This is the response by the writing team to the comments we received for the SOD Chapter 4 "Ecosystems, their properties, goods, and services" AR4 (Government and Expert review)

It should be noted that we have revised first all text, even if we planned to cut it to ensure no comments of the reviewers are not taken on board. Thus several comments may be annotated by 'A' agreed (done) despite the fact that the text was actually later removed (we had to considerably shorten the chapter). So you may find 'A' for text that is actually no longer present in the final version of the chapter.

Hint: To terminate a paragraph, i.e. to create a new one within a cell, press this key combination: Control^Alt^Return (Windows) or Control^Option^Return (Mac)

Comment responsibilities (see also separate spreadsheet):

af/gm	
bg	
jt	
pd/gm	
av/af	
af/hb	
gm	
af	
jp/rw/af/gm	
mr/jdc/af	

Please use the following terminology while adding notes in the last column:

A – Agreed

R – Rejected (add rationale)

L – Left it under advisement (should be avoided for FGD)

NA – Not applicable

TR – Text Removed

White areas in rightmost column indicate a comment concerning a typically technical detail

Comments left white concern non-chapter 4 texts

LA responsibility includes that of the CAs for whom that LA is responsible

bold - substantial comments.

red font - requires discussion in the writing team.

green font – CLA issue, possibly including CLAs from other chapters

G-4-xyzA: Is a cross reference to a government comment of chapter 4 with number xyz from batch A.

Note the letter A refers to the batch of comments (2nd column).

E-4-xyzA: Is a cross reference to an expert comment of chapter 4 with number xyz from batch A.

Following batches: GA, GLATE

SPM and TS comments are not contained in this spreadsheet

Chapter-Comment	Batch	From Page	From Line	To Page	To line	Comments	Notes of the writing team
G-4-1	A	0				Generally, I think that this chapter has improved a lot since the first version. Particularly, I think that the ratio of length to contents is much improved, so that I do not think the chapter would need to be shortened a lot. However, I have some specific suggestions for removal of material that appears of out place to me (see other comments).	A

						(Government of Switzerland)	
G-4-2	A	0				To shorten chapter 4, chapters 4.4.8 and 4.4.9 could be moved to chapters 3 and 6 respectively (and partly rewritten), and the heading of chapter 4 changed to " Terrestrial ecosystems, their properties, goods and services". There exists a certain overlap between chapters 3, 4 and 6 in any case, and the information on water systems in chapter 4 (particularly in 4.4.8) is rather incomplete. In general chapter 4 has a strong focus on temperature effects, and little focus on other climate factors such as precipitation. Some more focus should have been on other effects. (Government of Norway)	R - the outline of this chapter is agreed at plenary, we cannot make this change It needs also to be seen that it is not true that our chapter focuses only on temperature. While it is true that we use temperature throughout as a surrogate for climate change, following upscaling procedures, many studies we assess have been explicitly considering precipiation and possibly detailed hydrological effects. They have been taken into account in many studies and we also discuss explicitly such effects, e.g. B4.1, 4.4.2, 4.4.3, 4.4.4., 4.4.5, 4.4.10. Many studies we review have used such approaches and several are even based on sophisticated downscaling procedures.
G-4-3	A	0				There is a certain confusing overlap between chapter 4 and other chapters, such as chapter 3, 6 and 15), and one is left with an incomplete feeling when reading chapter 4. More informative references to other chapters should be given in the introduction of this chapter. (Government of Norway)	A - we have attempted to provide a more complete overview, and strengthened the introduction with respect to clarity what our mandate as given by the IPCC plenary was.
G-4-4	A	0				The authors of the chapter did not provided new synthesis of knowledge but mainly confirm information published in the TAR (e.g. the results presented by Gitay et al. 2001 are cited too frequently without any confrontations with recently published information). In the chapter 4 influence of climate change on biota is almost exclusively discussed despite the fact that title indicate that the ecosystem properties make the subject of analysis. Ecosystem is not biotic system but system of physical, chemical and biological interactions making functional unit (Reid et al. 2005, Tansley 1935). So the title of the chapter should be changed to be relevant to the contents. If ecosystem properties and services are really analysed, then solar energy fluxes (completely neglected in text), matter cycling including water (only casually discussed) etc. and climatic influences on those processes should be discerned. There are recent publications dealing with those processes.. Building on that knowledge will help to get new insight on climate change effects on ecosystems. (Government of Poland)	R - we have indeed now provided a substantial update on the TAR, with many new references (we used over 3000 references, mostly >2001) provided. We have revised the definition of an ecosystem as suggested, thank you. However, we cannot accept that solar energy flux is an ecosystem service. Moreover, it should be noted, that the crucial provisioning services are NOT in our mandate but treated by other chapters, notably chapter 5. So our focus is on biodiversity, supporting, and regulating services as now more explicitly explained in the introduction.
G-4-5	A	0				Replace the author name "Korner" or "Koerner" into "Körner" throughout the text and references. Change also "Schroter" into "Schröter" (Government of Switzerland)	A
G-4-6	A	0				Presented biotic classification consisting of biome, community and population categories is outdated and is not relevant to ecosystem approach. Discussing adaptation options authors do not use modern approach to nature protection like win-win strategy, ecosystem approach to nature conservancy etc. that have important bearing on adaptation strategies to climate change. (Government of Poland)	A - we have strengthened these aspects.

G-4-7	A	0				In general, the whole chapters gives a very good and comprehensive overview about already occurring and potential impacts of climate change on ecosystems and their properties and goods and services. Therefore, I have only some minor points listed below. (Government of Switzerland)	A - thank you
G-4-8	A	0				General Comment: there is also more recent CO2 literature (reviews) that the authors might use as references especially regarding forest ecosystems or tree responses and soil CO2 efflux as well as literature about CO2 effects on tree litter quality and decomposition there are some reviews and FACE experiment results), Abbreviations: these either need to be written "open" when first time mentioned in this chapter/add note or reference to glossary. Some background information about different biomes (pages 17-40) could be briefly listed in a separate table instead of including it into the text. There is quite little information from Scandinavian point of view. Many important authors are not included or mentioned (e.g. Jukka Laine, Finland, Kristina Nilsson, Sweden) and their information should be shortly added. The structure of the chapter is not always balanced, e.g. Biodiversity vs biogeochemical cycling issues. Should there be separate sections for tropical, temperate and boreal (taiga) forest biomes? In this chapter there is relatively little on changes in snowfall, snowpack accumulation and snowmelt, which have major significance for Finland. There is also relatively little on peatlands and forested permafrost regions in the boreal zone. Chapter 4 is also well written and is a successfull synthesis of a huge amount of literature (Government of Finland)	A - we have referenced several recent papers on these topics We have also made efforts to improve the balance between "biodiversity and biogeochemical cycling issues" and believe to have properly addressed those issues as reflected in the current literature. Despite the given page limitations we have made considerably efforts to also treat peatlands and permafrost issues with proper emphasis. We have considered papers by the mentioned authors, but have not cited them, since they discuss more aspects which are the focus of WGIII.
G-4-9	A	0				An important reference to be included with regards to ocean acidification in chapter 4 is lacking. A recent finding presented in a Nature article (2005, vol 437 #29) by Orr et. al. indicates a potential undersaturation with respect to aragonite expected to occur throughout the entire Southern Ocean and into the subarctic Pacific Ocean by 2100. The important ramifications this may have for high-latitude ecosystems should be highlighted. (Government of USA)	R - Thanks anyway, Orr et al., 2005 is indeed an important work, but this work was used considerably and already cited extensively in the SOD, section 4.4.9. Moreover, we make particular reference to the risks for "high latitude ecoystems", mostly Southern ocean as much as the page limitations allow us. This is also done in the ES, but was not possible for the SPM due to space limitations.
G-4-10	A	0				A lot of single results, but a consistent result, based on a hierarchy of influencing factors and effects is missing. I think, the basic knowledge for such a consistent picture is there. Based on the findings, a hierarchy of measures can be deduced, and one can easiliy deduce that first measure must be the reduction of green house gases. (Government of Germany)	A - we now provide a far better overview of impacts that are coherent and well supported
G-4-11	A	0				1. Additions to the item 4.1.2 on page 6 - The following should be added at the end of the line 20: efforts should be made also to keep the urban ecosystem healthy, which can be utilized as ecosystem services for urban residents	R - This formulation is strongly policy prescriptive - we also do not believe this relates to a climate change issue, rather directly to an ecosystem issue in an urban setting.

						(Government of Korea)	
G-4-12	A	3	0			Executive summary: ES does not give a balanced summary of the report. There are no introductory sentences about what the chapter is about/addresses; importance of precipitation changes and associated uncertainties are not addressed; Importance of extreme climatic events?; acknowledgement that land-use management and change may even be more important than climate change is missing; there is little about responses of water and biogeochemical cycles, but a lot about species change/shift; no mention of the word biome; no mention of future research priorities nor action to be taken by policy makers (Government of Finland)	A partly/R partly - Big efforts were made to improve the balance of the ES. However, we do not have the space for introductory sentences. Because precipitation changes are uncertain we do not emphasize them too much, but emphasize the asociated uncertainties for our assessment (e.g. 4.3 and key uncertainties in 4.4.8). Extreme events are addressed in the text (e.g. 4.3), some sections discuss them (e.g. 4.2, 4.4.2, 4.4.3, 4.4.4, 4.4.5, 4.4.6, 4.4.7, and 4.4.9), but an overall message is dificult to extract, as few modelling approaches simulate them. It is also not true, that we do not discuss the relative importance of LUC vs. CC. Given the restrictive page limitations, we actually donate very significant amounts of text to this topic (e.g. 4.2.2, 4.3, 4.4.10), including overall assessment (e.g. 4.4.11).
G-4-13	A	3	1	3	44	Generally: the findings should be formulated more explicitely . For instance, first sentence of ES(executive summary): what are the principle findings of TAR, or later for instance at line 19: name explicitely detrimental changes instead of 6 chapter numbers. For that purpose, make use of the subparas in chapter 4.4.2- 4.4.10 headed as "key vulnerabilities" and use table 4.2. In almost all chapters, it is stated that there is unsufficient knowlegde about adaptation costs. This statement should become part of the ES. Furthermore, the terms high,.....low confidence are only used in the ES. Therefore it is impossible to find the reference in the underlying subchapters and to judge whether the assessment is appropriate. It is also absolute unclear, were the assessment comes from; expert judgement, statistics...? Incorporate statements about confidence already in the main text, clarify where are the from or delete all such statements. finally, the executive summary should be consistent with the TS and SPM, what is not the case now. Statements in TS and SPM are not part of ES statements (see individual comments below). (Government of Germany)	A - we have reformulated the ES in a far more explicit way, and gathered together key research needs appropriately as informed by the gaps identified throughout. Whether findings are new relative to the TAR or not have been encoded by letters N,D,C etc. However, due to space limitations (the TAR ES (Gitay et al., 2001) alone was 6 times more pages than our ES) we are not able to summarize TAR findings extensively, for sure not in this very confined ES.
G-4-14	A	3	3	3	44	The summary should address the impacts of acidification of the oceans: “Recent findings forecast a drop in pH to 7.8 by 2100, and it may drop as low as 7.5 in a business-as-usual scenario changing ocean carbon chemistry at least 100 times faster than at any time in the last 100 000 years to a pH lower than anything experienced in the last 10 – 20 million years. Species relying upon building up calcium-based structures will be adversely affected including corals, lobsters, crabs and oysters. Higher levels of CO2 in seawater generally depress the physiological performance of sea creatures. It cannot be ruled out that these changes will also diminish other marine living resources.”	A - done

						Rationale: The Acidification of the ocean is dealt with in a report from The OSPAR Biodiversity Committee (BDC) based on available scientific literature on this topic. The report is available at the OSPAR website http://www.ospar.org/eng/html/welcome.html. In a press release from the meeting in BDC 13 – 17 March 2006 th it is said that the report "Ocean Acidification" confirms that high levels of carbon dioxide (CO2) in the atmosphere are changing ocean carbon chemistry at least 100 times faster than at any time in the last 100 000 years. The pH of seawater (the measure of the balance of acidity and alkalinity) has dropped from 8.2 to 8.1 over the past 200 years. Models forecast that it will drop to 7.8 by 2100, and may drop as low as 7.5 if there is a business-as-usual scenario. This would be lower than anything experienced in the last 10 – 20 million years. Marine species that rely upon building up calcium-based structures will be adversely affected. These include corals, crustaceans (e.g. lobsters, crabs) and molluscs (e.g. mussels, oysters). Higher levels of CO2 in seawater generally depress the physiological performance of sea creatures. It cannot be ruled out that these changes will also diminish other marine living resources. The OSPAR Biodiversity Committee said that: both acidification of the ocean due to elevated level of CO2 in the atmosphere caused by increased anthropogenic emissions of CO2 and climate change may have severe impacts on the marine environment. They therefore emphasised the need to find strategies and measures to mitigate these effects. (Government of Norway)	=HA262 A
G-4-15	A	3	3	3	3	Replace "relevant" with "valid" (Government of Netherlands)	TR
G-4-16	A	3	3	3	4	clarify in what there is high confidence; is it that there is more evidence in the new findings than in the TAR? How is this judged? (Government of Germany)	This is now given by codes
G-4-17	A	3	4	3	4	It is suggested to improve the language "from a broader ambit?". (e.g. broader range of studies?) (Government of Austria)	A - Text completely overhauled
G-4-18	A	3	4	3	4	Authors should explain how their ambit is broader than in the TAR. (Government of Australia)	A - Text completely overhauled
G-4-19	A	3	7	3	8	Delete "in terrestrial ecosystems" and "in the marine realm" (Government of Netherlands)	A - Text completely overhauled
G-4-20	A	3	11	3	12	clarify, is it 4.4.1-4.4.11 or 4.4.1, 4.4.11? (Government of Germany)	A
G-4-21	A	3	12	3	12	Comment: avoid too long sentences, start new sentence: "There is also growing evidence for a high.." (Government of Finland)	A - Text completely overhauled
G-4-22	A	3	12	3	14	Clarify, whether the medium confidence statement is valid for all statements, from line 12 on. (Government of Germany)	A
G-4-23	A	3	15	3	16	What is the meaning of the qualification "medium confidence after "vegetation structure", while "major" and "rapid" have been attributed their own confidence level ? More over "are possible" is vague statement. When you say that rapid shifts are possible (low confidence), do you really mean that we have high confidence that rapid shifts will not occur ? See remark on SPM page 2, line29 on a similar question. (Government of France)	A - Text completely overhauled. IPCC uncertainty language used
G-4-24	A	3	15	3	29	Comment: awkward sentence (too long and unclear), rewrite.	A - Text completely overhauled

