)	Changed.
5-470	A	19	10			Sentence beginning "This result is also noted..." appears incomplete or needs further clarification (Jo Hossell, ADAS)	Changed.
5-471	A	19	10	19	10	This result is also noted the in 2005' does not make sense. (John R Porter, KVL)	Changed.
5-472	A	19	10	19	10	2005? Or 2050 (Surinder Sagggar, Landcare Research)	Changed.
5-473	A	19	11	19	16	Words deleted and corrections are made in these lines kindly see the corrected manuscript (Dinesh Chandra Uprety, Indian Agricultural Research Institute)	Changed.
5-474	A	19	12	19	15	This sentence is only understandable if there is a conversion from fuelwood to charcoal. Is this the case? (John R Porter, KVL)	Rather both charcoal and firewood are woodfuels.
5-475	A	19	12	19	15	Why is charcoal separated from fuelwood? Surely it also comes from wood, so why does it not count as fuelwood? (David Price, Northern Forestry Centre)	Rather both charcoal and firewood are woodfuels.
5-476	A	19	18	19	19	Confusing use of "although" and "but" (David Price, Northern Forestry Centre)	Done.
5-477	A	19	18	19	21	This sentence could be phrased better. (Cynthia Rosenzweig, NASA/Goddard Institute For Space Studies at Columbia University)	Done.
5-478	A	19	22			already in 2005, CO2 emission credits have increased competitiveness of fuelwood dramatically in Europe. The EU biomass action plan documents a strong political will to further speed up this process. see also next comment (Marcus Lindner, European Forest Institute)	Included.
5-479	A	19	22	19	23	This sentence is unclear. I think the entire paragraph needs work. (David Price, Northern Forestry Centre)	Done.
5-480	A	19	23	19	23	After Hagler the year should be mention in the bracket (Dinesh Chandra Uprety, Indian Agricultural Research Institute)	Tech editing.
5-481	A	19	26	19	26	I agree, fisheries need a section and the impact of climate change needs to be	

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						highlighted (Nicholas Holden, University College Dublin)	
5-482	A	19	26	19	26	Words deleted and corrections are made in this sentence in the corrected manuscript (Dinesh Chandra Uprety, Indian Agricultural Research Institute)	
5-483	A	19	29			Section 5.3.3 reported a lot of considerations, but it is not possible to understand the trends of subsistence and smallholder agriculture and pastoralism as in previous sections on agriculture and forestry. Thus, I suggest to reduce the length of the section but report useful information and reference to address the aim of the section. (Marco Bindi, Dept. of Agronomy and Land Management)	Section now shortened and made clearer by use of a table.
5-484	A	19	29	19	29	This is not listed in the ToC (Nicholas Holden, University College Dublin)	Will be rectified.
5-485	A	19	29			Subheading 5.3.3 is absent in contents on p. 1. Substantially the sub-part 5.3.3 is part of agriculture (5.3.2.1) positioned here on too high level. In general part 5.3 (excluding 5.3.1) is weakly connected with climate change impact topic and might be presented more briefly. (Jüri Kadaja, Estonian Research Institute of Agriculture)	Because smallholder and subsistence farmers also raise livestock and make use of forest and fisheries resources, and because they suffer highly specific vulnerabilities, we disagree that this sub-section be subsumed into one on crops. The focus on stressors other than climate change is an agreed part of the chapter structure. The section has now been shortened.
5-486	A	19	29	20	49	Section 5.3.3. Not listed in contents (p. 1) but also not relevant to this report in the light of climate change. Could be relevant if it dealt with future trends but at present it is a general ramble. Remove it. (John R Porter, KVL)	The focus on stressors other than climate change is an agreed part of the chapter structure. The addition of the table has clarified the section and made it less of a “ramble”.
5-487	A	19	31	20	49	As with the previous sections, why are all the other influences on smallholders and subsistence farmers listed but no mention made of climate change impacts? Is it because no studies have been done? In my opinion this report should be making a strong statement with these sections but at present it is very weak (Nicholas Holden, University College Dublin)	The focus on stressors other than climate change is an agreed part of the chapter structure.
5-488	A	19	31	19	48	This is all about current operations and may be better included in section 5.2.3.1 (Jo Hossell, ADAS)	A new sub-division has made the issue of current situation and future trends clearer. As 5.2.3.1 has now been drastically shortened and moved back this would not be appropriate.
5-489	A	19	32	19	32	Year in the reference is not mentioned kindly complete it. (Dinesh Chandra Uprety, Indian Agricultural Research Institute)	There is no citation in the line specified.
5-490	A	19	33	19	36	Confusing and overlong sentence.	Sentence modified by addition of “and” after

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						(Emma Archer, University of the Witwatersrand)	“livelihoods.”
5-491	A	19	37	19	37	Gramatical errors are corrected in the corrected manuscript. (Dinesh Chandra Uprety, Indian Agricultural Research Institute)	I have not yet been able to access a readable version of this corrected manuscript.
5-492	A	19	38		48	There are additional risks from Sudan expereince. These include changing government macro economic policies and the lack of a formal marketing system where both the farmer and the pastoralits can sell this coomodities.Macro ploicies affect the flow and prices of goods, through for example inflation, the small producer requires and which he can not produce. Lack of a formal marketing system often results in lower prices for the goods of the small producer. Local taxes are also excised from the small producer. (Mohamed El Mahdi Beshir, Independent scholar and consultant)	Market failures in output supply as well as input supply, and macro-economic shocks will be mentioned in the SOD.
5-493	A	19	43			... drought and flood, crop and livestock diseases, and market shocks ... (Fischer Günther, International Institute for Applied Systems Analysis)	Accepted.
5-494	A	19	43	19	43	Mention the year of the reference (Dinesh Chandra Uprety, Indian Agricultural Research Institute)	There is no citation in the line specified.
5-495	A	19	45			Incomplete reference (Juerg Fuhrer, Federal AgroEcological)	If the reference is published or in circulation by the cut-off date, it will be cited directly. Otherwise, as the words referred to are those of one of the LAs, no citation will be needed.
5-496	A	19	45	19	49	Units are not clear in this paragraph. (Dinesh Chandra Uprety, Indian Agricultural Research Institute)	No units are appropriate for this sentence.
5-497	A	19	45	19	45	Mention the year in the bracket (Dinesh Chandra Uprety, Indian Agricultural Research Institute)	See response to 5-497.
5-498	A	19	46	19	46	Kindly mention the units? (Dinesh Chandra Uprety, Indian Agricultural Research Institute)	No units are appropriate for this sentence.
5-499	A	19	47	19	47	Kindly mention the units? (Dinesh Chandra Uprety, Indian Agricultural Research Institute)	No units are appropriate for this sentence.
5-500	A	19	48			Since people may work in off-farm and non-farm activities, it is suggested to add and, so to read “and / or” (Osvaldo Canziani, IPCC WG2 Co-chair)	Accepted.
5-501	A	19	48	19	48	Mention the year of the reference (Dinesh Chandra Uprety, Indian Agricultural Research Institute)	Many references can be provided, and were below (FOD p.20, 15-16) but references are not strictly needed for such a general statement.
5-502	A	19	50	20	3	para could be merged with the para below it LN5-10. (Jo Hossell, ADAS)	Following paragraph now summarised in a table, so no longer relevant.
5-503	A	20	0			threats caused by pandemics are mentioned. Here, animal diseases should be mentioned. There can be important effects on production and trade of animal	Will be accepted if space permits.

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						products, as shown most recent threats such as the avian flue. (Juerg Fuhrer, Federal AgroEcological)	
5-504	A	20	0	0	0	This page needs to be more clearly organized. (Cynthia Rosenzweig, NASA/Goddard Institute For Space Studies at Columbia University)	This has been done by putting much of the material in table form.
5-505	A	20	0			Section 5.3.3 -- Again, as for point 10 above, the section reviews various work, but what's the bottom line? And how does this bottom line change depending on (1) region and (2) the general view of what the world will look like in the future (e.g. a heavily globalised world, or one that has much more regional focus, etc) (Philip Thornton, International Livestock Research Institute (ILRI))	The general bottom line clarified in new draft, but distinctions by region and by global scenario would need more space and more data to discuss meaningfully.
5-506	A	20	1	20	2	Gramatical correction are done kindly see the corrected manuscript (Dinesh Chandra Uprety, Indian Agricultural Research Institute)	I have not yet been able to access a readable version of this corrected manuscript.
5-507	A	20	5	20	10	This section is overdeterministic - assumptions that all of this will take place. (Emma Archer, University of the Witwatersrand)	Rectified in new draft.
5-508	A	20	5	20	10	Probably need regional differentiation here -- while you do have fragmentation in some areas, also have massive rural-urban migration (Philip Thornton, International Livestock Research Institute (ILRI))	Space constraints preclude any detail on regional differentiation.
5-509	A	20	6	20	11	These lines are deleted for making it meaningful (Dinesh Chandra Uprety, Indian Agricultural Research Institute)	These lines now shortened and included in the table.
5-510	A	20	9			Land ownership is subject to traditional ruling. The Andean indigenous groups culture had led to the "minfundio" (small land parcels) due to the land distribution to the family descendants. However, the introduction of the cooperative work brought not only the organization of larger farms, but also the acquisition and communitarian use of agricultural equipment and joint marketing of commodities. (Osvaldo Canziani, IPCC WG2 Co-chair)	Land tenure has evolved in many different ways, driven by different forces, around the world, but only summary reference to these differences can be made here.
5-511	A	20	14			Regarding the climate issue, it should be noted, probably through cross reference with the regional chapters, in particular chapter 13, that rapid glacier melting is not only a critical degradation process but, basically, the disappearance of water sources. Smallholders established in the desert regions on both side of the Andes Cordillera are already suffering water shortages, particularly in La Niña weather conditions. This situation will worsen under the glaciers' disappearance trend. (Cross-refer to Chapter 13.) (Osvaldo Canziani, IPCC WG2 Co-chair)	Some reference is made, elsewhere in the chapter to reduction in irrigation water.
5-512	A	20	17	20	25	these lines are deleted because they were the repetition of the earlier version (Dinesh Chandra Uprety, Indian Agricultural Research Institute)	This comment is unclear.
5-513	A	20	19	20	21	Also need regional differentiation here -- why is it changing, where, which drivers	See comments above on regional

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						etc (Philip Thornton, International Livestock Research Institute (ILRI))	differentiation.
5-514	A	20	23			Incomplete reference (Juerg Fuhrer, Federal AgroEcological)	Hazell 2004—now rectified.
5-515	A	20	34	20	36	This sentence is also unclear. What is "pro-poor growth"? Does it mean poor growth will continue, because family farms are inefficient and do not generate employment, or does it mean positive growth for the poor, for the opposite reason? (David Price, Northern Forestry Centre)	"Pro-poor growth" not now used (though increasingly standard terminology for economic growth that favours the poor)
5-516	A	20	35			"pro-poor growth" meaning unclear (Norman Christensen, Duke University)	See response to 5-515.
5-517	A	20	45	20	50	Refer to comment about including the disequilibrium perspective above. There is a diversity of views on this issue, and this should be reflected. (Emma Archer, University of the Witwatersrand)	These lines now shortened and put in table form – the conclusion reached stands independently of controversies on disequilibrium grazing.
5-518	A	20	45	20	45	Mention year of the reference (Dinesh Chandra Uprety, Indian Agricultural Research Institute)	OK.
5-519	A	21	0	56		Section 4 contains many references to socio-economic impacts, including impacts on prices, trade and communities. Shouldn't these concerns be detailed in section 5.5 instead? (Pierre Bernier, Natural Resources Canada)	Comment has been accepted as fair and incorporated into redraft.
5-520	A	21	0	22		The discussion of the possible benefits of CO2 fertilisation overstates the certainties in the field. While experimental studies suggest that increased CO2 availability may increase yield, this is yet to be replicated on a crop-sized scale. Similarly there is little discussion of the impacts of increased levels of CO2 on areas that are water and nutrient limited. (Spencer Edwards, Department of Environment and Heritage)	A new discussion is now in 5.4.1 and 5.4.2 including issues of response in real fields and large scales.
5-521	A	21	2			General comments on section 5.4: This section will need to be restructured for the SOD. In particular, this section should be focussed on the impact of climate change on the different components of food, fibre and forest products. This should be done reporting, in different sub-sections, the results of the new studies since the TAR on the impact of increasing CO2 and changing climate on the different products. Whilst, in the following sections (e.g. 5.5 and 5.6) the adaptation capacity and the vulnerability should be reported. Moreover, always regarding section 5.4, in the SOD version the integration between the text and tables and boxes contents should be improved. For example in the present version the impact of increasing CO2 on crop products is reported in several parts (text, boxes and tables), the same for the impact of changing	Boxes have been merged into one section – 5.4.1—which also focuses on the combined impacts of CO2 and climate. A discussion on CO2 effects and modelling is also included in section 5.4.1.

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						temperature and precipitation. (Marco Bindi, Dept. of Agronomy and Land Management)	
5-522	A	21	2	56	16	Section 5.4 .- Key future impacts, vulnerabilities and their spatial distribution This section is quite extensive. It contains very interesting information; however, it misses to include some of the information suggested in the Guidance Notes. These, in addition to the Content Guide for Chapter 3 to 8, call for comments and references on agroforestry activities. Further, this long section includes extensive considerations on autonomous adaptation, which is completed in less than three pages (page 59, line 42 to page 62, line13, Section 56.- Planned Adaptation Options and Capacities). This structure and extension leave too little room to assist decision making, very particularly official and private groups from developing countries, by providing badly needed information. This concerns pre-adaptation and adaptation activities rather fundamental to cope with the problems which would arise to develop agricultural activities and operate within the global market conditions, under a new climate system. SOD should take care of this situations, most probably reducing the extension of section 5.4 and giving more to an integrated adaptation section under 5.6. Finally, it should be noted that section 5.4 includes only a few number of messages to decision making. (Osvaldo Canziani, IPCC WG2 Co-chair)	Comment now redundant or irrelevant as section has been revised.
5-523	A	21	2			Section 5.4. No mention of tsetse fly, mosquito, desert locust? (Richard Fleming, Great Lakes Forest Research Centre)	One reference on locusts included in 5.4.1.
5-524	A	21	2			Chapter 5.4 This is a key sub-chapter. It is generally fairly well written. In the impacts part, what it perhaps neglected is the possible importance of differences in cultivar responses. For instance, effects of warming must differ between early and late maturing cultivars of grain crops. It appears later as an adaptive measure, but it is also an important aspect when it comes to impacts. I also miss the aspect of pests and diseases, and the shift in their ranges with climate change. (Juerg Fuhrer, Federal AgroEcological)	Comment now redundant or irrelevant as section has been revised.
5-525	A	21	2			Section 5.4. This section is generally too long. The structure seems to result in a certain degree of repetitiveness which if restructured could bring down the page length and make the text much easier to follow. (Paula Harrison, University of Oxford)	Comment has been accepted as fair and incorporated into redraft.
5-526	A	21	4	24	20	Boxes 5.2 and 5.3 are very dense and detailed - could be simplified with reference to main processes and key elements of debate only (Edward Allison, University of East Anglia)	See above.
5-527	A	21	4	22	34	Box 5.2, on primary effects of elevated CO ₂ , should contain a short overview of	Comment has been accepted as fair and

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						recent research on ocean acidification due to elevated co2 levels - this process is thought to have important implications for marine food chains and for productive potential of heavily calcified organisms (molluscs and crustaceans in particular) (Edward Allison, University of East Anglia)	incorporated into redraft. Also covered in Chapter 4. Not yet. TBD with LA.
5-528	A	21	4	24	20	These two boxes are very useful summaries of the new information since the TAR, but it would be helpful to change the title on at least one of them to clearly distinguish the difference between the topics addressed. (Lenny Bernstein, IPIECA)	Boxes are now merged into one.
5-529	A	21	4			Box 5.2: The content of this box is generally ok. What I miss is the issue of CO2/water interactions in grasslands. Morgan et al. (Oecologia 140, 2004) have concluded that the CO2 response in several types of grasslands are mediated through altered soil water relations. (Juerg Fuhrer, Federal AgroEcological)	This is not new since the TAR.
5-530	A	21	4			Box 5.2 is well written. A figure explaining the interactive effects of temperature and CO2 on transpiration, yield, nitrogen content, etc. would be useful to this chapter. Also, the term "acclimation" needs to be defined. (Cynthia Rosenzweig, NASA/Goddard Institute For Space Studies at Columbia University)	Unfortunately there's no room for a figure.
5-531	A	21	5	24	48	Even at the risk of increasing the length of this chapter it would be desirable to illustrate much of the material in these pages by graphics depicting the main impacts (such as the contents of box 5.2 and 5.3, climatic extremes, effect on domestic animal physiology, animal disease, intensive livestock production, and historical land use change). (Mohamed El Mahdi Beshir, Independent scholar and consultant)	As above. TBD with Las.
5-532	A	21	5			Comments on BOX 5.2: This box as well box 5.3 should be moved after or in the sub-section describing the impact on food, pasture, livestock and forest (Marco Bindi, Dept. of Agronomy and Land Management)	Done.
5-533	A	21	5	23	50	Boxes 5.2 and 5.3 should be combined to eliminate separate discussion of impact from elevated CO2 without discussion of combined effects of CO2 x Temperature. See general comment #4 above. (Kenneth Cassman, University of Nebraska)	5.4.1 does precisely that.
5-534	A	21	5	23	50	These two boxes seem like a "machine gun" of facts with very little synthesis or within-paragraph organization. (Norman Christensen, Duke University)	Better synthesis has been provided in 5.4.1.
5-535	A	21	5	21	5	This box seems almost exclusively about new experiments since the TAR. Why then call it 'new knowledge?' The general conclusion for this box is that not much has changed since the TAR except with more focus on quality rather than quantity	Agree. New 5.4.1 better addresses new findings.

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						of yield. (John R Porter, KVL)	
5-536	A	21	8	21	38	The role of air pollutants (particularly ozone) should be acknowledged in Box 5.2 as limiting factors. Again, the new post TAR literature from Aspen FACE and SOYFACE is relevant. From the global perspective, the following state of science reviews are of interest: Percy et al. (2003) Tropospheric ozone: A continuing threat to global forests? pp 85-118 IN Karnosky et al (Eds.) Air Pollution, Global Change and Forests in the New Millenium . Elsevier, Oxford 468 pp. ; Emberson et al (Eds.) (2003) Air Pollution Impacts on Crops and Forests: A Global Assessment. Imperial College Press, London. 372 pp; and Ashmore(2005) Plant Cell and Environment 28: 949-964. (Kevin Percy, Canadian Forest Service)	To be included in new pollutants section. Also mentioned in 5.4.1.
5-537	A	21	10	21	14	Same to Page3 L 46-50 (Xie Liyong, Insitute of Agro-Environment and Sustainable Development)	We do not understand the point being made in this comment and therefore cannot respond.
5-538	A	21	11	21	11	It would be good here to specify whether "leaf photosynthesis" is net or gross. I am assuming the latter. (David Price, Northern Forestry Centre)	Removed leaf photosynthesis references in new 5.4.1. in any case, it was net photosynthesis.
5-539	A	21	21	21	23	Suggest adding "effects of air pollutants such as ozone" to the list (Fuhrer and Booker, 2003; Fiscus et al., 2005) (Fitzgerald Booker, USDA-ARS Plant Science Research Unit)	Tbi in new air pollutants section.
5-540	A	21	27	21	27	Although some FACE experiments indicate mean increases in crop yields by 15% at 550 ppm CO ₂ , the variability associated with this estimate is high (Fiscus et al., 2002; Fiscus et al., 2005), and the reasons for this are unclear. (Fitzgerald Booker, USDA-ARS Plant Science Research Unit)	Agreed. Not important within this particular write-up and new discussion in 5.4.1.
5-541	A	21	29	21	29	Concerning the impact on potato, please consider the Special Issue of the EU-CHIP project on the European Journal of Agronomy (Volume 17, Issue 4, November 2002) (Marco Bindi, Dept. of Agronomy and Land Management)	Removed single-crop results from new 5.4.1
5-542	A	21	29	21	30	Really? The result is maybe too high. (Xie Liyong, Insitute of Agro-Environment and Sustainable Development)	See above.
5-543	A	21	29			This is in agreement with findings from a 6-year FACE experiment conducted in Germany for a typical wheat-sugar beet- barley rotation (Waigel A, Manderscheid, R et al., 2005 - to be confirmed by literature search, website: http://www.aoe.fal.de/en/index.html) (Goetz M Richter, Rothamsted Research)	OK.
5-544	A	21	32	21	32	Mention the year in the bracket (Dinesh Chandra Uprety, Indian Agricultural Research Institute)	OK.

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5-545	A	21	33	21	34	Food quality of some crops may be reduced by CO ₂ , but soybean seed protein and oil concentration were not substantially affected by elevated CO ₂ (Heagle et al., 1998). (Fitzgerald Booker, USDA-ARS Plant Science Research Unit)	Not relevant in new 5.4.1. these analyses were already done in TAR.
5-546	A	21	33	21	34	Also mentioned on P 5 L 13-14 (Xie Liyong, Insitute of Agro-Environment and Sustainable Development)	OK.
5-547	A	21	36			The interaction between water and CO ₂ is not entirely clear. Mitchell et al. (2001/2?) showed in experiments in a controlled environment that the response of wheat followed the same pattern in irrigated and water-stressed treatments. (Goetz M Richter, Rothamsted Research)	Agreed. Not relevant in new 5.4.1. already partially discussed in TAR.
5-548	A	21	37	21	38	Don't follow this sentence at all? Needs an explanation or clearer wording. (Richard Fleming, Great Lakes Forest Research Centre)	Eliminated in 5.4.1
5-549	A	21	38	21	38	I suspect the following reference was intended: 174. Derner, J.D., H.B. Johnson, B.A. Kimball, P.J. Pinter Jr, H.W. Polley, C.R. Tischler, T.W. Bouttons, R.L. LaMorte, G.W. Wall, N.R. Adam, S.W. Leavitt, M.J. Ottman, A.D. Matthias, and T.J. Brooks. 2003. Above- and below-ground responses of C3-C4 species mixtures to elevated CO ₂ and soil water availability. Global Change Biology 9:452-460. (Bruce Kimball, USDA, Agricultural Research Service)	Included in 5.4.1
5-550	A	21	43	21	43	Mention the year in the bracket (Dinesh Chandra Uprety, Indian Agricultural Research Institute)	OK.
5-551	A	21				BOX 5.2 ~ omit. We know CC involved changes in climate (temp. pcpt, ..) & GHG concentrations. It is BOX 5.3 that has relevance. Augment BOX 5.3 with items from BOX 5.2 only where necessary to fill knowledge gaps. There should also be some new work on temp & pcpt effects relevant to these gaps. (Richard Fleming, Great Lakes Forest Research Centre)	Boxes have been merged.
5-552	A	22	9	22	9	Box 5.2, pg. 22, ln. 9: Cotton yield was increased at elevated CO ₂ in an open top chamber experiment as well (Heagle et al., 1999). (Fitzgerald Booker, USDA-ARS Plant Science Research Unit)	Relevant to TAR.
5-553	A	22	12	22	12	Missing references related to south Asian work are added (Dinesh Chandra Uprety, Indian Agricultural Research Institute)	Noted
5-554	A	22	13	22	14	Where does this come from -- it comes out as a key finding of the chapter, but where's the support for this? And why is it important, and how important is it? (Philip Thornton, International Livestock Research Institute (ILRI))	Eliminated in new 5.4.1.
5-555	A	22	16	22	19	Concering plantation crops, check the results reported for grapevine in the following papers: Bindi M., Fibbi L. and Miglietta F., 2001. Free Air CO ₂ Enrichment (FACE) of grapevine (<i>Vitis vinifera</i> L.): .): II. Effect on	Bindi et al. (2005) TBI in new section.

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						growth and grapes and wine quality. European Journal of Agronomy, 14: 145-155; Bindi M., Raschi A., Lanini M., Maglietta F., Tognetti R. (2005). Physiological and yield response of grapevine (Vitis vinifera L.) exposed to elevated CO2 concentrations in a Free Air CO2 Enrichment (FACE). Journal of Crop Improvement, 13: 345 - 359; Tognetti R., Raschi A., Longobucco A., Lanini M., Bindi M. (2005). Hydraulic Properties and Water Relations of Vitis Vinifera L. exposed to elevated CO2 Concentrations in a Free Air CO2 Enrichment (FACE). Phytion 45: 243-256 (Marco Bindi, Dept. of Agronomy and Land Management)	
5-556	A	22	20	22	20	Reference added (Dinesh Chandra Uprety, Indian Agricultural Research Institute)	I WAS NOT PROVIDED WITH Dinesh Chandra Uprety COMMENTS.
5-557	A	22	21	22	33	Should add the results of the ASPEN FACE (Karnosky, D.F., K.S. Pregitzer, D.R. Zak, M.E. Kubiske, G.R. Hendrey, D. Weinstein, M. Nosal and K.E. Percy, 2005. Scaling ozone responses of forest trees to the ecosystem level in a changing climate. Plant, Cell and Environment. 28: 965-981) who show that ozone fumigation to levels commonly found in populated areas eliminate the fertilisation effects of CO2. Also, there are some documented impacts of increased CO2 and O3 on tent caterpillars within the Aspen Face literature (Kopper, B.J. and R.L. Lindroth, 2003. Effects of elevated carbon dioxide and ozone on the phytochemistry of aspen and performance of an herbivore. Oecologia 134: 95-103; see also K.E. Percy et al 2002. Altered performance of forest pests under atmospheres enriched by CO2 and O3. Nature 420:403-407) (Pierre Bernier, Natural Resources Canada)	TBI in new pollutant section. Done.
5-558	A	22	21	22	33	It may be good to add the recent results on "web-FACE" by Korner et al (Körner C., R. Asshoff, O. Bignucolo, S. Hättenschwiler, S.G. Keel, S. Pelaez-Riedl, S. Pepin, R. R.T.W. Siegwolf and G. Zotz. 2005. Carbon Flux and Growth in Mature Deciduous Forest Trees Exposed to Elevated CO2. Science 309: 1360-1362) who report limited effects of enhanced CO2 on the growth of a number of species. (Pierre Bernier, Natural Resources Canada)	Done. Will consider.
5-559	A	22	21		26	add and consider Körner et al. 2005: Carbon Flux and Growth in Mature Deciduous Forest Trees Exposed to Elevated CO2, Science 309, 1360-1362. (Marcus Lindner, European Forest Institute)	Included in new 5.4.1. Done.
5-560	A	22	23	22	23	South Asian studies has not been mentioned here (Dinesh Chandra Uprety, Indian Agricultural Research Institute)	We do not understand the point being made in this comment and therefore cannot respond.
5-561	A	22	28	22	28	Corrections are made by deleting extra brackets (Dinesh Chandra Uprety, Indian Agricultural Research Institute)	OK.
5-562	A	22	29	22	29	Information on Brassica has been included	We do not understand the point being made in

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						(Dinesh Chandra Uprety, Indian Agricultural Research Institute)	this comment and therefore cannot respond.
5-563	A	22	31	22	33	The sentence should be moved in the next box (5.3) since in box 5.2 only the impact of elevated CO2 should be reported (Marco Bindi, Dept. of Agronomy and Land Management)	New section merges boxes. Sentence changed-obsolete.
5-564	A	22	31		33	This final sentence should be part of the initial section 'common features' (Juerg Fuhrer, Federal AgroEcological)	Sentence changed-obsolete.
5-565	A	22	31	22	33	I would add disturbances (flood, wind, fire). (Sylvie Gauthier, Laurentian Forestry Center, Canadian Forestry Service)	TBD, some mentioned in 5.4.2. Unfortunately this section is limited with CO2 effects only.
5-566	A	22	31		33	these are climate impact studies, wrong chapter... (Marcus Lindner, European Forest Institute)	Not so. Sentence changed. Curiously, this comment contradicts the previous one.
5-567	A	22	31	22	33	Ecosystem response will vary geographically, depending on..... Should add a phrase, land use change and land cover change (Shirong Liu, Institute of Forest Ecology, Environment and Protection, Chinese Academy of Forestry)	Obsolete.
5-568	A	22	34	22	35	Information on the changes in the cultivation, and the nutrient management technology for Brassica and rice under high CO2 have been included (Dinesh Chandra Uprety, Indian Agricultural Research Institute)	Where are these changes?
5-569	A	22	36			Box 5.3 No comment (Juerg Fuhrer, Federal AgroEcological)	OK.
5-570	A	22	37			Another good box (Cynthia Rosenzweig, NASA/Goddard Institute For Space Studies at Columbia University)	Thanks!
5-571	A	22	41		43	But it is not obviously change in rainfall so far and in the seeable future according to many studies. So the most important interaction is the interaction of CO2 and temperature. (Xie Liyong, Insitute of Agro-Environment and Sustainable Development)	Yes, but changes in precipitation may strongly affect yields of rainfed crops in the future.
5-572	A	22	45	22	45	Some of this information has been known since the 1980s - that on the effects of higher temperatures extending growing periods at northern latitudes. Much of the material may have been published since 2001 but it is not new information. The most sensible conclusion would be that work since the TAR has confirmed many earlier findings but has not added much new. (John R Porter, KVL)	Agreed and included in 5.4.2 and 5.4.1.
5-573	A	22	47	22	48	"Interactions with..." repeat of what is said earlier (Jo Hossell, ADAS)	
5-574	A	22	50			Insert a new sentence at line 50 as follows: "These shifts in photosynthetic optima	Not relevant to new section 5.4.1.