						(Government of Finland)	
G-4-25	A	3	15	3	16	Clarify, to what the medium confidence in line 16(end) refers to. Vegetation structure shift? (Government of Germany)	A
G-4-26	A	3	16	3	16	Replace "shifts" with "changes" (Government of Netherlands)	A - Text completely overhauled
G-4-27	A	3	17	3	18	clarify, to what the medium confidence in line 18 refers to. Vegetation structure shift is due to wild fires? Ancillary stresses? (Government of Germany)	A - Text completely overhauled
G-4-28	A	3	18	3	18	What statement is qualified medium confidence ? Does medium confidence apply to most regions, some or wildfire ? (Government of France)	A - Text completely overhauled
G-4-29	A	3	19	3	19	Delete "mainly" (Government of Netherlands)	A - Text completely overhauled
G-4-30	A	3	21	3	21	The following wording is suggested: Responses of endemic species in a broad range of geographic locations are …. (Government of Austria)	A - Text completely overhauled
G-4-31	A	3	21	3	22	Replace current sentence with "The size of the range of the vast majority of endemic species will shrink considerably (high confidence; 4.4.11) resulting in a reduced biodiversity, particularly at biodiversity hotspots (medium confidence; 4.4.10)" (Government of Netherlands)	A - Text completely overhauled
G-4-32	A	3	27	3	27	Replace "persistence" with "survival" (Government of Netherlands)	A - Text completely overhauled
G-4-33	A	3	27	3	28	natural adaptative capacity of tree species is not explicitely dealt with in 4.4.5, replenish 4.4.5 or delete reference to 4.4.5 (Government of Germany)	A - 4.4.5 has been subtantively revised, and now deals with natural adaptation of trees.
G-4-34	A	3	34	3	34	Do you mean that there is a fair chance that none of the shifts in vegetation structure will be driven by wildfire, and other ancillary stresses ? If not, the qualification should be"high confidence". The doubt about the generality of the process is expressed by "some". (Government of France)	Text revised to reflect medium confidence about disturbance impacts
G-4-35	A	3	41	3	42	Replace "developing coherent and detailed regional planning responses" with "developing a coherent and detailed planning of regional responses" (Government of Netherlands)	A
G-4-36	A	4	0	4	9	In the introduction it could be stated the big general role of the world ecosystems. All the ecosystems together play the "biogeogeochemical symphony" which is the key in keeping the conditions in the Earth proper (e.g. the atmospheric gas compositionfor) for the present life forms. The Earth with its functioning ecosystems is presently the only known planet supporting flourishing of both lower and higher life forms. (Government of Finland)	We partly agree to that suggestion, but we must be careful to keep the balance and not to put too much emphasis solely on the biogeochemistry. Depending on cultural background, some readership may consider provisional services or cultural services as important as the regulating services.
G-4-37	A	4	3	4	9	This material is partly redundant with material in section 4.1.2 (which does a much better job introducing ecosystem goods and services). In addition, this material presents a strange collection of items as a "definition" of ecosystem services (lines 7-9). I think this material (lines 3-9) should be omitted altogether. (Government of Switzerland)	A Cut with exception of first, reformulated sentence (see also G-4-38..39)

G-4-38	A	4	3	4	3	Comment: remove word now from the first sentence (Government of Finland)	A
G-4-39	A	4	4	4	4	Replace "persistence" with "preservation" (Government of Netherlands)	A
G-4-40	A	4	7	4	8	Rephrase to "global biogeochemcial cycles such as of carbon, nitrogen and water, and of global, regional and local environmental conditions." (Government of Netherlands)	R - cf. G-4-36 .. 37
G-4-41	A	4	11			Comment: title 4.1.1 Biomes, communities, population systems, and ecophysiology; move it from line 11 to line 39 (Government of Finland)	Suggesting partly followed by moving title to forward, but only to line 27
G-4-42	A	4	13	4	19	suggest to move to glossary (Government of Netherlands)	TR and revized
G-4-43	A	4	15	4	15	Comment: remove "(e.g. global biochemistry)" (Government of Finland)	A
G-4-44	A	4	21	4	21	Comment: start sentence: In this chapter the focus is on natural…" (Government of Finland)	A
G-4-45	A	4	23	4	23	complete reference; which WGI (TAR or 4AR), which chapter, chapter 2 of WGI? (Government of Germany)	A
G-4-46	A	4	28	4	29	Unfortunate wording of the sentence. Re-word to something like "...is complicated by an uneven understanding of the temporal and spatial scales of the response; processes at large spatial scales are characterized...". Reason: it is not the scales that are linked, but the response takes place on characteristic combinations of spatial and temporal scales. The rest is fine-tuning of language. (Government of Switzerland)	A - text improved, although not precisely following the suggestion
G-4-47	A	4	33	4	33	"Conversely" is inappropriate here, as the responses are not separated so clearly (yrs to centuries vs. months to centuries). In addition, the sentence is grammatically incorrect: "Conversely, responses ... show responses". Rather: "species and populations are characterized by responses..." (Government of Switzerland)	A - text improved, although not precisely following the suggestion
G-4-48	A	4	40	4	45	suggest to move to glossary (Government of Netherlands)	A - but implication for long-term cc impact responses retained
G-4-49	A	4	40	6	6	The importance of biodiversity is exaggerated. Energy fluxes and matter cycling are much more important for functioning of any ecological system then biodiversity services. Presented classification: biome, communities, populations, ecophysiological responses is very old classification and erroneously characterizes ecosystems. There is lack of landscape category despite the fact that one of the divisions of ecology concerns with landscapes. (Government of Poland)	First (importance of biodiversity): R - While it is true that there are many still unanswered questions with respect to the role of biodiversity and in particular its maintenance, this view appears not to represent what is stated in the literature (e.g. MEA). Second: R - It is true that biogeochemical cycling is
G-4-50	A	4	50			Incorrect order of the publication year of the references (Government of Korea)	A
G-4-51	A	5	4	5	4	Table 4.1. Explain NPP (not explained elswhere in the text) (Government of Finland)	Partly agreed - spelled out and a reference to glossary made
G-4-52	A	5	4	5	40	Table 4.1 column headings need further explanation, in particular "% transformed", "NPP" and "Ecosystem service" need to be defined. (Government of Australia)	This table has now been transformed into a figure. The sources for the information are cited in the caption of the table.

G-4-53	A	5	4	5	40	Inconsistent column heading in Tab. 4.1: rename "Ecosystem services" to "Ecosystem goods and services" (as mentioned correctly in the caption). (Government of Switzerland)	table converted to figure
G-4-54	A	5	4	5	4	Explain "NPP" (Government of Netherlands)	see G-4-51A
G-4-55	A	5	4	5	41	complete table 4.1:fill empty boxes, for instance, in columns for area, transformed, plant carbon, soil carbon of forests and woodlands, grasslands and savannas. It is not clear whether they are additiv to what we have in the subboxes. as in NPP column they are not additiv, clarify why forest as a whole has a NPP of 26.9Pg C/y whereas the sum of subboxes is 29.9PgC/y(same for grasland). what does "transformed" mean? (Government of Germany)	table converted to figure
G-4-56	A	5	4			Table 4.1: titles are unclear, e.g. % transformed? There are mixed spatial scales: ecosystems and biomes? Does the table follow the official biome classification? Is a global map of biomes useful? The numbers in the table do no always add up. (Government of Finland)	table converted to figure
G-4-57	A	5	4			Table 4.1: move table on the top of the page, explain abbreviation NPP in Table caption, list different ecosystem services only in the main biomes in order to clarify table; services like food and recreation should be listed for freshwater ecosystems also (Government of Finland)	table converted to figure
G-4-58	A	5	24	5	27	Only for the temperate forests timber and non-wood products are listed here. The forest products have importance also for economies of many countries in the boreal region. (Government of Finland)	table converted to figure
G-4-59	A	5	33	5	34	Inland wetlands and peatlands have importance also in regional hydrology. (Government of Finland)	table converted to figure
G-4-60	A	5	43	5	44	Comment: change sentence in the following manner, e.g.: "Communities form biomes and each community is characterized by a specific species composition and thus biodiversity." (Government of Finland)	A
G-4-61	A	5	43	6	6	suggest to move to glossary (Government of Netherlands)	A
G-4-62	A	5	46	5	46	Comment: change sentence, e.g.: "Population systems are formed by a particular species…" (Government of Finland)	A
G-4-63	A	5	50			"at a microscopic scale" - I suggest to change "starting at a microscopic scale" , since physiological processes are not limited only to microscopic scale like the transpiration example shows out. (Government of Finland)	A
G-4-64	A	5				Table lacks consistency: with grasslands and savannas and forests and woodland, all constituent parts are included, but not for freshwater lakes, rivers and wetlands. (Government of Netherlands)	table converted to figure
G-4-65	A	5				Tab. 4.1. In heading there are distinguished biomes not ecosystems. Ecosystems services are very poorly described e.g. temperate grassland provide many specific and important services in additions to those mentioned. In the table services are described in very inconsistent way (classification is not logical and chaotic). (Government of Poland)	table converted to figure
G-4-66	A	5				Suggest to move "cultivated lands" to the first row	table converted to figure

						(Government of Netherlands)	
G-4-67	A	5				Could the "other biomes" in the row on tundra and other palearctic biomes be specified? (Government of Netherlands)	table converted to figure
G-4-68	A	5				Add "prominent" to heading righthand column ("prominent ecosystem services") (Government of Netherlands)	table converted to figure
G-4-69	A	6	17	6	18	"local climate modifications" are included as a supporting service, while in figure 4.1 "climate" is mentioned as a regulating service (Government of Netherlands)	table converted to figure
G-4-70	A	6	20	6	20	replace "underpins" with "supports" (Government of Netherlands)	R - -underpins intimates the true natureof the relationship - it is more critical than just
G-4-71	A	6	22	6	38	the terms used in figure 4.1 are not fully consistent with the ecosystem services mentioned in table 4.1 (Government of Netherlands)	cf. G-4-69
G-4-72	A	6	39	6	40	Add "main" before "ecosystem goods" and delete "(this list is illustrative and not exhaustive)" (Government of Netherlands)	A
G-4-73	A	6	39			Figure 4.1: The figure is not very informative. Should there be a distiction made between goods and services? Is provisioning services=goods? Why is such prominence given to biodiversity maintenance? (Government of Finland)	It is not clear whether the suggestion is to delete this figure or not. Yes, there is a distinction to be made between goods and services, since some services, e.g. air purification, have little to do with what is commonly subsumed under the term goods (air a good produced by ecosystems?). Moreover, the service is to be distinguished from what is "served", e.g. to use a metapher: "A catering service is not the same as the food that such service provides to its clientele", regardless of the close relationship of the two. Unfortunately the MEA (e.g. Hassan et al., 2005, p. 29) is often not careful in this respect either and equates e.g. products of services with the services themselves.
G-4-74	A	6	41			Incorrect order of the publication year of the references (Government of Korea)	R - All citations refer to the same year. The sequence here is not alphabetical, since it follows the volume numbers (1..5) of the MEA reports cited, with the synthesis listed last.
G-4-75	A	6	46	6	51	The system presented seems inconsistent, in particular for i) and ii), "games" seems and odd item, is this a typo of "game"? Iii) seems to be missing something with regard to nutrient cycles. Why not merge i) and ii) and mention food (human: including game, roots, sees, nuts and other fruit, spices; fodder), fibre (including wood, textile) and medicinal and cosmetic products (including aromatic plants, pigments)? (Government of Netherlands)	A
G-4-76	A	6	46	6	47	Comment: avoid repetition, delete sentence: "This chapter discusses… ecosystems:" and rewrite it "Ecosystem services include i) primary production…" (Government of Finland)	A

G-4-77	A	6	48			Secondary production is not supporting service. Instead provide photosynthesis. (Government of Poland)	Done - However, we do not agree the reviewer that secondary production can not be a supporting service. Ex.: Good: Honey from wild bees. Growing/reproducing bee population is secondary production. The provisioning service of honey production is supported by the secondary production (or we risk double accounting, which should be avoided, cf. MEA). Meaning of "Instead provide photosynthesis" is not clear. If the reviewer means to list photosynthesis as well as primary production, we are reluctant. It is true that the MEA does list both, but in doing so risks some double-accounting. While it is correct that photosynthesis and primary production should be clearly distinguished, listing both is problematic.
G-4-78	A	6	49	6	49	Replace "games" by "game" (typo). (Government of Switzerland)	A
G-4-79	A	6	51	6	51	I sorely miss a mentioning of protection from gravitative natural hazards (landslides, erosion, avalanches, rockfall, ...). (Government of Switzerland)	A
G-4-80	A	6				Fig. 4.1. Inclusion of biodiversity maintenance into supporting services is not logical. Biodiversity depends on supporting services like solar energy partitioning for driving different processes e.g. water cycling, then on matter cycling, photosynthesis, soil formation. Use Millennium Ecosystem Assessment (MEA) classification. (Government of Poland)	Biodiversity maintenance differs from biodiversity per se. The first is a service, the second is not. The logic is far from as clear as the reviewer appears to believe, since it is a chicken -egg question, in which way you wish to break-up the systemic interdependence between what the government of Poland calls "supporting services" vs. "non-supporting services". Diversity is a structural property of ecosystems, to be considered plus/minus as given on short time scales. However the maintenance (or generation on evolutionary time scales) of biodiversity is a service underpinning the structural property of diversity. MEA is in some parts not so clear on these issues and certainly not the last word on them. However, we can be cautios
G-4-81	A	7	6	7	6	Comment: although resilience is explained in glossary, I think that brief description of this term should be included here into the text (Government of Finland)	A
G-4-82	A	7	8	7	8	Insert "possible" between "tolerate" and "rapid". (Government of Australia)	R - Since we have deleted rapid (G-4-83A) this comment does no longer apply
G-4-83	A	7	8			Clarify what is meant by rapid climatic changes. (Government of Poland)	TR
G-4-84	A	7	9	7	9	Comment: change word "subject" to word "subjected" (Government of Finland)	A

G-4-85	A	7	9	7	9	Add "other" before "human" (Government of Netherlands)	A
G-4-86	A	7	17	7	17	Comment: change word " such" to phrase "climate change" (Government of Finland)	A
G-4-87	A	7	19	7	22	give an example for the statement. (Government of Germany)	TR Strongly modified text so that there remains little need for an example
G-4-88	A	7	25	7	25	Comment: change word "diversity" to word "biodiversity" (Government of Finland)	A
G-4-89	A	7	26	7	30	Comment: avoid repetition, delete sentence: "Three effects…possible", rewrite " According to Millennium Ecosystem Assessment (2005b p 43-46) the loss of ecologically… resilience and secondly and secondly, loss of keystone species alters ecosystem functioning." (Government of Finland)	Partly A - This comment is in itself repetitious. Yet, we mostly follow advice and have improved text
G-4-90	A	7	28			What authors mean by redundant species. It should be: lost of species guilds. (Government of Poland)	R - Unclear comment, since first statement is meaningless. The second sentence would be wrong, since we refer here (first point) to within guild losses, i.e. before the entire guild is lost (cf. point 3).
G-4-91	A	7	35	7	35	Comment: Write "The TAR report.." instead of "The TAR chapter on ecosystems.." (Government of Finland)	A
G-4-92	A	7	35		44	This four-sentence summary of the TAR chapter on Ecosystems is not comparable the summaries of the other TAR chapters. This section (4.1.4) is presently so insignificant that it should be deleted. Alternatively, the authors could state more comprehensively the TAR conclusions about impacts on ecosystems. (Government of USA)	TR and explanation added that reference to TAR is made throughout the chapter where appropriate
G-4-93	A	7	40	7	42	This sentence does not make much sense – first, "in spite of" is a bad start; "Contrasting earlier views..." would be more appropriate, I think; second, the hypothesis that aquatic ecosystems are well buffered against the impacts (I assume) of warming is not disproven by the observation that freeze/thaw times have changed; these are physical aspects of the system that do not necessarily have much to do with the status of the ecosystem contained in a lake or river. (Government of Switzerland)	A
G-4-94	A	7	40	7	42	Comment: Sentence "In spite… froze later" awkward and should be reformulated. (Government of Finland)	A
G-4-95	A	7	40	7	42	Also nutrients status of the northern lakes would change as a result of increase in precipitation/leaching (Government of Finland)	L - This point was not particularly stressed by the TAR
G-4-96	A	7	43			"peat lands" should be "peatlands" (Government of Finland)	A
G-4-97	A	7	44	7	44	specify the meaning of "which". 4.2? (Government of Germany)	R - We assume the reviewer means "which new findings"? It is the purpose of the entire chapter to discuss which new findings. The executive summary summarizes those findings. Thus we see no place for doing this here.
G-4-98	A	7	52	7	52	Comment: explain unit ppmv (make a reference to glossary or use note)	agree

						(Government of Finland)	
G-4-99	A	8	1	8	1	Explain "LGM" (Government of Netherlands)	agree
G-4-100	A	8	1	8	1	Comment: write LGM when first time mentioned in the text (Government of Finland)	agree
G-4-101	A	8	3	8	3	specify reference; what chapter 2 of which report? (Government of Germany)	Chapter 1 of this report. "This volume, 1" or "this volume, 2"
G-4-102	A	8	3	8	6	Comment: delete sentence "Ecosystems of the distant past… composition" and continue text straight from the examples: " For example, grassland ecosystems…ago. (Government of Finland)	agree
G-4-103	A	8	8	8	8	Comment: Add word "and" between words "cool" and "low" (Government of Finland)	agree
G-4-104	A	8	11	8	24	Comment: Remove sentence "Dropping atmospheric CO2… Pleistocene" to the end of the previous paragraph on line 9 - 10, and delete the rest of the text in this paragraph (reduce the length of the text in this chapter section). (Government of Finland)	A- this section completely revised, shortened andincorporated into a more appropriate section in the final version.
G-4-105	A	8	16	8	16	Replace "latter" by "first" (Government of Netherlands)	agree
G-4-106	A	8	29	8	29	I have a hard time with the use of the word "resilience" in this chapter - if there is an agreed definition that is being used across all the IPCC chapters, then fine; to me, "resistance" is the ability of a system not to change under the impact of an exogeneous driver; resilience is the ability of a perturbed system to return to its previous state (or dynamics), and elasticity is the speed of the resilient response. This definition follows Grimm & Wissel (1997), Oecologia. In that sense, what should be used here is the term "resistant". (Government of Switzerland)	LA - We made improvements in the introduction to explain the term resilience better. The term was used as defined in the glossary. It is neither stability as understood to buffer impacts and "to resist significant change". It is also not understood as elasticity, since again that term has no clear meaning in ecology, unless understood as the conventional asymptotic stability (which is NOT how we use it) and then we use the term stability. While it is true that the term resilience is also often misused, we understand it here as the magnitude of change an ecosystem can cope with without moving over the separatrice separating multiple stability domains, assuming that non-existence is given as a second stable state in addition to the non-trivial "current" state for all ecosystems.
G-4-107	A	8	32	8	32	include between "The" and "links" "knowledge about" (Government of Germany)	agree
G-4-108	A	8	36	8	39	delete sentence starting from "For example" as this is not about climate variability and ecosystems or add statement on ecosystem response of the Alps to climate change (Government of Germany)	R - This section is about climate variability, including NAO. While it is true that responses by snow is by itself not an ecosystem response, snow is undoubtedly an important factor for many ecosystems in mountain regions such as the European Alps.

G-4-109	A	8	37	44	10	While the beginning and ending sections of the chapter represent a thoughtful overview or summary which is obviously a consensus view of the authors, some of the sections on the pages listed here deteriorate into a dump of unrelated sentences supported by one to 32 references. The key messages and consensus of the scientific literature (and the lead authors) is often lost in the litany of unrelated facts and citations. The “Impact Summaries” and “Key Vulnerabilities” sections on these pages are an exception and they do help the reader get to the bottom line. It is important that these are accurately synthesized in Chapter 19. (Government of USA)	Agree - all sections were subjected to a major rewrite to address this comment, and several others.
G-4-110	A	8	41	8	41	Replace "enhanced occurence of fires" by "more frequent fires" (Government of Netherlands)	agree
G-4-111	A	8	46	9	14	Comment: Use lesser examples in order to shorten the text e.g. rewrite text so that it is not so full of examples, heat wave example is ok, but the list of others; try to summarize the info for a couple of sentences (Government of Finland)	R - the wide range of examples gives an indication of how much variability plays a role in driving ecosystems, and by a wide range of mechanisms.
G-4-112	A	8	49	8	51	I think it would be appropriate to also mention the large droughts and the resulting forest dieback that took place in the 1950s in the western US (Allen & Breshears 1998, PNAS) and again in recent years (since about 2000) in the same area (Breshears et al. 2005, PNAS). (Government of Switzerland)	A - thank you for these useful references
G-4-113	A	8		11		No mention of satellites being used for ecosystem monitoring and ecosystem alerts that satellites now make possible – e.g. NOAA’s Coral Reef Watch. These new tools provide near-real-time and daily updates of environmental conditions in and around coral reef ecosystems - complete coverage. Over time these data provide assessments of tendencies and trends. (Government of USA)	A - good point - we now mention satellite based remote sensing and their importance for quantifying impacts and trends.
G-4-114	A	8		11		“Extremes” – Caribbean Coral Bleaching event in 2005! This major event should be highlighted, perhaps in Box 4.5. (Government of USA)	R - we could not find an academic publication referring to this event, e.g. by searching in ISI Web of Science
G-4-115	A	8				Comment: avoid repetition here, shorten the text (Government of Finland)	agree
G-4-116	A	9	1	9	2	It is difficult to evaluate this sentence; what are "continental mid- and high-latitude regions exactly"? Is Poland among them, for example? This should be specified better, perhaps by giving examples/references. Generally, I would actually doubt that wind, snow and frost are the main causes of forest damage across large areas - at least insects (particularly bark beetles) are likely to be among those agents as well. Please specify (I am not an expert and thus cannot make a suggestion how to change this). (Government of Switzerland)	TR
G-4-117	A	9	1	9	1	In addition to the Canadian example, the authors may wish to cite the model-based study by Bugmann & Pfister (2000), Reg Env Change 1, which found the same for high-altitude forests in the European Alps; hence this is not a "Canada-only" phenomenon. (Government of Switzerland)	A - thank you for this useful reference.
G-4-118	A	9	18	9	18	Comment: Box 4.1. change title: Ecological Impacts of the European heat wave 2003 (Government of Finland)	A - done
G-4-119	A	9	20			Comment: Box 4.1. Information about the observed main effects of heat wave 2003 could be listed in the similar manner as in SPM in order to shorten the text	R - this would not match the style in which these boxes are written. This box forms part of a cross-

						(Government of Finland)	chapter case study.
G-4-120	A	9	27	9	27	Comment: Box 4.1. write GPP open when first time mentioned (or add reference to glossary if it is explained there) (Government of Finland)	agree
G-4-121	A	9	37	9	37	What is the difference between drought and reduced humidity? (Government of Netherlands)	soil vs atmosphere phenomenon
G-4-122	A	9	45	9	48	delete last sentence; it is not about ecological impacts by 2003 heat wave. (Government of Germany)	agree
G-4-123	A	10	0			Comment: avoid repetition, reformulate sentences so that the text can be shortened (do not divide text into two sentences if you can tell the same information in one sentence; see next comment) (Government of Finland)	A
G-4-124	A	10	1			I suggest to include a short paragraph on N-deposition as a major driver of global change, showing manifold interactions with climate change, e.g. through impacts on productivity, nutrient cycling, or disturbances such as fire. In addition, there is now evidence that N-deposition can also enhance the spread of invasive alien species in some ecosystems. For example, in mediterranean ecosystems, N-deposition can favour the invasion of non-native grasses leading to higher fuel loads and higher flammability. As grasses can quickly recover after fires, a positive feedback loop develops with grass and fire until an annual grassland is stabilized under a frequent fire cycle (Allen 2004, D'Antonio and Vitousek 1992, Brooks et al. 2004, Fenn et al. 2003, Scherer-Lorenzen et al. 2007). As fire frequency in those ecosystems is also highly dependent on climate change, this example nicely illustrates the complex interactions between several drivers of global change. References: Allen EB (2004) Restoration of Artemisia shrublands invaded by exotic annual Bromus: A comparison between southern California and the intermountain region. USDA For Ser Proc 31:9-17 D'Antonio CM, Vitous (Government of Switzerland)	A- added emphasis on N deposition included.
G-4-125	A	10	6	10	9	Comment: "In the recent past… human mobility". Combine these sentences and information into single sentence, avoid unnecessary repetition (Government of Finland)	A
G-4-126	A	10	9	10	9	Comment: term "non-climate" change to "non-climatic" (Government of Finland)	A
G-4-127	A	10	9	10	12	Comment: combine sentences: "The explicit… outcomes… and consequently, many impact studies of climate change may be conservative estimates." . (Government of Finland)	A
G-4-128	A	10	9	10	12	Clarify the meaning of conservative in line11, does it mean impacts are underestimated or overestimated? Furthermore, clarify whether this conservativness is a result of the inclusion of non-climate drivers as it seems to be stated in the sentence in lines 9-10. (Government of Germany)	A
G-4-129	A	10	14			Incorrect order of the publication year of the references (Government of Korea)	A
G-4-130	A	10	19	10	22	This depends on the time scale considered. Effects of climatic change will take place on long-term, whereas effects of land-use are very much seen all the time (Government of Finland)	A
G-4-131	A	10	20			Incorrect order of the publication year of the references (Government of Korea)	A

G-4-132	A	10	20			Add that mosaic agricultural landscape composed of cultivated fields, midfield patches of trees, stretches of grasslands can modify effects of increasing temperature up to 2°C in temperate zone (Kedziora A., Ryszkowski L. 1999. Does plant cover structure in rural areas modify climate change effects. Geographia Polonica 72: 63-85). (Government of Poland)	NA - although important, a too detailed point for this section
G-4-133	A	10	26	10	26	What is "evolved flammability"? Maybe "increased flammability" is meant? I cannot imagine that this has anything to do with evolution. (Government of Switzerland)	A
G-4-134	A	10	29	10	29	A very recent paper that demonstrates the same for a very different area could be cited here: Schumacher & Bugmann (2006), GCB 12: 1435-1450 (June issue 0f GCB). (Government of Switzerland)	A - thank you for this useful reference.
G-4-135	A	10	37	10	37	Comment: explain CO, CH4 and H2 in Note or make a reference to glossary here (Government of Finland)	TR - it is not necessary to explain these in detail, they are now referred to merely as "trace gases"
G-4-136	A	10	41	10	41	Comment: explain DGVM here (write it open when first time mentioned here) (Government of Finland)	A - we now define DGVM at first use and is also in the glossary
G-4-137	A	10	42			Incorrect order of the publication year of the references (Government of Korea)	A
G-4-138	A	10	45			Incorrect order of the publication year of the references (Government of Korea)	A
G-4-139	A	10	49	10	49	Fires are not really "introduced". What is meant here is probably "anthropogenic". (Government of Switzerland)	A
G-4-140	A	11	1			Land use change and especially conversion of natural ecosystem to agroecosystem is more important threat than invasion of alien species (see Sax D.F., Stachowicz J., Gaines S. 2005. Species invasion, Sinauer Associates Publishers Sunderland, Massachusetts: 495 pp. (Government of Poland)	A
G-4-141	A	11	4			Incorrect order of the publication year of the references (Government of Korea)	A
G-4-142	A	11	8	11	8	I suggest to include: "There are several complex interactions betwen the invasion of alien species and other global changes, such as climate change, habitat fragmentation and N-deposition (Mooney & Hoobs 2000)". Reference: Mooney, H.A. & Hobbs, R.J., eds. (2000) Invasive species in a changing world, pp 457. Island Press, Washington, Covelo. (Government of Switzerland)	Addressed by modifying text to better express these suggested ideas, in the introductory para fro this section, indicating potential non-linear responses.
G-4-143	A	11	18	11	21	This is a strange sentence. It is not clear why "simple" scenarios should be sufficient for this - although I have a lot of sympathy, it would need to be backed up by a rationale to become meaningful (for example, it can become quite difficult to imitate a complex climate scenario in a real-world setting because changes (relative to the prevailing weather) need to be imitated rather than absolute amounts. -- Towards the end of the same sentence, all of a sudden precipitation variability is mentioned; so does the first part of the sentence implicitly refer to averages only? If so, then this should be made clear to begin with. (Government of Switzerland)	A
G-4-144	A	11	20	11	21	Comment: the latter part of this sentence is awkward (i.e. though these more recently include…) (Government of Finland)	A
G-4-145	A	11	23	11	23	Comment: delete word "recently"	A but then we need to delete also "more"