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						can be aided by GM technologies (Goklany 2003)" (Indur Goklany, Office of Policy Analysis, Department of the Interior)	
5-575	A	23	2			Add a new sentence at the end of this para, as follows: "GM technologies could also help reduce many of these pressures while at the same time minimizing costly or labor intensive inputs (Goklany 2001)." (Indur Goklany, Office of Policy Analysis, Department of the Interior)	There is a specific discussion in separate section.
5-576	A	23	4	23	21	Check the following references for the interactions between climate change and CO2 on crop: Ewert, F., Rounsevell, M.D.A., Reginster, I., Metzger, M.J., Leemans, R., 2005. Future scenarios of European agricultural land use. I. Estimating changes in crop productivity. Agriculture, Ecosystems and Environment 107, 101-116. Holden, NM and Brereton, AJ 2003. Potential impacts of climate change on maize production and the introduction of soybean in Ireland. Irish J. Agr. Food Res, 42:1-15 Holden, NM, Brereton, AJ, Fealy, R, Sweeney, J, 2003. Possible change in Irish climate and its impact on barley and potato yields. Agric. For. Meteorol., 116: 181-196 (Marco Bindi, Dept. of Agronomy and Land Management)	Included ewert et al., 2005 in 5.4.2
5-577	A	23	4	23	5	Obviously, northern sites seems to be benefitted by future increase in temperature. It is however not clear whether the fragile nature of these mountains/hilly areas would allow for significant increase in area for crop production. Increasing the area under crop might require cleaning of current forests for agricultural production which may lead to many problems further aggravating the situation. (Mudasser Muhammad, Global Change Impact Studies Centre (GCISC))	Agreed. Not relevant to new 5.4.1.
5-578	A	23	4	23	4	By "northern" do you mean "high latitude", but restricted to the northern hemisphere"? Please be precise (David Price, Northern Forestry Centre)	Corrected.
5-579	A	23	6	23	6	Similarly, does "southern regions" mean southern hemisphere or low latitude in the northern hemisphere? (David Price, Northern Forestry Centre)	See above.
5-580	A	23	7	23	21	For winter wheat in the UK it could be shown in a simulation study that crops sown early enough are likely to escape future drought stress by flowering and maturing about 4 weeks earlier by the 2050s - using HadCM2 medium high scenarios (Richter and Semenov, 2005). The combination of higher temperatures and CO2 concentrations are likely to result in yields increased by 1 to 1.5 t/ha. Using more recent scenarios these results were confirmed and differentiated for B2 and A2 emission scenarios (Richter et al., 2004). For a typical spring crop modelling showed quite different results: sugar beet yield increases are likely to	Table 5.2 has been eliminated. Detailed discussion of specific crop responses also eliminated, as mainly in line with TAR results.

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						depend on the allocation to soils of sufficient water availability (Richter et al., 2004 - Report to DEFRA, see above; Richter GM, Qi A, Semenov MA, Jaggard KW, 2005. Variability of UK sugar beet yields under climate change and soil use adaptation needs. Soil Use Management (in review)). - these references should be included in Table 5.2 Theme 1 (Goetz M Richter, Rothamsted Research)	
5-581	A	23	13	23	14	Does the result only fit to Philippines, or to all latitudes regions? The answer maybe is former. (Xie Liyong, Insititute of Agro-Environment and Sustainable Development)	
5-582	A	23	13	23	13	Deleted (Dinesh Chandra Uprety, Indian Agricultural Research Institute)	
5-583	A	23	16	23	21	Yes. It is right, and it is very important information. But it is not very clear, and should be discussed in details. (Xie Liyong, Insititute of Agro-Environment and Sustainable Development)	Comment has been accepted as fair and incorporated into redraft.
5-584	A	23	25	23	26	The Aranjuelo et al (2005) and Shaw et al (2003) references are missing from list (Bruce Kimball, USDA, Agricultural Research Service)	Noted.
5-585	A	23	39	23	48	In this paragraph, no results of studies on the selected crops (industrial, biofuels, etc.) are reported. Only general consideration are indicated. In the SOD the results on these crops should be reported. (Marco Bindi, Dept. of Agronomy and Land Management)	Agreed. Does not apply to new section 5.4.1.
5-586	A	23	39	23	48	Many of the problems raised in this para -- frost, fungi, pathogens -- are in theory, at least, more readily solvable with the use of GM technologies (Goklany 2001). (Indur Goklany, Office of Policy Analysis, Department of the Interior)	In Theory. GM were discussed in a separate section.
5-587	A	23	46	23	48	This Harvell et al. 2002 citation is used in three different places, to make three different points? I think here it is a bit misleading because the fungal disease mentioned was evidently not indigenous to Africa. So even if climate change occurred in Africa, geographic isolation would not prevent the disease and the crop from meeting. (David Price, Northern Forestry Centre)	Comment has been accepted as fair and incorporated into redraft.
5-588	A	23	47			For some reason, this example is highlighted three times in this chapter. Though it is interesting, it is not particularly illuminating. (Cynthia Rosenzweig, NASA/Goddard Institute For Space Studies at Columbia University)	Comment now redundant or irrelevant as section has been revised.
5-589	A	23	50	24	51	possibility to add Badeck, F.-W., A. Bondeau, K. Bottcher, D. Doktor, W. Lucht, J. Schaber and S. Sitch 2004. Responses of spring phenology to climate change. New Phytol. 162:295-309. (Marcus Lindner, European Forest Institute)	Comment now redundant or irrelevant as section has been revised.

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5-590	A	24	2	24	4	Cite work by Ted Hogg (CFS) in primary scientific literature for probably more moderate & reliable forecasts for western Canada. (Richard Fleming, Great Lakes Forest Research Centre)	Comment now redundant or irrelevant as section has been revised.
5-591	A	24	2	24	4	If this estimate of boundary shifts comes from where I think it comes, it is based on a single model and does not account for limitations in soils and seed dispersal distances. (David Price, Northern Forestry Centre)	Comment now redundant or irrelevant as section has been revised.
5-592	A	24	4	24	4	Words deleted (Dinesh Chandra Uprety, Indian Agricultural Research Institute)	Comment now redundant or irrelevant as section has been revised.
5-593	A	24	5			See Hogg and Bernier 2005 (Forestry Chronicle 81: 675-682) for an example of an application of a simple climate index to the analysis of potential shift in the southern limit of forests at the prairie-forest interface in Canada. (Pierre Bernier, Natural Resources Canada)	Comment now redundant or irrelevant as section has been revised.
5-594	A	24	5	24	5	Words deleted (Dinesh Chandra Uprety, Indian Agricultural Research Institute)	Comment now redundant or irrelevant as section has been revised.
5-595	A	24	7		19	Caution: this paragraph seems to reflect "old" understanding of potential species responses to temperature changes. We still lack reliable assessments of the process of species replacement at warm distribution limits. (compare e.g. papers by Craigh Loehle). It would also be interesting to add a paragraph on impacts of extreme events such as the heat wave 2003 in Europe. There are some papers in preparation documenting observed local differences in species responses to this event including die-back of drought sensitive species at the physiological species limit. (Marcus Lindner, European Forest Institute)	Comment now redundant or irrelevant as section has been revised.
5-596	A	24	7	24	10	I think this might be an oversimplification for many regions - the exploration of a species can not be seen only as a front that is advancing in a direction. This because there are for tree species areas far beyond the general front with different climatic situation where they are growing and from where they can spread. So for mountainous areas above the tree limit there are still small clusters of trees in depressions or on particularly warm sites. This suggest that spreading might go rather fast. (Mats Olsson, SLU)	Comment now redundant or irrelevant as section has been revised.
5-597	A	24	8	24	10	Ted Hogg has found evidence providing some support for broader theoretical work (Fleming 1996 - citation given above) suggesting that insect disturbance could be a key component of the causes underlying such disruption of local forest ecosystems, which, on a broader geographic scale, result in shifting forest/grassland boundaries.	Comment now redundant or irrelevant as section has been revised.

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						(Richard Fleming, Great Lakes Forest Research Centre)	
5-598	A	24	11	24	12	Why would increased seed production "counterbalance" effects of slow migration? Just because there are more seeds does not mean that a significant number will travel further. Is this actually what Stiling et al. found or was it just an untested hypothesis? If they did find this, perhaps briefly explain. (David Price, Northern Forestry Centre)	Comment now redundant or irrelevant as section has been revised.
5-599	A	24	13			word missing after "marginal" (Paula Harrison, University of Oxford)	Comment now redundant or irrelevant as section has been revised.
5-600	A	24	15	24	17	Poor choice of literature to support these points. Can refers to 1 insect. Better choice would be couple of broad reviews (e.g., Jesse Logan, Matt Ayres or Fleming, R.A. 2000. Climate change and insect disturbance regimes in Canada's boreal forests. Word Resources Review 23(3): 520-555). (Richard Fleming, Great Lakes Forest Research Centre)	Done.
5-601	A	24	17	24	19	Better citations are work of Allan Carroll or Jesse Logan. (Richard Fleming, Great Lakes Forest Research Centre)	Done.
5-602	A	24	17	24	17	Unit of CO2 measurement is corrected (Dinesh Chandra Uprety, Indian Agricultural Research Institute)	OK.
5-603	A	24	19			See work by Carroll et al on how the dramatic outbreak of mountain pine beetle in Canada is linked to winter warming (Carroll, A. L. S. W. Taylor J. Régnière & L. Safranyik. 2004. Effects of climate change on range expansion by the mountain pine beetle in British Columbia. pp. 223-232 in T.L. Shore, J.E. Brooks & J.E. Stone (Eds). Natural Resources Canada, Canadian Forest Service, Pacific Forestry Centre Information Report BC-X-399, Victoria BC 298 p.) (Pierre Bernier, Natural Resources Canada)	Done.
5-604	A	24	19	24	19	CFS, 2003 (David Price, Northern Forestry Centre)	Comment now redundant or irrelevant as section has been revised.
5-605	A	24	19	24	19	Report of amelioration of high temperature effect by elevated CO2 in rice is included (Dinesh Chandra Uprety, Indian Agricultural Research Institute)	OK.
5-606	A	24	23			Comments on sub-section 5.4.1: The general comments reported above for the section 5.4 are still valid for this sub-section. A lot of information on different aspects are reported, but these are not very well integrated, ranging from experimental to modelling results and from CO2 to climate change impacts. Moreover, the references about perennial crops should be completed introducing the results of a series of paper published by Gregory Jones on Grapevine (see his web site http://www.sou.edu/geography/jones/cv.htm); whilst for olive the references should be removed since these were already in the TAR	Comment now redundant or irrelevant as section has been revised. Comment raises broader issues than is feasible to discuss within the limitations of space provided.

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						(Marco Bindi, Dept. of Agronomy and Land Management)	
5-607	A	24	23			Section 5.4.1 -- I agree with the comment in line 24 that this section needs heavy restructuring (Philip Thornton, International Livestock Research Institute (ILRI))	This section has been entirely re-written. See new sections 5.4.1 and 5.4.2.
5-608	A	24	36	24	36	No Box 5.4. (John R Porter, KVL)	Does not apply to revised sections.
5-609	A	24	37			replace "gotten" with "became"! (Jo Hossell, ADAS)	Does not apply to revised sections.
5-610	A	24	37	24	37	gotten clearer' is awful English. (John R Porter, KVL)	Does not apply to revised sections.
5-611	A	24	37	24	37	replace "gotten" with "become" (David Price, Northern Forestry Centre)	Does not apply to revised sections.
5-612	A	24	41	24	41	There is great confusion over the terms 'adaptation' and 'mitigation' - ie. Adpatation mitigates yield impacts. You need to be very careful about these terms in an IPCC report. For mitigation you mean 'reduces'. (John R Porter, KVL)	Does not apply to revised sections.
5-613	A	24	44			How many is enough - strange wording? (Paula Harrison, University of Oxford)	Does not apply to revised sections.
5-614	A	24	48			5.3.1 should probably read 5.4.1. (Fischer Günther, International Institute for Applied Systems Analysis)	Does not apply to revised sections.
5-615	A	24	48			What is 5.3.1? (Jüri Kadaja, Estonian Research Institute of Agriculture)	Does not apply to revised sections.
5-616	A	24	50			Section 5.34.1.1 I seem to be reading the same points over & over again in slightly difference contexts. (Richard Fleming, Great Lakes Forest Research Centre)	Does not apply to revised sections.
5-617	A	24	50			5.4.1 instead of 5.3.1 (Juerg Fuhrer, Federal AgroEcological)	Does not apply to revised sections.
5-618	A	25	0			Another concern relates to the quantitative data for yield changes (better: potential yield) due to climate change. For instance, on pg 25 data from different studies are compared. It should be made clear that any yield projection depends on the assumptions in the climate models (e.g., emission scenario), which affects the level of changes in precipitation and in temperature, and assumptions in the yield models (e.g., soils properties). (Juerg Fuhrer, Federal AgroEcological)	Agreed. But it does not apply to revised sections.
5-619	A	25	10	25	23	There is no mention here of whether nutrient supplies limit responses. Are we to assume that for all of these cited experiments, nutrients were non-limiting? It would be good to know this for sure.	Does not apply to revised sections.

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						(David Price, Northern Forestry Centre)	
5-620	A	25	11	25	13	Awkward sentence (Norman Christensen, Duke University)	Does not apply to revised sections.
5-621	A	25	12	25	16	References are not found. Sri Lanka and Philippines have same latitudes, and similar climate. What is the reason to result in the different experimentation result? Study from China (not published) showed that the biomass of rice increased significantly, while the grain yield of rice increased no significant under 550ppm CO ₂ and +1 , 650ppm CO ₂ and +2 , respectively. The experimentation also showed that bad accuracy control would result in errors. (Xie Liyong, Insititute of Agro-Environment and Sustainable Development)	Does not apply to revised sections.
5-622	A	25	14			300ppm is this the correct level or a typo (Jo Hossell, ADAS)	OK.
5-623	A	25	21			The wording 'these results contrast with those for China' is inappropriate. First, from the description it is very likely that the studies in India and China used different climate scenarios; second, the results for China are not necessarily inconsistent with the finding that temperature increases and precipitation decreases both lead to a yield reduction. Also, rice in China is both indica and japonica whereas rice in India is exclusively indica. Finally, as is actually clearly pointed out in Ch. 5, climate change impacts on crops can be rather location-specific and variable, certainly in countries as large as India or China. Both aggregation of results and comparison is therefore sometimes difficult. (Fischer Günther, International Institute for Applied Systems Analysis)	Agreed. Does not apply to revised sections.
5-624	A	25	21	25	23	Is this a contrast when both show a yield decrease (Jo Hossell, ADAS)	Does not apply to revised sections.
5-625	A	25	21	25	23	It is not clear why and how these results contrast with those from China. (Jørgen E. Olesen, Danish Institute of Agricultural Sciences)	Does not apply to revised sections.
5-626	A	25	25	25	29	Awkward sentence (Norman Christensen, Duke University)	Does not apply to revised sections.
5-627	A	25	30	25	30	Superflous word are deleted (Dinesh Chandra Uprety, Indian Agricultural Research Institute)	Does not apply to revised sections.
5-628	A	25	35	25	35	Add the following references after :critical": Goklany (1995, 2000). (Indur Goklany, Office of Policy Analysis, Department of the Interior)	These are not post.
5-629	A	25	37	25	38	The sentence has corrected (Dinesh Chandra Uprety, Indian Agricultural Research Institute)	Does not apply to revised sections.
5-630	A	25	39	29	39	Deleted (Dinesh Chandra Uprety, Indian Agricultural Research Institute)	Does not apply to revised sections.
5-631	A	25	40	25	41	It is unclear what "grain protein" refers to (i.e., rice, wheat, etc.). Please clarify.	Comment has been accepted as fair and

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						Also, soybean seed protein and oil content were not substantially affected by elevated CO ₂ (Heagle et al., 1998). (Fitzgerald Booker, USDA-ARS Plant Science Research Unit)	incorporated into redraft.
5-632	A	25	40	25	49	Grain quality again!!! There is too much repetition and padding in the chapter - it could be reduced by 50% without losing impact and this would improve its clarity and structure. (John R Porter, KVL)	See above. Does not apply to revised sections.
5-633	A	25	44			fertilization instead of supply (Juerg Fuhrer, Federal AgroEcological)	Does not apply to revised sections.
5-634	A	25	45	25	46	In fact, how to improve the N use efficiency is a core issue to be considered. (Xie Liyong, Insititute of Agro-Environment and Sustainable Development)	Does not apply to revised sections.
5-635	A	26	0			Table 5.2, Theme 5: Table is not comprehensive, and data with two decimals should be educed to numbers with a max of 1 decimal (Juerg Fuhrer, Federal AgroEcological)	Table was removed and a subset of its results moved to text in 5.4.2.
5-636	A	26	7			Table 5.2 NOTE: It should be noted that there is not a previous Table 5.1; however, such a table is mentioned in page 55 line 2 and would be devoted to yield changes in major smallholder's crops, in certain developing countries. In this regard, the reference, between brackets, in page 25, line 27 to Table ?? could be the missing one. In fact it should contain C4 yields (maize. Sorghum and millet), which crops are important in developing countries. This issue needs clarification. Coming to Table 5.2,there is no doubt that cross-reference with regional chapters would improve the content, providing missing references from developing regions. (Osvaldo Canziani, IPCC WG2 Co-chair)	Table was removed and a subset of its results moved to text in 5.4.2.
5-637	A	26	7	28	3	This table is hard to follow--not sure it adds much value (Norman Christensen, Duke University)	Comment now redundant or irrelevant as section has been revised.
5-638	A	26	7			Tale 5.2, Theme 1: Description is unclear (Juerg Fuhrer, Federal AgroEcological)	Table was removed and a subset of its results moved to text in 5.4.2.
5-639	A	26	7			Need to be consistent in use of terms - either corn or maize (Jo Hossell, ADAS)	Table was removed and a subset of its results moved to text in 5.4.2.
5-640	A	26	7	28	3	Please include another column in Table 5.2 mentioning the technique employed for analysis. Type of technique used in the analysis such as regression analysis, biophysical model, or ricardian analysis etc is important in comparing the the results of various studies as mention in the column "impact". (Mudasser Muhammad, Global Change Impact Studies Centre (GCISC))	Table was removed and a subset of its results moved to text in 5.4.2.
5-641	A	26	7	28	2	This table provides much to high a level of detail and it does not provide much in	Table was removed and a subset of its results

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						terms of adding an overview. Also much of this information is likely to be duplicated in the continental chapters. In the current form, I suggest that it is omitted. (Jørgen E. Olesen, Danish Institute of Agricultural Sciences)	moved to text in 5.4.2.
5-642	A	26	7	26	13	Are these themes reported in the executive summary or conclusions? There generally seems a lack of clarity and much overlap between the outcomes of the TAR and FAR. This is a serious issue that needs to be sorted out. (John R Porter, KVL)	Table was removed and a subset of its results moved to text in 5.4.2.
5-643	A	26	10	26	10	Sentence readjusted (Dinesh Chandra Uprety, Indian Agricultural Research Institute)	
5-644	A	26	12	28	3	Table 5.2 comment: This table should give explicit information about the type of study (i.e. field experiment, controlled condition field study, growth chamber, greenhouse, or simulation modeling) for each item on the list. This information is crucial in order to interpret the reliability/uncertainty of the information. (Kenneth Cassman, University of Nebraska)	Table was removed and a subset of its results moved to text in 5.4.2.
5-645	A	26	12			Table 5.2. Howden and Jones (2004). Should the impact read "...to \$550M/yr"? Ramankutty et al. (2002) - loss not lass? Refs by Ewert et al. (20050) and Rounsevell et al. (2005) in Agriculture, Ecosystems and Environment, vol. 107 and Audsley et al. (in press) Environmental Science and Policy may be useful here. The latter (attached) includes 3 time periods (2020, 2050 and 2080) for 2 GCMs and 4 SRES scenarios for predictions of yield, profitability and agricultural land use for Europe. There are also several references on agricultural impacts for Europe in ch. 12 that may be useful - see section 12.4.7. (Paula Harrison, University of Oxford)	Table was removed and a subset of its results moved to text in 5.4.2.
5-646	A	26	12			The effects of climate change on sugar yields reported for the UK could possibly be extended to all of north-west and central Europe as an earlier study based on HadCM2 scenarios showed (Jones et al., 2003); Jones, P. D., Lister, D. H., Jaggard, K. W. and Pidgeon, J. D., 2003. Future climate change impact on the productivity of sugar beet (<i>Beta vulgaris</i> L.) in Europe. Climatic Change 58, 93-108. (Goetz M Richter, Rothamsted Research)	Does not apply to revised sections.
5-647	A	26	12			Nice table. Perhaps restructure it so that the areas with positive changes are in one section and the areas of negative changes are in another. In general, though, these tables are helpful. (Cynthia Rosenzweig, NASA/Goddard Institute For Space Studies at Columbia University)	Does not apply to revised sections.
5-648	A	26	25	26	25	unwanted words are deleted	Does not apply to revised sections.

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						(Dinesh Chandra Uprety, Indian Agricultural Research Institute)	
5-649	A	26	27	26	27	Table missing (Dinesh Chandra Uprety, Indian Agricultural Research Institute)	Does not apply to revised sections.
5-650	A	26	36	26	36	Mention the year in the bracket (Dinesh Chandra Uprety, Indian Agricultural Research Institute)	Does not apply to revised sections.
5-651	A	26	45	26	45	New reference included (Dinesh Chandra Uprety, Indian Agricultural Research Institute)	Does not apply to revised sections.
5-652	A	26		26		Table 5.2., pg. 26: The table lacks several elevated CO2 studies on crop plant responses conducted since TAR: e.g., (McKee et al., 1997; Ainsworth et al., 2002; Fiscus et al., 2002; Jablonski et al., 2002; Booker et al., 2005). (Fitzgerald Booker, USDA-ARS Plant Science Research Unit)	Does not apply to revised sections.
5-653	A	26		28		<p>I am not familiar with many of these studies, and there are too many to check quickly for this review. However, I strongly suspect several caveats need to be made. First, I think the models used were relatively simple, and they typically ignore expected interactions between elevated CO2 and other environmental factors (Tubiello and Ewert, 2002). Moreover, those models that have been used the most in climate change assessments have been validated the least against data from elevated-CO2 experiments (Tubiello and Ewert, 2002).</p> <p>For example, the simple models assume that a crop grows and develops at air temperature, rather than at the crop's own temperature, yet elevated CO2 causes wheat canopies to warm 0.6 to 1.2°C above air temperature due to the direct effects of the elevated CO2 on the plants' stomatal aperture. Such warming would be in addition to any global warming of air temperature, and it could cause similar consequences, such as changes in yield and major shifts in the optimal production regions of each crop species.</p> <p>Most simple models also use an average daily temperature to drive physiological processes. However, nighttime minimum temperatures are projected to increase more than daytime maximum temperatures, so nighttime processes such as growth respiration will likely be affected more than daytime photosynthesis by global warming, a subtle but potentially important effect not captured in many plant growth models.</p> <p>Another important aspect is that CO2 affects water relations, yet most simple models do not simulate stomatal responses. Especially for C4 species, the primary effects of elevated CO2 are on plant water relations. Moreover, many models do not utilize humidity as an input, so even at today's CO2 concentrations, models developed in humid regions may require modification for use in arid regions.</p>	Many of these comments have been incorporated in sections 5.4.2 and 5.4.1.

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						<p>The shifting of the optimum temperature for photosynthesis with increasing CO₂ concentration (Long, 1991) has been ignored in the simple models (Tubiello and Ewert, 2002). Likewise, down-regulation of photosynthesis and re-allocation of nitrogen resources are ignored. Generally, problem soil conditions such as salinity or acidity are not considered. Likewise, weeds, diseases, and insect pests have usually been neglected in assessment studies although reviews indicate global change effects on them may be important.</p> <p>Regardless of CO₂, many of the models contain functional relationships for many physiological processes that are based on temperature, yet these relationships may not be valid for the higher temperature ranges expected with global warming.</p> <p>(Bruce Kimball, USDA, Agricultural Research Service)</p>	
5-654	A	27	0			<p>Entries in Table 5.2 for Fischer et al. Could be made more precise. Sector/crop: 9 crop and livestock sectors including wheat, rice, other cereals, oilseeds, industrial crops, etc. Comments: Study combines spatially detailed agronomic assessment with general equilibrium food system analysis, quantifying production, demand and international trade among 34 countries/regions. Also looks at food security impacts under alternative SRES development path and climate change scenarios. (Fischer Günther, International Institute for Applied Systems Analysis)</p>	Does not apply to new sections.
5-655	A	27	0			<p>Table 5.2, Theme 3 Impacts are generally more severe: Insert Richter et al., 2004; Richter et al., 2005 study in England for wheat and sugar beet. Comment: increased variability of yields for sugar beet depending of soil water availability; mitigation: irrigation or re-allocation of crops, partly adaptation through modified sowing and harvest date (Goetz M Richter, Rothamsted Research)</p>	Does not apply to new sections.
5-656	A	27	0			<p>Table 5.2, Theme 3 Impacts are generally more severe in southern Italy using HadRM3 outputs for the south-east (Apulia, Bari Foggia region: Richter et al., 2005c; Risk indicators for crop management in hilly terrain. Poster at Interdrought-II) shows that under both scenarios extreme drought effects are likely with crop failure in more than 50% of the years by the end of the century assuming current varieties and management. (Goetz M Richter, Rothamsted Research)</p>	Does not apply to new sections.
5-657	A	27	2	27	3	<p>Table 5.2, Theme 3. First row, column 4: Why are these effects classified as "more severe" when the magnitude of the (positive) responses shown here are smaller than in the Table for Theme 1? Perhaps the description of this Theme needs to be revised? (David Price, Northern Forestry Centre)</p>	Does not apply to new sections.

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5-658	A	28	6		15	more work has been done since 2003! (too many to cite here...) (Marcus Lindner, European Forest Institute)	Does not apply to new sections.
5-659	A	28	13			Sentence starting with 'However, in addition ...' is entirely out of place. (Fischer Günther, International Institute for Applied Systems Analysis)	
5-660	A	28	15			Add to the end of the sentence, as follows: "..., some of which may increase yields (e.g., through reductions in frost, increases in precipitation)." (Indur Goklany, Office of Policy Analysis, Department of the Interior)	Does not apply to new sections.
5-661	A	28	17	28	17	Statements such as 'risks of soil degradation in crop lands are likely to alter' is a good example of a 'say-nothing' sentence and there are many of these in the chapter. The reader is interested in how they will alter and takes it as given that things alter. (John R Porter, KVL)	Does not apply to new sections.
5-662	A	28	19	29		Soil erosion can be contained quite effectively using herbicide tolerant (HT) crops, e.g., Roundup Ready crops. In 2001, the use of HT GM soybean reduced pesticide usage by 14,350 tons (in terms of active ingredients) while increasing farmers' net income by over \$1 billion (Gianessi et al. 2002). Other HT crops — canola, corn and cotton — reduced pesticide use by an additional 6,250 tons (and increased farmers' income by over \$200 million). According to a survey done by the American Soybean Association (2001), because of the increased popularity of Roundup Ready soybean, 73 percent of the soy farmers were leaving more crop residue on the soil; and soy acreage that was "no till" doubled to 49 percent between 1996 and 2001 while "reduced till" acres increased by one-fourth, accounting for another 33 percent of soybean acres. It estimated that these practices saved 247 million tons of topsoil in 2000, and reduced the number of times a farmer had to run equipment over the field, saving 234 million gallons of fuel (see also Fawcett and Towery (2002). References: [1] Leonard P. Gianessi, Cressida S. Silvers, Sujatha Sankula and Janet E. Carpenter, Plant Biotechnology: Current and Potential Impact For Improving Pest Management In U.S. Agriculture: An Analysis of 40 Case Studies, Executive Summary (Washington, DC: National Center for Food and Agricultural Policy 2002). [2] American Soybean Association, ASA Study Confirms Environmental Benefits of Biotech Soybeans, Novemebr 12, 2001, online at < http://www.soygrowers.com/newsroom/releases/2001%20releases/r111201.htm >, visited on November 22, 2002. [3] R. Fawcett and D. Towery, Conservation Tillage and Plant Biotechnology (West Lafayette, IN: Conservation Technolgy Information Center, 2002) (Indur Goklany, Office of Policy Analysis, Department of the Interior)	Comment raises broader issues than is feasible to discuss within the limitations of space provided.

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5-663	A	28		28		We have to emphasize the importance for irrigation and water constraints of wastewater reuse (Cristobal Felix Diaz Morejon, Ministry of Science, Technology and the Environment)	Some additional discussion on water resources in 5.4.2.
5-664	A	29	1	29	50	Noting in this section about the impact of rising nighttime temperatures, as opposed to the rise in average temperature, and the associated impact on plant respiration. Because global warming will cause a much greater increase in nighttime temperature compared to daytime temperature or average daily temperature, this is a key issue. The Peng et al 2004 PNAS paper (already cited in the chapter) is a good example of this potential impact. Other key points here are that we have poor fundamental understanding of the impact of rising nighttime temperatures (as opposed to average temperature) on crop yields, and that most simulation model studies that are cited in the chapter rely on models that utilize daily or higher time steps (and hence average daily temperatures) to simulate the effects of climate change. From my view, a critical research need is to better understand the impact of rising nighttime temperatures on plant respiration. Current models and previous published studies as cited in the chapter are highly suspect because they are not sensitive diurnal temperatures. (Kenneth Cassman, University of Nebraska)	Does not apply to new sections. In any case, this is a pre-TAR issue, as many papers addressing night-time vs. daytime warming were published before 2001, with extensive simulation exercises. The issue of respiration is also pre-TAR, and there are no clear indications of whether respiration will be affected by such trends.
5-665	A	29	2		4	Don't understand this sentence. Usually moving water leaches mineral salts out of soil. In addition, rainfall water is quite free of minerals. (Jüri Kadaja, Estonian Research Institute of Agriculture)	This study has nothing to do with leaching and all to do with water availability in the soil profile.
5-666	A	29	4	29	5	Greater leaching from increased number of intense rainfall events should result in reduced soil salinity. Something appears to be wrong with the current text. (Kenneth Cassman, University of Nebraska)	Text was modified. See above.
5-667	A	29	4			The effect of CO ₂ on cumulative ET from crops must be questioned because of counteracting effects of CO ₂ on stomatal conductance and on plant biomass. The statement is also not clearly related to the previous sentence. (Goetz M Richter, Rothamsted Research)	Does not apply to new section.
5-668	A	29	25	29	35	In this paragraph it is important to emphasize that will decrease the available water, because when the accumulated snow is smaller, smaller will be the water coming from spring thawing (Cristobal Felix Diaz Morejon, Ministry of Science, Technology and the Environment)	This sentence does not imply there will be less snow cover. Does not apply.
5-669	A	29	25	29	25	Crop damage from frosts may increase from global warming as crops may be more advanced but then get hit by a late frost that damages them more than if they had developed more slowly.	Very good point. No more mention of frost damage in text however.