						(Government of Finland)	
G-4-146	A	11	31	11	34	Comment: sentence is too long and awkward, rephrase. (Government of Finland)	A
G-4-147	A	11	49	11	52	insert in line 51 between "than" and "mean" "enhanced" (Government of Germany)	addressed
G-4-148	A	11	49			Incorrect order of the publication year of the references (Government of Korea)	A
G-4-149	A	12	1	12	1	Ecosystem processes do not "depend on" steep environmental gradients, but they vary strongly along such gradients. Please correct. (Government of Switzerland)	A
G-4-150	A	12	5	12	5	Comment: explain RCM here (or make reference to glossary/note) (Government of Finland)	A was already in the glossary (Could it be that reviewers did not get a copy of the glossary?)
G-4-151	A	12	17	12	28	Comment: combine this information into previous paragraph which is now on page 11 and where some uncertaincies concerning climate change models and interactive factors are already explained (shorten the text significantly) (Government of Finland)	A partly R partly - Text was considerably shortened but was not combined with previous paragraph, since we believe the additional point LUC was not yet explained in the previous paragraph
G-4-152	A	12	20			Incorrect order of the publication year of the references (Government of Korea)	A
G-4-153	A	12	24			Add e.g. that increasing cover of area by forest increases evaporation and then recycling of evaporated water by convective storms (Ryszkowski L., Kedziora A. 2004. Energetic of ecosystem and landscape changes. Ecological Questions 5: 9-21. (Government of Poland)	R, TR - Too detailed for this text
G-4-154	A	12	33	12	43	This introduction is fine, but it is totally disconnected from the remainder of section 4.4. This section is quite long, and therefore I think that these introductory sentences should provide a "road map" to the structure of the section - whose rationale, as a matter of fact, is still not overly clear to me! (Government of Switzerland)	A
G-4-155	A	12	36	12	36	Replace "presence" by "present" (the presence is not the same as the present). (Government of Switzerland)	A
G-4-156	A	12	46	17	13	I am surprised that authors do not mention here BVOCs (Biogenic Volatile Organic Compounds) which are known to represent nearly 10% of the carbon fixed by primary producers and released back to the atmosphere. BVOC emissions increase with increasing temperature and they will influence carbon sequestration. BVOCs are also important feedback system for plants to adapt in extreme conditions due to direct cooling effect of BVOC volatilization and indirectly via activated formation of secondary aerosols in atmospheric reactions. More information available from "PEÑUELAS J., LLUSIA J., 2003 BVOCs: Plant defense against climate warming? Trends in Plant Science 8: 105-109." (Government of Finland)	10% is an overstatement, suggest to mention VOCs somewhere in this section, but refrain from overselling. There is no proof that the response of global warming is reflected in short term T-responses. NOT YET DONE
G-4-157	A	12	52			Incorrect order of the publication year of the references (Government of Korea)	A

G-4-158	A	13	0	17		Comment: CO2 effects with simultaneously increasing O3; some brief mentioning could be included in this general part (there are several relatively long-term CO2 x O3 studies already, have they shown any clear trend or does it depend on the species/ecosystem studied)? How about plants' own emissions which may affect climate and carbon cycling at least at regional level (VOCs; terpenes and isoprenes from forest trees et cetera)? These could be briefly mentioned somewhere here? (Government of Finland)	Should be added somewhere with emphasis on the surprising CO2xO3 interaction found in the Aspen-FACE
G-4-159	A	13	4	13	9	clarify, what does the phrase "several aspects remain uncompletely tested" mean. which aspects? What does it mean? They are not tested because they are not part of the models? Or there are no data (Government of Germany)	A - the sentence has been expanded with examples
G-4-160	A	13	4			Incorrect order of the publication year of the references (Government of Korea)	A
G-4-161	A	13	8			Incorrect order of the publication year of the references (Government of Korea)	A
G-4-162	A	13	21	13	21	Comment: explain unit Pg (Government of Finland)	explained in () A - definition added
G-4-163	A	13	42			Incorrect order of the publication year of the references (Government of Korea)	A
G-4-164	A	13	46	13	46	Comment: replace word "long" with "longer" (Government of Finland)	done R - "long" is what is meant
G-4-165	A	13	47	13	47	Only very few out of the relatively few experiments with forest stands are dealing with mature systems (which may not yet be in a steady-state anyway); hence the reference to the observation periods that would be required before "a new steady state is reached" is misleading since this statement implies that prior to the CO2 experiment, the systems WERE in a steady state, which I would doubt even for Körner's excellent canopy crane experiment. This should be re-worded accordingly. (Government of Switzerland)	This is a misunderstanding of the phrase 'steady state'. This should not be read as 'stable'. In order to clarify the meaning an explanation in () was added. Steady state refers to land area based processes/conditions, not to a certain age etc.
G-4-166	A	14	13			„Water saving“ with CO2 ? This seems very theoretically, since the increased CO2-level is combined with other effects of climate change like higher temperatures, which will prolong the vegetation period and will induce a higher water demand, i.e. net evaporation. Both is very water consuming. Moreover, it is a fact that enhanced O3-levels (a result of the changed “air cocktail”) in the air will impair the stomata control, thus leading to increased inefficient water losses through the vegetation. (Government of Germany)	too complicated to cover this in full here. A warmer climate would also enhance evaporative forcing. A phrase was added, saying that this is the result of experiments, not theory based projection wl: R - numerical models show that the net balance of
G-4-167	A	14	27			Enhanced nitrogen availability is useless, if no water is available. In this context, please consider the results of the following paper: Geßler, A., K. Jung, R. Gasche, H. Papen, A. Heidenfelder, E. Börner, B. Metzler, S. Augustin, E. Hildebrand und H. Rennenberg. 2005. Climate and forest management influence nitrogen balance of European beech forests: microbial N transformation and inorganic N net uptake capacity of mycorrhizal roots. European Journal of Forest Research 124: 95-111. (Government of Germany)	not clear how this should link to the water statement as made. No text change
G-4-168	A	14	27			“Soil nitrogen availability …” and in a subordinate clause: “especially in the light of N-deposition trends.” This is the only place in the report where the N-deposition is mentioned! It is a new “site factor” for forests and not to neglect. I recommend to insert some more facts and data on this item. N availability is increased for the most forests in industrialized areas by the factor 2-10 due to atmospheric input.	text extended by mentioning this 2-10 fold increase

						(Government of Germany)	
G-4-169	A	14	32			“C-storage will reduce nutrient availability”?? The beneficial effect of C-sequestration is the enhancement of water storage capacity in soils, the storage of nutrient cations and the release of nutrients in the mineralization process. The cation storage in humus is to neglect, the nutrient cation concentration in humus is to neglect. Overall, humus prevents losses of nutrients. The main source for nutrient cations is the weathering of silicates and the mineralization of organic substance. In the mineral soil humus the cation concentration is low. Really important is, on the other hand, the nutrient cation depletion of soils via acidification due to atmospheric input of S and N. This is not mentioned here. (Government of Germany)	Language so bad that the meaning is unclear.I do not agree with the first sentence if I understand it correctly. The amounts of additional C relevant here are too small to affect water storage significantly. A phrase was added with regard to cation depletion. However, globally, acid rain impacted areas are quite small.
G-4-170	A	14	36			Incorrect order of the publication year of the references (Government of Korea)	A
G-4-171	A	14	51	14	52	In which models are "individual fire-generated age classes" not simulated? I presume the statement refers to DGVMs, but this should be made clear, as regional-scale models typically include those. (Government of Switzerland)	R - The statement refers to continental-scale carbon balances. DGVMs typically do not include (yet) fire-induced age classes.
G-4-172	A	14	52	15	1	This is basically correct, but I do not think that we could model the dependency of the CO2 effect as a function of age classes, so this failure may not be primarily a problem of modeling, but one of understanding. HOWEVER, I think the sentence is mis-constructed on another level: what is probably meant is that C dynamics in global models cannot be simulated accurately because they lack the age structure. These structural aspects area probably causing a lot of the northern hemisphere C sink in these decades. THIS HAS NOTHING TO DO WITH THE MODELING OF A POSSIBLE CO2 FERTILIZATION EFFECT, however! (Government of Switzerland)	The original text was cryptic indeed. Most of this side tracking issue was omitted wl: R - the sentence begins with "individual fire-generated age-classes are not explicitly simulated", so the sentence says exactly what is being suggested.
G-4-173	A	14	52			Incorrect order of the publication year of the references (Government of Korea)	A
G-4-174	A	15	1	15	3	This paragraph started off with fire regimes, and then went astray (see my comment on p. 15 line 1). In the following sentence, it goes further astray, as this sentence deals with upscaling in a very general sentence. Perhaps this should be omitted here?? (Government of Switzerland)	omitted wl: A - The sentence was moved to the beginning of 4.4.1 where DGVMs are discussed more generally.
G-4-175	A	15	3	15	6	Also this material appears misplaced to me - the paragraph should be on fire (see topical sentence p. 14 line 49), but all of a sudden migration issues in DGVMs are discussed. (Government of Switzerland)	omitted wl: R - Continuing with the topic of migration is
G-4-176	A	15	5	15	6	The modelled carbon sequestration gain from northward migration of the boreal forest are likely to be overoptimistic. Why? I was missing the explanation from here or in 4.4.5 (Government of Finland)	I agree, omitted wl: R - the explanation follows from the senetence as is;
G-4-177	A	15	13			Incorrect order of the publication year of the references (Government of Korea)	A
G-4-178	A	15	16			Incorrect order of the publication year of the references (Government of Korea)	A
G-4-179	A	15	17	15	18	This second half of this sentence implies that changes in management practices or plantation forests may (though after a long time lag) "replace" old-growth forests. I doubt that a replacement of old-growth forests (even only in terms of C-sequestration) will ever be possible. (Government of Switzerland)	rephrased wl: A - the wording does not imply that old-growth forests (ie forests containing old trees) have the

G-4-180	A	15	23			Incorrect order of the publication year of the references (Government of Korea)	A
G-4-181	A	15	30	15	31	This is a surprising use of the acronym "NEP" - to the best of my knowledge, Net Ecosystem Exchange (NEE) is synonymous with "Net Ecosystem Productivity" (NEP), and this refers to the instantaneous flux between the biosphere and the atmosphere. Over larger spatial and temporal scales, including mortality events, one usually talks about "Net Biosphere Productivity" (NBP) (see definitions by the IGBP). I think it is highly confusing to use a term "Net Ecosphere Productivity", whose meaning is not clear - is this synonymous with NEE or with NBP?? (Government of Switzerland)	Glossary, changed to NBP and explained
G-4-182	A	15	31	15	32	"The rate of increase of NEP slows around 2030 as CO2 fertilization itself saturates". There is no reference or explanation to what this CO2" saturation is based on. (Government of Finland)	see the cited paper wl: R - CO2 fertilisation saturation with increasing CO2 concentration follows directly from the physiology of CO2 fertilisation and is well-established
G-4-183	A	15	38	15	38	Comment: use subscript in word CO2 for number 2 (Government of Finland)	A - done
G-4-184	A	15	41	15	44	The possible impacts of a change in the biosphere needs to be highlighted and explained more clearly and should be tied into the discussion of observed changes to biogeochemical processes that is presented in Chapter 7 of the Working Group 1 report. The authors should place more prominence on the finding that deforestation could provide an additional release of CO2 into the atmosphere, adding between 29-129ppm to the atmosphere by 2100. This finding should be clearly articulated in the Executive Summary. (Government of Australia)	A - This is indeed a very important point and we made first efforts to coordinate with WGI Ch7 and properly describe those effects. However, to state this in the ES or in the SPM is impossible, because relatively detailed given the space limitations.
G-4-185	A	15	52	16	2	Comment: awkward sentence, rewrite (Government of Finland)	A - done
G-4-186	A	16	25			Figure 4.2: How to interpret the figure could be better described (Government of Finland)	A - done - we removed explanatory text from the figure caption, enhanced it and inserted it into the text
G-4-187	A	16	25			Comment: Figure 4.2 point year 2030 somehow in the figure (perhaps inside the line figure itself could be text "year 2030" and arrow indicating it), replace figure either on the top or bottom of page (Government of Finland)	R - We do not want to give an overly precise impression, since the turn-around point is associated with considerable uncertainties. However, the new, updated figure is updated.
G-4-188	A	16	36	16	36	Comment: in figure text use subscript in word CO2 for number 2 (Government of Finland)	A -done
G-4-189	A	17	0	40		Comment: represent different biome or ecosystem types' characteristics as well as their goods and services information briefly in some sort of summary table, it might clarify and shorten the text (Government of Finland)	R - We had this some sort of summary table and it was critized by many reviewers and used up lots of scarce space. A strength of the TAR was to describe comrehensively goods and services of ecosytems and we therefore only briefly summarise them in this chapter again where relevant.
G-4-190	A	17	6			add "in coccolithophores" after reduced calcification	R - This is not really restricted to coccolithophores

						(Government of Finland)	alone
G-4-191	A	17	9	17	14	harmonise the content of this subpara throughout chapters 4.4.2-4.4.10 (for instance in 4.4.2 area is not included but in other chapters it is). (Government of Germany)	A - we have attempted to do so as far as possible.
G-4-192	A	17	11	17	11	Comment: explain N20 (Government of Finland)	R - We do not believe this is really needed given the IPCC context and that N2O is a Kyoto-Protocol gas
G-4-193	A	17	18	17	18	I was missing the approximate cover area of deserts -compare to e.g. Grasslands and savanna chapter (Government of Finland)	To avoid repetition table 4.1 was referenced. But its now inserted
G-4-194	A	17	46	17	49	Sentence "In the Chihuhuan deserts…" Malcolm et al 2006, same information is repeated in the key vulnerabilities, avoid repetition (Government of Finland)	Repetition removed
G-4-195	A	18	10	18	10	Comment: add semicolon and space between words "scenarios" and "Currie" (Government of Finland)	Done
G-4-196	A	18	15			Incorrect order of the publication year of the references (Government of Korea)	Fixed
G-4-197	A	18	27	18	30	Sentence redundant to page 17, line 46 to 49 (Government of Switzerland)	Fixed
G-4-198	A	18	27			Incorrect order of the publication year of the references (Government of Korea)	Fixed
G-4-199	A	18	31	18	31	Comment: delete letter t after word 2050 (Government of Finland)	Done
G-4-200	A	18	42	18	42	Comment: Box 4.3 remove 'from word 6 000 (Government of Finland)	Done
G-4-201	A	18		19		Box 4.3: We disagree with the statements about the Sahelian Zone and the impressions that serious drought continues there without qualification. The statement below, supported and drawn from the papers below, have found recent precipitation and primary production trends to the contrary. We feel it is dangerous to state unequivocal statements about on-going drought in the Sahel when there are recently published papers to the contrary. The statements about rain use efficiency attributed to Hein and Ridder (2006—not 2007) are only based upon 1 site in the Sahel Zone and are contradicted by the Prince et al. (1998) paper below. Examination of Sahelian rainfall and primary production time series from 1981 to 2005 reveals two periods; (a) 1981–1993 marked by below average NDVI and persistence of drought with a signature large-scale drought during the 1982–1985 period; and (b) 1994–2005, marked by a trend towards 'wetter' conditions with region-wide above normal NDVI conditions with maxima in 1994 and 1999. These patterns agree with recent region-wide trends in Sahel rainfall. However taken in the context of long-term Sahelian climate history, these conditions are still far below the wetter conditions that prevailed in the region from 1930 to 1965. These recent patterns can be considered as a gradual recovery from extreme drought conditions that peaked during the 1983–1984 period (Anyamba et al. 2005, Hermann et al. 2005, Nicholson 2005, and Olsson et al. 2004).	The view has now been reflected in the Box - taking care to incoporate other findings too i.e. need for caution in the recovery theory