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						(John R Porter, KVL)	
5-670	A	29	29			winter crops - maybe useful to specify as this term seems to be in use for different groups of crops. E.g. the crops sown in autumn (winter rye, winter wheat), the crops are grown in winter time in greenhouses, ... (Jüri Kadaja, Estonian Research Institute of Agriculture)	Does not apply to revised sections.
5-671	A	29	41	29	42	Polley (2002) might be a more comprehensive reference for elevated CO2 effects on crop WUE. Booker et al. (2004) also found that twice-ambient CO2 increased production water use efficiency in soybean. In fact, whole-plant water loss was lower at elevated CO2 despite an increase in leaf area. (Fitzgerald Booker, USDA-ARS Plant Science Research Unit)	Will consider.
5-672	A	29	44		45	Is it true that drought stresses arise profitability and profitability is reduced if variability of yields is reduced? How? (Jüri Kadaja, Estonian Research Institute of Agriculture)	Good point. Eliminated from revised text.
5-673	A	29	47			See comment 4, above. (Indur Goklany, Office of Policy Analysis, Department of the Interior)	
5-674	A	29	47	30	7	again: more work has been done since 2003! (Marcus Lindner, European Forest Institute)	Updated references included in revised text.
5-675	A	30	0			A third aspects relates to irrigation demand. This aspect is not comprehensively covered and the message is not very clear. Statements such as 'are likely' and 'in many regions' are not objective. Citation of the Döll paper is not sufficiently comprehensive (e.g., missing reference years). Moreover, irrigation should always be related to the availability of water for irrigation. In some areas, irrigation demand may increase, but water demand for other purposes will avoid additional water availability. (Juerg Fuhrer, Federal AgroEcological)	New discussion on water demand included in new 5.4.2.
5-676	A	30	9	30	29	Some anecdotal evidence from a recent questionnaire survey of farmers in the UK suggests that some levels of autonomous adaptation are already occurring ADAS (2005) Farmers' Voice Survey, unpublished summary report of postal survey. For further details contact Sam Beechener Tel: 01525 864904 (Jo Hossell, ADAS)	Will consider.
5-677	A	30	9	30	11	Spellings and line corrections are made (Dinesh Chandra Uprety, Indian Agricultural Research Institute)	Does not apply to new section.
5-678	A	30	16	30	18	Awkward sentence (Norman Christensen, Duke University)	Does not apply to new section.
5-679	A	30	16		18	This sentence could be phrased better (Cynthia Rosenzweig, NASA/Goddard Institute For Space Studies at Columbia University)	Does not apply to new section.

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5-680	A	30	16	30	16	unwanted words are deleted (Dinesh Chandra Uprety, Indian Agricultural Research Institute)	Does not apply to new section.
5-681	A	30	20	30	22	unwanted words are deleted (Dinesh Chandra Uprety, Indian Agricultural Research Institute)	Does not apply to new section.
5-682	A	30	20	30	20	Units of temperature is corrected (Dinesh Chandra Uprety, Indian Agricultural Research Institute)	Does not apply to new section.
5-683	A	30	24			Check numbers given for wheat without and with adaptation; results listed are not plausible. (Fischer Günther, International Institute for Applied Systems Analysis)	Does not apply to new section. Why were results not plausible?
5-684	A	30	39			Role of trade as an adaptation tool. Recommend the author look at Goklany (1995, 2000, 2005b). (Indur Goklany, Office of Policy Analysis, Department of the Interior)	Revised sections has extended reference list.
5-685	A	30	39	30	39	Additional reference included (Dinesh Chandra Uprety, Indian Agricultural Research Institute)	OK
5-686	A	30	42	31	7	An important point is that irrigation only uses about 5% of the total global water cycle - ie 3000 km ³ out of a total cycle of 7000 km ³ and only about 0.2 bn ha out of 1.4 bn ha of arable land is irrigated. So do not overstate the importance of irrigation and changes in the demand for irrigation as a result of climate change. Any change in irrigation will not have a large global effect although may be regionally important as stated. (John R Porter, KVL)	Point not taken. Irrigation uses 80% of the total fresh water resources used by all economic sectors, with some regions experiencing stress in the form of water withdrawals vs. available renewable resources. See section 5.4.2.
5-687	A	30	43	30	50	It is very important to cross-reference to other IPCC chapters here - plus have other references in addition to those shown. (Emma Archer, University of the Witwatersrand)	Does not apply to revised sections.
5-688	A	30	43	30	43	Sentence is corrected (Dinesh Chandra Uprety, Indian Agricultural Research Institute)	OK.
5-689	A	30	46			Döll not Doll (Juerg Fuhrer, Federal AgroEcological)	Yes.
5-690	A	30	46	30	46	unwanted words are deleted (Dinesh Chandra Uprety, Indian Agricultural Research Institute)	Does not apply to revised sections.
5-691	A	30	47	30	49	These lines are deleted to make correct sences (Dinesh Chandra Uprety, Indian Agricultural Research Institute)	Does not apply to revised sections.
5-692	A	31	0			there is only one study cited! The issue also appears earlier (5.2.1.3), which makes it difficult to recognize the key message. (Edward Allison, University of East Anglia)	Expanded discussion in 5.4.2
5-693	A	31	1	31	4	I find this projection of REDUCED irrigation demand in N Africa and Middle East to be quite surprising. Firstly, it is not intuitive because it is not clear why the	Agreed. New extended section in 5.4.2 solves this problem by citing more studies.

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						optimal season in that region should "shift" to the winter months. I.e., why is winter not the optimal season now--surely it is not too cold? Second, if this is a reasonable finding, I think it needs more exposure, i.e. in the summary and/or conclusions. (David Price, Northern Forestry Centre)	
5-694	A	31	1	31	1	Sentence is corrected (Dinesh Chandra Uprety, Indian Agricultural Research Institute)	
5-695	A	31	3	31	10	Unwanted words and lines are deleted (Dinesh Chandra Uprety, Indian Agricultural Research Institute)	
5-696	A	31	9			Table 5.3 is quite useful, but I would like to see a column added, which contains information about possible tradeoffs of these measures. (Juerg Fuhrer, Federal AgroEcological)	Moved to other section.
5-697	A	31	9			Table 5.3. Add references, as follows: Row 3, Goklany (2000, 2001, 2005b); row 6, Goklany (2001); row 8, Goklany (1992, 2000); row 9, Goklany (1995, 2000); last row, Goklany (2000, 2001, 2005b). (Indur Goklany, Office of Policy Analysis, Department of the Interior)	Moved to other section.
5-698	A	31	10			In Table 5.3 more descriptive abbreviations would work better than initials. (Cynthia Rosenzweig, NASA/Goddard Institute For Space Studies at Columbia University)	Moved to other section.
5-699	A	31	12	31	18	Most of the references to support Table 5.3 are old and pre the TAR. Needs critical updating. (John R Porter, KVL)	Comment has been accepted as fair and incorporated into redraft.
5-700	A	31	19	31	19	Sentence is corrected (Dinesh Chandra Uprety, Indian Agricultural Research Institute)	
5-701	A	31	25	31	29	These lines are deleted to avoid the repetition (Dinesh Chandra Uprety, Indian Agricultural Research Institute)	
5-702	A	31	45	31	45	Clarify bracketed word (Dinesh Chandra Uprety, Indian Agricultural Research Institute)	
5-703	A	31	50	31	50	Spelling corrected (Dinesh Chandra Uprety, Indian Agricultural Research Institute)	
5-704	A	31		5	31	In Table 5.3 I think that would be included the use of early warning systems and the wastewater reuse (Cristobal Felix Diaz Morejon, Ministry of Science, Technology and the Environment)	Moved to other section.
5-705	A	32	1	33	18	Could there be some substantial expansion of some particular fruit trees in some areas? Citrus trees in N-A for example? (Pierre Bernier, Natural Resources Canada)	Good point. Not included in present draft.

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5-706	A	32	2	32	50	Maybe included the example of orange tree plantation in Florida(USA) destroyed by effects of successive hurricanes in last three years. The same case are the effects of hurricanes over orange trees and other fruit trees in Cuba. (Cristobal Felix Diaz Morejon, Ministry of Science, Technology and the Environment)	Good point. Not included in present draft.
5-707	A	32	2			Section 5.4.1.2. Too much detail given page limitations. Summarise the general trends in pghs 2-6 in 1-2 sentences & add these sentences to the end of the 1st pgh. (Richard Fleming, Great Lakes Forest Research Centre)	Comment has been accepted as fair and incorporated into redraft.
5-708	A	32	2	33	18	Section 5.4.1.2. This section on perennial crops contains a lot of gloomy statements and a couple of optimistic ones. Generally the various crops are not handled equally - that is to say that, except for vines, only temperature and storms feature. It also says that 'down regulation' will reduce the importance of the elevated CO2 response but later says that vines show a strong positive reaction to elevated CO2 in terms of quantity and quality. Please do not fall into the IPCC gloom machine - forest systems in scandinavia are showing increased growth rates and they are the very perennial. (John R Porter, KVL)	Good point. Not included in present draft.
5-709	A	32	2	32	2	corrected (Dinesh Chandra Uprety, Indian Agricultural Research Institute)	
5-710	A	32	3	32	6	Spellings and line corrections are made (Dinesh Chandra Uprety, Indian Agricultural Research Institute)	
5-711	A	32	4	32	13	The Caribbean countries may be included (Cristobal Felix Diaz Morejon, Ministry of Science, Technology and the Environment)	OK—will consider.
5-712	A	32	6	32	7	In the longest such experiment ever conducted, Idso and Kimball (2001) reported that for the last 4 of a 13 year-long experiment with sour orange trees, the ratio of enriched tree biomass production to that of the ambient trees plateaued at 1.75 in spite of some down-regulation of photosynthesis. In a recent paper soon to be published (Kimball, B.A., and S.B. Idso. 2005. Long-term effects of elevated CO2 on sour orange trees. In K. Omasa, I. Nouchi, and L.J. De Kok (eds.) Plant Responses to Air Pollution and Global Change, Springer-Verlag, Tokyo. (in press).), the plateau has continued for another 5 years. A 75% sustained relative increase in growth for the last nine years of a 17-year experiment is huge in spite of down-regulated photosynthesis. Similarly, the woody plants studied in FACE projects as reviewed by Kimball et al. (2002) were more responsive to elevated CO2 than annual herbaceous plants. (Bruce Kimball, USDA, Agricultural Research Service)	Good point. Not yet included in present draft. Some of this information however is pre-TAR.

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5-713	A	32	10			"is" should be "are" (Norman Christensen, Duke University)	Comment now redundant or irrelevant as section has been revised.
5-714	A	32	13	32	13	New reference included (Dinesh Chandra Uprety, Indian Agricultural Research Institute)	
5-715	A	32	15	32	32	The problem with grapevines is not only the increasing temperature in the "classic" growing areas, it is also the freshwater limitation. Such is the case in an important wine basin, the central western Argentina and Central Chile, where the lack of snow-melt in the years 1969/70 led to an economic disaster in both countries. Increasing temperatures and the abovementioned water limitation has brought a process of adaptation by relocating vineyards to Patagonia. (Osvaldo Canziani, IPCC WG2 Co-chair)	Good point. Example to be included in "current" climate signals. Issue to be included in revised sections.
5-716	A	32	27			Harrison (2000) - missing from the reference list. This is probably because this ref does not exist. Use Harrison, P.A., Butterfield, R.E. and Orr, J.L. (2000). Modelling climate change impacts on wheat, potato and grapevine in Europe. In: T.E. Downing, P.A. Harrison, R.E. Butterfield and K.G. Lonsdale (Eds.) Climate Change, Climatic Variability and Agriculture in Europe. Research Report No. 21, Environmental Change Institute, University of Oxford, Oxford, pp.367-390. (Paula Harrison, University of Oxford)	Too old.
5-717	A	32	27	32	29	Current restrictions in the use of particular grape varieties within different appellations in France may reduce adaptive capacity (Jo Hossell, ADAS)	Comment now redundant or irrelevant as section has been revised.
5-718	A	32	34	32	40	It is surprising not to have a reference on fruits like nuts, almonds, pistachios, dates, etc which are of extensive use over all the world. (Osvaldo Canziani, IPCC WG2 Co-chair)	Yes. To be included in new perennial section.
5-719	A	32	38			Check these statements in relation with other work such as "Climate Change and the Mediterranean" edited by L. Jeffic, J.D. Milliman, and G. Sestini (2002) (a more recent version may be out) which concluded that "A 1.5 degree C increase in temperature would lead to a major increase in land degradation, deterioration of water resources, decline in agricultural production and damage to natural, terrestrial and aquatic ecosystems." (Cynthia Rosenzweig, NASA/Goddard Institute For Space Studies at Columbia University)	Will check.
5-720	A	32	48		50	This sentence could be phrased better. (Cynthia Rosenzweig, NASA/Goddard Institute For Space Studies at Columbia University)	Agreed.
5-721	A	32		32		More references are included in Table 5.3 kindly see the corrected manuscript (Dinesh Chandra Uprety, Indian Agricultural Research Institute)	OK.

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5-722	A	33	6	33	6	Bracket altered (Dinesh Chandra Uprety, Indian Agricultural Research Institute)	OK.
5-723	A	33	7	33	7	I am not familiar with the literature being cited, but was any reference made to the socio-economic implications of the findings reported? This would be very interesting here (Nicholas Holden, University College Dublin)	Most of reporting of socioeconomic impact is in 5.5 of the SOD.
5-724	A	33	8	33	9	Corrections are made (Dinesh Chandra Uprety, Indian Agricultural Research Institute)	OK.
5-725	A	33	9	33	10	The second occurrence of the Harvell et al. 2002 citation. This one, I think, is OK (David Price, Northern Forestry Centre)	OK.
5-726	A	33	18	33	23	Sentence is changed (Dinesh Chandra Uprety, Indian Agricultural Research Institute)	OK.
5-727	A	33	21			General Comments on section 5.4.2. The quantification of the uncertainties reported in this section should be extended to other sections and supported by references. (Marco Bindi, Dept. of Agronomy and Land Management)	Comment has been accepted as fair and incorporated into redraft.
5-728	A	33	21			Section 5.4.2 Shorten section with 1 concise pgh under each of the section's sub headings, being careful not to repeated any points made earlier. 2nd pgh should appear where pastures 1st discussed (p13-15?) or perhaps in the suggested report Glossary if other chpts also refer to pastures. Anyhow - it appears to be a good set of definitions. (Richard Fleming, Great Lakes Forest Research Centre)	The section will be substantially shortened and redundancy checked.
5-729	A	33	21			5.4.2. This chapter is well written. Much of the information under 5.4.2.2 is taken from Lüscher et al. (2005). Perhaps this review could be cited as such, and not only in relation to a particular statement on pg 34/line 47, and 35/line13, for which the original work is cited in the review. (Juerg Fuhrer, Federal AgroEcological)	Thanks. The review by Luscher et al. will be cited.
5-730	A	33	21	34	9	Livestock production here only concerns ruminant animals. What about non-ruminant animals, like pigs and poultry? (Jørgen E. Olesen, Danish Institute of Agricultural Sciences)	For SOD, we will have some material on swines and poultry concerning heat stress.
5-731	A	33	23	33	34	Should be in the future trends section (Philip Thornton, International Livestock Research Institute (ILRI))	Agreed.
5-732	A	33	26	33	34	Move to section 5.3 on future trends? (Paula Harrison, University of Oxford)	Agreed.
5-733	A	33	27			"smallholders"? (Norman Christensen, Duke University)	Yes.
5-734	A	33	32	33	34	Is there a more up to date projection that can be used here?	Comment now redundant as section has been

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						(Emma Archer, University of the Witwatersrand)	revised.
5-735	A	33	32			The sentence is perhaps correct but nevertheless somewhat misleading as it makes no difference between a ha of marginal grassland and a ha of intensively used triple-cropped arable land. If you want to provide meaningful examples, it would be better not to mix up pastures and arable land. (Fischer Günther, International Institute for Applied Systems Analysis)	The overall trend is useful to mention but details to be deleted.
5-736	A	33	47	33	47	sentence changed (Dinesh Chandra Uprety, Indian Agricultural Research Institute)	Comment now redundant as section has been revised.
5-737	A	33	48	34	9	Remove. Redundant. Covered in section 5.1. (Richard Fleming, Great Lakes Forest Research Centre)	This section will be merged with 5.1.
5-738	A	34	4			Sentence starting with 'In many parts of the world ...' is unclear in the middle part. (Fischer Günther, International Institute for Applied Systems Analysis)	Deleted.
5-739	A	34	4			Provide references (Paula Harrison, University of Oxford)	Deleted.
5-740	A	34	5	34	5	Sentence readjusted (Dinesh Chandra Uprety, Indian Agricultural Research Institute)	Comment now redundant as section has been revised.
5-741	A	34	7	34	7	Units of temperature is corrected (Dinesh Chandra Uprety, Indian Agricultural Research Institute)	Comment now redundant as section has been revised.
5-742	A	34	11	34	30	Here again, too much emphasis on separate CO2 effect rather than on the CO2 x Temp interaction. (Kenneth Cassman, University of Nebraska)	More to be added on temp effect on soil C.
5-743	A	34	11			5.4.2.1 Effects of climate change on soils not only concern nitrogen cycling, but also carbon. Here, only CO2 effects are covered, whereas temperature effects are not. However, in the long run, effects on SOM are key issues for the sustainability of agroecosystems! (Juerg Fuhrer, Federal AgroEcological)	More to be added on temp effect on soil C.
5-744	A	34	11	34	30	Reference to the paper: Bellamy P.H., Loveland P.J., Bradley R.I., Lark R.M. & Kirk G.J.D. (2005) Carbon losses from all soils across England and Wales 1978–2003. Nature, 437, 245-248, might be appropriate in this section (Nicholas Holden, University College Dublin)	Agreed.
5-745	A	34	13	34	30	The authors should consider another body of soils literature dealing with CO2 and O3 impacts from Aspen FACE. The paper by Loya et al. in 2003 (Nature 425: 705-707) on new carbon formation and a listing of recent references on physical, chemical and biological soil processes found in Karnosky et al. (2005) Plant Cell and Environment 28: 965-981 presents novel conclusions from fast growing northern forest species of different successional traits. (Kevin Percy, Canadian Forest Service)	Agreed, to be moved in 5.1.

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Chapter-Comment	Batch	From Page	From Line	To Page	To line	Comments	Notes of the writing team
5-746	A	34	15	34	16	The recent UK study on trends in soil organic matter would be useful to cite here, especially with regard to feedback loops that reinforce global warming. Citation: Bellamy et al. 2005. Carbon losses from all soils across England and Wales, 1978-2003. Nature 437:245-248. (Kenneth Cassman, University of Nebraska)	Agreed, to be moved in 5.1.
5-747	A	34	15	34	16	I am not sure this statement is true, and the use of "could also be" is appropriate. But I cannot recall where I read evidence to the contrary; i.e., that some recalcitrant pools really are quite stable. Maybe a paper in Science, published in last couple of years? (David Price, Northern Forestry Centre)	Agreed, but see below. Gill et al. 2002.
5-748	A	34	16	34	16	The Gill et al. (2002) reference that follows on line 19 also provides evidence that CO2 enrichment may promote more rapid turnover of older, more recalcitrant soil pools of organic C. (Wayne Polley, USDA/Agricultural Research Service)	Agreed.
5-749	A	34	20	34	44	Unecessary,rewrite (Dinesh Chandra Uprety, Indian Agricultural Research Institute)	Comment now redundant as section has been revised.
5-750	A	34	27			In a... - fragment (Jüri Kadaja, Estonian Research Institute of Agriculture)	Fragment deleted.
5-751	A	34	29	34	30	In my opinion, the literature does not support the idea that respiration acclimates to short-term changes in temperature. Apparent down-regulation of soil respiration at increased temperature may simply reflect the more rapid depletion of easily-decomposed organic substrates at the higher temperature (Kirschbaum MUF. 2004. Soil respiration under prolonged soil warming: are rate reductions caused by acclimation or substrate loss? Global Change Biology 10: 1870-1877). (Wayne Polley, USDA/Agricultural Research Service)	S Agreed this was not meant, rephrase.
5-752	A	34	29	34	30	If space allows, it may be worth noting that CO2 enrichment typically increases soil respiration, partly by increasing the availability of C substrates and partly by increasing the partitioning of C into labile fractions, the latter trend supported by results from annual grassland (Hungate BA, Holland EA, Jackson RB, Chapin FS III, Mooney HA, Field CB. 1997. The fate of carbon in grasslands under carbon dioxide enrichment. Nature 388: 576-579) and perennial grassland (Gill et al. 2002). (Wayne Polley, USDA/Agricultural Research Service)	S Agreed, to be briefly cited in 5.1.
5-753	A	34	31	34	31	Add: Soil carbon may be more vulnerable to climate change and changing land use than expected. Bellamy et al. (2005) show that carbon was lost from soils across England and Wales between 1978 and 2003 at a mean rate of 0.6% per year. [Ref. Bellamy PH, Loveland PJ, Bradley RI, Lark RM, GJD Kirk (2005)	Agreed, to be moved in 5.1.

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Chapter-Comment	Batch	From Page	From Line	To Page	To line	Comments	Notes of the writing team
						Nature 437(8): 245-248. (Surinder Saggar, Landcare Research)	
5-754	A	34	34	35	27	There should be mentioned the problem that drying in steppe and mountain regions in Central Asia, South America and other regions and connected to in desertification of the pastures moves multiplied during last decades cattle stock to naturally more wetter sites like wetlands (peatlands, lake shores, river valleys etc.) with potential high feedback to water resources, carbon release etc. (Andrey Sirin, Institute of Forest Science Russian Academy of Sciences)	Interesting, if there is a reference to cite this would go in adaptation section.
5-755	A	34	38	34	38	Replace "moreover" with "however!" (David Price, Northern Forestry Centre)	Done.
5-756	A	34	42	34	45	This needs to be stated more clearly; not sure what point was intended (Norman Christensen, Duke University)	Shortened and clarified.
5-757	A	34	45	34	45	line has been corrected (Dinesh Chandra Uprety, Indian Agricultural Research Institute)	Comment now redundant as section has been revised.
5-758	A	34	46	34	47	The statement that CO2 enrichment often favors forbs at the expense of grasses is supported by the study of: Polley HW, Johnson HB, Derner JD. 2003. Increasing CO2 from subambient to superambient concentrations alters species composition and increases above-ground biomass in a C3/C4 grassland. New Phytologist 160: 319-327. (Wayne Polley, USDA/Agricultural Research Service)	Reference added.
5-759	A	34	48			Add location of the study (Juerg Fuhrer, Federal AgroEcological)	Done.
5-760	A	34	48			Need some clarification as to what sort of changes occurred (Jo Hossell, ADAS)	Done.
5-761	A	35	2	35	4	Corrected (Dinesh Chandra Uprety, Indian Agricultural Research Institute)	Comment now redundant as section has been revised.
5-762	A	35	5	35	7	What were the conditions under which this change would occur? Can you cite a GCM scenario or some other climate change projection? (David Price, Northern Forestry Centre)	Comment now redundant as section has been revised.
5-763	A	35	9	35	11	Again, what are the specifications of this "climate envelope model"? (David Price, Northern Forestry Centre)	Comment now redundant as section has been revised.
5-764	A	35	11			Missing reference (Juerg Fuhrer, Federal AgroEcological)	Year to be added.
5-765	A	35	11	35	13	This may be my ignorance, but can you explain whether "annuals" specifically excludes grass species? I.e., does this mean dicot herbaceous species only or are other monocots included? (David Price, Northern Forestry Centre)	Comment now redundant as section has been revised.

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Chapter-Comment	Batch	From Page	From Line	To Page	To line	Comments	Notes of the writing team
5-766	A	35	18			Provide references (Paula Harrison, University of Oxford)	Comment now redundant as section has been revised.
5-767	A	35	22		27	Need to clarify that these responses will depend on the effects on water availability (Norman Christensen, Duke University)	Comment now redundant as section has been revised.
5-768	A	35	22			(Shukla 2003) is not in your references. (Cynthia Rosenzweig, NASA/Goddard Institute For Space Studies at Columbia University)	Comment now redundant as section has been revised.
5-769	A	35	22	35		Subscript in CO2 is to be corrected in entire document (Dinesh Chandra Uprety, Indian Agricultural Research Institute)	Done.
5-770	A	35	24	35	24	Unecessary words in the line are delete (Dinesh Chandra Uprety, Indian Agricultural Research Institute)	Comment now redundant as section has been revised.
5-771	A	35	26			One of the main points of Chapter 5 is that "Many forests will be unable to adjust to warming, and will be replaced by species better adapted to warmer temperatures such as grasslands. As warming continues, many tree species shift to higher altitudes and/or latitudes." Also, in their chapter they say that "Future increases in climatic variability and the incidence of extreme climatic events are expected to suppress C3 competitive dominance and promote invasion of C4 species, especially weeds (Chapter 5, Page 35, Line 25). In contrast, Chapter 4 makes the point that "it has been shown that the tree-grass balance in savannas may shift toward trees (which are C3). Granted that these are opposing statements, I suggest you contact Chapter 4 and resolve this inconsistency. Also, what is the evidence you give for other forested areas losing to weeds? (Cynthia Rosenzweig, NASA/Goddard Institute For Space Studies at Columbia University)	This section will be checked for consistency with the forestry section and with the ecosystem Chapter (4). The sentence does however not refer to trees but only to herbaceous species. This has been clarified
5-772	A	35	27			Missing reference (Juerg Fuhrer, Federal AgroEcological)	Comment now redundant as section has been revised.
5-773	A	35	27			Explain what is meant by the "50% C4 line" (Paula Harrison, University of Oxford)	Comment now redundant as section has been revised.
5-774	A	35	34			Provide references (Paula Harrison, University of Oxford)	Comment now redundant as section has been revised.
5-775	A	35	36			CO2 instead of carbon dioxide (Juerg Fuhrer, Federal AgroEcological)	Done.
5-776	A	35	44			Defra 2000, should be MAFF 2000 (Jo Hossell, ADAS)	Will be checked.
5-777	A	35	44			Decrease cited - does it refer to population levels or species numbers? (Jo Hossell, ADAS)	Comment now redundant as section has been revised.

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Chapter-Comment	Batch	From Page	From Line	To Page	To line	Comments	Notes of the writing team
5-778	A	35	44	35	44	"decreased by 1.5-2.3 times" is very confusing. Can you report this as a percentage of estimated initial values? (David Price, Northern Forestry Centre)	Comment now redundant as section has been revised.
5-779	A	35	48			This sub-section should refer to the new hemorrhagic diseases transmitted by rodents whose habitat is in corn-fields and temperate forest. These diseases are produced by some genus of viruses identified as hantaviruses. (Cross refer to chapter 8) (Osvaldo Canziani, IPCC WG2 Co-chair)	Comment now redundant as section has been revised.
5-780	A	35	48			Section 5.4.2.4. Does this really fit into this chapter? (Paula Harrison, University of Oxford)	Section deleted.
5-781	A	35	48			Are these interactions significant for pastoral productivity? (Jo Hossell, ADAS)	Section deleted.
5-782	A	35	48	36	12	This section seems to reflect the specific interests of the authors more than saying anything useful about the effects of climate change on animal pests. In fact much of the chapter reads in such a way - as if the various authors have not given careful enough consideration to assembling all the relevant information in the area of interest - by doing a proper literature search. (John R Porter, KVL)	Section deleted.
5-783	A	35	50	36	2	There is no evidence presented that changes in vole populations in Mongolia are related to climate change. This is also a general comment on much of the material in the chapter. If this is a chapter about climate change effects on food and fibre then there should always be evidenced statements that noted or measured changes be linked via experiment or modelling to changes in climate. The reason for saying this is that if the IPCC report is not completely scientifically solid, this opens the possibilities for the critics of IPCC to point to weaknesses. (John R Porter, KVL)	Section deleted.
5-784	A	35	50	36	1	What is the meaning of the word "overgrowth"? I am not familiar with it. Do you mean a population explosion preceeding a crash? I.e., characteristic cycle for many small mammals? (David Price, Northern Forestry Centre)	Section deleted.
5-785	A	36	9		12	This sentence seems out of place (Norman Christensen, Duke University)	Section deleted.
5-786	A	36	14			Comments on section 5.4.2.5. In this sub-section the authors reported general information that are well known, without any results from studies on the impact of climate change on animal physiology. Thus, in the SOD references on this task will be needed. (Marco Bindi, Dept. of Agronomy and Land Management)	We are searching for further references on this.

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5-787	A	36	14			5.4.2.5 The information is mainly concerned with impacts of warm weather on current animal species and breeds. The option of moving these around appears later in the chapter, but would be an important aspect here too. I also miss mentioning the problem of possible drinking water shortages for animals. (Juerg Fuhrer, Federal AgroEcological)	Adaptation is dealt with in a separate section Water shortage will be developed.
5-788	A	36	16	36	24	Is this para necessary - It is largely repeated in the next (Jo Hossell, ADAS)	This has been restructured in a single section.
5-789	A	36	17	36	17	I think "converse" should be "conserve" (David Price, Northern Forestry Centre)	Done.
5-790	A	36	17	36	18	Lines are corrected (Dinesh Chandra Uprety, Indian Agricultural Research Institute)	Comment now redundant as section has been revised.
5-791	A	36	26	36	41	Here again cross reference with regional chapters to provide more information on the reduction of dairy and meat production under climate stress (see Chapter 13) (Osvaldo Canziani, IPCC WG2 Co-chair)	Cross reference will be made.
5-792	A	36	26	36	41	It is not clear what the message is here. (Jørgen E. Olesen, Danish Institute of Agricultural Sciences)	Comment now redundant as section has been revised.
5-793	A	36	31	36	31	Corrected (Dinesh Chandra Uprety, Indian Agricultural Research Institute)	Comment now redundant as section has been revised.
5-794	A	36	37	36	37	This is is out of my area, but these two sentences sound like direct contradictions. If temperature is the same, what is it that causes different reductions in VFI? (David Price, Northern Forestry Centre)	Comment now redundant as section has been revised.
5-795	A	36	43			Comments on section 5.4.2.5. Additional information may be collected from the paper: Wittmann, EJ and Baylis, M, 2000. Climate change: Effects on Culicoides-transmitted viruses and implications for the UK. Vet. J., 160: 107-117 (Marco Bindi, Dept. of Agronomy and Land Management)	This reference will be considered, section has been restructured.
5-796	A	36	43			Sub-section 5.4.2.6 . It misses the very important "foot and mouth" disease having connection with climate conditions. (Osvaldo Canziani, IPCC WG2 Co-chair)	This issue will be considered if references allow.
5-797	A	36	43			Section 5.4.2.6 - Some work has been done on tryps (see e.g. McDermott et al. 2001, Effects of climate, human population and socio-economic changes on tsetse-transmitted trypanosomosis to 2050 . In Black and Seed (eds), World Class Parasites – Vol. 1. The African Trypanosomes. Kluwer). And, for that matter, in a discussion of agricultural impacts, what about a short summary of human health impacts, as they may have an impact on labour supply in rural areas (e.g. HIV/AIDS, Malaria) -- and for Malaria, there is some predictive work from Snow and colleagues at Wellcome/KEMRI in Kenya. (Philip Thornton, International Livestock Research Institute (ILRI))	This reference will be considered, section has been restructured.

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5-798	A	37	2	37	2	Replace "40° line of North latitude" with "40° N" (David Price, Northern Forestry Centre)	Done.
5-799	A	37	12	37	12	Defra 2000, should be MAFF 2000 (Jo Hossell, ADAS)	Will be checked.
5-800	A	37	16			Provide references (Paula Harrison, University of Oxford)	Reference will be made to health chapter.
5-801	A	37	16	37	19	Line is corrected and readjusted (Dinesh Chandra Uprety, Indian Agricultural Research Institute)	Comment now redundant as section has been revised.
5-802	A	37	18	37	22	Again this is not my area, but I think you should state the area or region over which these estimated losses apply. By implication it is the State of Queensland but perhaps not? (David Price, Northern Forestry Centre)	Comment now redundant as section has been revised.
5-803	A	37	24			Comments on section 5.4.2.7. As reported above I suggest to move this sub-section in a separate section on adaptation (Marco Bindi, Dept. of Agronomy and Land Management)	Agreed.
5-804	A	37	24			5.4.2.7 The first paragraph repeats what has been summarized earlier. The rest of this sub-chapter should be in line with the earlier chapter on pasture productivity and pasture quality. Pg 38/line 5 is a strong statement without reference! What does 'likely' mean? (Juerg Fuhrer, Federal AgroEcological)	Reference will be added. Section has been revised.
5-805	A	37	27	37	27	unwanted words are deleted (Dinesh Chandra Uprety, Indian Agricultural Research Institute)	Comment now redundant as section has been revised.
5-806	A	37	33	37	33	Superfluous word is deleted (Dinesh Chandra Uprety, Indian Agricultural Research Institute)	Comment now redundant as section has been revised.
5-807	A	37	36	37	38	This statement is only true for sites with well drained soils. When soils are wet, even if grass is growing it cannot be grazed without soil damage. There are of course ways around this (low ground pressure machines for cutting and off-field feeding or smaller animals with larger hooves) but these would require a complete change in the nature of system management (Nicholas Holden, University College Dublin)	Comment has been accepted as fair and incorporated into redraft.
5-808	A	37	36	37	38	Longer housing in spring may still be needed if soil moisture conditions and hence poaching risk increase with higher winter/spring rainfall. Any reduction in winter housing need would depend also on moisture levels in autumn and susceptibility of soil to poaching (Hossell, JE, Ramsden, SJ, Gibbons, J, Harris, D, Pooley, J and Clarke, J (2001). Timescale of farmlevel adaptations and responses to climate change. ADAS Final report to MAFF for project cc0333). Housing in summer may also be needed in dry conditions in order to avoid	Comment has been accepted as fair and incorporated into redraft.

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Chapter-Comment	Batch	From Page	From Line	To Page	To line	Comments	Notes of the writing team
						damage to pastures - latter point is already mentioned on p38 ln 28 (Jo Hossell, ADAS)	
5-809	A	37	36	37	38	Increased production during a longer growing season depends on the availability of light. In some locations (high latitudes) the increased temperature at the ends of the season will not lead to increased production, because radiation levels are low. (Jørgen E. Olesen, Danish Institute of Agricultural Sciences)	Comment has been accepted as fair and incorporated into redraft.
5-810	A	37	40	37	46	Unecessary words in the line are delete (Dinesh Chandra Uprety, Indian Agricultural Research Institute)	Comment now redundant as section has been revised.
5-811	A	37	48	38	3	Reporting cattle losses in terms of head/feedlot provides the reader with no way to judge the seriousness of the loss. How many head of cattle in a typical feedlot and what, if any, are normal losses? Also, if a cow dies in a feedlot, is it a total economic loss for the operator, or is there some salvage value? (Lenny Bernstein, IPIECA)	Comment now redundant as section has been revised.
5-812	A	37	50	38	5	Species written in Italics (Dinesh Chandra Uprety, Indian Agricultural Research Institute)	Comment now redundant as section has been revised.
5-813	A	38	8	38	10	This is not necessarily the case. Not everyone can afford to undertake such measures (including largescale commercial farmers). What about more vulnerable livestock system due to intensive grazing and genetic diversity? This section is rather overoptimistic about the ability of intensive farming systems to show management flexibility and adapt. (Emma Archer, University of the Witwatersrand)	Comment now redundant as section has been revised.
5-814	A	38	10			This sentence could be phrased better. (Cynthia Rosenzweig, NASA/Goddard Institute For Space Studies at Columbia University)	Comment now redundant as section has been revised.
5-815	A	38	19	38	19	Ref. Year is missing kindly mention the year (Dinesh Chandra Uprety, Indian Agricultural Research Institute)	Comment now redundant as section has been revised.
5-816	A	38	30	38	33	Where, how, and with whom, precisely, is management flexibility a possibility? (Emma Archer, University of the Witwatersrand)	Comment has been accepted as fair and incorporated into redraft.
5-817	A	38	32	38	35	Lines deleted to make it meaningful (Dinesh Chandra Uprety, Indian Agricultural Research Institute)	Comment now redundant as section has been revised.
5-818	A	38	38	38	40	It is not clear what environmental changes these effects refer to. (Jørgen E. Olesen, Danish Institute of Agricultural Sciences)	Comment has been accepted as fair and incorporated into redraft.
5-819	A	38	38	38	40	Over what period and under which climate scenario(s) do these changes and projections apply? (David Price, Northern Forestry Centre)	Comment has been accepted as fair and incorporated into redraft.
5-820	A	38	40			Interesting! I would like to have this reference, but it is not in your work-cited pages.	Reference will be provided.

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						(Cynthia Rosenzweig, NASA/Goddard Institute For Space Studies at Columbia University)	
5-821	A	38	40	38	43	Lines deleted to make it meaningful (Dinesh Chandra Uprety, Indian Agricultural Research Institute)	Comment now redundant as section has been revised.
5-822	A	38	46		49	Awkward sentence (Norman Christensen, Duke University)	Comment now redundant as section has been revised.
5-823	A	38	46			In cold regions ...'. Sentence not clear. (Fischer Günther, International Institute for Applied Systems Analysis)	Comment now redundant as section has been revised.
5-824	A	38	47	38	47	"exit" should be "exist" (David Price, Northern Forestry Centre)	Comment now redundant as section has been revised.
5-825	A	38	47	38	47	"decreased" should be "increased" or "warmer", surely???? (David Price, Northern Forestry Centre)	Corrected.
5-826	A	38	48	38	48	What is meant by "cold wave duration". This and the previous paragraph need careful editing. (David Price, Northern Forestry Centre)	Corrected.
5-827	A	39	1			I suggest to merge sub-section 5.4.2.8 with 5.4.2.5 in order to add information of the impact on livestock (Marco Bindi, Dept. of Agronomy and Land Management)	Agreed.
5-828	A	39	1			5.4.2.8 This text is too long and there are way too many details. (Juerg Fuhrer, Federal AgroEcological)	Comment has been accepted as fair and incorporated into redraft.
5-829	A	39	1			It means me that the term 'biophysical' in the subheading is not reflected in the following text - one can expect there discussion about impact of changed environment on the biological processes in animal organisms. Maybe better to use word 'bioclimatological' which is more directed to the output of these processes. (Jüri Kadaja, Estonian Research Institute of Agriculture)	Comment now redundant as section has been revised.
5-830	A	39	2	39	2	unwanted words are been deleted (Dinesh Chandra Uprety, Indian Agricultural Research Institute)	Comment now redundant as section has been revised.
5-831	A	39	3	39	25	Shorten as only describing one study? (Paula Harrison, University of Oxford)	Comment has been accepted as fair and incorporated into redraft.
5-832	A	39	3	39	25	This section seems very detailed when compared to others. Could the content be distilled down to a couple of simple messages? (Nicholas Holden, University College Dublin)	Comment has been accepted as fair and incorporated into redraft.
5-833	A	39	4	39	25	Need to state which HADCM model this is - HADCM2 HADCM3 etc - Also would it be simpler (and shorter) to tabulate the results? (Jo Hossell, ADAS)	Comment has been accepted as fair and incorporated into redraft.
5-834	A	39	4	39	25	This paragraph can be substantially reduced (Jørgen E. Olesen, Danish Institute of Agricultural Sciences)	Comment has been accepted as fair and incorporated into redraft.

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5-835	A	39	8	39	25	The generally accepted abbreviation for the Canadian GCM is "CGCM", followed by "1", "2" or "3" for the version number, as appropriate. When referring to these scenarios, can you be more explicit about the IPCC scenario?: e.g., was it IS92A as was commonly used for baseline projections? (David Price, Northern Forestry Centre)	Comment has been accepted as fair and incorporated into redraft.
5-836	A	39	9			Which Hadley Centre model - HadCM2 or HadCM3? (Paula Harrison, University of Oxford)	Comment has been accepted as fair and incorporated into redraft.
5-837	A	39	21	39	25	Rewritten after deleting unnecessary sentences (Dinesh Chandra Uprety, Indian Agricultural Research Institute)	Comment now redundant as section has been revised.
5-838	A	39	27			Awkward sentence (Norman Christensen, Duke University)	Comment has been accepted as fair and incorporated into redraft.
5-839	A	39	30			What means 'for each increase in THI above 70'? (Fischer Günther, International Institute for Applied Systems Analysis)	Will be clarified if kept in the revision.
5-840	A	39	35	39	36	Rewritten (Dinesh Chandra Uprety, Indian Agricultural Research Institute)	OK
5-841	A	39	38			Section 5.4.2.9 will need to be improved in SOD since the argument is extremely important, but in the present version the information reported are limited and not very well articulated (Marco Bindi, Dept. of Agronomy and Land Management)	Comment has been accepted as fair and incorporated into redraft.
5-842	A	39	38			5.4.2.9 The issue of CO2 effects on evapotranspiration appears several times and here too. Still, there is no clear message, and stomatal effects may not scale to the full canopy! (Juerg Fuhrer, Federal AgroEcological)	OK
5-843	A	39	40	39	42	It is important here to cross reference to other IPCC chapters and other material that deal with land surface modification feedbacks (material in Working Group 1?) (Emma Archer, University of the Witwatersrand)	Will do where possible.
5-844	A	39	40			Instead of saying vegetation degeneration it should be more appropriate to say retrogression or decadence (Osvaldo Canziani, IPCC WG2 Co-chair)	Comment has been accepted as fair and incorporated into redraft.
5-845	A	39	43	39	43	corrected (Dinesh Chandra Uprety, Indian Agricultural Research Institute)	
5-846	A	39	44	39	47	It's not clear to me why dry land salinisation would increase at elevated CO2 due to lower stomatal conductance. Lower conductances, all other parameters being equal, would decrease transpiration and might increase soil water content, not decrease it (which would lead to salinisation). Also, why would decreased rainfall lower the risk of salinisation (van Ittersum reference is incomplete).	Comment has been accepted as fair and incorporated into redraft.

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Chapter-Comment	Batch	From Page	From Line	To Page	To line	Comments	Notes of the writing team
						(Fitzgerald Booker, USDA-ARS Plant Science Research Unit)	
5-847	A	39	47	39	49	Rewritten after deleting unnecessary sentences (Dinesh Chandra Uprety, Indian Agricultural Research Institute)	
5-848	A	39	49		50	Need to clarify this sentence to differentiate between per individual productivity versus overall herd productivity (i.e., numbers of animals). (Norman Christensen, Duke University)	Comment has been accepted as fair and incorporated into redraft.
5-849	A	39	49		50	This sentence could be phrased better. (Cynthia Rosenzweig, NASA/Goddard Institute For Space Studies at Columbia University)	Agreed—will clarify in the revision.
5-850	A	40	1			Pg 40/line 1: The statement 'is most likely' is in contrast to the indicated medium confidence. (Juerg Fuhrer, Federal AgroEcological)	Done.
5-851	A	40	1	40	2	I would have thought that you could cite this as "High confidence". Surely if the system is already stressed, then increasing herd size can only make things worse? (David Price, Northern Forestry Centre)	Good point—will consider in the revision.
5-852	A	40	4	40	4	Rewritten (Dinesh Chandra Uprety, Indian Agricultural Research Institute)	
5-853	A	40	8			Comments on section 5.4.3: It is necessary to define which crops should be analysed in this section. More specifically, plantation crops include only equatorial or tropical crops like tea, coffee, etc. or also other perennial crops like olive, grapevine, orange, citrus, fruit crop, etc. The same for industrial crops, here the authors mentioned only cotton and root crops, but also tuber crops (e.g. potato) or tomato are usually considered industrial crops. Finally, the impact of climate change on biofuel crops is not reported. (Marco Bindi, Dept. of Agronomy and Land Management)	Addressed in SOD.
5-854	A	40	8			5.4.3 This chapter is in the wrong place. It covers issues already contained in previous sub-chapters (5.4.1.2). (Juerg Fuhrer, Federal AgroEcological)	Addressed in SOD.
5-855	A	40	8	40	8	Is the distinction between plantation crops mentioned here (eg coconut) and tree crops (p24/p32) a common one? I cannot see why the material on page 32 is separate from this material. (Nicholas Holden, University College Dublin)	Addressed in SOD.
5-856	A	40	8			Section 5.4.3. The section on industrial crops seems well argued and linked to evidence. The style and content of this section should be used as a model for the rest of the chapter. (John R Porter, KVL)	OK.
5-857	A	40	10	40	35	These two paragraphs did not contain any helpful information for the reader. In	Addressed in SOD.

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						particular, the first could removed, whilst the latter should be updated with references on impacts studies, if available, or removed. (Marco Bindi, Dept. of Agronomy and Land Management)	
5-858	A	40	12			Under industrial crops add biofuels (Osvaldo Canziani, IPCC WG2 Co-chair)	Done.
5-859	A	40	23		25	What is the connection this sentence to the point of the paragraph? (Norman Christensen, Duke University)	Corrected.
5-860	A	40	24	40	24	Rather than "years", I would have thought "decades". Or are you referring only to damage caused by the 1996 and 1998 cyclones, in which case you should make this clear. (David Price, Northern Forestry Centre)	Corrected.
5-861	A	40	30	40	32	The effects of elevated CO2 on cotton growth and yield were intensively studied during the 1980s using open-top chambers (Kimball, B.A., and J.R. Mauney. 1993. Response of cotton to varying CO2, irrigation, and nitrogen: yield and growth. Agronomy Journal 85(3):706-712), and the first FACE experiments were conducted on cotton (Mauney, J.R., B.A. Kimball, P.J. Pinter Jr., R.L. LaMorte, K.F. Lewin, J. Nagy, and G.R. Hendrey. 1994. Growth and yield of cotton in response to a free-air carbon dioxide enrichment (FACE) environment. Agricultural and Forest Meteorology 70:49-67.) These experiments were more definitive than those of Chen et al in my opinion, and one reason few studies have been done on cotton since the TAR is that it already had been well studied. (Bruce Kimball, USDA, Agricultural Research Service)	Addressed in SOD.
5-862	A	40	33	40	33	Refrence Incomplete (Dinesh Chandra Uprety, Indian Agricultural Research Institute)	Addressed in SOD.
5-863	A	40	34			The number "3-25" should be "3- 25%" (Xie Liyong, Insititute of Agro-Environment and Sustainable Development)	Corrected.
5-864	A	40	34	40	34	"3-25" should be "3-25%", presumably. (David Price, Northern Forestry Centre)	Corrected.
5-865	A	40	37	40	37	The detrimental effects of air pollutant ozone on cotton yield were ameliorated by increasing atmospheric CO2 concentrations across a range of soil N levels (Heagle et al., 1999). Increases in yield and effects on lint and seed quality at elevated CO2 were diminished in clean air versus non-filtered air with added ozone, suggesting that some beneficial effects of elevated CO2 occur due to the prevention of ozone stress. (Fitzgerald Booker, USDA-ARS Plant Science Research Unit)	Addressed in SOD (See box on FACE).
5-866	A	40	37	40	47	I think this paragraph and some following could have a new subheading "CO2 - climate interactions".	Not required to be followed.

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						(David Price, Northern Forestry Centre)	
5-867	A	40	44	40	44	Out of context and changed (Dinesh Chandra Uprety, Indian Agricultural Research Institute)	OK.
5-868	A	40	45	40	46	This reference to Harvell et al. 2002 makes little sense to me. Why would host density increase in a plantation, where the density is presumably constant over the life of the coffee crop? (David Price, Northern Forestry Centre)	Rewritten.
5-869	A	40	49	41	1	Related to previous comment about paragraph heading, this first sentence should be moved up and merged with paragraph starting at P. 40, L. 16, or even deleted. (David Price, Northern Forestry Centre)	Rewritten.
5-870	A	41	1	41	11	How important is this in the overall context? (Jørgen E. Olesen, Danish Institute of Agricultural Sciences)	Rewritten.
5-871	A	41	13		15	Awkward sentence (Norman Christensen, Duke University)	Rewritten.
5-872	A	41	14	41	14	Sentence corrected (Dinesh Chandra Uprety, Indian Agricultural Research Institute)	Rewritten.
5-873	A	41	23			repetition of pg 35!! (Juerg Fuhrer, Federal AgroEcological)	Addressed.
5-874	A	41	23	41	25	This has already been mentioned twice previously? (Paula Harrison, University of Oxford)	Addressed.
5-875	A	41	23	41	25	The issue of outbreak of fungi in coffee is mentioned several times throughout the chapter. This can be greatly reduced (Jørgen E. Olesen, Danish Institute of Agricultural Sciences)	Addressed.
5-876	A	41	23	41	25	Yet a fourth reference to Harvell et al. 2002! Again, I don't think this citation is appropriate here because you are confusing effects of climate change in the geographic region with the effects of introducing an exotic species into a new region with the same climate. I.e., if the fungus was not present in its original habitat, it is unlikely to appear spontaneously. (David Price, Northern Forestry Centre)	Rewritten.
5-877	A	41	25			This study is highlighted too much. (Cynthia Rosenzweig, NASA/Goddard Institute For Space Studies at Columbia University)	Rewritten.
5-878	A	41	27	41	29	This part that begin with "One of the main challenges And finishseveral years to decades ", I think that would go in the beginning of point 5.4 or inclusive in the beginning of the Chapter, because define the necessity to continue to evaluate the impact of climate changes in a number of years. It is valid for all crops and to point out that is a multifactorial process	OK.

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Chapter-Comment	Batch	From Page	From Line	To Page	To line	Comments	Notes of the writing team
						(Cristobal Felix Diaz Morejon, Ministry of Science, Technology and the Environment)	
5-879	A	41	29	41	29	I agree that these experiments were valuable but I don't think you can refer to them as "recent" if they were completed and lasted 13-14 years! (David Price, Northern Forestry Centre)	Noted.
5-880	A	41	31	41	34	On line 33, insert "partly" before "counterbalanced" in line 33. Idso & Kimball's results suggest that the ratio of aboveground wood mass grown under enhanced CO2 levels to the wood mass under lower CO2 levels seems to be stable at around 1.8. Therefore, the early growth spurt was not quite counterbalanced. (Indur Goklany, Office of Policy Analysis, Department of the Interior)	Noted.
5-881	A	41	36	41	47	The paragraph makes a point that there was a down-regulation of photosynthesis and enzyme acclimation. However, the paragraph should also point out that for the last 4 of the 13 year-long experiment with sour orange trees, the ratio of enriched tree biomass production to that of the ambient trees plateaued at 1.75 in spite of the down-regulation of photosynthesis. In a recent paper soon to be published (Kimball, B.A., and S.B. Idso. 2005. Long-term effects of elevated CO2 on sour orange trees. In K. Omasa, I. Nouchi, and L.J. De Kok (eds.) Plant Responses to Air Pollution and Global Change, Springer-Verlag, Tokyo. (in press).), the plateau has continued for another 5 years. A 75% sustained relative increase in growth for the last nine years of a 17-year experiment is huge in spite of down-regulated photosynthesis. (Bruce Kimball, USDA, Agricultural Research Service)	
5-882	A	41	38	41	41	Mention the year in the bracket (Dinesh Chandra Uprety, Indian Agricultural Research Institute)	OK.
5-883	A	41	45	41	47	This must refer to "perennial" plants? Does such an acclimation always occur or is it determined by nutrient deficiencies? (Jørgen E. Olesen, Danish Institute of Agricultural Sciences)	OK.
5-884	A	41	46			insert 'perennial' plants (Juerg Fuhrer, Federal AgroEcological)	OK.
5-885	A	41	47	41	47	Does this assume that a new stable CO2 concentration is achieved, or is it compatible with an ever increasing CO2 concentration? (Nicholas Holden, University College Dublin)	
5-886	A	41	49			5.4.3.1 This is an important aspect, but the heading is not appropriate and the text is not in the right place. (Juerg Fuhrer, Federal AgroEcological)	This section will now be in WG3.
5-887	A	41	50	42	14	These two paragraphs may be used in a mitigation chapter but in my opinion do not fit in 5.4.3.1	Para dropped.

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Chapter-Comment	Batch	From Page	From Line	To Page	To line	Comments	Notes of the writing team
						(Fischer Günther, International Institute for Applied Systems Analysis)	
5-888	A	42	0			<p>5.4.4. One of the main messages in this chapter is that forest productivity will generally increase with climate change and increasing 'CO₂'-fertilization. However, if I read the evidence for the CO₂-stimulation presented in Box 5.2 (Pg 22), I find no support for this statement. In fact, there is more evidence now that forest don't benefit from increased CO₂ in the long-run, perhaps with the exception of short rotation plantations of fast-growing species. In fact, Koerner et al. (Science 309, 2005) stated that "there was no overall stimulation in stem growth and leaf litter production after 4 years. Photosynthetic capacity was not reduced, leaf chemistry changes were minor, and tree species differed in their responses. Although growing vigorously, these trees did not accrete ore biomass carbon in stems in response to elevated CO₂, thus challenging projections of growth responses derived from tests with smaller trees." Hence, the report should be more careful when making statements about CO₂ fertilization of trees.</p> <p>With respect to positive climate change effects, the report emphasizes the effect of warming, which in fact leads to longer growing seasons and thus increased NPP. However, the uncertainty of estimating constraints to NPP due to changes in precipitation is not fully explored. Moreover, the report addresses the issue of extreme events and their impacts, but there appears to be no balance between the positive effects of warming and the negative effects of extremes.</p> <p>While generally well-written and easy to read, there are too many vague statements and notions without reference. Although many of these seem reasonable, the terms likely, very likely, or virtually certain are not appropriate. Also, emphasis is clearly on US forest, while boreal or Mediterranean forests are not given sufficient attention. What will happen to forests and forestry in Russia, for example?</p> <p>(Juerg Fuhrer, Federal AgroEcological)</p>	The main message will stay (see the revised box 5.3), however the level of certainty in this forecast is downplayed. On ecosystem effects: those are covered in Chapter 4 and as so only a few examples (preferably reviews) will stay in this section.
5-889	A	42	1	42	2	"C3 plants and possess a large structure". Do you mean they are "large woody C3 plants"?	Will clarify in revision.
						(David Price, Northern Forestry Centre)	
5-890	A	42	2		5	Again, this seems disconnected from the remainder of the paragraph	Comment now redundant or irrelevant as section has been revised.
						(Norman Christensen, Duke University)	
5-891	A	42	3			Since in Brazil first and in Argentina later sugar cane alcohol is used as fuel and more recently, in Argentina, soybean oil is used as biodiesel, it would be good to refer to these biofuels already in use. Cross-refer with Chapter 13.	Comment now redundant or irrelevant as section has been revised.
						(Osvaldo Canziani, IPCC WG2 Co-chair)	
5-892	A	42	7	42	14	I suggest that this paragraph is omitted	Comment has been accepted as fair and

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Chapter-Comment	Batch	From Page	From Line	To Page	To line	Comments	Notes of the writing team
						(Jørgen E. Olesen, Danish Institute of Agricultural Sciences)	incorporated into redraft.
5-893	A	42	7	42	14	In previous IPCC reports the LESS energy scenario has been presented, which is highly dependent on the contribution of biomass to the global energy supply to reduce C emissions. An issue that needs to be discussed in this context is the land area required to grow the biomass. This is large and it should be noted that it is not only price that limits the adoption of biomass but also the competition for land to grow food or fibre. (John R Porter, KVL)	This should be considered explicitly in the sustainable development section—Jelle?
5-894	A	42	7	42	7	Mention the year in the bracket (Dinesh Chandra Uprety, Indian Agricultural Research Institute)	
5-895	A	42	8	42	9	The statement about subsidies being required to make agricultural biofuels economically feasible is already out of date. Note that the citation for this statement is 2003, when oil was less than \$40 per barrel. At prices above \$50 per barrel, the calculus for cost effectiveness of biofuels made from corn grain and soybean biodiesel changes such that they are cost-effective when compared to imported oil for many developed countries. Indeed, the substantial increase in fossil fuel energy since 2004 due to demand for energy in China and India that is well above projections, means that a significant portion of global cereal production will be used for biofuels, and this marked change is NOT considered in the FAO and IFPRI projections for food demand/supply balance. For example, the new Energy Bill in the USA mandates production of more than 7.5 billion gallons of biofuels by 2012, at which point such production will require 25% of total USA corn grain production based on trendline yields by 2012. Because the USA produces 40% of global corn supply, USA biofuel production in 2012 will require 9% of the global corn supply. Other countries are also expanding biofuel production from crops in response to higher oil prices. Hence, the prognosis for meeting food demand, and especially adequate food supply at reasonable cost for the worlds poor, is even more precarious--with or without climate change. (Kenneth Cassman, University of Nebraska)	We agree that much has changed since 2003 and will take elements of this comment into consideration in the revision. The current energy price volatility requires that a long view be taken. This is likely to be taken up explicitly in section 5.5.
5-896	A	42	8	42	8	Delete one "Schneider and" (David Price, Northern Forestry Centre)	OK
5-897	A	42	15	42	16	Rewritten after deleting unnecessary sentences (Dinesh Chandra Uprety, Indian Agricultural Research Institute)	
5-898	A	42	17			Comments on section 5.4.4: There are several paragraphs without any reference, in the SOD these should be supported by references, otherwise they should be removed. Moreover, helpful information for subsections: insect damage, fire risk, extreme events and insurance may be provided by the final report of the MICE	CHECK WHEN AVAILABLE

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						project (EVK2-CT-2001-00118) and next coming special issue on Climate Research (coordinator Jean Palutikof jean.palutikof@metoffice.gov.uk) (Marco Bindi, Dept. of Agronomy and Land Management)	
5-899	A	42	17	49	13	The point 5.4.4 Forestry is very large in comparison with other related points(NEED TO BE REVISED BECAUSE EXIST IDEAS THAT ARE REPEATED) (Cristobal Felix Diaz Morejon, Ministry of Science, Technology and the Environment)	Done.
5-900	A	42	17			I think disturbances should be emphasized even more in this section. I see disturbances such as fire, insects, wind as catalysts for rapid change in forests. For example, see Weber and Flannigan 1997 Environmental Reviews 5:145-166. (Mike Flannigan, Canadian Forest Service)	Disagree: this topic is covered by chapter 4. We provide only a few examples and rely on Chapter 4 for thorough analysis.
5-901	A	42	17			Section 5.4.4. Comment L45-46 applies throughout this section. Numerous unsupported assertions are made. Because of this, I have unreservedly suggested possible specific refs. (where I had the full citations at hand), or authors names (where I don't have the full citations at hand) which can be used for initiating literature searches. On fire see work by Stocks, Flannigan, Amiro. On insects see above. On insect-fire interaction see Fleming et al. 2002, given above. (Richard Fleming, Great Lakes Forest Research Centre)	Generally, the suggested changes are more applicable to Chapter 4. Otherwise, the corrections are made as advised.
5-902	A	42	17			Section 5.4.4. This section is a bit confused in the sense that it starts by saying that global forest production will tend to increase as a result of higher CO2, nutrients and temperature. However, the rest of the section mainly discusses those factors that will reduce forest production - such as insects and weather extremes. The section on insurance (p47 l.14) also suggests that forest insurance costs will increase but it is not clear how this fits with increased production. This illustrates a general issue in the chapter - that it does not read as a coordinated whole but contains many internal contradictions and reads as a disconnected assembly of contributions. (John R Porter, KVL)	The section is reorganized as advised.
5-903	A	42	19	42	24	Should note at the end of the para that so far the net effect in the northern latitudes seems to have been an increase in greenness and greater C-sink capacity (see, e.g, Schimel et al. 2001). (Indur Goklany, Office of Policy Analysis, Department of the Interior)	C sink entirely covered by WG3/ch9; otherwise changed as advised.
5-904	A	42	19	42	33	Provide references (Paula Harrison, University of Oxford)	Paragraph dropped - obsolete.
5-905	A	42	19	42	20	Some references would be nice here. This is a very definitive statement with little backup of the type needed for this document (Nicholas Holden, University College Dublin)	Paragraph dropped - obsolete.