						References: Anyamba, A. and Tucker, C.J., 2005. Analysis of Sahelian vegetation dynamics using NOAA-AVHRR NDVI data from 1981–2003. J. Arid Environment 63:596-614. Herrmann, S. M., Anyamba, A., and Tucker, C.J., 2005. Recent Trends in Vegetation Dynamics in the African Sahel and their Relationship to Climate. Global Environmental Change 15:394-404. Nicholson, S. 2005. On the question of the ‘‘recovery’’ of the rains in the West African Sahel. J. Arid Environments 63:615–641. Olsson, L., Eklundh, L. and Ardoe, J. (2005) A recent greening of the Sahel – trends, patterns and potential causes. Journal of Arid Environments 63:556-566. Prince, S. D., Brown de Colstoun, E. and Kravitz, L.L. (1998) Evidence from rain-use efficiencies does not indicate extensive Sahelian desertification. Global Change Biology 4, 359-374. (Government of USA)	
G-4-202	A	18				Box 4.3. The very important role of people should be stressed (overgrazing) in description of Sahel. (Government of Poland)	This is a chapt 9 - Africa part of the box. In this chapter the focus is on ecosystem response to climate variability as an anlog for future climate change impacts in arid regions in the tropics likely
G-4-203	A	19	36	19	36	Comment: Start sentence: e.g. " Wetter periods and also increase in temperature..", now the sentence is awkward (Government of Finland)	Done
G-4-204	A	19	41	19	41	Comment: replace word "current" with "currently" (Government of Finland)	Done
G-4-205	A	19	42	19	42	Comment: …" to maintain deserts as they are…" ? (Government of Finland)	Clearified
G-4-206	A	19	49	19	49	Comment: use commas ", i.e., through dust loads,", it clarifies text (Government of Finland)	Done
G-4-207	A	19	49	19	49	Comment: delete "ecosystem degradation" and use term desertification instead, i.e. Rewrite "the effect of desertification" (Government of Finland)	Done
G-4-208	A	19	52	19	52	Comment: prevention of land degradation might be cheaper than soil restoration? I am pretty sure that it is cheaper and probably soil restoration is at best difficult if not imbossible in arid areas? Delete this sentence. (Government of Finland)	Done
G-4-209	A	20	2	20	3	Comment: Sentence "Community participation… (Duraiappah et al. 2005)" is awkward and too long, reformulate better. Line 3: e.g. with small letter (Government of Finland)	Done
G-4-210	A	20	24			Incorrect order of the publication year of the references (Government of Korea)	agree
G-4-211	A	21	3	21	4	Specify in in which way Oklahoma grassland depends on intra and interseasonal rainfall change. (Government of Germany)	text deleted

G-4-212	A	21	3	21	3	Comment: correct: intra- (Government of Finland)	text deleted
G-4-213	A	21	8	21	14	The meaning of the acronyms "MAP" and "MAR" must be explained, and if possible only one of them should be used, as I assume they mean the same, namely mean annual rainfall/precipitation. (Government of Switzerland)	agree - glossary
G-4-214	A	21	8	21	8	Comment: explain abbreviation MAP here (Government of Finland)	agree - glossary
G-4-215	A	21	14	21	14	Comment: explain abbreviation MAR here (Government of Finland)	agree - glossary
G-4-216	A	21	27	21	27	when does woody vegetation start to show positive carbon sequestration? After 0.1° warming? (Government of Germany)	text now focuses on vegetation shifts, not carbon sequestration
G-4-217	A	21	41	21	41	Comment: delete word field, unnecessary (Government of Finland)	agree - done
G-4-218	A	22	0			Comment: "CO2 effects on litter decomposition are minor", however, does the quality and quantity (litter inputs in grasslands) alter? Is it possible that through increased litter inputs and quality changes there might be effects on nutrient cycling on long term? VAM responses to elevated CO2 have been studied and there could be included some sort of information about them; mycorrhizas are essential in C and nutrient cycling in grassland ecosystems (does the species composition in fungal symbionts change and if it does, does it affect the host plant success)? (Government of Finland)	This is a high level of detail, but studies suggest these effects were more important at below-ambient CO2 (e.g. Gill 2002, Nature 417, 279-282
G-4-219	A	22	3	22	5	Comment: the first sentence in paragraph is awkward and unclear, rephase it (Government of Finland)	agree- done
G-4-220	A	22	4	22	5	The phrase "but increases of 54% in net fixation expected CO2 doubles" is mysterious to me - first, it appears to contradict most experimental findings, which yielded LOWER values; and second, its grammar is strange and should be improved to clarify the meaning. (Government of Switzerland)	agree - text reworded
G-4-221	A	22	15	22	15	This statement may be a gross exaggeration - while I appreciate William Bond's research very much, I would be hesitant to cite the result from his work as a general consensus statement. The political relevance of such results could be tremendous and may lead to fairly bad conclusions ("we should do fire suppression worldwide to suck up all the carbon that we are emitting"). On a scientific level, I think that Bond's findings define the absolute maximum possible values under extreme assumptions, and are unlikely to be backed by other studies in their magnitude. (Government of Switzerland)	agree - text revised to reflect this concern
G-4-222	A	22	18	22	20	I am not sure we can state this as a general finding; what is implied here is that growth of grasses is stimulated less by enhanced CO2 than growth of tree regeneration. In addition, I do not know what the phrase "in grass fires" at the end of the sentence means - trees do not grow "in grass fires", they typically grow in the first half to two thirds of the growing season. (Government of Switzerland)	References cited that back the statement (Ainsworth et al), and sentecnes reworded
G-4-223	A	22	30	22	30	Comment: delete sentence "Field experiments… vegetation response", it is unnecessary repetition, and start the paragraph with the second sentence. (Government of Finland)	agree- done
G-4-224	A	23	1	23	1	This is a meaningless sentence that should be removed or replaced by real contents. At the very least, the specific chapter(s) would need to be indicated here.	agree- done

						(Government of Switzerland)	
G-4-225	A	23	1	23	1	The sub-section on Adaptation costs should be either populated or deleted. (Government of Australia)	agree- moved to section 4.6
G-4-226	A	23	13	23	24	These sub-section (here and elsewhere) are problematic for two reasons, I think. First, why do they exclusively focus on changes in temperature? The rationale for this would need to be explained somewhere, I think. Second, these statements are not really a summary, but new material is presented here, so the title is quite misleading. I found these sections so awkward that I would omit them (similar but shorter remarks follow in the other instances where such "summaries of T changes" are mentioned). (Government of Switzerland)	agree - now in text or table 4.2
G-4-227	A	23	38			Add the following goods and services very important for mediterranean regions: medicinal herbs, spices, tourism (Government of Switzerland)	agree - added
G-4-228	A	24	1			Incorrect order of the publication year of the references (Government of Korea)	agree
G-4-229	A	24	2	24	2	Comment: explain GMT abbreviation (Government of Finland)	agree - now "a global mean warming"
G-4-230	A	24	9	24	9	The citation "Group 2005" is incorrect, it should read "Allen Consulting Group, 2005". (Government of Australia)	agree- corrected
G-4-231	A	24	11	24	11	Does the climate change impact e.g. different vegetation cover interact with the fire regime shifts or is it climate change itself, e.g. higher temperatures? (Government of Germany)	Text revised
G-4-232	A	24	13	24	13	What are "fire escapes" as opposed to "fire risk" (mentioned on the next line)? (Government of Switzerland)	Individual events vs an overall state
G-4-233	A	24	39	24	41	Comment: "Ecosystem carbon storage may increase due to reductions in litter decomposition"… In fact, there are relatively few CO2-litter decomposition studies that show clear and consistent CO2-induced reductions in litter decomposition. Secondly, there are no long-term field incubation studies at the moment, so basically more information is needed and it should be stated here. In addition, majority of studies have concentrated on studying the early litter decomposition dynamics; more information about CO2 effects on latter stages still needs to be obtained. I also believe that there is more recent information about Mediterranean plant species than this De Angelis et al. 2000 paper, which could be used here as a reference (for instance FACE experiments in Italy; Cotrufo et al. 2005 et cetera?). in other words, there is no support for the hypothesis that CO2 enrichment would increase ecosystem carbon storage via decreased litter decomposition rates. (Government of Finland)	agree - we now cite de Graaf (2006) global change biology

G-4-234	A	25	0	29		Comment: forests or trees can themselves also affect regional climate by releasing VOC's. There could be some sort of mentioning this also in this section. In addition, tree genotype/species can influence its response to CO2 clearly (direction and magnitude of response may vary within and between the species quite a lot); which means that maintaining biodiversity may be a good adaptation method. Tree species and genotype also affects the magnitude of soil CO2 efflux clearly which is an essential part of C cycle (see King et al. 2004) (Ki132, Ki133, Ki126???) most likely to me seems Ki133. If the species composition in forests changes due to increasing CO2, would this also lead changes in C cycling? This is an issue which could be discussed here. There is also information about tree litter decomposition and CO2 effects on it (several reviews and FACE experiments) and it may be included here. How about tree root symbionts (ectomycorrhizas) which are large C sink in forests and of which without trees would not grow (CO2 effects on them have been studied, but there is no mentioning of them here)? (Government of Finland)	disagree - this is more a WG1 issue, chapter 7
G-4-235	A	25	19	25	19	Ill-worded sentence: Warming and drying do not threaten range reductions, but they are likely to induce such reductions. Please re-word accordingly. (Government of Switzerland)	agree- reworded
G-4-236	A	25	24	25	24	Replace "be realized" by "result" (awkward wording). (Government of Switzerland)	agree - reworded
G-4-237	A	25	26	25	34	Again, I have great difficulty with this focus on temperature change alone, and on calling this a "summary" which it isn't (see my longer comment on p. 23 lines 13ff.) (Government of Switzerland)	agree - key messages captured into table 4.2 and body of text
G-4-238	A	25	33	25	33	The citation "Group 2005" is incorrect, it should read "Allen Consulting Group, 2005". (Government of Australia)	agree- corrected
G-4-239	A	25	36	25	39	Omit if there are no real contents here. (Government of Switzerland)	agree - removed to section 4.6
G-4-240	A	25	36	25	36	insert such a subchapter in 4.4.2 and 4.4.3 too. however this very subchapter is not clear about policy implications (Government of Germany)	agree - removed to 4.6
G-4-241	A	25	44	25	44	Ill-defined phrase "densely treed canopy". Would one seriously talk about "untreed canopies"? Perhaps use "dense tree canopy" instead; or even better, make clear which forest definition is being used, as the numbers may differ strongly depending on the definition. (Government of Switzerland)	A
G-4-242	A	25	46	25	48	Disagree with statement in line 48, it is not the high productivity which makes forest attractive for agricultural use, it is the land itself which is needed for agricultural production. (Government of Germany)	R - Bad land is rarely of interest for agriculture. Similarly a natural grassland where water is a limiting factor vs. forested land, the forested land is preferred due to its higher productivity. Of course all this is to be understood within geographical constraints of accessibility etc.
G-4-243	A	25	50	25	50	Comment: use subscript in word CO2 for number 2 (Government of Finland)	A

G-4-244	A	25	51	26	2	In Scandinavian conditions an important share of the organic material is in soil as peat. In Finnish conditions, nearly 8-10 times more organic material is bound in soils as than in forests (Laine etc.). The man-made changed organic soil areas (ditched) can be used for other purposes (the peat resources as fuel) and at the same time the emissions from land use can be diminished. (Government of Finland)	A - It is not clear why the reviewer makes these statements. We guess that the meaning of our statements were not clear enough, text improved.
G-4-245	A	26	1	26	1	Comment: correct 1640 (Government of Finland)	A
G-4-246	A	26	5	26	5	Add after "livelihoods,": "many of which are non-timber forest products (NTFP)" (Government of Switzerland)	A - text improved
G-4-247	A	26	20	26	20	"Minimum climatic requirements" is an ambiguous term - what is meant here is low temperature (but not, for example, low soil moisture availability), right? If so, then this should be re-worded to something like "limited by low temperature", or so. (Government of Switzerland)	R - It is both meant, i.e. limitation by low temperature and/or lack of soil moisture
G-4-248	A	26	21	26	21	Figure 4.4 does not show "vegetation changes" that are abbreviated by "VC" - what is meant here? Please clarify this - probably "VC 1" is "Northern evergreens expanding"? (Government of Switzerland)	A
G-4-249	A	26	21	26	21	…changes (VC 1 to 3), but…. (Government of Canada)	A
G-4-250	A	26	22	26	22	"many may be impacted detrimentally, notably for stronger warming": if a comparative such as "stronger" is used, then it would be important to state relative to what – but more importantly, I think this argument has not so much to do with warming as it has to do with drying (drought being driven mainly by precipitation, and less so by temperature). Hence I'd suggest to mention drought explicitly, as it underlines most of the decline of forests shown in Fig. 4.4 ("VC 6"), I believe. (Government of Switzerland)	A
G-4-251	A	26	23		30	This list of 32 references to support one sentence does not add value to the chapter. Half of the references were prior to the publication of the TAR and, at a minimum, should be deleted. The IPCC authors should critically review and synthesize the literature, not simply list articles. (Government of USA)	A partly - Pre TAR references were listed when they are missing from the TAR, yet provided important contributions. So we do not agree to delete them merely on the basis of a principle. Moreover the page limitations given to our chapter are so tight, that we can not go into a detailed review of all the work which has been contributed since the TAR. However, we do not list these references only, but also make a synthesis (later statements refer explicitly to this list), and the statement itself is such an effort (cautiosly formulated and attempting to make a balanced summary). The remainder of the
G-4-252	A	26	25			Incorrect order of the publication year of the references (Government of Korea)	A
G-4-253	A	26	30	26	30	"Average productivity gains result...": averaged over what? Global average? Average for some vegetation types? Please clarify. (Government of Switzerland)	TR
G-4-254	A	26	31	26	31	Comment: use subscript in word CO2 for number 2 (Government of Finland)	A
G-4-255	A	26	32	26	32	…increases to compensate…	A