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5-906	A	42	19	42	19	Sentence corrected (Dinesh Chandra Uprety, Indian Agricultural Research Institute)	
5-907	A	42	20			substitute "growing" for "vegetation" (Norman Christensen, Duke University)	Done.
5-908	A	42	21	42	21	Sentence corrected (Dinesh Chandra Uprety, Indian Agricultural Research Institute)	
5-909	A	42	22	42	26	Rewritten after deleting unnecessary sentences (Dinesh Chandra Uprety, Indian Agricultural Research Institute)	
5-910	A	42	24			add 'intensity' (Reinhold Glauner, Inst. for World Forestry)	I disagree as the effects will be regionalized.
5-911	A	42	27	42	34	Repetition and deleted (Dinesh Chandra Uprety, Indian Agricultural Research Institute)	
5-912	A	42	28			change 'new species' to 'better adapted' or 'site-adapted species' (Reinhold Glauner, Inst. for World Forestry)	Paragraph dropped - obsolete.
5-913	A	42	29	42	33	Here it is stated that climate change is likely to increase timber production, but in the initial parts of chapter 5 it is stated that there will probably not be an increased demand for timber products in the future. How, will the increased timber production interact with a stagnating demand? (Jørgen E. Olesen, Danish Institute of Agricultural Sciences)	Paragraph dropped - obsolete.
5-914	A	42	31		34	Given that markets are flat, the benefits to consumers would presumably be because of lower prices due to high supply? (Norman Christensen, Duke University)	Yes. Paragraph dropped - obsolete.
5-915	A	42	36	42	36	Rewritten after deleting unnecessary sentences (Dinesh Chandra Uprety, Indian Agricultural Research Institute)	
5-916	A	42	37	42	42	This affirmation is very strong, and for this reason need too serious bibliographical references (Cristobal Felix Diaz Morejon, Ministry of Science, Technology and the Environment)	References provided.
5-917	A	42	37	42	50	This whole section needs references if it is to make such definitive statements (Nicholas Holden, University College Dublin)	References provided.
5-918	A	42	37	43	21	This review lacks a few key steps in the assessment: 1. review consolidated knowledge about CO2 fertilization in growing forests! Experiments have recently shown more and more that the ecosystem response is less positive than thought earlier. 2. Most models include simple response functions which reflect the older state of knowledge with much more positive effects of CO2 increase. Be careful with simulated NPP increases from models! 3. Climate change scenarios do not yet include climate variability and extreme events in satisfying way. Most of the	Subchapter is restructured; and the proposed changes were implemented.

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						model assessments thus cannot reflect realistic responses! cf. Cias et al. paper on Heat wave 2003 and its impacts on NPP... (Marcus Lindner, European Forest Institute)	
5-919	A	42	38	42	40	should have reference there; it also seems contradictory to recognize those statements with the prediction that wood supply will increase. (Sylvie Gauthier, Laurentian Forestry Center, Canadian Forestry Service)	References provided.
5-920	A	42	41	42	43	Mention the year in the bracket (Dinesh Chandra Uprety, Indian Agricultural Research Institute)	
5-921	A	42	44	42	50	Should this para be in introduction to this section (ie under 5.4.4) (Jo Hossell, ADAS)	Obsolete.
5-922	A	42	44		46	BUT: see Körner et al 2005 and other recent papers on smaller effects! (Marcus Lindner, European Forest Institute)	The section is on SIMULATED effects. Limitations are listed below.
5-923	A	42	44	42	47	Generalized statement has been deleted (Dinesh Chandra Uprety, Indian Agricultural Research Institute)	Done.
5-924	A	42	46	42	47	Suggestions as above regarding inclusion of ozone as major limiting co-factor. Here, the paper by Felzer et al. (2004) Tellus 36B:230-248 is perhaps the best landscape level estimate of historical offsets from ozone on carbon sequestration in crops and forests. (Kevin Percy, Canadian Forest Service)	Included in Box 5.3
5-925	A	43	1	43	20	this section could be reduced. (Norman Christensen, Duke University)	Reduced.
5-926	A	43	1	43	5	Repetitive - omit? (Paula Harrison, University of Oxford)	Done.
5-927	A	43	1	43	5	Is this paragraph needed? (Nicholas Holden, University College Dublin)	Not really -- Paragraph deleted.
5-928	A	43	8	43	8	Reference incomplete (Dinesh Chandra Uprety, Indian Agricultural Research Institute)	No reference on this line.
5-929	A	43	12			Regarding the word "predict", how good were these predictions? It may be more prudent to use the word "estimate" rather than "predict." (Indur Goklany, Office of Policy Analysis, Department of the Interior)	Done
5-930	A	43	12	43	12	According to the reference (and my personal knowledge) "MC" should be "MC1". (David Price, Northern Forestry Centre)	Done.
5-931	A	43	19	43	24	Lines changed & reference required (Dinesh Chandra Uprety, Indian Agricultural Research Institute)	Done.
5-932	A	43	20			The authors may wish to refer to Ferguson et al 2003 as an example of climate change considered in the estimation of forest yield. Changes in fire regimes attributed to changing climate and its effect on forest ecology should be	Paragraph revised. The reference seems inappropriate for illustration of CC impact on yield estimations.

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						emphasised in 5.4.4. (Kim Ritman, Bureau of Rural Sciences)	
5-933	A	43	23			Useful information on forest fire risk and climate change may obtained from the following papers: Flannigan M, Campbell I, Wotton M, Carcaillet C, Richard P, Bergeron Y (2001) Future fire in Canada's boreal forest: paleoecology results and general circulation model – regional climate model simulations. Can J For Res 31: 854–864 Flannigan MD, Stocks BJ, Wotton BM (2000) Climate change and forest fires. Sci Total Environ 262: 221-229 Williams AAJ, Karoly DJ, Tapper N (2001) The sensitivity of Australian fire danger to climate change. Clim Change 49: 171-191. (Marco Bindi, Dept. of Agronomy and Land Management)	Included.
5-934	A	43	23	44	13	could be condensed. As mentioned there is an extreme year to year variability in forest fires. It is always difficult to assess changes when the phenomenon is one that is rare at the human time scale, but not so rare for tree populations. It is very important here that the baseline period for comparison is stated. Otherwise the increase decrease discussion is meaningless. Bergeron et al . 2004 Ambio, have shown that in most regions of Canada, current and projected fire frequency are lower than that before 1850. I also question our ability to assess whether some of the apparent increase mainly reflect the fact that we are looking at a phenomenon that occurs at the century scale while comparing it to a relatively short time period baseline. (Sylvie Gauthier, Laurentian Forestry Center, Canadian Forestry Service)	Done.
5-935	A	43	24	43	29	There should also be a section on fire risk under livestock production and rangelands/grasslands (Emma Archer, University of the Witwatersrand)	Wrong section.
5-936	A	43	24	44	13	There is evidence for increased fire activity in parts of the world (Mouillot and Field 2005. GCB 11:398-420; Podur et al. 2002 Cand. J. Forest Res. 32:195-205 - see also Soja et al. 2004 JGR 109 and estimates for area burned in Russia for 2003 exceed 20 million ha - Intl Forest Fire News and Global Fire Monitoring Web site) Also, with climate change and warmer temperatures fire activity will increase, there will be more ignitions and a longer fire season(Flannigan et al 2005 Climatic Change 72:1-16; Flannigan et al. 1998. J Vegetation Science 9:469-476.; Flannigan et al. 2001 Can. J. For. Res. 31:854-864; Gillett et al. 2004 GRL 31(18); Price and Rind 1994 J. Climate 7:1484-1494; Wotton and Flannigan 1993 Forestry Chronicle 69:187-192; Wotton et al. 2003. Climatic change 60:275-295). Also there is the potential for a positive feedback from ghg emissions	Included.

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						released by wildfire (Amiro et al. 2001 Can. J. For Res 31:512-525; Page et al.2002 Nature 420:61-65) (Mike Flannigan, Canadian Forest Service)	
5-937	A	43	26	43	26	I think "topography" is a better word than "relief" here. (David Price, Northern Forestry Centre)	Done.
5-938	A	43	31	43	39	Reference should be made to the feedback effects of forest fires on the climate, at regional (i.e. enhanced acidic deposition and dangerous particulate dissemination) and global scales (GHG). (Osvaldo Canziani, IPCC WG2 Co-chair)	Seems more appropriate in Chapter 4.
5-939	A	43	31	43	29	Cross refer to chapter 8 (Osvaldo Canziani, IPCC WG2 Co-chair)	Done.
5-940	A	43	32			... due to extremely high temporal and spatial variability.' Variability of what? (Fischer Günther, International Institute for Applied Systems Analysis)	Corrected.
5-941	A	43	33	43	33	Ref. Missing and repeted from earlier sentences (Dinesh Chandra Uprety, Indian Agricultural Research Institute)	Corrected.
5-942	A	43	36		39	2003 was another extreme year, perhaps much more drastic than 1998. 2002 and 2005 were also pretty bad. see e.g. Global Fire Monitoring Center webpage (Marcus Lindner, European Forest Institute)	Obsolete.
5-943	A	43	41	43	42	Here it is clearly stated that the fire risk increase could be seen in areas where there is an increased aridiity. Should be mentioned also in the summary and the conclusion (Jørgen E. Olesen, Danish Institute of Agricultural Sciences)	Declined due to space constraints.
5-944	A	43	43	43	44	The suggestion that wetter condtions may make fires more severe does not fit with current observations. A wetter climate also enhances decomposition. (Pierre Bernier, Natural Resources Canada)	Revised.
5-945	A	43	43	43	45	I am not aware of studies that have shown that wetter years increase the fuel and, fire severity in the dry years. (see the paper of Moritz et al 2004 Frontiers in ecology and environement) where they questioned the fuel build-up effects (Sylvie Gauthier, Laurentian Forestry Center, Canadian Forestry Service)	Revised.
5-946	A	43	43			Drop ', as well as forest fires'; it is already mentioned in the previous sentence. (Fischer Günther, International Institute for Applied Systems Analysis)	Done.
5-947	A	43	48	43	50	Work from Y. Bergeron's group suggests that fire frequency in the more humid eastern portion of the boreal forest has not been increasing, and may even decrease as a result of climate change (e.g. Girardin, M.P., J. Tardif, M.D. Flannigan, B.M. Wotton and Y. Bergeron. 2004. Trends and periodicities in the Canadian Drought Code and their relationships with atmospheric circulation for the southern Canadian boreal forest. Can. J. For. Res. 34: 103-119.; Bergeron, Y.,	Revised.

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						B. Denneler, D. Charron and M.P. Girardin 2002. Using dendrochronology to reconstruct disturbance and forest dynamics around Lake Duparquet, northwestern Quebec. Dendrochronologia 20: 175-189; Bergeron, Y. 1998. Les conséquences des changements climatiques sur la fréquence des feux et la composition forestière au sud-ouest de la forêt boréale québécoise. Géographie physique et Quaternaire, 52: 1-7). (Pierre Bernier, Natural Resources Canada)	
5-948	A	44	0			This section is too loose. It needs a table perhaps, or to be reorganized. (Cynthia Rosenzweig, NASA/Goddard Institute For Space Studies at Columbia University)	Revised.
5-949	A	44	1		3	last phrase needs clarification. It should be noted somewhere that where climate change increases fire occurrence, the rate of forest change (as in composition) will be accelerated. (Norman Christensen, Duke University)	Revised. The second point seems to be more appropriate for chapter 4.
5-950	A	44	1		3	Add also example of record fire seasons in Europe 2003 and 2005. For example in Portugal more than 400 000 ha were lost in 2003. This was 300% higher than average of previous two decades (from a FAO press release). (Marcus Lindner, European Forest Institute)	FOR HEAT WAVE CROSSCHAPTER STUDY.
5-951	A	44	5	44	13	not clear why this is in the fire-climate section (Sylvie Gauthier, Laurentian Forestry Center, Canadian Forestry Service)	Deleted.
5-952	A	44	5	44	13	Is this paragraph in the right place? It seems to be more about insects than fire (I guess the same goes for page 44 lines 42 to 43) (Nicholas Holden, University College Dublin)	Changed as advised.
5-953	A	44	5		13	shift paragraph down to next chapter (Marcus Lindner, European Forest Institute)	Changed as advised.
5-954	A	44	6	44	6	See the work of Fleming, R.A., J.N. Candau and R.S. McAlpine, 2002. (Landscape-scale analysis of interactions between insect defoliation and forest fire in Central Canada. Climatic Change 55: 251-272) on fire-insect interactions. (Pierre Bernier, Natural Resources Canada)	Changed as advised.
5-955	A	44	10	44	13	See work by Carroll et al on how the dramatic outbreak of mountain pine beetle in Canada is linked to winter warming (Carroll, A. L. S. W. Taylor J. Régnière & L. Safranyik. 2004. Effects of climate change on range expansion by the mountain pine beetle in British Columbia. pp. 223-232 in T.L. Shore, J.E. Brooks & J.E. Stone (Eds). Natural Resources Canada, Canadian Forest Service, Pacific Forestry Centre Information Report BC-X-399, Victoria BC 298 p.) (Pierre Bernier, Natural Resources Canada)	Changed as advised.
5-956	A	44	11	44	11	Acronyms should be spelled out	No acronyms on this line.

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						(Dinesh Chandra Uprety, Indian Agricultural Research Institute)	
5-957	A	44	15	44	15	Move the title of the subsection before the previous paragraph (Marco Bindi, Dept. of Agronomy and Land Management)	Done.
5-958	A	44	15	44	28	I think there are a few references that should be included here with some discussion(Fleming 2000 World Resource Review 12:520-554; Fleming et al. 2002. Climatic Change 55:251-272; Logan et al. 2003. Front. Ecol. Environ. 1:130-137; Volney and Fleming, 2000. Agriculture, Ecosystems and Environment 82:283-294) (Mike Flannigan, Canadian Forest Service)	References are modified; however the section is considerably shortened due to length limits.
5-959	A	44	16	44	28	insect damage: are only the pest moving due to climate change; any counterbalancing migration? (Indur Goklany, Office of Policy Analysis, Department of the Interior)	Comment unclear.
5-960	A	44	16	44	20	References! (Nicholas Holden, University College Dublin)	Obsolete: the section is significantly shortened due to space constraint.
5-961	A	44	20	44	22	This sound very much like my own work (Fleming, R.A. and G.M Tatchell, 1995. shifts in the flight periods of British aphids: a response to climate warming? Pages 505-508 in R Harrington and N. E Stork (eds.), Insects in Changing Environment. Academic Press, London, UK. 535p). If so, it was demonstrated with data on (mostly agricultural pest) aphids in Britain. So this statement might be better placed in an agricultural part of this chpt after replacing "Canada" with "Britain". (Richard Fleming, Great Lakes Forest Research Centre)	The reference is Canadian Forest Service, 2003, Forest Ecosystems of Canada , which was heavily cited by Sten: http://ecosys.cfl.scf.rncan.gc.ca/issues/clim_chg_e.asp . The whole section is reorganized and references changed.
5-962	A	44	22	44	24	I think the idea here is the MPB could get into jackpine east of the Rocky Mtns & go into eastern Canada from there. REF = Allan Carroll. (Richard Fleming, Great Lakes Forest Research Centre)	Obsolete: the section is significantly shortened due to space constraint.
5-963	A	44	22	44	22	Systematic name for mountain pine beetle: Dendroctonus ponderosae (David Price, Northern Forestry Centre)	Obsolete: the section is significantly shortened due to space constraint.
5-964	A	44	24	44	27	Remove. Like many current exotic introductions, ALB is a consequence of increasing transportation, not C.C. (Richard Fleming, Great Lakes Forest Research Centre)	Obsolete: the section is significantly shortened due to space constraint.
5-965	A	44	25			The term 'vulnerable' needs definition (Juerg Fuhrer, Federal AgroEcological)	Obsolete: the section is significantly shortened due to space constraint.
5-966	A	44	25	44	25	Corrected (Dinesh Chandra Uprety, Indian Agricultural Research Institute)	
5-967	A	44	27	44	28	So, what is the statement in this sentence? Anything is possible? (Juerg Fuhrer, Federal AgroEcological)	The statement is that the total effect on forestry remains highly uncertain. The sentence changed to state that explicitly.

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5-968	A	44	27	44	28	Very vague and not really a great step forward from what was known at the time of TAR (?) (Nicholas Holden, University College Dublin)	Comment accepted. The statement is that the total effect on forestry remains highly uncertain. The sentence is changed to state that explicitly.
5-969	A	44	30	44	37	Maybe included SEVERE ELECTRIC STORMS for their influences over forest fires (Cristobal Felix Diaz Morejon, Ministry of Science, Technology and the Environment)	I disagree as the overall effect of climate change on global lightning activity is still unknown. E.g., Williams, 2005, Lightning and Climate: a review. Atmospheric research 76, 272-287.
5-970	A	44	31	44	37	In some areas the changes in weather extremes might have positive impacts, e.g., less snow, lower costs for maintaining roads, less ice damage, etc. This should be noted. Also, how much confidence is there that winds will increase? Is this borne out by empirical long term data? See, e.g., [1] Barring L. and von Storch, H. 2004. Scandinavian storminess since about 1800. Geophysical Research Letters 31: 10.1029/2004GL020441; [2] Hage, K. 2003. On destructive Canadian prairie windstorms and severe winters. Natural Hazards 29: 207-228. (Indur Goklany, Office of Policy Analysis, Department of the Interior)	1. Disagree. These examples rather correspond to changes in mean temperature/precipitation and not an increase in extremes. Note that the next sentence mentions an extreme heterogeneity of the extreme events. 2. Weather extremes are covered by WG1 Chapter 10, which e.g. (in FOD) mentions increased intensity and decreased number of storm events. Cross-referenced.
5-971	A	44	31	46	15	Something should be concluded on spring or autumn frosts that might damage young shoots. On one hand the climate is getting warmer but on the other hand the growing season starts earlier and ends later when the nights are long and radiation losses can be big. (Mats Olsson, SLU)	Accepted – thanks.
5-972	A	44	31	44	37	It is probably worth making the point here that poor management practices in the past can often exacerbate effects of increased variability and extreme events. E.g., clearcutting forest can contribute to increased flashiness of streamflows leading to soil erosion and mudslides, sometimes causing human catastrophes. I am not sure where this is documented in the scientific literature but I think it is generally accepted, from news media reports. (David Price, Northern Forestry Centre)	I don't know of any reference to support such discussion.
5-973	A	44	32			Add "early thaw" to the list. In the boreal forest, winter logging is quite important in regions with a lot of wet areas and early thaws can curtail harvesting. (Pierre Bernier, Natural Resources Canada)	Accepted.
5-974	A	44	35			Replace "increased" with "changes in". See comment 26 (Indur Goklany, Office of Policy Analysis, Department of the Interior)	Disagree. This sentence states it explicitly that the changes in extremes will show extreme heterogeneity. Amended as suggested, the whole sentence would be redundant. Reference to WG1 Chapter 10 on extreme events included.

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5-975	A	44	36	44	36	This statement clearly indicates that there will be a very high spatial variability in the impact. This should probably be pointed out in the conclusion and summary as well (Kenneth Cassman, University of Nebraska)	Agree, but subject to space constraints.
5-976	A	44	36		37	I believe that after 2003 this statement cannot be made any more. See Cias et al 2005 and other papers on impacts of Heat Wave 2003. Also other papers are stating the general much higher importance of extreme events! (Marcus Lindner, European Forest Institute)	These lines discuss wind/ice/snow damage – nothing to do with the heat wave. I suspect that the comment was misplaced; the previous paragraph is changed.
5-977	A	44	39	44	50	See comment 26. (Indur Goklany, Office of Policy Analysis, Department of the Interior)	I suspect this is the comment 70 in the version I am given. I generally disagree that the increased intensity of extreme events can be positive; rather, the changes in mean temperature/precipitation can make a positive effect, which is mentioned in a correspondent section.
5-978	A	44	39	44	45	References? I thought this report was a compilation of knowledge gained since TAR, not just a text on all possible impacts (Nicholas Holden, University College Dublin)	This is a reference.
5-979	A	44	40			damage to individual trees ... trunk breakage, add: to complete stand destruction in hte scale of tens - hundreds of ha. (Marcus Lindner, European Forest Institute)	Corrected as advised.
5-980	A	44	41	44	41	corrected (Dinesh Chandra Uprety, Indian Agricultural Research Institute)	
5-981	A	44	42			Check spelling (Juerg Fuhrer, Federal AgroEcological)	Corrected as advised.
5-982	A	44	45	44	45	Deleted and sentence is rewritten (Dinesh Chandra Uprety, Indian Agricultural Research Institute)	
5-983	A	44	47		50	Higher precipitation in winter + higher temp = less frost, water saturation more frequent. Plus more frequent and stronger storm events = higher risk! Trees in water saturated soils are less stable. (Marcus Lindner, European Forest Institute)	Sentence amended. Note however that the WG1 message differs: less frequent storm events.
5-984	A	44	50			This sentence needs to be rewritten. Also, is this evidence for all regions? (Cynthia Rosenzweig, NASA/Goddard Institute For Space Studies at Columbia University)	Sentence deleted (wrong chapter)
5-985	A	45	0			Interaction with land use change: This section is too vague! (Juerg Fuhrer, Federal AgroEcological)	Amended.
5-986	A	45	3	45	3	Authors should try to explain the uncertainties on global changes and their	We try hard.

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						impacts on various aspects of agroforestry ecosystems, fisheries and live socks (Dinesh Chandra Uprety, Indian Agricultural Research Institute)	
5-987	A	45	4			delete 'a' (Juerg Fuhrer, Federal AgroEcological)	Thanks – changed.
5-988	A	45	4			... as only a few models ... (Fischer Günther, International Institute for Applied Systems Analysis)	Thanks – changed.
5-989	A	45	4			Word missing between "a" and "models" (Paula Harrison, University of Oxford)	Thanks – changed.
5-990	A	45	7	45	13	Add references in the SOD at this paragraph or remove it (Marco Bindi, Dept. of Agronomy and Land Management)	Accepted.
5-991	A	45	7			Change temperature growth to temperature increases as less confusing with tree growth. Add references to this paragraph. (Paula Harrison, University of Oxford)	Paragraph changed.
5-992	A	45	7	45	13	refernces (Nicholas Holden, University College Dublin)	Paragraph changed.
5-993	A	45	7	45	7	I suggest changing "growth" to "increase" (Jørgen E. Olesen, Danish Institute of Agricultural Sciences)	Paragraph changed.
5-994	A	45	8	45	10	A reference is needed for this statement. (Paul J. Hanson, Oak Ridge National Laboratory)	Paragraph changed.
5-995	A	45	10	45	10	Corrected (Dinesh Chandra Uprety, Indian Agricultural Research Institute)	
5-996	A	45	10	45	23	corrected (Dinesh Chandra Uprety, Indian Agricultural Research Institute)	
5-997	A	45	12	45	12	Could insert "dieback and/or" before "reductions in decomposition rates"? (David Price, Northern Forestry Centre)	Paragraph changed.
5-998	A	45	15		21	Doubtful that forest change will be gradual as indicated here. More likely that change will be associated with disturbance events that favor regime change. See Scheffer and Carpenter 2003 TREE 18:648-657 (Norman Christensen, Duke University)	Paragraph dropped – obsolete.
5-999	A	45	15			References would be helpful to support the claims made. (Fischer Günther, International Institute for Applied Systems Analysis)	Paragraph dropped – obsolete.
5-1000	A	45	15	45	17	A reference is needed for this statement. (Paul J. Hanson, Oak Ridge National Laboratory)	Paragraph dropped – obsolete.
5-1001	A	45	15		21	This is rather speculative. I do tend to agree with teh statement that composition changes have been overestimated in the early 90s. But we have only witnessed few extreme years like 2003, there are more to come... (Marcus Lindner, European Forest Institute)	Paragraph dropped – obsolete.

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5-1002	A	45	16			“recent analyses”, add reference (Juerg Fuhrer, Federal AgroEcological)	Paragraph dropped – obsolete.
5-1003	A	45	19	45	21	This sentence should be reworded for clarity: "Another mediating effect under elevated CO2 could be increased density of the root system." (David Price, Northern Forestry Centre)	Section dropped
5-1004	A	45	22	45	35	One of the tasks assigned to chapter 5 is to include agroforestry issues. This subsection offers the opportunity to refer to the climatic aspects of soil conservation in agroforestry and to the improvement of micro- climate conditions by or within an agroforestry system (Osvaldo Canziani, IPCC WG2 Co-chair)	Section dropped due to space limitations.
5-1005	A	45	23	45	35	Add references in the SOD at this paragraph or remove it (Marco Bindi, Dept. of Agronomy and Land Management)	Section dropped.
5-1006	A	45	23	45	35	I suggest to include after the end Coastal regions inland, AND CAN TO INTRODUCE SEVERE DAMAGES IN MANGROVE PLANTATIONS (Cristobal Felix Diaz Morejon, Ministry of Science, Technology and the Environment)	Section dropped.
5-1007	A	45	24			A reference is needed. (Fischer Günther, International Institute for Applied Systems Analysis)	Section dropped due to space limitations.
5-1008	A	45	24	45	35	References - essential for this section ("recent studies...") (Nicholas Holden, University College Dublin)	Section dropped due to space limitations.
5-1009	A	45	28			author missing on 2004 reference (Paula Harrison, University of Oxford)	Section dropped due to space limitations.
5-1010	A	45	33	45	35	Are there P&P mills that close to sea level? (Pierre Bernier, Natural Resources Canada)	Removed.
5-1011	A	45	33	45	35	This is probably true, but my understanding is that the commercial lifespan of a typical pulp or paper mill is about 25 years (certainly no more than 50)... which means that constructing a new mill at higher elevation is hardly an issue! (David Price, Northern Forestry Centre)	Removed.
5-1012	A	45	34			Few mills located within 2 m of sea level (Norman Christensen, Duke University)	Removed.
5-1013	A	45	35			... currently located in the coastal regions to relocate inland. (Fischer Günther, International Institute for Applied Systems Analysis)	Removed.
5-1014	A	45	38	45	50	This entire section is rather out of place - it is not sufficiently linked into the rest of the chapter. (Emma Archer, University of the Witwatersrand)	The subchapter was restructured.
5-1015	A	45	38	46	15	Severe storms and storm felling of wood (due to wind velocity and soft watersaturated ground) may increase the supply of low quality wood that is not	We tried to escape biofuel discussion here due to space limitations – it belongs to energy

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						suitable as pulpwood or lumber (because of physical damages and rot attack) and that will go to the biofuel market and impact on availability and price of biofuels (Mats Olsson, SLU)	chapter.
5-1016	A	45	42	45	42	Corrected and sentence changed (Dinesh Chandra Uprety, Indian Agricultural Research Institute)	
5-1017	A	45	48			compare figures with chap 5 page 6 line 37; there 450 Mio people are mentioned (Reinhold Glauner, Inst. for World Forestry)	<p>You can't compare pg 6: The FAO estimates that the livelihoods of roughly 450 million of the world's poorest people are entirely dependent on managed ecosystem services</p> <p>And page 45: It is estimated that 60 million highly forest-dependent people live in the rainforests of Latin America, South-east Asia and West Africa. An additional 350 million people are directly dependent on forest resources for subsistence or income, and 1.2 billion people in developing countries use trees on farms to generate food and cash</p> <p>The first number includes all sectors and the poorest people; the second – forestry only.</p>
5-1018	A	46	6	46	6	Careless writing without reading the reference papers (Dinesh Chandra Uprety, Indian Agricultural Research Institute)	Strange comment—not sure what answer did the referee expect.
5-1019	A	46	7	46	13	I do not find this sentence very informative. (Jørgen E. Olesen, Danish Institute of Agricultural Sciences)	Reference to overadaptation excluded – otherwise I believe that it is important to stress that the forest-based communities are within the risk group.
5-1020	A	46	8	46	9	Deleted and sentence is rewritten (Dinesh Chandra Uprety, Indian Agricultural Research Institute)	
5-1021	A	46	10	46	10	What is meant by ' "overadaptation" to a particular sector' ? (David Price, Northern Forestry Centre)	Reference to overadaptation excluded.
5-1022	A	46	13		15	This needs a supporting NTFP example (Norman Christensen, Duke University)	Can't do due to space constraint—reference included.
5-1023	A	46	14			cancel 'extremely' (Reinhold Glauner, Inst. for World Forestry)	OK.
5-1024	A	46	17			Comments on section 5.4.4.2: This section should be moved in a specific section on Adaptation strategies (see general comments on section 5.4)	Done.

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						(Marco Bindi, Dept. of Agronomy and Land Management)	
5-1025	A	46	19	47	12	Warmer winters without frost in the ground but water saturated soils may make forest operations at northern latitudes difficult or impossible. Forest operations may therefore in a warmer climate have to be moved to the summer period and that will have implication on the structure of the road net and road maintenance. (Mats Olsson, SLU)	Included as “shift timing of management operations.
5-1026	A	46	20	46	20	Sentence changed to make it meaning full (Dinesh Chandra Uprety, Indian Agricultural Research Institute)	
5-1027	A	46	25			More specific statement would be useful (Juerg Fuhrer, Federal AgroEcological)	Section condensed.
5-1028	A	46	27			I would like to see a Table with adaptation options, similar to Table 5.3 for agriculture (Juerg Fuhrer, Federal AgroEcological)	Done.
5-1029	A	46	29	46	30	Words changed (Dinesh Chandra Uprety, Indian Agricultural Research Institute)	
5-1030	A	46	31	46	31	What is meant by "provide connectivity" here? Is this a reference to wildlife corridors? (David Price, Northern Forestry Centre)	Obsolete – section condensed.
5-1031	A	46	32	46	35	Never heard of prescribed burning to reduce insect attacks (except for locusts). I would have thought the risk of the fire 'escaping' in a forest setting would be too great. The vast majority of 'non-chemical' forest insect control in Canada is with Bt (Bacillus thuringiensis), & of course this involves delivery of chemicals in the mix to create proper viscosity of the sprayed material through the airplane's nozzles, proper size of droplets to reduce drift & proper adhesive properties to let the drops stick to the target foliage, and some UV protectant so the Bt will remain active long enough for an insect (usually spruce budworm) larva to eat it. (Richard Fleming, Great Lakes Forest Research Centre)	As a matter of fact, it's from a publication where the referee have participated: “Prescribed burning has also been recommended as one potential adaptation option for reducing forest vulnerability to increased insect outbreaks.” Climate Change Impacts and Adaptation: A Canadian Perspective. 2004. Since the referee disagrees with these options, I will remove both statements.
5-1032	A	46	35	46	35	Word deleted (Dinesh Chandra Uprety, Indian Agricultural Research Institute)	
5-1033	A	46	47	46	47	Where are these "high-intensity forest plantations in the boreal regions"? There are not too many in Canada (yet) and I would be surprised to hear about them in Russia or Siberia. Maybe Scandinavia, or perhaps northern China? Please be specific. (David Price, Northern Forestry Centre)	Can't accommodate the comment due to section size limitations. The reference is (Weih M. Intensive short rotation forestry in boreal climates: present and future perspectives [Review]. [Review] Canadian Journal of Forest Research-Journal Canadien de la Recherche Forestiere. 34(7):1369-1378, 2004 Jul.)

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5-1034	A	46				<p>section 5.4.4.2: Need to consider the size of the forested landbase over which going to do adaptation. Intervention to assist only likley to take place on the harvested land base. There is a large are we do not manage intensively. For example in BC, Canada 24Mha is considered operable at about 0.2 Mha per year, the remaining 38Mha is subject to some fire protection but we will have to adjust to whatever autonomous adaptations occur "naturally". In areas where we think we can do something there is still the question of what is the right time to act and what future time period do you target in terms of selecting the climate capabilities of the planted trees (see Spittlehouse, D.L., 2005. Integrating climate change adaptation into forest management. The Forestry Chronicle 81:91-695.) Lacking in our knowledge of the climatic limits of many forest species, this includes the major timber species. Intervention is likely to focus on major species and most forest species will have to adjust as best the can even in the managed forest. There are institutional and policy barriers to responding to climate change in forestry. For example, seed planning zones, reforestation standards and hydrologic and wildlife management guidelines are designed for the current climate regime. There are no requirements for adaptation strategies in forest management plans, nor are there guidelines and sufficient experienced personnel to aid such activities. There are many stakeholders whose different needs are supplied by forests and therefore have different vulnerabilities to climate change. (David Spittlehouse, BC Ministry of Forests)</p>	Very good comment—incorporate into planned adaptation section.
5-1035	A	47	2	47	2	<p>Strategies to meet the challanges of global climate changes should be compherensively written in a seperate chapter (Dinesh Chandra Uprety, Indian Agricultural Research Institute)</p>	Agree.
5-1036	A	47	8	47	9	<p>End of this sentence doesn't make sense (Paula Harrison, University of Oxford)</p>	Sentence changed.
5-1037	A	47	9			<p>Something missing in this sentence (Norman Christensen, Duke University)</p>	Sentence changed.
5-1038	A	47	15		23	<p>This insurance discussion seems a bit flimsy. Increase in insurance losses could easily reflect the simple increase in numbers of people and extent of resources at risk? (Norman Christensen, Duke University)</p>	Relocated. Note the wgI discussion on the increasing severity of extreme events. Include reference.
5-1039	A	47	15	47	15	<p>Word deleted (Dinesh Chandra Uprety, Indian Agricultural Research Institute)</p>	
5-1040	A	47	17	47	17	<p>Given the previous sentence, I think it would be good to insert "further" before the word "escalation". Also, delete the (second) occurrence of "is likely".</p>	Sentence changed.

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						(David Price, Northern Forestry Centre)	
5-1041	A	47	21	47	21	Which regions of the world actually insure forests? Most forests are considered to be too low value, relative to risk exposure, to be worth insuring, surely? Most countries/companies accept that losses will occur and take this into account in their management planning and protection expenditures. Given climate change, and the uncertainties of its impacts, insuring forests is even less likely in the future. (David Price, Northern Forestry Centre)	The section is relocated and changed. The actual citation: "There may be a role for government-backed disaster insurance for forest owners. Assigning liability for forest damage from climate change and collecting damages is problematic under a court-based system, because of the large number of causal agents scattered far beyond the jurisdictional boundaries of any court. However, governments might consider a GHG-based tax supporting a fund for adaptation projects or damages to reduce the individual forest owner's climate change-related risks." FAO Forestry Paper 144. Climate change and the forest sector. Possible national and subnational legislation. By: Kenneth L. Rosenbaum, Dieter Schoene and Ali Mekouar Food and Agriculture Organization of the United Nations Rome, 2004
5-1042	A	47	25			Sub-section Industry and market: changed distribution of raw material. Since the overuse of tropical/subtropical hardwoods and fine grain, woods, used in fine, expensive cabinet making and wood carving, it is suggested that a reference on the loss the market will suffer of high quality, fine grain woods, with the already observed increasing costs for fine pieces of furniture and other specific works. (Osvaldo Canziani, IPCC WG2 Co-chair)	I don't know of any reference to modelled climate change impact on timber for cabinet making. Note that fine tropical woods have been substituted for to some extent by temperate hardwood. Also, prices of tropical wood did not increase in the 1970s and 1980s. The FAO price report may provide more info on that.
5-1043	A	47	27	47	34	references (Nicholas Holden, University College Dublin)	Section changed.
5-1044	A	47	29		34	Increasing energy prices could drastically change this picture. Future timber prices could be strongly driven by energy prices! (Marcus Lindner, European Forest Institute)	Section changed.
5-1045	A	47	39			What is meant by '... will first benefit the producers in lower latitudes ...'? Do you mean 'initially'? (Fischer Günther, International Institute for Applied Systems Analysis)	Changed.

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5-1046	A	47	44	48	3	The arguments given in this section are not always consistent. I would argue that a major shift of primary energy sources to biomass (from forestry) is possible but would probably increase prices of wood and wood prices and therefore the product substitution claimed in the beginning of this section is not warranted. (Fischer Günther, International Institute for Applied Systems Analysis)	Section changed.
5-1047	A	47	44	48	1	References - this reads like an author's opinion (Nicholas Holden, University College Dublin)	Section changed.
5-1048	A	47	44	47	44	Is it possible to assign a confidence level to this statement (i.e., that climate change will NOT lead to decreased wood supply)? Based on what I have read here, I would say it rates at least medium if not high confidence. (David Price, Northern Forestry Centre)	Confidence level assigned.
5-1049	A	47	46	47	49	Sentence deleted to make it meaningful (Dinesh Chandra Uprety, Indian Agricultural Research Institute)	?
5-1050	A	47	49			Awkward sentence (Norman Christensen, Duke University)	Deleted.
5-1051	A	48	1	48	1	Sentence corrected (Dinesh Chandra Uprety, Indian Agricultural Research Institute)	
5-1052	A	48	5			Section 5.4.4.3. This structure makes the text repetitive as a lot of this section could easily have been integrated into previous sections more concisely (Paula Harrison, University of Oxford)	Section merged.
5-1053	A	48	5	49	4	not clear why different chapters are needed for enterprise and regional scale! Merge this section into above section! (Marcus Lindner, European Forest Institute)	Section merged.
5-1054	A	48	7	48	13	The discussion here centres on timber production for world trade. Would it be possible to consider writing a few lines biomass energy which still consitutes up to 70% of domestic energy sources in several African countries? (Mohamed El Mahdi Beshir, Independent scholar and consultant)	We didn't specifically consider the biomass energy in this chapter, partially due to the lack of references.
5-1055	A	48	7		18	This is a really awkward paragraph (Norman Christensen, Duke University)	Obsolete.
5-1056	A	48	14			After carbon credits a reference on the coordination among international conventions would be opportune. In fact, the UNFCCC should not work against the UNCBD. So was expressed by the revisited COP-6, when it was mentioned that any application of the Kyoto Protocol Article 12 shall not promote the loss of biological diversity (e.g. using exotic species for afforestation/reforestation in the habitat of different tree species). (Osvaldo Canziani, IPCC WG2 Co-chair)	Misplaced comment?
5-1057	A	48	15	48	17	Corrected and readjusted	

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						(Dinesh Chandra Uprety, Indian Agricultural Research Institute)	
5-1058	A	48	20	48	29	Following the above comment (Page 47, line 25) it would be opportune to mention that, because of the longer time to obtain well developed hardwood, fine grain tree species, the confidence in the increase of timber production involves only certain species, particularly those of rapid rate of growth. (Osvaldo Canziani, IPCC WG2 Co-chair)	See Page 47, line 25.
5-1059	A	48	20	49	4	Highly speculative, Reduce to 1 concise pgh. (Richard Fleming, Great Lakes Forest Research Centre)	Section changed.
5-1060	A	48	20	48	29	The yield increase mentioned do not document a substantially higher increase in production at high compared with low latitude regions. Yet this is one of main conclusions in the chapter. (Jørgen E. Olesen, Danish Institute of Agricultural Sciences)	There is no such conclusion for forestry .
5-1061	A	48	20	48	29	The predicted increases in forest NPP are large in all regions of the world - but in the introduction to the section it states that there are regional differences in forest production, with the inference that some regions will decline - but this seems not to be the case in the data on p. 48. (John R Porter, KVL)	These large-scale projections doesn't show the variability within the regions. Compare discussion of Mendelsohn, 2003.
5-1062	A	48	26		29	This discussion seems to be at odds with the overall projection for wood demand. If that remains flat then are forestry jobs likely to increase...even if there's more forest? (Norman Christensen, Duke University)	This section is changed.
5-1063	A	48	29			English Pounds? Perhaps better to use another currency (Juerg Fuhrer, Federal AgroEcological)	Obsolete.
5-1064	A	48	29	48	30	Deleted to make it meaningful (Dinesh Chandra Uprety, Indian Agricultural Research Institute)	
5-1065	A	48	34			Producers' welfare sensitivity Sensitivity to what? (Fischer Günther, International Institute for Applied Systems Analysis)	Changes made.
5-1066	A	48	34	48	36	Should "welfare sensitivity" be defined? It is not clear to me what this is (Nicholas Holden, University College Dublin)	Changes Made.
5-1067	A	48	36	48	38	sentence deleted (Dinesh Chandra Uprety, Indian Agricultural Research Institute)	
5-1068	A	48	44	48	44	Sentence corrected (Dinesh Chandra Uprety, Indian Agricultural Research Institute)	
5-1069	A	48	50	49	2	Over what period do these projections of losses and gains apply? (David Price, Northern Forestry Centre)	Up to 2100. Changes incorporated.
5-1070	A	49	0			I find the general text on fisheries (p. 49 et seq.) to be quite satisfactory and have no significant comments.	Thank you very much.

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						(John Steele, Woods Hole Oceanographic Institution)	
5-1071	A	49	3	49	3	Where is the "mid-Atlantic region"? Do you mean eastern seaboard of the USA? (David Price, Northern Forestry Centre)	Changed.
5-1072	A	49	6			Section 5.4.4.4 should be supported by references in SOD (Marco Bindi, Dept. of Agronomy and Land Management)	Done.
5-1073	A	49	6			Sub-section 5.4.4.4 Environmental consequences It is not quite true that long-term change in forest composition is likely to be of little or, at most, moderate significance. At the current state of knowledge / identification / classification of a substantially large number of unknown species, the introduction of exotic species and the development of ecotones will mask / cancel out the biological diversity available in any forest, specially that of tropical ones. Very recently a legal case opposing a change in the landscape in a highly tourist environment was won, in the Argentina 's justice system because any change in forest composition, in temperate/cold forest would critically diminish the landscape beauty, which is the selling factor in this industry. As a matter of fact the second following sentence mentions the value of plants used in pharmaceutical and medical areas. In this regard, the efforts undertaken by the GEF/STAP to recover ancient / indigenous medicines and the use of their plants and fruits, as well as some animals, works in opposition to the concept expressed at the beginning of this sub-section. See also Chapter 5 page 56 lines 10 and 11. (Osvaldo Canziani, IPCC WG2 Co-chair)	Obsolete.
5-1074	A	49	6			Finally, the chapter deals mainly with production and economics related to production. Other services are not sufficiently covered, such as protection in alpine areas, carbon storage, biodiversity etc. Sub-chapter 5.4.4.4. is very short with no reference cited. Perhaps these issues are covered in another part of the report. In this case, cross-referencing seems essential. (Juerg Fuhrer, Federal AgroEcological)	The section is deleted as belonging to other chapters.
5-1075	A	49	6	49	15	this paragraph seems to be only concerned with tree vegetation in the forest. There may be some change in wildlife, fungi, small mammals insects and so on, if talking only about the forest tree vegetation change and its impact it should be clearly stated (Sylvie Gauthier, Laurentian Forestry Center, Canadian Forestry Service)	The section is deleted as belonging to other chapters.
5-1076	A	49	8	49	13	References - this is an important section and is treated too lightly (Nicholas Holden, University College Dublin)	The section is deleted as belonging to other chapters.
5-1077	A	49	8		10	there is significant impact on water yield, biodiversity, very few studies have investigated such consideration. but see Lasch, P., M. Lindner, M. Erhard, F.	The section is deleted as belonging to other chapters.

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						Suckow and A. Wenzel 2002. Regional impact assessment on forest structure and functions under climate change - the Brandenburg case study. Forest Ecology and Management. 162:73-86. (Marcus Lindner, European Forest Institute)	
5-1078	A	49	8	49	13	Are there no studies that can be referred to? (Jørgen E. Olesen, Danish Institute of Agricultural Sciences)	The section is deleted as belonging to other chapters.
5-1079	A	49	8	49	13	A consequence of increased production is increased biological acidification with consequences for soil properties, water quality and biodiversity (Mats Olsson, SLU)	The section is deleted as belonging to other chapters.
5-1080	A	49	8	49	13	This paragraph seems a bit strange. The last sentence seems to contradict the first, but perhaps this can be resolved by changing "moreover" to "however". (David Price, Northern Forestry Centre)	The section is deleted as belonging to other chapters.
5-1081	A	49	8	49	9	Disagree with the statement that long term changes likely to be of little or moderate significance to ecological services etc. No one has done an analysis so prudent to be cautious on such statements. (David Spittlehouse, BC Ministry of Forests)	The section is deleted as belonging to other chapters.
5-1082	A	49	9			what is meant with "landscape" as ecosystem service? (Marcus Lindner, European Forest Institute)	The section is deleted as belonging to other chapters.
5-1083	A	49	10			So what about bottomland forests? (Norman Christensen, Duke University)	The section is deleted as belonging to other chapters.
5-1084	A	49	11	49	11	Sentence corrected (Dinesh Chandra Uprety, Indian Agricultural Research Institute)	The section is deleted as belonging to other chapters.
5-1085	A	49	16			Section 5.4.5 is a very well organised, the information is reported in a concise way and supported by references. As I did previously, however, I suggest also in this case to report impact and adaptation in separate sections. (Marco Bindi, Dept. of Agronomy and Land Management)	Thank you very much. Comment has been accepted as fair and incorporated into redraft.
5-1086	A	49	16			Section 5.4.5. I do not feel qualified to comment on the fisheries section. (John R Porter, KVL)	
5-1087	A	49	18	49	28	Move to section 5.2 on current trends? (Paula Harrison, University of Oxford)	Sections have been revised.
5-1088	A	49	26			Table 5.4: does this table include fishing production from sea-farming? If so, where is it computed?, under capture or aquaculture production? (Osvaldo Canziani, IPCC WG2 Co-chair)	Checking with FAO.
5-1089	A	49	26			There are no such tables (i.e. Table 5.4) for crops, livestock or forestry. I think it is also not needed for fisheries. (Fischer Günther, International Institute for Applied Systems Analysis)	Discussed at Merida meeting and disagree.
5-1090	A	49	34			It should be noted that a significant portion of the capture fishery is converted to	Comment has been accepted as fair and

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						food for livestock. (Franklin Schwing, NOAA Fisheries Service)	incorporated into redraft.
5-1091	A	49	38	54	14	The narrative and the material in box 5.4 and 5.5 could be better depicted in graphics. I feel this is important as the graphics will convey the picture better. (Mohamed El Mahdi Beshir, Independent scholar and consultant)	Nice idea, but who would do it?
5-1092	A	49	38	49	42	The listing of the first three items (i, ii, and iii) should be complemented with a comment on the different effects of temperature rises in closed and opened hydrographic systems. In close lakes, with no migration possibilities to colder waters, the vulnerability is larger (Osvaldo Canziani, IPCC WG2 Co-chair)	Insufficient space to devote to a review of the TAR.
5-1093	A	49	38	50	2	Negative impacts include increased thermal stratification will isolate primary producers from nutrient sources in many ecosystems. Positive impacts include stratification may enhance photosynthetic rates in low light, high latitude systems. (Franklin Schwing, NOAA Fisheries Service)	More extensively covered in Chapter 4.
5-1094	A	49				section 5.4.4.4: The quasi-market services (Non-timber forest products) have become a major economic activity and source of income for local communities (see for BC, /www.fpb.gov.bc.ca/news/releases/2004/05-25.htm). May be more so if people are displaced from timber harvesting by affects of climate change. (David Spittlehouse, BC Ministry of Forests)	Comment raises broader issues than is feasible to discuss within the limitations of space provided.
5-1095	A	50	4	50	16	Should these two paragraph reiterate the reference to the effect of oceanic current 's changes, as happens with ENSO changing, though temporarily, but with a remarkable economic lost? An example is the distribution of fish stocks leading to severe fishing crises in Ecuador, Peru and Chile because of the deflection of the Humboldt current and the lack of appropriate fishing fleets). (Osvaldo Canziani, IPCC WG2 Co-chair)	Comment has been accepted as fair and incorporated into redraft.
5-1096	A	50	4	50	4	African, Asian, European data are missing (Dinesh Chandra Uprety, Indian Agricultural Research Institute)	Insufficient space for detail.
5-1097	A	50	9		11	This is the problem of extrapolating a laboratory study to the field. Won't growth in the field likely depend most on food availability? (Norman Christensen, Duke University)	Yes, this is a <i>ceteris paribus</i> argument.
5-1098	A	50	11	50	11	Ref.missing (Dinesh Chandra Uprety, Indian Agricultural Research Institute)	Comment now redundant as section has been revised.
5-1099	A	50	12	50	16	Reference to Allison Perry et al's (2005) recent study, published in 'Science' on north sea fish species' northwards range shift here... (Edward Allison, University of East Anglia)	Possibly, but it doesn't add much new (in spite of appearing in Science).
5-1100	A	50	13	50	14	Is this correct? Cfr chapter 13 of the Arctic Climate Impact Assessment, which seem to indicate that there is not a rapid temperature increase in the Northeast	Refer to material on climate trends and to chapter 15.

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Chapter-Comment	Batch	From Page	From Line	To Page	To line	Comments	Notes of the writing team
						Atlantic. (Alf Håkon Hoel, University of Tromsø)	
5-1101	A	50	21			Meridional? (Norman Christensen, Duke University)	Yes, that's correct.
5-1102	A	50		50		A clear impact of water availability is the case of a prolonged drought in Cuba island that affected considerably the water supply to fish breeding stations with appreciable diminution in the yields, because the water is essential for inland aquaculture. (Cristobal Felix Diaz Morejon, Ministry of Science, Technology and the Environment)	Point made already.
5-1103	A	51	2	51	31	References? (Nicholas Holden, University College Dublin)	Comment now redundant as section has been revised.
5-1104	A	51	7	50	7	Unit of temperature corrected (Dinesh Chandra Uprety, Indian Agricultural Research Institute)	
5-1105	A	51	8	51	9	One can also envision that increased temperatures will bring increased ecosystem productivity, which in turn may positively affect fish growth. Cfr again chapter 13 of the Arctic Climate Impact Assessment. (Alf Håkon Hoel, University of Tromsø)	Refer to chapter 15.
5-1106	A	51	11			should edit to (iii) inland fisheries, anadromous fisheries, and fish (Franklin Schwing, NOAA Fisheries Service)	Comment has been accepted as fair and incorporated into redraft.
5-1107	A	51	13			add- and exacerbated by altered land use adjacent to streams and within watersheds. (Franklin Schwing, NOAA Fisheries Service)	Comment has been accepted as fair and incorporated into redraft.
5-1108	A	51	15			Sub-section 5.4.5.3 Regional scale A reference on the fishing vulnerability to climate variability (i.e. the ENSO in eastern Pacific Ocean) is an important regional factor. It should be mentioned or cross referenced with chapters 4 and 13. (Osvaldo Canziani, IPCC WG2 Co-chair)	Comment has been accepted as fair and incorporated into redraft.
5-1109	A	51	17	54	14	With reference to earlier comments about structure, I wasn't sure here whether this should be confined to projected impacts of vulnerability on fish production and distribution, or on the fishery systems more generally. There is a mixture here. I didn't find, anywhere, mention of livelihood diversification and geographical mobility as existing adaptive strategies of many fisherfolk and fishing enterprises, both large and small-scale. (Edward Allison, University of East Anglia)	Comment has been accepted as fair and incorporated into redraft.
5-1110	A	51	17	51	31	I found this confusing - the first paragraph states that 'possibilities for enterprise-scale adaptation are therefore very limited' and the next paragraph says "affected	Comment has been accepted as fair and incorporated into redraft.

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						fishing enterprises and communities have developed considerable adaptability". Which is it? (Edward Allison, University of East Anglia)	
5-1111	A	51	17	52	28	This section includes very few references compared to others (Norman Christensen, Duke University)	Some references added.
5-1112	A	51	30	50	31	Deleted to make it meaningful (Dinesh Chandra Uprety, Indian Agricultural Research Institute)	Disagree.
5-1113	A	51	34			Table 5.5 could be dropped as it is not really very helpful for the reader in understanding climate change impacts on fisheries as the discussion of impacts in the remainder of this section is rather general. (Fischer Günther, International Institute for Applied Systems Analysis)	Discussed at Merida. It matches a Table in the TAR. May consider deleting if space is tight.
5-1114	A	51	38	51	38	Deleted (Dinesh Chandra Uprety, Indian Agricultural Research Institute)	Disagree.
5-1115	A	51	46	51	46	Unit of temperature is corrected (Dinesh Chandra Uprety, Indian Agricultural Research Institute)	Disagree.
5-1116	A	52	1	52	19	ENSO and NAO should be defined (Nicholas Holden, University College Dublin)	Elsewhere?
5-1117	A	52	4			Beamish et al. (1999) showed a global synchrony between the abundance of several major fish populations with indices of climate. Full reference- Beamish, R.J., D.J. Noakes, G.A. McFarlane, L. Klyashotorin, V.V. Ivanov, and V. Kurashov. 1999. The regime concept and natural trends in the production of Pacific salmon. Ca. J. Fish. Aquat. Sci. 56: 516-526. (Franklin Schwing, NOAA Fisheries Service)	Comment raises broader issues than is feasible to discuss within the limitations of space provided.
5-1118	A	52	9			The full citation to King (2005) is King, J.R. (ed.). 2005. Report of the Study Group on the Fisheries and Ecosystem Responses to Recent Regime Shifts. PICES Scientific Report No. 28, 162 pp. (Franklin Schwing, NOAA Fisheries Service)	Thanks done.
5-1119	A	52	12	52	13	Deleted (Dinesh Chandra Uprety, Indian Agricultural Research Institute)	
5-1120	A	52	18	52	18	Gramatically corrected (Dinesh Chandra Uprety, Indian Agricultural Research Institute)	
5-1121	A	52	31	53	26	This box is too long and could be shortened to essentially make the main point - changes in temperature lead to changes in ocean circulation, which affects productivity and the composition of the plankton, this, in turn, affects the structure and productivity of fish communities, but it is difficult to say whether productivity in the N atlantic will decline overall, or there will simply be declines in currently important fishery species that will be offset by gains in others with different	Moved to chapter 4.

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						feeding and thermal optima... (Edward Allison, University of East Anglia)	
5-1122	A	52				ENSO and NAO need to be spelled out at first use (Norman Christensen, Duke University)	Elsewhere?
5-1123	A	53	10			The formulation 'they have become more sensitive to the effects of the climate indicator (the NAO)' does not seem optimal to me. The sensitivity of fish stocks may exist with regard to climate or specific attributes of climate but it can at best be correlated with a climate indicator. (In my terminology an indicator indicates something but does not cause anything). (Fischer Günther, International Institute for Applied Systems Analysis)	Correct, but you may end up grappling with Hume's problem concerning induction.
5-1124	A	53	10	53	10	Gramatically corrected (Dinesh Chandra Uprety, Indian Agricultural Research Institute)	
5-1125	A	53	36	53	38	Words deleted for correction (Dinesh Chandra Uprety, Indian Agricultural Research Institute)	
5-1126	A	53	36	53	36	Reference missing (Dinesh Chandra Uprety, Indian Agricultural Research Institute)	
5-1127	A	53	37			Awkward sentence (Norman Christensen, Duke University)	Will improve it.
5-1128	A	53	37	53	38	Sentences are corrected (Dinesh Chandra Uprety, Indian Agricultural Research Institute)	
5-1129	A	53	40	53	41	Unit corrected (Dinesh Chandra Uprety, Indian Agricultural Research Institute)	
5-1130	A	53	47	53	47	Species name should be written in Italics another name is missing (Dinesh Chandra Uprety, Indian Agricultural Research Institute)	
5-1131	A	54	12			final sentence in box out of place? (Norman Christensen, Duke University)	Yes, will consider how to rewrite.
5-1132	A	54	17	56	19	The title could include 'fisheries' and there is no reason why fishers (who are, in the vast majority members of smallholder/rural/subsistence production systems) should not be included. (Edward Allison, University of East Anglia)	Comment has been accepted as fair and incorporated into redraft. Accepted: sub-section titles generally refer to "Smallholder and subsistence farmers" but new text at 5.3.3.1 makes it clear that pastoralists, artisanal fisherfolk and households dependent on family-level aquaculture are included.
5-1133	A	54	17			This section on SSAP is very important because it represent a step forward compared with previous impact assessments mainly focussed on market oriented agriculture. In particular the environmental role of these should be addressed as much as possible in the SOD.	Accepted: issue of environmental role will be accepted subject to space constraints.

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						(Marco Bindi, Dept. of Agronomy and Land Management)	
5-1134	A	54	17			5.4.6 This chapter repeats much of the earlier chapters on impacts. This repetition is disturbing. For instance, Table 5.3 lists autonomous adaptations in agriculture, and chapter 5.4.6.3 addresses the same issue again. My suggestion would be to have the information on agriculture in one place, and likewise for forestry and fisheries. (Juerg Fuhrer, Federal AgroEcological)	Shortening and clarification of this chapter, and introduction of conceptual diagram should rectify this – but it is important to state that smallholder and subsistence farmers suffer biophysical impacts of CC on crop yields <i>plus</i> other impacts.
5-1135	A	54	17			Section 5.4.6 - I think the mixed systems that predominate in many parts of the tropics have to be brought more to the fore -- there is not much that has been written on CC impacts and adaptation (as far as I know), but this relates to point 3 above. (Philip Thornton, International Livestock Research Institute (ILRI))	Accepted.
5-1136	A	54	17	54	17	Reference has been corrected as per requirement (Dinesh Chandra Uprety, Indian Agricultural Research Institute)	This comment is unclear.
5-1137	A	54	34			Sub-section 3.4.6.2 Probable impact of climate change and increased climate variability. Chapters 7 and 13 include even case studies on this issue. Therefore cross referencing with the appropriate sector and regional chapters is opportune. (Osvaldo Canziani, IPCC WG2 Co-chair)	Chapters 7 and 13 will be studied with a view to informing the analysis and cross-referencing.
5-1138	A	54	46	54	46	References have been corrected (Dinesh Chandra Uprety, Indian Agricultural Research Institute)	I have not had access to a readable version of these comments.
5-1139	A	55	2			As already mentioned Table 5.1 has to be included (see comments on page 26, line 7) (Osvaldo Canziani, IPCC WG2 Co-chair)	An appropriate table will be included.
5-1140	A	55	2			The cited findings of Jones and Thornton, namely that aggregate estimates can hide substantial heterogeneity of impacts, were also pointed out in Fischer et al., 2002b. (Fischer Günther, International Institute for Applied Systems Analysis)	Accepted, the reference will be cited.
5-1141	A	55	2	55	2	Where is this table? How important is it? (Nicholas Holden, University College Dublin)	An appropriate table will be included.
5-1142	A	55	9			Define SSAP earlier in this section (Paula Harrison, University of Oxford)	Acronym (formerly smallholder and subsistence agriculture and pastoralism) not now used.
5-1143	A	55	9	55	9	SSAP? (Nicholas Holden, University College Dublin)	Acronym (formerly smallholder and subsistence agriculture and pastoralism) not now used
5-1144	A	55	18	55	20	This section should be expanded. (Emma Archer, University of the Witwatersrand)	Expansion will be considered if space allows and if issues are not treated elsewhere in the chapter.