						(Government of Canada)	
G-4-256	A	26	33	26	34	Delete ", and precipitation increases under water limited conditions.". This has been stated just before. (Government of Switzerland)	
G-4-257	A	26	41	26	41	I fully agree that climate variability is at least as important as average climate - a reference that could be used here to support this point is Bugmann & Pfister (2000), Reg Env Change 1. (Government of Switzerland)	A
G-4-258	A	26	43	26	44	I do not follow - yes precip is distributed in a highly uneven manner across the globe; what does this have to do with uncertainty about future precipitation? The logic is not clear here, I think, and should be made more explicit. (Government of Switzerland)	A
G-4-259	A	26	45	26	46	I do not follow - yes the upper bound for precipitation is of less concern than the lower bound, but what does the phrase "since extreme persistent flooding alone results in tree mortality"? The relationship between the two parts of the sentence is not clear - why is this "since" (= "because")? What has "alone" to do in this sentence? That this is the SINGLE cause of tree mortality??? Please re-word to clarify the meaning of this sentence. (Government of Switzerland)	A reworded
G-4-260	A	27	1	27	1	…net forest carbon exchange… (Government of Canada)	A
G-4-261	A	27	10	27	10	I agree that soil fertility encompasses many things, including high water holding capacity, a deep rooting zone, etc.; however, when reading the sentence for the first time, I equated "fertile" with "nutrient-rich", and then the sentence is nonsensical. To avoid such confusion, I would suggest to replace "fertile soils" by "soils with a high capacity to store plant-available water" ("water holding capacity" wouldn't be appropriate either, unfortunately). (Government of Switzerland)	R - The words were on purpose chosen this way, since fertile includes in our understanding not only "soils with a high capacity to store plant-available water" but also nutrient-rich soils, and soil structure supporting plant growth etc. etc. We need to be succinct due to the page limitations and try to avoid having to list all these aspects
G-4-262	A	27	10			"… impacts can be offset by fertile soils". That is correct, but in temperate and industrialized regions this is often not the case, due to acidification induced nutrient losses. In the context "forests and CO2" the book "Carbon forms and functions in forest soils" from McFee and Kelly is missing. There are interesting overview papers on the interactions of carbon and other element cycles. (Government of Germany)	R - Then the soils are no longer that fertile and therefore the compensation does not take place to the same extend.
G-4-263	A	27	17			Add that poor sanitary conditions of forests caused e.g. by accumulation of fell trees caused by strong wind stimulates outbreak of pests. That ties pests outbreaks with climate change (increased frequency of strong wind appearance). (Government of Poland)	R - This idea exists, but is heavily debated, since there is only convincing evidence avaiable for special cases
G-4-264	A	27	23	27	23	"stronger": relative to what? Perhaps better: "likely to become a major factor"? (Government of Switzerland)	A
G-4-265	A	27	23			Incorrect order of the publication year of the references (Government of Korea)	A
G-4-266	A	27	24	27	24	Replace "cold temperature" by "low temperature" - temperature is neither cold nor hot. (Government of Switzerland)	A
G-4-267	A	27	26	27	26	Replace "will" by "could" (or "are likely to", or something else that does NOT imply certainty). (Government of Switzerland)	A

G-4-268	A	27	28	27	28	I suggest to add the following to highlight the interaction with biodiversity, which itself is also vulnerable to climate change; after "manner,": "and also by the diversity of tree species within a forest (Jactel et al. 2005)," Reference : Jactel, H., Brockerhoff, E., & Duelli, P. (2005). A test of the biodiversity-stability theory: meta-analysis of tree species diversity effects on insect pest infestations, and re-examination of responsible factors. In Forest diversity and function: Temperate and boreal systems (eds M. Scherer-Lorenzen, C. Körner & E.-D. Schulze), Vol. 176, pp. 235-262. Springer, Berlin, Heidelberg, New York. (Government of Switzerland)	A partly, but sentence would become very long, yet text improved to capture the reviewer's intent
G-4-269	A	27	31	27	32	Start a new sentence at the beginning of line 31, as this is NOT a contradiction ("whereas") to the preceeding material. Start this sentence by "For diseases, some findings...". The current wording of lines 26-32 implies that uncertainties are high when it comes to insects, but that the case is fairly clear with regard to diseases! (Government of Switzerland)	A
G-4-270	A	27	32			Incorrect order of the publication year of the references (Government of Korea)	A
G-4-271	A	27	35			Incorrect order of the publication year of the references (Government of Korea)	A
G-4-272	A	27	39	27	39	"and" is inappropriate to join the two parts of the sentence. I would suggest to use a semi-colon (;) after the reference, and then to continute with "for example, for southern Finland...". (Government of Switzerland)	A - full stop, not semicolon
G-4-273	A	27	43			Incorrect order of the publication year of the references (Government of Korea)	A
G-4-274	A	27	46	27	46	Delete "in" just in before "El Nino". (Government of Switzerland)	A
G-4-275	A	27	48	27	48	Another example for changing fire regimes is the case of the central European Alps (mainly Switzerland), where wildfires so far have not been a prominent disturbance agent except under special conditions, but they may become much more widespread under climatic change. The brand-new paper by Schumacher & Bugmann (2006), GCB 12:1435-1450 suggests this, and the reference could be cited here as a complement to the studies from already fire-prone regions that are in the current text. (Government of Switzerland)	A
G-4-276	A	27	49	27	52	This sentence refers to fire effects on tundra not forest. Perhaps it should be move to the tundra section (Government of Canada)	TR
G-4-277	A	27	49			Incorrect order of the publication year of the references (Government of Korea)	A
G-4-278	A	28	4			Incorrect order of the publication year of the references (Government of Korea)	A
G-4-279	A	28	11	28	12	Here, and in many other instances, things are explained in parentheses, and then without any delimiter a reference is added. This is hindering the flow of reading; separate the reference(s) in parentheses by a semicolon or at least a comma from the other text. (Government of Switzerland)	A

G-4-280	A	28	20	28	20	The reference to Kurz and Apps 1999 to support that boreal forest has been lost at the southern boundary is incorrect. While fires have been more frequent in this zone, the paper does not support the statement that boreal forest has been converted to some other vegetation type. The authors state pg 544 that land use change does not appear to be a significant factor for the Canadian forest land base over the 70yrs of the retrospective study. (Government of Canada)	TR
G-4-281	A	28	22			Incorrect order of the publication year of the references (Government of Korea)	A
G-4-282	A	28	32			Incorrect order of the publication year of the references (Government of Korea)	R -This would distort the relation between the estimates given and the references
G-4-283	A	28	36	28	36	Replace "…due to intensified, agricultural management and climate change" with "…due to intensified silviculture management and climate change…" (Government of Canada)	R - The reason being that agricultural land is abandoned and afforested, which is made possible thanks to intensified agricultural management.
G-4-284	A	28	38	28	38	Yes land use changes may dominate impacts in some areas and over some time horizon; but with the generality that the statement has here, I doubt that it is universally true. Re-write to something like "Although land-use changes may dominate impacts in some areas, particularly for the first half of the 21st century, ..." (Government of Switzerland)	A
G-4-285	A	28	40			Incorrect order of the publication year of the references (Government of Korea)	A
G-4-286	A	28	45			Incorrect order of the publication year of the references (Government of Korea)	A
G-4-287	A	29	0	32		Comment: in addition to warming, especially polar areas are subjected to increasing UV-B radiation. Some sort of brief mentioning could be made how climate warming together with increasing UV-B may affect tundra and arctic ecosystems (plants, mire or bog ecosystems, productivity, methane emissions). (Government of Finland)	{Johnson, 2002, Jo44; Zepp, 2003, Ze24; Callaghan, 2004, Ca112} ???
G-4-288	A	29	5	29	8	As in earlier instances, I doubt the usefulness of this "summary", which focuses on temperature alone. (Government of Switzerland)	TR - The intention was not to summarize anything for the subsection, but to distill material to be used
G-4-289	A	29	15		19	Suggest clarifying the sentence to ensure readers aren't led to believe that polar bears live in the Antarctic. For example, insert "the Arctic's" just before "polar bears" (Government of USA)	Accepted
G-4-290	A	29	17	29	19	This statement is ill-worded. The relative clause (", which...") refrs to the southern ocean and the sub-antarctic islands, and therefore it should not contain a reference to polar bears, which occur only in the Arctic. Please re-word. (Government of Switzerland)	Same as G-4-289
G-4-291	A	29	21	29	25	what about the impact of enhanced C sequestration through expanding forests or woodlands on GHG balance, which arre counterbalancing CH4 emissions? (Government of Germany)	This is one of the possible components in the 'changes in the greenhouse balance', so there is no contradiction.
G-4-292	A	29	21	29	21	If, as defined on line 13, "Tundra" means everything north of the boreal forest (which may be a questionable definition to begin with, but perhaps it is no drama), then one should mention "Tundra ecosystems" on line 21, rather than "Arctic ecosystems. Alternative: Write "Tundra and arctic ecosystems" on line 21.	Accepted

						(Government of Switzerland)	
G-4-293	A	29	26		27	For clarity, suggest rewriting as “harbors unique species that contribute to global biodiversity and thet are important as renewable….” (Government of USA)	Accepted
G-4-294	A	29	27	29	27	Replace "are" by "is" (grammar error). (Government of Switzerland)	Corrected
G-4-295	A	29	29		31	Suggest rewriting as “all forming part of a unique body of knowledge traditionally transmitted from generation to generation.” (Government of USA)	Accepted
G-4-296	A	29	32	29	34	This point is more compex. It is true that the dry habitats in tundra are potential sources of CO2, even in the present climatic conditions (see Heikkinen J.E.P., Virtanen T., Huttunen J.T., Elsakov V. and Martikainen P.J. 2004. Carbon balance of East European tundra. Global Biogeochemical Cycles 18. 10.1029/2003GB002054, 2004). However, a key question is would the dry surfaces, if collapsed with warming, create fen type habitats (wet surfaces) which in contrast to the dry habitats are net sinks for CO2, but sources for CH4. (Government of Finland)	Accepted
G-4-297	A	29	32	29	32	Arctic and subarctic ecosystems are more than bogs! Therefore, phrase the parenthesis as "(particularly ombrotrophic bog communities)". (Government of Switzerland)	Accepted
G-4-298	A	29	42	29	45	This sentence is mysterious to me. It appears that the term "edificator" is common in the Russian scientific literature only, so it would need a better explanation than the one given here (note that the term is also used on line 47. What is the difference between novel thermal autonomous adaptation" and non-autonomous (?) adaptation? Why is it "novel"? What is a "current local zonal distribution"? (Government of Switzerland)	Accepted, corrections are made in the text
G-4-299	A	29	42			Incorrect order of the publication year of the references (Government of Korea)	A
G-4-300	A	29	45	29	45	Replace "rates of change" by "rates of climate change". (Government of Switzerland)	Accepted
G-4-301	A	29	51	30	7	What is the role of this example? The focus on Marion island would need to be explained, and the general conclusions arising from this example would need to be brought out better. (Government of Switzerland)	This example was aimed to introduce some data from the Southern hemisphere.
G-4-302	A	29				Chapter 4.4.6 about Tundra and arctic ecosystems should include something about the combined effects of climate and pollution (or effects of changing climate on pollution: release with melting ice and more precipitation (cf. i.e ACIA report and chapter 15 in the present report)). There should be a clearer reference to chapter 15 - stating that more information can be found in that chapter. (Government of Norway)	This subject should probably be considered in Chapter 15. ???
G-4-303	A	30	5		5	Biota can be “introduced” in ways having nothing to do with climate changes. Would “migrant biota” be a better phrase? Revise to clarify the nature of “introduced” biota. Species introduced by climate change? By man? (Government of USA)	Accepted

G-4-304	A	30	11	30	14	It is not really true that BIOME4 and similar models are operating on the "biome level" - they are based on Plant Functional Types, which admittedly are NOT species, but they are not biomes, either. This sentence would need to be re-phrased to take this into account. The days of modeling biomes directly are over since about 20 years now! (Government of Switzerland)	Accepted, corrected
G-4-305	A	30	19			Incorrect order of the publication year of the references (Government of Korea)	A
G-4-306	A	30	23			Incorrect order of the publication year of the references (Government of Korea)	A
G-4-307	A	30	27	30	30	How the "lateral shift of the mineral matrix" is slowing decomposition? Please explain (root or leave litter?) (Government of Finland)	Corrections are made in the text
G-4-308	A	30	27		30	These two sentences are not well written. There are too many thoughts coupled together in unclear ways. (Government of USA)	Same as G-4-307
G-4-309	A	30	30	30	30	Drought stress is known to increase the growth of aphid populations due to highly concentrated phloem sap. Therefore new pest problems may arise. Aphids are also important vectors of plant diseases. That should be noted. (Government of Finland)	This subject may be considered in Chapter 15
G-4-310	A	30	34		34	What is an “icing rise event”? Can this be described in different words? (Government of USA)	Accepted, corrected
G-4-311	A	30	35		36	Incorrect order of the publication year of the references (Government of Korea)	A
G-4-312	A	30	35		35	“reduce abundance” of what? (Government of USA)	Corrected
G-4-313	A	30	39	30	42	This sentence on invasive weeds would more properly fit at line 20 after the discussion of vegetation changes, rather than its current location in the middle of a discussion of animals. (Government of Australia)	This item concerns not plant but animal 'weeds'
G-4-314	A	31	15		34	Recent studies in Alaska (Steve Amstrup and others) indicate that the number of cubs has increased but the survival of cubs has decreased during the period that sea ice declined precipitously. (Government of USA)	Interesting
G-4-315	A	31	28	31	28	Comment: Box 4.4. correct: "to the.." (Government of Finland)	corrected
G-4-316	A	31	28	31	28	change "tot he" into "to the" (Government of Switzerland)	corrected
G-4-317	A	31	39	31	39	The point is not so much that conifers would be darker than tundra vegetation, but that they are taller and thus are covered by snow for much less time in winter than tundra vegetation, which is the major albedo effect. Hence, replace "darker" by "taller". (Government of Switzerland)	The Russian term 'dark coniferous' trees includes such species as spruce, fir and Siberian pine, and has no English equivalent. We dropped it in the text to avoid misunderstanding
G-4-318	A	31	49	31	50	The characterisation of increases in methane emissions as "dramatic" needs to be explained. The authors should provide figures for the projected increase in methane figures. (Government of Australia)	Accepted, corrected

G-4-319	A	32	6	32	6	migratory species are also native in their tundra habitat if they always have been there during the summer; "non-native" implies that these species originally haven't been there and came from other places. (Government of Switzerland)	Accepted, corrected
G-4-320	A	32	7	32	7	Replace "migratory species" by "migratory birds" (avoid having twice the same noun in one sentence). (Government of Switzerland)	Accepted, corrected
G-4-321	A	32	10	32	12	Again, I have great difficulty with this focus on temperature change alone, and on calling this a "summary" which it isn't (see my longer comment on p. 23 lines 13ff.) (Government of Switzerland)	This comment refers to comment G-4-226A. This text was never planned to be a 'summary' and was always planned to be dropped in the sense that it is incorporated into Table 4.2.
G-4-322	A	32	12	32	12	clarify bullet point, is it above 4°C average temperatrue change? (Government of Germany)	These values are global changes to make the sensitivity assessment comparable. See also G-4-321
G-4-323	A	32	14		18	As described earlier, residents of the Arctic are 10% indigenous and 90% more recent immigrants. Why are there no policy or sustainable development issues for the 90% of the population? (Government of USA)	This subject is specially addressed in the Chapters on sociological aspects (Work Group 3)
G-4-324	A	32	23	32	23	Replace the parenthesis by "(ca. 20-24% of all land) - depending on how one counts, one arrives at a number of up to 24.3% (Kapos et al., 2000). (Ka130???) (Government of Switzerland)	done
G-4-325	A	32	28	32	33	What is completely forgotten here is C storage. Mountains harbor a disproportionately large fraction of the world's forests (28%, with a land area of only 24%). In addition, many mountain forests are under a less intensive management regime than lowland forests (because of accessibility problems) and thus they tend to have larger C stores than lowland forests. Hence, mountain forests are of particular relevance also for the global C cycle. (Government of Switzerland)	inserted a sentence to this effect before the last sentence of this paragraph
G-4-326	A	32	30		32	Whishful reasoning. (Government of Poland)	I do not follow. To better qualify this statement, I decided to add two examples.
G-4-327	A	32	31	32	32	Comment: correct protection (Government of Finland)	done
G-4-328	A	32	31	32	31	change "protec.tion" into "protection" (Government of Switzerland)	done
G-4-329	A	32	33	32	33	add behind "due to" " their spectacular landscape and " (Government of Germany)	done
G-4-330	A	32	37	32	37	Replace "dominated" by "overriden"? (Government of Switzerland)	done
G-4-331	A	32	44	32	44	Comment: change"to find climatic conditions in tomorrow's climate which are similar to today" to "in order to survive (Government of Finland)	replaced by "will have to migrate upward in order to survive"
G-4-332	A	32	48	32	48	Comment: phrase genetically deteriorate species" is awkward; you mean reduce genetic diversity within species? (Government of Finland)	replaced by "lead to reduced genetic diversity within species"
G-4-333	A	33	1			Incorrect order of the publication year of the references (Government of Korea)	corrected

G-4-334	A	33	9	33	14	As climatic zones are established on vegetation distribution, it is surprising that the "treelines are controlled by carbon balance" as it is stated. Please explain, how treelines are controlled by that (Government of Germany)	changed the wording of the sentence to clarify that the carbon balance hypothesis is considered to be a bit outdated, and that the vurrent view focuses on growth limitation by low temperatures
G-4-335	A	33	11	33	11	Correction: "surprisingly" is spelled incorectly (Government of Canada)	corrected
G-4-336	A	33	11	33	11	Comment: correct misspelling; surprisingly (Government of Finland)	corrected
G-4-337	A	33	13	33	14	The number of 6.7 ± 1.6 °C stems from the study by Paulsen & Körner (2004), hence the other references should not be listed here if this exact number is to be cited. HOWEVER, I think that this number has been arrived at in some sort of a haphazard way (without going into the details here), and I think it would be much more appropriate to state that treeline occurs globally at a seasonal mean temperature (not ground temperature) of 6-7 °C; like this, the other references could be retained, which I would prefer. (Government of Switzerland)	changed according to the comment.
G-4-338	A	33	20			Incorrect order of the publication year of the references (Government of Korea)	corrected
G-4-339	A	33	22	33	22	Replace "suffer from" by "be subject to" - increased AET is not a problem per se, particularly not in cold climates; up to a certain degree, it is an advantage. (Government of Switzerland)	done
G-4-340	A	33	23			Incorrect order of the publication year of the references (Government of Korea)	I do not follow; 1999 is earlier than 2004.
G-4-341	A	33	25	33	25	Correction: "continental climates" instead of "continental climata" (Government of Canada)	done (although a matter of style, I suppose).
G-4-342	A	33	25	33	25	As it stands now, this statement is simply wrong. Remove "subalpine", and it is much more likely to be correct. (Government of Switzerland)	done
G-4-343	A	33	35	33	35	Correction: "patterns" instead of "patters" (Government of Canada)	done
G-4-344	A	33	36	33	37	Warming caused by increased precipitation? There is a problem here - what is the meaning of this sentence? (Government of Switzerland)	Sentence re-phrased to take this comment into account. The warming is likely to be increased by higher winter precip, which will lead to higher snow accumulation and later snowmelt at high altitudes.
G-4-345	A	33	36	33	38	check statement in line 36 "warming caused by increased precipitation", in my view it should read the other way round "increased precipitation caused by warming" (Government of Germany)	see response to G-4-344
G-4-346	A	33	42			Incorrect order of the publication year of the references (Government of Korea)	corrected
G-4-347	A	34	0	35		Comment: how about combined eutrophication and climate warming effects; are there any studies about that? Boreal peatlands can be affected by enhanced UV-B radiation also (potential effects on methane fluxes, water quality e.g. DOC in surface waters, effects on plankton)? (Government of Finland)	Appropriate reference made in the text re impacts of UVB on peatlands and water quality
G-4-348	A	34	6	34	6	Comment: delete "30% loss of birds" within the brackets (Government of Finland)	done (because all the other references are not qualified further by detail statements).

G-4-349	A	34	6			Incorrect order of the publication year of the references (Government of Korea)	corrected
G-4-350	A	34	9	34	9	I am not an expert on this, but I find it very surprising that no study on adaptation costs and opportunities should exist for mountain ecosystems. Not even for the Alps? (Government of Switzerland)	Wengen-2006 Workshop (4-6 October) is devoted to this topic and could provide some insights. Need to check.
G-4-351	A	34	17	34	20	Again, I have great difficulty with this focus on temperature change alone, and with calling this a "summary" which it isn't (see my longer comment on p. 23 lines 13ff.) (Government of Switzerland)	The LAs need to come to an agreement regarding what policy to adopt here - should these "summaries" be retained, enhanced, or omitted? I cannot take a decision from the point of view of one particular section.
G-4-352	A	34	21	34	21	I would suggest that a paragraph or two should be added on carbon storage and likely changes thereof in mountain regions. Schimel et al. (2002), EOS, or a new paper by Zierl & Bugmann (2007), Clim Change in press could be helpful here. It is interesting to note that according to these studies, carbon storage would increase somewhat until 2050, and towards 2100 a source would result - this is in line with global-scale assessments, but it is not self-evident that regional signals are similar to continental and global ones. (Government of Switzerland)	done (at the end of the "Impacts" part of 4.4.7).
G-4-353	A	34	23			Section 4.4.8: states that wetlands are considered distinct form rivers and lakes, but does not do so (Government of Finland)	This is not correct. The three major kinds of systems are discussed distinctly though not under three
G-4-354	A	34	35			The new organic material is graowing on the wetlands and it is researched (Markku Mäkilä, GTK, 2006) that 5-20% of the biomass will stratify as new peat. All the actions which can quicken the growth of new biomass on man-made areas can also diminish the emissions from organic soils. In some cases peat fuel excavation can change the thick emitting peat layers to better growing area. The positive impacts can be seen e.g. on old ditched agricultural peat fields or forests. (Government of Finland)	The increase in peat is not occurring in all peatlands; rather the excavation for fuel and oxidation of peat result in the release of CO2.
G-4-355	A	34	52	35	3	Indicate microclimatic regulation. (Government of Poland)	The comment is not clear. Wetlands and other inland water ecosystems influence microclimates
G-4-356	A	34				Chapter 4.4.8 about Wetlands, Freshwater lakes and rivers could be moved and incorporated in chapter 3. Otherwise, this chapter (4.4.8) should include more about the precipitation effects on the water systems (cf. chapter 3) - too strong focus on the temperature effects, very vague on the precipitation effects. (Government of Norway)	The chapter is in accordance with the IPCC Plenary decision. As far as precipitation effecxts are concerned, these have been addressed as hydrological regimes.
G-4-357	A	35	5	35	27	as in chapter 1, a short description about increases in dissolved organic carbon should be given. In addition, at this point, the reader should get a hint to chapter 1 where additional impacts on water quality are given (Government of Sweden)	appropriate change is made
G-4-358	A	35	13	35	13	Comment: replace word "nuisance" with "harmful" or "toxic" (Government of Finland)	agreed
G-4-359	A	35	15	35	15	Add after Schindler, 2004) with consequent changes in water chemical conditions (Weyhenmeyer, 2004) Full reference: Weyhenmeyer, G. A. 2004. Synchrony in relationships between the North Atlantic Oscillation and water chemistry among Sweden’s largest lakes. Limnol. Oceanogr. 49: 1191-1201. (Government of Sweden)	reference added

G-4-360	A	35	23			Incorrect order of the publication year of the references (Government of Korea)	corrected
G-4-361	A	35	26			Incorrect order of the publication year of the references (Government of Korea)	corrected
G-4-362	A	35	32			Incorrect order of the publication year of the references (Government of Korea)	corrected
G-4-363	A	35	33	35	33	Comment: replace phrase "in dryland wetlands" with "in non-coastal wetlands" (Government of Finland)	dryland refers to the arid and semiarid regions of the world and has been correctly used.
G-4-364	A	35	34	35	34	Riparian ecosystems, known to be resilient to natural flow regimes, are highly vulnerable to changes in temperature and environmental variability above existing regional thresholds. I suggest to add after "(Bauder 2005)": "Changes in climate and in land use will place additional pressures on already stressed riparian ecosystems along many rivers in the world (Naiman et al., 2005)". (Government of France)	reference added appropriately.
G-4-365	A	35	38		42	Clarify meaning. (Government of Poland)	The comment is not understood. We do not have enough page space to elaborate this para.
G-4-366	A	35	49	35	51	Add after the first sentence of the paragraph after "temperature change, with the exception of physical data such as data on the timing of lake ice breakup. Here an increase in annual mean air temperatures of 1°C revealed an up to 35 days earlier ice breakup in the warmest southern part of Sweden but only an about 4 days earlier ice breakup in the colder northern part of Sweden due to a nonlinear relationship between air temperature and ice breakup dates (Weyhenmeyer et al. 2004). another example is a 2-3 °C temperature rise that can increase the DOC release by up to 700 %. Full reference: Weyhenmeyer, G. A., M. Meili and D. M. Livingstone. 2004. Nonlinear temperature response of lake ice breakup. Geophysical Research Letters 31: L07203, doi: 10.1029/2004GL019530. (Government of Sweden)	Reference added approriately
G-4-367	A	35	49		51	Many other functions like e.g. evaporation, control of diffuse pollution etc. are neglected. (Government of Poland)	The comments are not related to this para. The wetland function of controlling diffuse pollution is added suitably on page 34.
G-4-368	A	36	1		7	Authors neglect important information (See for example Gleick P.H. 2003: Global freshwater resources: soft-path solution for the 21st Centure, Science 302: 1524-1528, or WMO 1997. Comprehensive assessment of the freshwater resources in the world. World Meteorological organization, Geneva: 33 pp.; Kedziora A., Olejnik J. 2002. Water balance in agricultural landscape and options for its management by change in plant cover structure of landscape. In: Landscape ecology in ecosystem management. Ed. L. Ryszkowski. CRC Press Boca Raton: 57-110); and many others. (Government of Poland)	Reference to Gleick is added appropriately. The others are not relevant to the section.
G-4-369	A	36	10			4.4.9: Comments (1) increase in thremal stratification -> oxygen defriciency in coastal areas and marginal seas, loss of habitats, impacts on whole ecosystems and distribution of spacies (2) increase in nutrient fluxes from land during winter (e.g. To Baltic Sea) -> increase in production -> hypoxic events become more regular as decomposition of organic matter uses oxygen (Government of Finland)	Done - These have been included
G-4-370	A	36	25			Incorrect order of the publication year of the references (Government of Korea)	Done

G-4-371	A	36	29			Incorrect order of the publication year of the references (Government of Korea)	Done
G-4-372	A	36	33		36	“Coral Reefs , cold water corals and ecosystems :which ones. Need to be more precise. (Government of USA)	No change – as the rest of the sentence makes this more explicit
G-4-373	A	36	41	38	4	“Box 4.5: spell out GCMs line 13; Changes in Nutrients and fine sediments could be related to climate changes e.g. precipitation and river flow.” (Government of USA)	Done
G-4-374	A	36	48			Incorrect order of the publication year of the references (Government of Korea)	Done
G-4-375	A	37	1	37	1	Please, explain the process of coral decline. The term "bleaching" remains obscure for a nonspecialist reader. (Government of Finland)	Done – explained and refered to Chapter on coral bleaching
G-4-376	A	37	1	37	1	Comment: Box 4.5 add full stop after word bleaching (Government of Finland)	Done
G-4-377	A	37	5			Incorrect order of the publication year of the references (Government of Korea)	Done
G-4-378	A	37	10	37	10	Comment: explain abbreviation SST (Government of Finland)	Done
G-4-379	A	37	22	37	23	This claim is not well supported by quantiative data. At the least, the statement needs to be clarified in the use of the term 'corals' - does this mean coral species, or coral abundance? (Government of Australia)	Coral Box– done
G-4-380	A	37	24	37	24	Statement implies losses are due to climate change or coral bleaching. This is not the case, as stated in later chapters (Chapter 16, pg 9, lines 33-35). This statement needs to be clarified and qualified. (Government of Australia)	Coral Box– done
G-4-381	A	37	25	37	26	Lack of availability of suitable substrate is also an important factor limiting development of quantitatively similar reef development in higher latitudes, as stated in Chapter 6, page 21, lines 2-5. (Government of Australia)	Coral Box– done
G-4-382	A	37	28			Incorrect order of the publication year of the references (Government of Korea)	Done
G-4-383	A	37	48	37	48	Check Chapter cross-reference to Box 11.1. (Government of Australia)	Checked and changed
G-4-384	A	37	50			Incorrect order of the publication year of the references (Government of Korea)	Done
G-4-385	A	37	52			Incorrect order of the publication year of the references (Government of Korea)	Done
G-4-386	A	38	3			Incorrect order of the publication year of the references (Government of Korea)	Done
G-4-387	A	38	20			Incorrect order of the publication year of the references (Government of Korea)	Done
G-4-388	A	38	25		34	“explain IS92a for readers who will look at only a few chapters.” (Government of USA)	Explained
G-4-389	A	38	36	38	39	Comment: replace word "understandings" with word "knowledge" (Government of Finland)	Done