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5-1145	A	55	20			The HIV / AIDS is treated in Chapter 8, a cross reference is necessary. (Osvaldo Canziani, IPCC WG2 Co-chair)	Cross reference will be made, and an additional reference has now been cited.
5-1146	A	55	24		25	Awkward sentence (Norman Christensen, Duke University)	No longer relevant: these sections now heavily shortened and incorporated into new section 5.5.
5-1147	A	55	35	55	50	Reference here again to earlier point about the relationship between adaptive capacity for farmers and soil quality, especially soil nutrient supply capacity, which buffers against the negative impact of climate variability and drought on crop yields and yield stability. (Kenneth Cassman, University of Nebraska)	No longer relevant: these sections now heavily shortened and incorporated into new section 5.5.
5-1148	A	55	35			5.4.6.4. The report should not only emphasize the negative side of climate change, but also the positive ones. In 2003, hot/dry weather caused crop losses in some parts of Europe, while others experienced excellent yields. (Juerg Fuhrer, Federal AgroEcological)	No longer relevant: these sections now heavily shortened and incorporated into new section 5.5.
5-1149	A	56	1			What do you mean when you say "recognition"? (Cynthia Rosenzweig, NASA/Goddard Institute For Space Studies at Columbia University)	No longer relevant: these sections now heavily shortened and incorporated into new section 5.5.
5-1150	A	56	6			year missing from reference (Paula Harrison, University of Oxford)	No longer relevant: these sections now heavily shortened and incorporated into new section 5.5.
5-1151	A	56	10		16	Other factors which contribute to endangering biodiversity in regions characterized by subsistence and smallholder agriculture include drought, displacement and conflict. These factors lead to gradual erosion of valuable genetic material (mostly food grains and legumes) as planting seed dwindles from to year. In Sudan such a phenomenon had resulted from drought and conflict conditions which had forced people out of their homes. Sudan biodiversity country study of 2000 had alluded to this contingency in the jubraka or home garden which is an important source of food for the household before harvest takes place. Here a wide variety of crops is grown in many parts of rural Sudan. Displacement due to drought and conflict had in Sudan experience had impacted biodiversity as seen from above. (Mohamed El Mahdi Beshir, Independent scholar and consultant)	No longer relevant: these sections now heavily shortened and incorporated into new section 5.5.
5-1152	A	56	17	56	20	Not in proper place needs to be rechecked (Dinesh Chandra Uprety, Indian Agricultural Research Institute)	Disagree.
5-1153	A	56	19	57	32	Fisheries needed in this section, as the editors already point out - the earlier-mentioned 'Fish to 2020' study might fit here... (Edward Allison, University of East Anglia)	Comment has been accepted as fair and incorporated into redraft. Comment raises broader issues than is feasible

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							to discuss within the limitations of space provided.
5-1154	A	56	19			Chapter 5.5 This chapter only deals mainly with agriculture. Are there no socio-economic aspects related to forestry and climate change? The part on forests (pg 57) does not really address the topic of this chapter, and it fails to address the issue of costs. (Juerg Fuhrer, Federal AgroEcological)	Comment raises broader issues than is feasible to discuss within the limitations of space provided.
5-1155	A	56	19			Section 5.5 - again, I am not sure a great deal has been written on this, but a cost of CC will be marginal impacts on social networks and cultural structures (e.g. adaptation/coping mechanisms in areas that are intensifying, becoming better linked with markets, with huge strains being put on traditions -- Maasai lands south and west of Nairobi, as one example). (Philip Thornton, International Livestock Research Institute (ILRI))	Noted, but unclear how to deal with
5-1156	A	56	21			Cross reference to the regional chapters is necessary. (Osvaldo Canziani, IPCC WG2 Co-chair)	Comment has been accepted as fair and incorporated into redraft.
5-1157	A	56	21			5.5.1 When making projections about global economic costs of climate change, it should be made clear on what underlying assumptions about socio-economic and technological developments these projections are based on. This is missing here completely. (Juerg Fuhrer, Federal AgroEcological)	It is not feasible to discuss within the limitations of space provided.
5-1158	A	56	21			Good survey, but this section needs to be tightened. (Cynthia Rosenzweig, NASA/Goddard Institute For Space Studies at Columbia University)	Comment has been accepted as fair and incorporated into redraft.
5-1159	A	56	23	57	29	This section is rather repetitive with previous sections; and should be edited accordingly. In addition, more cross referencing should take place. (Emma Archer, University of the Witwatersrand)	Comment has been accepted as fair and incorporated into redraft.
5-1160	A	56	23	57	32	This section seems very redundant and choppy--I presume that it will be smoothed out when all the pieces are in (Norman Christensen, Duke University)	Disagree.
5-1161	A	56	25	56	25	Mention the year and the reference in the bracket (Dinesh Chandra Uprety, Indian Agricultural Research Institute)	Comment now redundant as section has been revised.
5-1162	A	56	27	56	27	, is included (Dinesh Chandra Uprety, Indian Agricultural Research Institute)	Comment now redundant as section has been revised.
5-1163	A	56	28	56	39	Replace lines 28 through 30 with lines 36 to 39 as modified as follows: "Food security is influenced by political, economic, and social conditions, in addition to productivity of the food and agricultural sector which depends on technology and climatic factors (Goklany 1998, 1999a; Leichenko and O'Brien, 2002). Economic	Disagree.

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						development and trade, in particular, are key determinants of food security, as they enable food-deficit countries to purchase food from countries with surpluses (Goklany 1995, Fischer et al., 2002)." With these changes, Section 5.5.4.1 can be dropped. (Indur Goklany, Office of Policy Analysis, Department of the Interior)	
5-1164	A	56	30	56	30	Sentence has been corrected (Dinesh Chandra Uprety, Indian Agricultural Research Institute)	Noted, but unclear how to deal with.
5-1165	A	56	32	56	32	Sentence has been corrected (Dinesh Chandra Uprety, Indian Agricultural Research Institute)	Noted, but unclear how to deal with.
5-1166	A	56	33	56	33	Sentence has been deleted (Dinesh Chandra Uprety, Indian Agricultural Research Institute)	Noted, but unclear how to deal with.
5-1167	A	56	36	56	46	Not well linked to previous text on global economic costs - just seems to repeat text from Section 5.4. (Paula Harrison, University of Oxford)	Comment has been accepted as fair and incorporated into redraft.
5-1168	A	56	36	56	39	This part also mentioned on page 22 L 41-47. (Xie Liyong, Insitute of Agro-Environment and Sustainable Development)	Noted, but unclear how to deal with.
5-1169	A	56	39	56	39	In the meantime the proceedings of the Royal Society have been published, so in the SOD you could include the references (http://www.pubs.royalsoc.ac.uk/phil_trans_bio_food_crops.shtml) (Marco Bindi, Dept. of Agronomy and Land Management)	Valid comment, still to be incorporated.
5-1170	A	56	39			Which report of the Royal Society? The list of references does not include any information. (Osvaldo Canziani, IPCC WG2 Co-chair)	Valid comment, still to be incorporated
5-1171	A	56	39	56	40	Another critical issue relates to CO2 effects. Many of the projections of yield changes are derived from simulations with crop models. Typically, in these models CO2 effects are represented in a very simplistic way. As outlined earlier in the report, CO2 fertilization may be strongly overestimated. This is mentioned on pg 56/line 39-40, but the reader is left without a clear message. As a consumer of this report, I expect from IPCC to express a clear view on this issue. The report should more carefully formulated, and confidence levels should be attached to all projections, together with some interpretation. I would also suggest to clarify what the cause is of the uncertainty represented by the ranges of yield changes. (Juerg Fuhrer, Federal AgroEcological)	This is dealt with explicitly in 5.4.1 of the SOD.
5-1172	A	56	39	56	41	This statement must depend on species and communities (Jørgen E. Olesen, Danish Institute of Agricultural Sciences)	Noted, but unclear how to deal with.
5-1173	A	56	42	56	42	Sentence is readjusted and unwanted words deleted	Noted, but unclear how to deal with.

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						(Dinesh Chandra Uprety, Indian Agricultural Research Institute)	
5-1174	A	56	44	56	44	Word deleted (Dinesh Chandra Uprety, Indian Agricultural Research Institute)	Noted, but unclear how to deal with.
5-1175	A	56	50	56	50	Sentence is readjusted and unwanted words deleted (Dinesh Chandra Uprety, Indian Agricultural Research Institute)	Noted, but unclear how to deal with.
5-1176	A	57	1	57	1	Sentence is readjusted and unwanted words deleted (Dinesh Chandra Uprety, Indian Agricultural Research Institute)	Noted, but unclear how to deal with.
5-1177	A	57	7	57	9	GOOD POINT! But could be more specific. In N.A. the key factor is forest disturbance: fire, & esp. insects (insect outbreaks occur over a much, much greater spatial extent than fires [partly because fires are easier to control], so even though fire impacts are greater locally where they occur, on a regional basis, insects have a greater impact. These disturbances may be key factors in a +ve feedback loop whereby warmer climate causes more disturbance which releases more C from forests which increases atm CO2 which causes further climate warming (REFS = insects: Fleming 2000 ~ see above, fire: Apps, Stocks, Flannigan). (Richard Fleming, Great Lakes Forest Research Centre)	Valid comment, still to be incorporated.
5-1178	A	57	17	56	19	Need to rephrase/clarify this sentence (Jo Hossell, ADAS)	Noted, but unclear how to deal with.
5-1179	A	57	29	57	29	, is included (Dinesh Chandra Uprety, Indian Agricultural Research Institute)	Noted, but unclear how to deal with.
5-1180	A	57	35			5.5.2 Very short and vague indeed. (Juerg Fuhrer, Federal AgroEcological)	Noted, but unclear how to deal with.
5-1181	A	57	35			Section 5.5.2 - can't this be integrated with section 5.5.1? (Paula Harrison, University of Oxford)	Noted, but unclear how to deal with.
5-1182	A	57	39	57	41	Deleted (Dinesh Chandra Uprety, Indian Agricultural Research Institute)	Noted, but unclear how to deal with.
5-1183	A	57	46			Helpful information for section 5.5.3 could be collected from the following papers: M. V. K. Sivakumar, H. P. Das, O. Brunini, 2005. Impacts of Present and Future Climate Variability and Change on Agriculture and Forestry in the Arid and Semi-Arid Tropics. Climatic change, 70: 31-72 Yanxia Zhao, Chunyi Wang, Shili Wang, Lourdes V. Tibig, 2005. Impacts of Present and Future Climate Variability On Agriculture and Forestry in the Humid and Sub-Humid Tropics. Climatic Change, 70: 73-116 (Marco Bindi, Dept. of Agronomy and Land Management)	Comment raises broader issues than is feasible to discuss within the limitations of space provided.
5-1184	A	57	46			5.5.3 This regional assessment is very valuable, but I wonder if the information could not be better balanced with the projections of climate change in different	Noted, but unclear how to deal with.

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Chapter-Comment	Batch	From Page	From Line	To Page	To line	Comments	Notes of the writing team
						FAO regions in 5.3.1. (Juerg Fuhrer, Federal AgroEcological)	
5-1185	A	57	46			Section heading - should this be impacts rather than costs? (Jo Hossell, ADAS)	Noted, but unclear how to deal with.
5-1186	A	57	48	57	48	Reference is correctly placed (Dinesh Chandra Uprety, Indian Agricultural Research Institute)	Comment now redundant as section as been revised.
5-1187	A	57	49			"major gains in potential agricultural land..." Does this mean yield of, productive capacity of, area of? (Jo Hossell, ADAS)	Valid comment, still to be incorporated.
5-1188	A	57	50	57	40	9% does not seem substantial compared to the 20-70% cited before. Is the 9% value correct? If so, perhaps this needs rewording? (Nicholas Holden, University College Dublin)	Valid comment, still to be incorporated.
5-1189	A	58	0			Why only these 3 regions and not others - not justified? Also text on Asia and Latin America does not seem to describe costs and other socio-economic impacts, but is mainly physical impacts? (Paula Harrison, University of Oxford)	Comment raises broader issues than is feasible to discuss within the limitations of space provided.
5-1190	A	58	2	58	5	Reconstructed correctly (Dinesh Chandra Uprety, Indian Agricultural Research Institute)	Comment now redundant as section as been revised.
5-1191	A	58	5	58	20	Is most of this section based on Parry et al 2004 or were other sources used as well? (Nicholas Holden, University College Dublin)	Noted, but unclear how to deal with.
5-1192	A	58	9			why should higher CO2 levels lead to a deterioration of rangelands in Africa? Is this backed up by information in the previous chapters? (Juerg Fuhrer, Federal AgroEcological)	YES.
5-1193	A	58	11	58	11	Superfluous word is deleted (Dinesh Chandra Uprety, Indian Agricultural Research Institute)	Comment now redundant as section as been revised.
5-1194	A	58	13		20	This paragraph needs reorganization. (Norman Christensen, Duke University)	Comment has been accepted as fair and incorporated into redraft.
5-1195	A	58	13	58	14	This statement needs to be backed up by references. I would suspect that the food security situation in Africa strongly interacts with the prevailing economic and political situations. (Jørgen E. Olesen, Danish Institute of Agricultural Sciences)	Noted, but unclear how to deal with
5-1196	A	58	15	58	22	Not clear, needs to be rewritten (Dinesh Chandra Uprety, Indian Agricultural Research Institute)	Comment now redundant as section as been revised.
5-1197	A	58	23	59	17	These sections do not seem to address the socioeconomic impacts, they simply recount yield changes (the data should perhaps be earlier in the chapter). To be relevant here the knock-on effects should be detailed	Comment raises broader issues than is feasible to discuss within the limitations of space provided.

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						(Nicholas Holden, University College Dublin)	
5-1198	A	58	30	58	33	These results are not supported by a reference. Add the reference in the SOD (Marco Bindi, Dept. of Agronomy and Land Management)	Comment has been accepted as fair and incorporated into redraft.
5-1199	A	58	30			Does the Hadley Center climate model say anything about the effects of C2 on crop yields? I doubt. (Fischer Günther, International Institute for Applied Systems Analysis)	Valid comment, still to be incorporated.
5-1200	A	58	30	58	33	This an example of a situation where a much more specific description on which SRES scenarios and which time slices the results refer to (Jørgen E. Olesen, Danish Institute of Agricultural Sciences)	Comment raises broader issues than is feasible to discuss within the limitations of space provided.
5-1201	A	58	30	58	32	This is incorrect, or at least it is confused. The HadCM2 model does not make any projections of the "direct physiological effects of CO2 on crop yields". I know what you mean but it needs to be clarified. (David Price, Northern Forestry Centre)	Valid comment, still to be incorporated.
5-1202	A	58	31	58	33	Here again, too much emphasis on separate CO2 effect rather than on the CO2 x Temp interaction. (Kenneth Cassman, University of Nebraska)	Valid comment, still to be incorporated
5-1203	A	58	31	58	33	This is such an important statement that it seems necessary to explain why these opposite reposnes are predicted. Surely the source reference (not cited apparently) discussed this matter? (Nicholas Holden, University College Dublin)	Valid comment, still to be incorporated.
5-1204	A	58	31	58	33	Are there any evidences to explain that result in so big difference between East and Southeast Asia and Central and South Asia? Because of water, Temperature, or disease and pest? (Xie Liyong, Insititute of Agro-Environment and Sustainable Development)	Valid comment, still to be incorporated.
5-1205	A	58	32			why would elevated CO2 have a positive effect in E and SE Asia, and a negative effect on yield in Central and S Asia? (Juerg Fuhrer, Federal AgroEcological)	Valid comment, still to be incorporated.
5-1206	A	58	37	58	40	As comment above - what is the unit of measure? (Jo Hossell, ADAS)	Noted, but unclear how to deal with.
5-1207	A	58	39	58	45	Where will the water come from to allow increased yields in Central Asia and the North China plains, which crop yields are currently highly water-limited? Again, this seems to be a slight of hand, and biased towards the optimistic. (Kenneth Cassman, University of Nebraska)	Comment considered valid but on balance it is felt due consideration has been given to the point.
5-1208	A	58	39	58	39	"in all land as well as in current cultivated land" is confusing. Actually this entire paragraph needs careful editing. (David Price, Northern Forestry Centre)	Comment has been accepted as fair and incorporated into redraft.
5-1209	A	58	41	58	41	Delete "pushes"?	Noted, but unclear how to deal with.

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Chapter-Comment	Batch	From Page	From Line	To Page	To line	Comments	Notes of the writing team
						(David Price, Northern Forestry Centre)	
5-1210	A	58	41	58	41	Ref. Is modified (Dinesh Chandra Uprety, Indian Agricultural Research Institute)	Comment now redundant as section has been revised.
5-1211	A	58	42	58	45	Will all readers understand triple, double and single planting? (Nicholas Holden, University College Dublin)	Comment raises broader issues than is feasible to discuss within the limitations of space provided.
5-1212	A	58	42	58	42	Spelling of "Yangtze" (David Price, Northern Forestry Centre)	Comment has been accepted as fair and incorporated into draft.
5-1213	A	58	42	58	42	Sentence is corrected (Dinesh Chandra Uprety, Indian Agricultural Research Institute)	Comment now redundant as section has been revised.
5-1214	A	58	45			what are the implications of these shifts? On a regional or national level, does it matter where food is produced? (Juerg Fuhrer, Federal AgroEcological)	Comment raises broader issues than is feasible to discuss within the limitations of space provided.
5-1215	A	58	48	58	50	Rewritten (Dinesh Chandra Uprety, Indian Agricultural Research Institute)	Comment now redundant as section as been revised.
5-1216	A	58	50			Any projection of regional changes depends on the GCM used. This is a statement which should be up front! (Juerg Fuhrer, Federal AgroEcological)	Comment raises broader issues than is feasible to discuss within the limitations of space provided.
5-1217	A	59	1	59	1	Correction made (Dinesh Chandra Uprety, Indian Agricultural Research Institute)	Comment now redundant as section as been revised.
5-1218	A	59	5	59	5	Sentence reconstructed (Dinesh Chandra Uprety, Indian Agricultural Research Institute)	Comment now redundant as section as been revised.
5-1219	A	59	6	59	12	Here again, a very optimistic and largely subjective statement about how it is LIKELY that the projected 10% decrease in maize production in Latin America due to climate change can be overcome by plant breeding and technological interventions--given the history of yield increases since 1950. Note the last point in particular, which is not consistent with recent trends of slowing in crop yield growth--including maize--and lack of an increase in maize yield potential since the 1970s (citations given in earlier comment above). Note also the earlier point that expansion of maize production area in Latin America will occur on ever more marginal soils, including highly weathered oxisols as is occurring in the Amazon Basin where soybean area has increased by 12 M ha within the past 10 years, and now is rotated with corn, sorghum and cotton with high input levels and relatively low yields for these rotation crops. Finally, there has been substantial investment in research to increase maize yields in subsaharan Africa during the past 15 years made by IITA, CIMMYT, the Rockefeller Foundation (among others) and yet there has been little increase in maize yields during this period (see FAO yield	Valid comment, statements concerning adaptation will derive of the adaptation section. We will strive to report both sides of the argument for likelihood that adaptation will succeed in developing countries.

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						data for SSA for maize). So, why the optimism about technological and genetic solutions in LA or SSA? (Kenneth Cassman, University of Nebraska)	
5-1220	A	59	10	59	10	Gramatically corrected (Dinesh Chandra Uprety, Indian Agricultural Research Institute)	Comment now redundant as section as been revised.
5-1221	A	59	16	59	17	Gramatically corrected (Dinesh Chandra Uprety, Indian Agricultural Research Institute)	Comment now redundant as section as been revised.
5-1222	A	59	17			something wrong here? (Norman Christensen, Duke University)	Comment now redundant as section as been revised.
5-1223	A	59	17	59	17	What does "respectively" refer to here? This sentence is very confused. (David Price, Northern Forestry Centre)	Comment now redundant as section as been revised.
5-1224	A	59	20	59	39	This section should be expanded, with cross references to other sections in the chapter that have relevance to food security. In addition, the recognition elsewhere in the chapter that food security comprises both supply and access aspects should be reflected every time food security is mentioned. This was also raised in the ZOD. (Emma Archer, University of the Witwatersrand)	Comment now redundant as section as been revised.
5-1225	A	59	20	59	39	It is hard to understand why a sub-sub-section 5.5.4.1 has been included when there is not much difference in the text, with the probable exception of the reference to Leichenko and O'Brien, 2002. (Osvaldo Canziani, IPCC WG2 Co-chair)	Comment has been accepted as fair and incorporated into redraft.
5-1226	A	59	20			5.5.4. This is a very important aspect, which would deserve a bit more attention. It puts climate change effects in context with other pressures. It should help the reader to see whether the projected changes (previous chapters) are important against other threats and socio-economic problems. (Juerg Fuhrer, Federal AgroEcological)	Comment has been accepted as fair and incorporated into redraft.
5-1227	A	59	22	59	39	Another highly optimistic summary about future food supply and food security that is not consistent with the evidence of (1) rate of growth in yields of the major food crops that is below the rate of growth in demand, (2) decreasing area of cultivated land devoted to production of the cereal crops, (3) replacement of land lost to urbanization/industrialization by ever more marginal land, and (4) current statements in Chapter 5 about the increasing net stressfulness on global crop production due to climate change. Why is there such pressue to be so optimistic and to not cite other views on this topic published in highly respected journals? (Kenneth Cassman, University of Nebraska)	We don't understand this comment. Most of the discussion in lines 22-39 concerns reasons for concern about food security, especially at regional scales.
5-1228	A	59	22	59	39	It is very good to have a section on food security. However, future concerns will also deal with food quality and food safety. I suggest that these issues are also	Comment raises broader issues than is feasible to discuss within the limitations of space

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						considered in the chapter. (Jørgen E. Olesen, Danish Institute of Agricultural Sciences)	provided.
5-1229	A	59	22			Is this section a repeat? (Cynthia Rosenzweig, NASA/Goddard Institute For Space Studies at Columbia University)	Noted, but unclear how to deal with.
5-1230	A	59	22	59	26	Really a key point, and one that I don't think is given adequate prominence in the chapter. Globally, the issues are probably readily dealt with, but the huge problems are in the details of local variation. (Philip Thornton, International Livestock Research Institute (ILRI))	Comment has been accepted as fair and incorporated into redraft.
5-1231	A	59	24	59	24	Unit is corrected (Dinesh Chandra Uprety, Indian Agricultural Research Institute)	Comment now redundant as section has been revised.
5-1232	A	59	25	59	25	What is a "serious food insecurity situation"? I think this can be worded a lot better. (David Price, Northern Forestry Centre)	Comment has been accepted as fair and incorporated into redraft.
5-1233	A	59	28	59	30	For a certain country, food safe and security is depending on its economic purchase. But for global prospective, the market supply is the most important key factor. The global crops production is affected by climate change. (Xie Liyong, Insitute of Agro-Environment and Sustainable Development)	Comment has been accepted as fair and incorporated into redraft.
5-1234	A	59	30	59	30	Single factor like temperature changes (uncertain) were solely considered for making models resulting their nonvalidation (Dinesh Chandra Uprety, Indian Agricultural Research Institute)	Noted, but unclear how to deal with.
5-1235	A	59	32	59	33	This isolated strong statement needs explanation! (Juerg Fuhrer, Federal AgroEcological)	Noted, but unclear how to deal with
5-1236	A	59	32			Fischer et al. 2005 state that crop price changes simulated with a general equilibrium food system model in response to climate change are generally modest. For the range of scenarios, in the case of HadCM3 climate projections, cereal prices increase 2-20% (scenario B1 to A1FI); for CSIRO the increase is 4-10% (scenario B1 to A2) in comparison to simulations without climate change. It is worth noting that these results refer to the end of the simulation period in 2080. For earlier decades, before 2050, simulated prices under climate change are often lower than in simulations without climate change since the benefits of increased CO2 levels materialize faster than the negative impacts of temperature and precipitation changes. [Fischer, G., M. Shah, F. Tubiello and H. van Velthuizen, 2005. Socio-economic and climate change impacts on agriculture: an integrated assessment, 1990-2080. Phil. Trans. R. Soc. B doi:10.1098/rstb.2005.1744.] (Fischer Günther, International Institute for Applied Systems Analysis)	Comment has been accepted as fair and incorporated into redraft.
5-1237	A	59	34	59	34	South Asian studies were included	Noted, but unclear how to deal with.

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						(Dinesh Chandra Uprety, Indian Agricultural Research Institute)	
5-1238	A	59	35			I suggest to combine 5.5.4.1 with the rest of the text under 5.5.4, thus avoiding duplication of the information. (Juerg Fuhrer, Federal AgroEcological)	Comment has been accepted as fair and incorporated into redraft.
5-1239	A	59	35			Section 5.5.4.1. Why is this a separate section and not integrated with 5.5.4? (Paula Harrison, University of Oxford)	Comment has been accepted as fair and incorporated into redraft.
5-1240	A	59	35	59	39	This does not need to be a separate section. The whole of 5.5.4 is weak given how important the subject is. Is it true that there have only been 3 significant publications on this topic since TAR? (Nicholas Holden, University College Dublin)	Comment has been accepted as fair and incorporated into redraft.
5-1241	A	59	35			Section 5.5.4.1 repeats what is said in paras above Ln28-30 (Jo Hossell, ADAS)	Comment has been accepted as fair and incorporated into redraft.
5-1242	A	59	35			Why such subheading for one short paragraph not responding to its subject? (Jüri Kadaja, Estonian Research Institute of Agriculture)	Comment has been accepted as fair and incorporated into redraft.
5-1243	A	59	42	62	15	There is nothing on planned adaptation in fisheries/aquaculture. What forms might that adaptation take? Somewhere else in the report (or another!) there was a mention of a need for more flexible international fishing agreements - that is certainly one form of 'planned adaptation'. What else can be planned in the fisheries and aquaculture sectors? (Edward Allison, University of East Anglia)	Comment has been accepted as fair and incorporated into redraft. Discussed in SOD.
5-1244	A	59	42			Comments on section 5.6. This section as mentioned in the comments on section 5.4 should include all the type of adaptation options: political, social, economic, agronomic, cultural. Different subsections could be organised for reporting these adaptation options (Marco Bindi, Dept. of Agronomy and Land Management)	Section reorganised in SOD.
5-1245	A	59	42			Chapter 5.6 The title of this chapter is misleading. The text lists different options for planned adaptations. (Juerg Fuhrer, Federal AgroEcological)	Taken care of.
5-1246	A	59	42	59	42	Reference was corrected (Dinesh Chandra Uprety, Indian Agricultural Research Institute)	OK.
5-1247	A	59	49	59	49	Maybe that is placed a mistake when is written see Box 5.3, because in reality it is referred to Box 5.6 where is written about Biotechnology (Cristobal Felix Diaz Morejon, Ministry of Science, Technology and the Environment)	Corrected.
5-1248	A	59	49	59	50	Unwanted words deleted (Dinesh Chandra Uprety, Indian Agricultural Research Institute)	OK.
5-1249	A	60	1			Refernce for first para; Goklany (2005b).	OK.

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						(Indur Goklany, Office of Policy Analysis, Department of the Interior)	
5-1250	A	60	1	60	3	were readjusted to make them meaningful (Dinesh Chandra Uprety, Indian Agricultural Research Institute)	OK.
5-1251	A	60	4			typo fisheries (Fischer Günther, International Institute for Applied Systems Analysis)	Done. OK.
5-1252	A	60	4	60	4	"fishers" should be "fisheries" (David Price, Northern Forestry Centre)	Done. OK.
5-1253	A	60	13	60	26	This paragraph misses a very important question. How could any adaptation strategy, at local, national and even regional scales, be developed to face climate change implications, when there is not enough basic data? It is evident that, in many developing countries, official and private organizations are still failing to know their country climate conditions. The UNFCCC, following the goal in the Convention Article 5, has undertaken actions to improve climate observations, monitoring and the collection of related socio-economic data. This is a question to be presented to decision making, recommending official and private organizations to develop the information necessary to undertake the simplest warning responsibilities necessary to safeguard their national communities from extreme events. Section 5.8.2 Research Gaps and Priorities, shall re-emphasize this point. When the climatic conditions are known, the territorial ordering will be a fact and adaptation actions would have the necessary support. (Osvaldo Canziani, IPCC WG2 Co-chair)	Discussed in missing gaps.
5-1254	A	60	21			Uncertainty and the perceived long time horizon are part of the explanation. But there also large differences in national economic interests and consequences, exposure to (negative) climate change impacts, and coping capacity, which make finding a consensus so slow and painful. (Fischer Günther, International Institute for Applied Systems Analysis)	OK.
5-1255	A	60	28	60	34	Given that this paragraph begins "Many researchers..." it seems wrong to only cite one reference (Nicholas Holden, University College Dublin)	OK.
5-1256	A	60	30	60	30	Deleted for making it meaningful (Dinesh Chandra Uprety, Indian Agricultural Research Institute)	OK.
5-1257	A	60	37	60	40	Repetition of earlier lines Needs to be rewritten (Dinesh Chandra Uprety, Indian Agricultural Research Institute)	Done.
5-1258	A	60	41	60	41	If I understand this sentence as it is intended to be understood, then you need to insert "by" before "purposeful" (David Price, Northern Forestry Centre)	Done.

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5-1259	A	60	48			Drop 'in the United States and other countries'; I do not think there is sufficient objective reason to single out US vis-a-vis other countries. (Fischer Günther, International Institute for Applied Systems Analysis)	Yes.
5-1260	A	60	49	60	50	Corrected and readjusted (Dinesh Chandra Uprety, Indian Agricultural Research Institute)	OK.
5-1261	A	61	1	61	24	Deleted and corrected (Dinesh Chandra Uprety, Indian Agricultural Research Institute)	OK.
5-1262	A	61	2	61	4	It would be opportune to say that past experiences have shown remarkable failures, as have been shown over the 50 years time span, and, very particularly, under the exacerbated weather and climate conditions of the last decades. (Osvaldo Canziani, IPCC WG2 Co-chair)	Discussed in SOD 5.2
5-1263	A	61	11			Reference Goklany (2001a, 2005b). (Indur Goklany, Office of Policy Analysis, Department of the Interior)	OK.
5-1264	A	61	13			Box 5.6 This is a highly controversial issue, and the text does not sufficiently address the various aspects. I refer to publications such as by McGlughlin, AgBioForum 2(3/4), 163-174 (1999) and Altieri and Rosset (AgBioForum 2 (3/4), 155-162) etc. The authors should give more specific examples supporting the value of biotechnology in the climate change context. I also find the statement one-sided that biotechnology will be a crucial adjunct to conventional breeding. Clearly, there are opposing views on this. (Juerg Fuhrer, Federal AgroEcological)	Box dropped.
5-1265	A	61	13			Comments on Box 5.6. This box takes a limited view of the role of biotechnology could play in addressing issues caused by or related to climate change. In addition to helping relieve stress from low moisture and high temperature conditions (as already noted in the box), biotechnology can be useful in a variety of other ways. First, to the extent that CC causes yields to decrease, there will be increased pressure to cultivate marginal areas (e.g., areas with highly saline or acidic soils, poor drainage, etc.). This means adapting to such eventualities. [The following is taken from Goklany (2001), which provides the references] In this regard, biotechnology can help in the development of cereals which are tolerant of poor climatic and soil conditions; specifically, cereals which are tolerant to aluminum (so that they can grow in acidic soils), drought, high salinity levels, submergence, chilling and freezing (De la Fuente et al. 1997, Apse et al. 1999, Kasuga et al. 1999, Swaminathan 1999, Conway and Toennissien 1999, Moffat 1999a, Zhang 1999). The ability to grow crops in such conditions could be critical for developing countries: 43% of tropical soils are acidic (World Bank 1994); more cropland is lost to high salinity than is gained through forest clearance; and	Comment has been accepted as fair and incorporated into redraft.

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						<p>salinity has rendered one-third of the world's irrigated land unsuitable for growing crops (Frommer et al. 1999). Moreover, if the world warms, the ability to tolerate droughts, high salinity, submergence and acidity could be especially important for achieving global food security. In Kasuga et al.'s (1999) experiments, 96.2% of GM plants survived freezing, compared to 9.5% for the wild-type plant. Corresponding numbers for drought were 76.7% vs. 1.8% and, for salinity stress, 78.6% vs. 17.9%. Second, if CC makes insects, nematodes, bacteria, viruses, and fungi more prevalent, biotechnology can help develop plant defenses to such problems. For instance, papaya, which, for instance, had been ravaged in Hawaii by the papaya ringspot virus, has now made a comeback due to a bioengineered variety resistant to that virus (Conway and Toennissien 1999, Ferber 1999). Moreover, it should be noted that the experience with Bt crops (especially cotton) has been on the whole quite positive. It has increased yields, even as pesticide usage has dropped (Goklany 2001). Biotechnology can also help develop: [1] Rice with the property of being able to close stomata more readily (Mann 1999a). This ought to increase water use efficiency and net photosynthetic efficiency. Both aspects will be useful under dry conditions – conditions which, moreover, may get more prevalent in some areas under global warming. [2] Rice with the alternative C4 pathway for photosynthesis. This trait could be especially useful if there is significant warming because the C4 pathway is more efficient at higher temperatures (Ku et al. 1999, Edwards 1999, Conway and Toennissien 1999). In addition, efforts are underway to try to reengineer RuBisCO – an enzyme critical to all photosynthesis – by using RuBisCO from red algae, which is a far more efficient catalyst for photosynthesis than that found in crops (Mann 1999b). If higher temperatures render fruits, for instance, more susceptible to spoilage, they can be bioengineered for delayed ripening, thereby increasing their shelf life and reducing post-harvest losses. These include bananas and plantains, important sources of food for many African nations (Conway and Toennissien 1999), and, in the U.S., melons, strawberries and raspberries (Lemaux 1999). (Indur Goklany, Office of Policy Analysis, Department of the Interior)</p>	
5-1266	A	61	14			<p>To provide a more complete overview of the different tools available to adapt agriculture to climate change, BOX 5.6 should include not only biotechnology, but also other techniques as conventional breeding and germoplasm recover of old cultivars (Marco Bindi, Dept. of Agronomy and Land Management)</p>	Comment has been accepted as fair and incorporated into redraft.
5-1267	A	61	14	62		<p>Box 5.6 on Biotechnology. See General Comment #7--far too optimistic about the role of biotech and ignores the alternative view that biotech solutions will not</p>	Comment has been accepted as fair and incorporated into redraft.

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						have a large impact on such key crop traits as yield potential, drought resistance, nitrogen efficiency, resistance to heat stress. It is critical that this section cites some of these alternative views from highly respected plant physiologists, and also that this section not be so biased towards biotech as a "silver bullet". I will send key references by R. Ford Denison and Tom Sinclair shortly, because I don't have them on hand. (Kenneth Cassman, University of Nebraska)	
5-1268	A	61	14	62	14	The central point of biotech, GMOs and climate gets really lost here. This box is important and needs to be reorganized to focus on the possible role of biotech in coping and adapting to climate change (Norman Christensen, Duke University)	Comment has been accepted as fair and incorporated into redraft.
5-1269	A	61	14			Box 5.6 - I suggest changing the title of this box - to suggest that any one isolated thing such as biotech is the answer to something as vastly complex as adaptation to CC, even if meant somewhat ironically, is asking for trouble, in my view. (Philip Thornton, International Livestock Research Institute (ILRI))	Comment has been accepted as fair and incorporated into redraft.
5-1270	A	61	26	61	27	Abiotic stress due to ozone air pollution should be included in the list of abiotic stressors. Research is underway at our laboratory and others to increase crop plant tolerance to ozone. (Fitzgerald Booker, USDA-ARS Plant Science Research Unit)	Comment has been accepted as fair and incorporated into redraft.
5-1271	A	61	40	61	43	These two sentences should be updated as follows: "Farmer's use of transgenic crops, while limited, is growing rapidly, as farmers become better aware of their economic and environmental risks and benefits. Eight countries -- the U.S, Argentina, Canada, Brazil, China, Paraguay, India, South Africa -- have more than half a million hectares each under GM crops Update the area for GM crops to "81 million hectares in 2004, an increase of 20 percent over the 2003 area [ISAAA 2005]" (Indur Goklany, Office of Policy Analysis, Department of the Interior)	The box has been revised and greatly shortened—mention of regions has been eliminated.
5-1272	A	61	48			Is the UK not part of Europe???! (Juerg Fuhrer, Federal AgroEcological)	Comment has been accepted as fair and incorporated into redraft.
5-1273	A	61	48	61	48	I think it is also fair to include North America in the list of regions where there is "considerable public resistance" to GM foods. Certainly this is true of Canada and I am pretty sure it is the case in USA. (David Price, Northern Forestry Centre)	Comment has been accepted as fair and incorporated into redraft.
5-1274	A	61	49	61	49	I have a pet peeve about the common use of the term "food chain" when applied to human food. If it is a chain, who (or what) is eating the humans?!!!! (David Price, Northern Forestry Centre)	Comment has been accepted as fair and incorporated into redraft.
5-1275	A	61				BOX 5.6 paints a pretty rosy picture for bio-tech. CFS is doing some work on	Comment has been accepted as fair and

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						<p>putting the Bt (defined above) gene into trees. One problem is potential physiological costs to the tree having to carry this gene - presumably proper engineering will minimize this. A much bigger problem is that, if such trees are grown over large spatial extents, they provide a strong selective force on the pest to develop resistance to the Bt, & insects have developed Bt resistance in the past. CFS is also working on incorporating the Bt gene into (non-replicating) viruses which can transport it more effectively & presumably with less additional chemicals in the spray mix. I think it will be a very long time before the public is ready to have airplanes spraying viruses over our forests! There is a lot of resistance to GMOs in Canada among the public & much suspicion of the big chemical companies involved (e.g. Monsanto). Much of this has been rough on by the companies themselves through their own, now public, "track records" of secretive, unethical, & occasionally even illegal activities.</p> <p>(Richard Fleming, Great Lakes Forest Research Centre)</p>	incorporated into redraft.
5-1276	A	61				<p>There is the column for Biotechnology in page 61. However, there is no comment or description on nitrogen fertilizer use and agricultural production. Cereal yield is closely related with the amount of fertilizer application. Even in developing countries, when they put more nitrogen fertilizer to their field, they can get more cereal. Fertilizer application is essential for the food production. Nitrogen fertilizer use is closely related with the climate change. Generation of nitrous oxide is related with nitrogen fertilizer application. I think IPCC must comment on these phenomena in Chapter 5.</p> <p>We have some paper on this field.</p> <ol style="list-style-type: none"> 1. Kawashima H., M. J. Bazin and J. M. Lynch (1996) Global N2O Balance and Nitrogen Fertilizer, Ecological Modeling, Vol.87, pp.51-57. 2. Kawashima H., M.J. Bazin & J.M. Lynch (1997) A Modeling Study of World Protein Supply and Nitrogen Fertilizer in the 21st Century, Environmental Conservation, 24, pp.50-56. 3. Shindo, J. Okamoto, K. and Kawashima, H. (2003) A model based estimation of nitrogen flow in the food production-supply system and its nvironmental effects in East Asia. Ecological Modelling Vol.169, pp.197-212. 4. Shindo, J. Okamoto, K. and Kawashima, H. Prediction of the environmental effects of excess nitrogen caused by increase food demand with rapid economic growth in eastern Asian countries, 1960-2020. Ecological Modelling (accepted) <p>(Hiroyuki Kawashima, The University of Tokyo)</p>	Comment has been accepted as fair and incorporated into redraft.
5-1277	A	62	2	62	4	Despite the source of this statement, I find this worrying. Was this conclusion	Comment has been accepted as fair and

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						drawn after adjustment of results for education and stress pressure? In developed countries most people will be educated to a degree that they can readily understand the concepts of biotechnology, and they can afford to resist it because they do not face food insecurity. This is probably not the case in developing countries. I am not convinced that this should be included here (Nicholas Holden, University College Dublin)	incorporated into redraft.
5-1278	A	62	17			Section 5.7 contains a lot of definitions about sustainability, vulnerability, etc., but the implication for sustainable development are not defined. In the SOD the information reported in this section should be reorganised to address the title. Moreover the use of acronyms should be reported together the full name. (Marco Bindi, Dept. of Agronomy and Land Management)	Comment has been accepted as fair and incorporated into redraft.
5-1279	A	62	17			Chapter 5.7 This chapter is fairly well written and easy to read. However, it overlaps with earlier chapters dealing with adaptations, and it sounds very much like a 'personal view', rather than a summary of facts. Fishery is not addressed. As it stands no, there is no need for a sub-chapter 5.7.1. (Juerg Fuhrer, Federal AgroEcological)	subtitle 5.7.1 removed. Some adaptation parts moved to cha. 5.2.4. and 5.6. .Fishery has been addressed, but additional comments from Keith Brander are welcome.
5-1280	A	62	17			Section 5.7 - I felt that this section needs attention. There are few clear links in this section from what has gone before in the chapter, and no links either to the uncertainties and research gaps in 5.8. Also I don't see much assessment with regard to the household level and the crucial societal aspects that are part and parcel of adaptive capacity -- education and training, institutional development, etc. And again, I would have thought that something needs to be said about the assumptions concerning what the world may look like in 30-50 years' time. (Philip Thornton, International Livestock Research Institute (ILRI))	Links expressed.
5-1281	A	62	19			The train of thought of this section is not clear. (Cynthia Rosenzweig, NASA/Goddard Institute For Space Studies at Columbia University)	Agreed, try to improve.
5-1282	A	62	19			The implications for fisheries needs to be added. (Franklin Schwing, NOAA Fisheries Service)	Fisheries is addressed need input from fishers.
5-1283	A	62	19	62	50	General description, Deleted, Corrections were made to make it meaningful, (Dinesh Chandra Uprety, Indian Agricultural Research Institute)	Accepted
5-1284	A	62	22	62	29	Need to cross reference to other sections of the chapter and to other IPCC chapters. (Emma Archer, University of the Witwatersrand)	Tried.
5-1285	A	62	31	62	31	"Human societies have....developed the capacity to adapt... " I would qualify this with the word "often". There are documented cases of populations that have disappeared, evidently because of unwillingness or inability to adapt to	Done.

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						environmental change. (E.g., some recent articles in Nature). (David Price, Northern Forestry Centre)	
5-1286	A	62	36	62	45	Read these points earlier. Redundant. (Richard Fleming, Great Lakes Forest Research Centre)	Partly shifted/removed.
5-1287	A	62	37			Define LDC? (Paula Harrison, University of Oxford)	Done, now under 5.2.4.
5-1288	A	62	37	62	37	LDC in full (Nicholas Holden, University College Dublin)	See above.
5-1289	A	62	45			Insert at the following sentence at the end: "A society's vulnerability also depends on its ability to harness existing technologies, as well as develop (and use) new ones (Goklany 1995, 2005b)." (Indur Goklany, Office of Policy Analysis, Department of the Interior)	Done but shortened, now under 5.2.4.
5-1290	A	63	3			Insert on this line, the following sentences: "Noting that greater vulnerability to climate-sensitive hazards (e.g., hunger, malaria, and other infectious diseases) is both a cause and consequence of the lack of sustainable development in many parts of the developing world, Goklany (2000) would focus on reducing vulnerability to these specific hazards that are urgent today and might be exacerbated by climate change. He argues that measures to address these hazards and threats today would also help societies cope with the impacts of climate change, when they occur in the future. His analysis indicates that for the next several decades, the global benefits of such an approach would exceed those accruing from any mitigation scheme at a much smaller cost, mainly because this approach focuses on current high priority problems (Goklany 2003, 2005). Moreover, addressing these problems now would advance sustainable development because these climate-sensitive hazards are themselves barriers to sustainable development (Goklany 2005b)." (Indur Goklany, Office of Policy Analysis, Department of the Interior)	Partially addressed, should go under 5.2.4.
5-1291	A	63	3	63	3	GEF in full (Nicholas Holden, University College Dublin)	Done.
5-1292	A	63	3	63	3	I don't recognize GEF abbreviation. Maybe it can be defined here? I guess there will be a list of acronyms etc. (David Price, Northern Forestry Centre)	Done.
5-1293	A	63	20	63	21	Agricultural intensification does not necessarily lead only to environmental costs. It can also lead to environmental benefits by reducing the amount of land in cultivation which, in turn, means less habitat loss, less carbon emissions, lower socioeconomic costs for setting land aside for either sequestration or conservation, and -- to the extent inputs are a function of cultivated area -- lower inputs. [See	Shortened and included.

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						Goklany 1998, 2005b] (Indur Goklany, Office of Policy Analysis, Department of the Interior)	
5-1294	A	63	26	63	27	In general, most adaptation measures have to be implemented at specific locations but a substantial amount of work can be undertaken before implementation which is not necessarily location specific. For example, if one wants to develop drought resistant GM crops, one first has to identify and isolate genes that convey that trait. This kind of development work does not have to be site specific. It can, and, in fact, has started today. [Similarly for the crops listed in comment 33.] Eventually of course, planting has to be in specific areas with specific crops. (Indur Goklany, Office of Policy Analysis, Department of the Interior)	Ok, understood. Could go into chapter 5.6.
5-1295	A	63	27			Limited non-climate stress ... I don't think this sentence is needed or useful; preparedness can and should be achieved through better knowledge rather than having to stress the agricultural sector. (Fischer Günther, International Institute for Applied Systems Analysis)	Sentence removed as proposed.
5-1296	A	63	36			The term "Trifinio" should be explained. It is an old Spanish word referring to the point / instance of convergence and agreement about common interests of three jurisdictional or territorial divisions (i.e. the use of resources from an international river basin). (Osvaldo Canziani, IPCC WG2 Co-chair)	Done.
5-1297	A	63	41	63	42	I am not sure what is meant by "regional and international landscape development." In any case, another approach would be to reduce current causes of habitat loss, which would reduce existing threats to biodiversity. One approach would be to produce more food per acre of land and liter of water while limiting chemical inputs. This would help reduce the most significant current threats to terrestrial and freshwater biodiversity, while helping meet global food needs (Goklany 2000, 2005b). (Indur Goklany, Office of Policy Analysis, Department of the Interior)	Suggestions could go into Chapter 5.6.
5-1298	A	63	44	63	45	This sentence is confused in that it seems to say that Picea abies and Pinus sylvestris are indigenous to North America when in fact this redistribution would only occur in Europe or Eurasia. (David Price, Northern Forestry Centre)	Corrected.
5-1299	A	63	44	63	47	Picea abies and Pinus sylvestris are not US species (David Price, Northern Forestry Centre)	
5-1300	A	64	2			I agree completely with the organisation of this section that reports the levels of uncertainty in the assessments. In the SOD I suggest to report only the new findings after the TAR. In the present version there are also findings already reported in the TAR.	Corrected.

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						(Marco Bindi, Dept. of Agronomy and Land Management)	
5-1301	A	64	2			Chapter 5.8 5.8.1 Include in the first section (important findings...): In the medium to long term, the magnitude of the effect of CO2 on crop yields and forest growth is unclear, particularly in combination with other factors such as increasing temperature. (Juerg Fuhrer, Federal AgroEcological)	Comment now redundant or irrelevant as section has been revised.
5-1302	A	64	11			Section 5.8.1 Findings and Key Conclusions Page 64 line 13 to line 23 in page 67, repeat the terms of The Executive Summary, or vice versa. (Osvaldo Canziani, IPCC WG2 Co-chair)	Comment now redundant or irrelevant as section has been revised.
5-1303	A	64	22			Append at the end of this line the following: "..., especially if they involve the use of GM crops." (Indur Goklany, Office of Policy Analysis, Department of the Interior)	Comment now redundant or irrelevant as section has been revised.
5-1304	A	64	23		23	This same sentence had occurred on page 3. I am still unable to figure out its meaning. (Mohamed El Mahdi Beshir, Independent scholar and consultant)	Comment now redundant or irrelevant as section has been revised.
5-1305	A	64	26	64	29	the results presented on the transition from natural forest to planted system appeared to me as projection, not facts...(see P. 18 line 14-15) is it the case? If so please adapt this sentence (Sylvie Gauthier, Laurentian Forestry Center, Canadian Forestry Service)	Comment now redundant or irrelevant as section has been revised.
5-1306	A	64	32			In addition to the points mentioned some more must be mentioned: mechanisms/institutions that foster adaptation to extreme events and mitigate their impacts; further progress in international agreements and cooperation (e.g. for coping with water scarcity; adaptation in fisheries; climate mitigation; R&D and technology transfer). (Fischer Günther, International Institute for Applied Systems Analysis)	Comment has been accepted as fair and incorporated into redraft.
5-1307	A	64				Section 5.8 See comments above for p3-6. (Richard Fleming, Great Lakes Forest Research Centre)	We do not understand the point being made in this comment and therefore cannot respond.
5-1308	A	65	8	65	8	Suggest revising sentence to read: "In the field many factors such as air, soil and water quality; (Fitzgerald Booker, USDA-ARS Plant Science Research Unit)	Comment now redundant or irrelevant as section has been revised.
5-1309	A	65	16			Drop the indication of high/medium confidence in this bullet as all these bullets are supposed to be concluded with high confidence. (Fischer Günther, International Institute for Applied Systems Analysis)	Comment now redundant or irrelevant as section has been revised.
5-1310	A	65	16	65	19	Restructure this bullet so that the statements associated with high confidence remain and the medium confidence statement is moved to the section below. (Paula Harrison, University of Oxford)	Comment now redundant or irrelevant as section has been revised.

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5-1311	A	65	17	65	17	Should this statement be in the medium confidence section? (Nicholas Holden, University College Dublin)	Comment now redundant or irrelevant as section has been revised.
5-1312	A	65	22	65	24	See point 18. I have doubts about whether this statement is true in general. It may be under specific circumstances, but these should be stated. (Nicholas Holden, University College Dublin)	Comment now redundant or irrelevant as section has been revised.
5-1313	A	65	26	65	30	The following statement should be added, i.e. decreased precipitation and climate extreme events resulted from climate change is likely to negatively affect forest growth and timber production. (Shirong Liu, Institute of Forest Ecology, Environment and Protection, Chinese Academy of Forestry)	Comment has been accepted as fair and incorporated into redraft.
5-1314	A	65	27			what means virtually certain? The conclusion about CO2 effects on forage quality appears under 'high confidence' and again under 'medium confidence' (Juerg Fuhrer, Federal AgroEcological)	Comment now redundant or irrelevant as section has been revised.
5-1315	A	65	27	65	31	I am surprised about this statement. It seems to be considering only the effect of Temperature increase without considering any of the limiting or counterbalancing factors that were discussed afterward. (Sylvie Gauthier, Laurentian Forestry Center, Canadian Forestry Service)	Comment now redundant or irrelevant as section has been revised.
5-1316	A	65	27	66	26	These two sections (high and medium confidence) seem to be a little contradictory. One implies little major impact and only a temperature benefit, while the other seems less positive (lower NPP, loss of forest area). ??? Not sure if I understand what the message is here???? (Nicholas Holden, University College Dublin)	Comment now redundant or irrelevant as section has been revised.
5-1317	A	65	27	65	30	the authors should include reference to the fact that while increasing temperature may enhance growth, changing precipitation patterns, increasing cloudiness (lowered solar radiation) and other factors such as rising levels of air pollutants, increasing insect disturbance etc may interact to limit the positive effect. While strictly true as written, it leaves the impression that forest response is monotonic and unresponsive to other co-occurring global change stressors also influenced by temperature. (Kevin Percy, Canadian Forest Service)	Comment now redundant or irrelevant as section has been revised.
5-1318	A	65	38	65	39	see comment to page 50 (Alf Håkon Hoel, University of Tromsø)	OK.
5-1319	A	66	11			This bullet should not that CO2 would help moderate any increases in water demand. (Indur Goklany, Office of Policy Analysis, Department of the Interior)	Comment has been accepted as fair and incorporated into redraft.
5-1320	A	66	14			Last sentence not well formulated. Also, the argument given may hold for irrigation water demand but not water demand in other sectors, which is likely to	Comment now redundant or irrelevant as section has been revised.

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						increase with temperature. (Fischer Günther, International Institute for Applied Systems Analysis)	
5-1321	A	66	19	66	23	See above comments regarding CO2 effects on grain versus soybean protein and oil concentrations. (Fitzgerald Booker, USDA-ARS Plant Science Research Unit)	Comment now redundant or irrelevant as section has been revised.
5-1322	A	66	26	66	28	as previously stated, it would be useful to include other limiting factors as above (Kevin Percy, Canadian Forest Service)	Comment has been accepted as fair and incorporated into redraft.
5-1323	A	66	34		36	if not energy prices are changing the picture... (Marcus Lindner, European Forest Institute)	Comment has been accepted as fair and incorporated into redraft.
5-1324	A	66	46			As said before, snow-pack decrease will cause negative impacts only in very specific regions, e.g. Himalayas, northwest China, etc. A more general limitation will be enhanced overall or seasonal water scarcity. (Fischer Günther, International Institute for Applied Systems Analysis)	Comment has been accepted as fair and incorporated into redraft.
5-1325	A	67	4	67	4	Increasing levels of tropospheric ozone may diminish the aerial fertilization effect of elevated CO2 in C3 crops. (Fitzgerald Booker, USDA-ARS Plant Science Research Unit)	May come through in SOD as Long's FACE results are explicitly examined.
5-1326	A	67	4			A more robust statement is to say that climate change will probably not significantly change the global agricultural potential. The indication is that the agricultural production potential is likely increasing initially somewhat but then decreasing. Climate change computed for high emission scenarios produces for most climate models a slight negative impact on global agricultural potential. (Fischer Günther, International Institute for Applied Systems Analysis)	Comment has been accepted as fair and incorporated into redraft.
5-1327	A	67	4	67	5	It is not clear to me what evidence presented in the chapter is used to support this statement (Nicholas Holden, University College Dublin)	Comment has been accepted as fair and incorporated into redraft.
5-1328	A	67	13	16		should add "particularly in regions where aridity increases". (Sylvie Gauthier, Laurentian Forestry Center, Canadian Forestry Service)	Comment now redundant or irrelevant as section has been revised.
5-1329	A	67	13	67	15	Altered precipitation extremes should be changed, decreased precipitation, will increase fire risk. (Shirong Liu, Institute of Forest Ecology, Environment and Protection, Chinese Academy of Forestry)	Comment now redundant or irrelevant as section has been revised.
5-1330	A	67	14			Increased fire risk is an impact currently predicted with high confidence for the boreal forests of Central and Western Canada. See Flannigan, M.D., Logan, K.A., Amiro, B.D., Skinner, W.R. and Stocks, B.J. 2005. Future area burned in Canada. Climatic Change. 72:1-16 (Pierre Bernier, Natural Resources Canada)	Comment now redundant or irrelevant as section has been revised.
5-1331	A	67	18			Freshwater fisheries are more sensitive to climate change ... More sensitive than	See comment 5-140 and note.

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						what? (marine fisheries). (Fischer Günther, International Institute for Applied Systems Analysis)	
5-1332	A	67	18	67	19	What does this mean? (Nicholas Holden, University College Dublin)	Numbering not clear.
5-1333	A	67	23			A key vulnerability of marine fisheries is increased vertical stratification (high confidence), which will reduce the movement of nutrients into the photic zone of many ecosystems dependent on upwelling. (Franklin Schwing, NOAA Fisheries Service)	Comment has been accepted as fair and incorporated into redraft.
5-1334	A	67	26			The second row, on fisheries, third column, mentions 'populations' - clarify that this is 'fish populations' (Edward Allison, University of East Anglia)	Comment has been accepted as fair and incorporated into redraft.
5-1335	A	67	26			Table 5.6 Would the authors consider inserting another row; I suggest a focus on air pollutants with ozone as an example, combined crops/forests (vulnerable systems) reduced water use efficiency, reduced Ps, decreased growth, selection for tolerant genotypes (Impacts); global background levels have been rising, productivity and health of systems will be negatively affected above certain levels etc (Description); level of effect will depend upon flux into the plant; thresholds are being elaborated through free air and flux-based investigations; medium confidence? (Kevin Percy, Canadian Forest Service)	May come through in SOD as Long's FACE results are explicitly examined.
5-1336	A	69	0			Section 5.8.2 -- what struck me from reading the chapter is the knowledge back hole concerning shifts in weather variability, both (1) understanding what form these may take, and (2) what impacts these may have on vulnerable households -- in many ways we really don't know, and these are critical knowledge gaps. Similarly, for activities that purport to have a development and poverty alleviation focus, the importance of assessing impacts at the household level is absolutely critical -- in this respect, the global or regional picture can be wildly misleading. It is not just the issue of household enterprises, their complementarities and interactions and competitions (for labour etc), and how these elements can get balanced under situations of great stress or change; it is also the issue of coping strategies that depend in so many places on social exchange networks and off-farm activities. (Philip Thornton, International Livestock Research Institute (ILRI))	Well said.
5-1337	A	69	4			Section 5.8.2 Research Gaps and Priorities. Since AR4 is to provide guidance on the vulnerability, impacts and adaptation to climate change of the FFF systems, and such a guidance must be useful to all countries of the world, the critical basic information limitations, which affect even	Comment has been accepted as fair and incorporated into redraft.

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						the full knowledge of many countries climate and freshwater resources, should be the subject of the necessary recommendations. Another research gap is the one involving faulty information on social and economic integrated impacts. This shortcoming also affects some developed countries. (Osvaldo Canziani, IPCC WG2 Co-chair)	
5-1338	A	69	4			Section 5.8.2 -- A third area that struck me on reading the chapter is that little is said in any detail about vulnerability now, nor how this may change in the future - - and ultimately this will be a major driver of the R&D agenda for any poverty alleviation focus. This implies critical needs for hotspot analyses and innovative impact assessment and priority setting frameworks that can provide information at the local level, as well as at the societal level. (And why just MCE, p 63, lines 11-17 -- many other tools/techniques (e.g. Cost-Benefit Analysis sensu stricto) to quantify societal impact etc). (Philip Thornton, International Livestock Research Institute (ILRI))	We hope to address this in a more general way with a global map, but space limits will preclude a more extensive regional analysis.
5-1339	A	70	0			The reference list is in very poor shape. It is very difficult to evaluate some sections because of the poor referencing and incomplete reference list. (Nicholas Holden, University College Dublin)	Comment has been accepted as fair and incorporated into redraft.
5-1340	A	70	0			there are many other studies of climate change impacts on Bulgarian agriculture by V. Alexandrov (C. Gregory Knight, Pennsylvania State University)	Comment has been accepted as fair and incorporated into redraft.
5-1341	A	70	1	85	19	Major work required on references, as I am sure you know. I noted that many references are attached at the tail ends of other references and need to be moved to correct alphabetical position. (David Price, Northern Forestry Centre)	Comment has been accepted as fair and incorporated into redraft.
5-1342	A	70	45			the author is Alexandrov not as listed (C. Gregory Knight, Pennsylvania State University)	Comment has been accepted as fair and incorporated into redraft.
5-1343	A	73	13	73	13	Conley, M.M., B.A. Kimball, T.J. Brooks, P.J. Pinter Jr., D.J. Hunsaker, G.W. Wall, N.R. Adam, R.L. LaMorte, A.D. Matthias, T.L. Thompson, S.W. Leavitt, M.J. Ottman, A.B. Cousins, and J.M. Triggs. 2001. CO2 enrichment increases water use efficiency in sorghum. <i>New Phytologist</i> 151(2): 407-412. (Bruce Kimball, USDA, Agricultural Research Service)	Comment has been accepted as fair and incorporated into redraft.
5-1344	A	73	28	73	28	I suspect the following reference was intended: 174. Derner, J.D., H.B. Johnson, B.A. Kimball, P.J. Pinter Jr, H.W. Polley, C.R. Tischler, T.W. Bouttons, R.L. LaMorte, G.W. Wall, N.R. Adam, S.W. Leavitt, M.J. Ottman, A.D. Matthias, and T.J. Brooks. 2003. Above- and below-ground responses of C3-C4 species mixtures to elevated CO2 and soil water availability. <i>Global Change Biology</i> 9:452-460.	Comment has been accepted as fair and incorporated into redraft.

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						(Bruce Kimball, USDA, Agricultural Research Service)	
5-1345	A	73	48	73	49	I suspect the following reference was intended: 174. Derner, J.D., H.B. Johnson, B.A. Kimball, P.J. Pinter Jr, H.W. Polley, C.R. Tischler, T.W. Bouttons, R.L. LaMorte, G.W. Wall, N.R. Adam, S.W. Leavitt, M.J. Ottman, A.D. Matthias, and T.J. Brooks. 2003. Above- and below-ground responses of C3-C4 species mixtures to elevated CO2 and soil water availability. Global Change Biology 9:452-460. (Bruce Kimball, USDA, Agricultural Research Service)	Thanks—will be included.
5-1346	A	77	44	77	44	158. Kimball, B.A., C.F. Morris, P.J. Pinter Jr., G.W. Wall, D.J. Hunsaker, F.J. Adamsen, R.L. LaMorte, S.W. Leavitt, T.L. Thompson, A.D. Matthias, and T.J. Brooks. 2001. Elevated CO2, drought and soil nitrogen effects on wheat grain quality. New Phytologist 150(2):295-303. (Bruce Kimball, USDA, Agricultural Research Service)	Thanks—will be included.