G-4-390	A	38	39		46	"Need to connect what is said here on Antarctic and Southern Ocean to chapter 6 where there is no information on Antartica" (Government of USA)	NB: Chapter 6 needs to include reference to this section!!
G-4-391	A	39	12			Incorrect order of the publication year of the references (Government of Korea)	Done
G-4-392	A	39	13		17	"the increased fine sediment particles due to increased continental erosion can also affect the cold water corals " (Government of USA)	No reference given to support this statement therefore not included
G-4-393	A	39	23	39	27	Both statements should become part of the executive summary. (Government of Germany)	Done – included in ES
G-4-394	A	39	23		24	Insert "long-term" preceding "method of reducing impacts." (Government of USA)	I don't agree – it is the only short or long term method therefore inappropriate to add long term
G-4-395	A	39	32	39	32	add after "delta T": "and of CO2 concentration. Please specify what is meant by delta T (local temperature change against which baseline? (Government of Germany)	Done – CO2 added to subtitle, good idea
G-4-396	A	39	32	40	1	The dot points for this section on impacts need to be more clearly presented and broken into categories. At present impacts over time (eg. to 2050) are mixed with temperature increases and atmospheric concentrations, these three causes of impacts should be broken up and more clearly explained. Additionally the 2050 scenarios should point out what atmospheric concentration the impacts are based upon. (Government of Australia)	Done – these have been clarified and rearranged into categories
G-4-397	A	39	35	39	35	Explain 'export production'. (Government of Australia)	Done- explained
G-4-398	A	39	36	39	42	clarify, what is the reason for the described changes. changes of temperature (and give the range of temperature changes) or changes in CO2 concentration? (Government of Germany)	Done clarified in sub title
G-4-399	A	39	48	39	49	Is this intended to mean extinction of species, or depletion of populations? This needs to be clarified. Further, these statistics would be more accurate and more usefully indicative of future problems if they were about degradation of ecosystems/depletion of populations/deterioration in values, rather than 'loss of species'. (Government of Australia)	Reference made to coral box for full explaination
G-4-400	A	39	52	40	1	clarify, what is the reason for the described changes changes of temperature (and give the range of temperature changes) or changes in CO2 concentration? (Government of Germany)	Referenced to coral box 4.5. Reasons for CO2 changes are given in text i.e. ocean uptake of CO2 based on "business as usual emission scenarios.
G-4-401	A	40	7	40	8	The sentence beginning "Ocean uptake of…." should be deleted. The London Convention and OSPAR do not deal with ocean uptake of anthropogenic uptake of CO2 and analysis of these treaties is outside the ambit of the Chapter. (Government of Australia)	OSPAR does deal with this – in 2006 they published a report on ocean acidification – which is now cited - Haugen et al. 2006
G-4-402	A	40	9	40	12	insert this text into the executive summary (Government of Germany)	Done -Now inserted in ES
G-4-403	A	40	15	44	7	Section "4.4.10 Cross-biome impacts" contains a lot of useful information, but its structure is too dense. It would benefit from being broken-up into shorter paragraphs with italicised sub-headings (as in section 4.4.9). For example, the second paragraph (from page 40, line 21 to page 41, line 5) might be subdivided according to biome, geographical area or latitudinal variation.	A - four subsection titles were added

						(Government of UK)	
G-4-404	A	40	21	40	22	In the case of boreal and temperate trees and forests, I would like to see more emphasis on the various risks caused by climatic change. Espacially the risks caused by warming winters to the overwintering of the trees are now virtually lacking in the report. According to the hypothesis presented by Melvin Cannell (1985), the trees may deharden and even start to grow during the mild spells in winter and get damaged during subsequent periods of frost. Overview of this frost damage hypothesis is given by Hänninen et al. (2001). Even though recent studies do not predict such catastrophic damage as the earlier ones did, the hypothesis is still one among those causing major uncertainties to the predictions about the effects of climatic change in temperate and boreal forests (Hänninen et al. 2005; Hänninen 2006). References: Cannell, M.G.R. 1985. Analysis of risks of frost damage to forest trees in Britain. In: Tigerstedt, P.M.A., Puttonen, P. and Koski, V. (eds.) Crop physiology of forest trees. Helsinki University Press, Helsinki, p. 153-166. Hänninen, H., Beuker, E., Johnsen, Ø., Leinonen, I., Murray, M., Sheppard, L. and Skrøppa, T. 2001. Impacts of climate change on cold hardiness of conifers. In: Bigras, F.J. and Colombo, S.J. (eds.). Conifer Cold Hardiness. Kluwer Academic Publishers, Dordrecht, p. 305-333. Hänninen, H. 2006. Climate warming and the risk of frost damage to boreal forest trees: identification of critical ecophysiological traits. Tree Physiology 26:889-898. Hänninen, H., Kolari, P. and Hari. P. 2005. Seasonal development fo Scots pine under climatic warming: effects of photosynthetic production. Canadian Journal of Forest Research 35: 2092-2099. (Government of Finland)	A - A sentence with 2 of the citations proposed has been added.The effect indeed is important.
G-4-405	A	40	27	40	28	This sentence sounds as if the studies cited just above did not include a CO2 effect, which is not correct. Re-word to something like "Drought stress could to a certain extent be counteracted by a higher water use efficiency under elevated CO2, ...". (Government of Switzerland)	A - changed wording from focus on "die-back" to focus on "drought stress" being counteracted. Wording does not imply that previous studies did not include the effect, which they did. Gerten et al.
G-4-406	A	40	28	40	29	Comment: use subscript in word CO2 for number 2 (Government of Finland)	A - done
G-4-407	A	40	43	40	43	Replace "over" by "relative to" (clearer). (Government of Switzerland)	A - "realtive to" is not what is meant, but the wording was improved to "at the expense of"
G-4-408	A	40	45			Incorrect order of the publication year of the references (Government of Korea)	A
G-4-409	A	40	53	40	53	Typo "loose" (correct: lose). (Government of Switzerland)	A - done
G-4-410	A	41	46	41	47	This is a question of time scale (again), I think - in the long run, climatic effects could (and are likely to) override land use effects with regard to both C storage and biodiversity. See also my comment on p. 28 line 38; on p. 42, line 13, some allusion is made to this effect, but there should be a stronger and more concentrated message, I think. (Government of Switzerland)	A - Carefully considered throughout and text in all places improved to clarify this question
G-4-411	A	41	46	41	47	insert this text into the executive summary (Government of Germany)	R - ES had to be reformatted according to general instructions for entire report and was overhauled completely. We have considered this suggestion, but given the balance we had to strike and space limitations, we were not able to follow this suggestion directly. However, it influenced our wording at least indirectly.

G-4-412	A	41	48			Incorrect order of the publication year of the references (Government of Korea)	A
G-4-413	A	41	52	42	2	insert this text into the executive summary, add also text from page 50 lines 21-22, and 33-34. (Government of Germany)	Addressed, though have not included latter page references
G-4-414	A	42	2			Incorrect order of the publication year of the references (Government of Korea)	A
G-4-415	A	42	9	42	9	Replace "and are" by "and decreases are". (Government of Switzerland)	A
G-4-416	A	42	9	42	10	Comment: correct "are likely to virtually occur in all biomes" (Government of Finland)	A
G-4-417	A	42	10	42	10	Something went wrong with EndNote here – what is "Re105"? (Similar problems appear further below). (Government of Switzerland)	A
G-4-418	A	42	14	42	20	Comment: how about northern species extinction and ecosystem losses, for instance shorter and warmer winters can result extinction of relict species (for instance, Phoca hispida saimensis in Finland). It is true that most biodiversity losses occurs at more southern latitudes but it should be recognized that also northern species and ecosystems are lost. If winters become warmer and shorter, northern latitude countries could also have larger pest species diversity and invasion and thereby perhaps larger pest problems, which in turn negatively affects agriculture and forestry as well as natural ecosystems. This could be discussed briefly. (Government of Finland)	A - as much as possible (no reference given)
G-4-419	A	42	22	42	22	Replace "development" by "land use". (Government of Switzerland)	A
G-4-420	A	42	22		29	Add that during next 50 years (2000-2050) human population will increase by 2 billions and to feed them agricultural production ought increase by 50%. That will be achieved from smaller arable land (degradations of soils) and with less water. Thus intensification of production is indispensable (Brown L. 2003: Plan B. Rescuring a planet under stress and civilization in trouble. Norton, New York: 271 pp.; Millennium ecosystem assessment 2005). (Government of Poland)	A
G-4-421	A	42	23			Incorrect order of the publication year of the references (Government of Korea)	A
G-4-422	A	42	25	42	25	What is "high biological value" here? This would need to be specified. Then, in the parenthesis "this trend" is alluded to, but the main clause does not contain any indication about a trend. (Government of Switzerland)	A
G-4-423	A	42	31	42	31	Ethanol? (Government of Switzerland)	A
G-4-424	A	42	37	42	39	This list of references is a very mixed bag - according to the text, it should refer to European studies on land use and climate change. To the best of my knowledge, not all references had that focus; for example, Scheller & Mladenoff was about Wisconsin; Araujo et al. did not consider land use at all; hence I think these references should be checked again. (Government of Switzerland)	A
G-4-425	A	42	37		39	Incorrect order of the publication year of the references (Government of Korea)	A

G-4-426	A	42	39	42	41	This sentence implies that the previous material has not dealt with biodiversity, which is plainly wrong (e.g. Schröter et al., Araujo et al., etc.). Thus, the flow of thought in the text is not clear here, and this part of the chapter should be streamlined for clarity and consistency. (Government of Switzerland)	A
G-4-427	A	43	22	43	22	Comment: add word "geographic" before word "barriers" (Government of Finland)	A
G-4-428	A	43	28			Incorrect order of the publication year of the references (Government of Korea)	A
G-4-429	A	43	48	43	51	Comment: use subscript in word CO2 for number 2. There are several review articles which state that the main finding in CO2 studies is that elevated CO2 alters litter C:N ratio; however, the knowledge about other litter chemical factors (especially micronutrients, cell wall chemistry, low-molecular-weight phenolics et cetera) plus physical quality factors are less studied. It could be stated here more specifically which factors are ment when term "nutritional quality" is used. Is there any knowledge about indirect CO2 effects on soil food web, which is essential for nutrient and C cycling? (Government of Finland)	A
G-4-430	A	43	51	43	51	Comment: explain abbreviation DOC (Government of Finland)	Is in glossary
G-4-431	A	44	12	44	34	I think that this portion of text should be omitted entirely from the report. Essentially, it continues the debate (if not to say the fierce fight) that is going on between some exponents of the DGVM community and some exponents of the bioclimatic envelope modeling community about who is right, who is wrong, and who is "intellectually bancrupt". This does not help at all. (Government of Switzerland)	TR
G-4-432	A	44	36	44	36	Replace "Lower" by "Moderate" (otherwise the sentence makes little sense). (Government of Switzerland)	A
G-4-433	A	44	36	44	36	Comment: correct sentence "Lower CO2 rise and climate change.." (Government of Finland)	A
G-4-434	A	44	46			Incorrect order of the publication year of the references (Government of Korea)	A
G-4-435	A	44	47	44	48	How can 12-52% of species GROUPS correspond to exactly 15'589 SPECIES??? This is mysterious. (Government of Switzerland)	A - The range refers to the range of % of each of the major groups (e.g., birds, mammals) that are endangered - the number is the actual sum total. Can be clarified perhaps with rewriting.
G-4-436	A	44	48	44	50	Comment: "Threat of.. risk"; awkward sentence, rewrite (change the order of the words) (Government of Finland)	A - Text substantially rewritten
G-4-437	A	44				Section 4.4.11 Global synthesis including impacts on biodiversity: Table 4.2 and Figure 4.5 represent a useful approach for synthesis but are not explained well enough to be understood. Additionally, underlying uncertainties in this synthesis are not presented or described. Since these syntheses are likely to be incorporated into the Summary for Policy Makers and receive widespread citation and reprinting, these shortcomings are troublesome.	A - A more complete upscaling and downscaling to provide a range of potential temperatures. This captures a great deal of the uncertainty whi is referred to here. The text explaining how the process was performed was modified and additional supplemental information will be placed on a website. This table is only a summary of what is in the literature. Whenever this information has been placed elsewhere (e.g., SPM) then appropriate

						Table 4.2 and Figure 4.5 should only be retained if measures of confidence, as defined for use within IPCC assessments, are incorporated. Where numerical estimates of impact are stated as ranges (e.g., 18 – 20%), clarify whether the ranges imply a measure of uncertainty around a mean estimate or some other measure of confidence. If there are significant differences in the confidence in different impacts listed in Table 4.2, the means of reconciling differences in uncertainties such that a tabulated summary is sensible must be presented. For example, Table 4.2 event 18 is that 42% existing Arctic tundra remains stable while event 35 is extinction of 21 – 40% of Proteaccae. Is the stable tundra more certain than extinction of Protaeccae? Is it reasonable to compare these events within the same synthesis table?	placed elsewhere (e.g., SPM) their appropriate confidence has been assigned to it. Many of the entries have also been clarified. Information on the models used have been listed in the caption. Colors have been removed from the table but remain in the figure to correspond more generally to the burning embers of the IPCC. This table, ultimately is a reflection of the literature - an easy to use summary and we have maintained the author's own assessment. Only when statements from the table have been moved into the SPM have they been assigned appropraite IPCC confidence levels.
						In Table 4.2, events that have the same impact titles (e.g., extinction of plants) and refer to the same region (e.g., Europe), appear in substantially different warming ranges. Presumably, this is because different models are involved. Is there useful information in these differences or are the models just inconsistent? Is the 0.1 °C significance on the rows of Table 4.2 meant to imply that the event in that row will occur above exactly that temperature? It's important to reflect the temperature ranges over which these events will occur and the uncertainty in some way, else readers may over interpret the authors intentions. Model simulations and analyses were used to derive many of the estimates in these syntheses. The models used and analysis approaches should be described more fully. In particular, the degree to which the models incorporate human activities including land use and land cover change should be explained. Unfortunately, the explanations of Table 4.2 and Figure 4.5 are inadequate to all reasonable evaluation of their contents and implied conclusions. The color codes and abbreviations should be defined carefully. Relationships between the same colors in different parts of Table 4.2 (e.g., orange within light yellow versus orange across table rows) must be explained. Assuming that all numbers in the event number column of Table 4.2, on the map in Figure 4.5 (a), and on the plot in Figure 4.5 (b), refer to the same thing, the numbers do not seem consistent. On Figure 4.5 (b), labels such as Amazon collapse appear to be aligned with numbers that appear on the map in Figure 4.5 (a) outside of Amazonia. Numerous similar inconsistencies seem to occur between (a) and (b) in Figure 4.5. If the formatting and description of Table 4.2 and Figure 4.5 cannot be improved substantially, these items should be deleted from the chapter and should not appear in the Summary for Policy Makers.	

						(Government of USA)	
G-4-438	A	45	1	45	9	Table 4.2 - The chapeaux and methodological explanation is poorly drafted. In addition the uncertainties inherent in using the technique of upscaling need to be included. It needs to be made clear that while, in principle the methodological approach is fine and not inconsistent with section 2.2.2.6 (although that only concerns the reverse process of downscaling), nevertheless, the table will have some inconsistencies in that the amount of regional warming for a given amount of global warming could vary from case to case for a given region. This is because of variations in the GCMs used between the individual studies. It seems from the chapeaux that in some cases the regional warming is not available, so the authors don't have the option of using a common upscaling GCM across all studies. It would be advisable for the chapeaux to note this issue and give an estimate of the uncertainty it introduces into the temperature thresholds assigned to a given impact event. (Government of Australia)	A - We have improved the description of how the methods were performed and provided more information on each entry and providing the information requested.
G-4-439	A	45	1	45	55	Table 4.2 - No.8: The range quoted does not come from the cited work but rather the original article in Nature 427:145-148 (Government of Australia)	N
G-4-440	A	45	1	45	55	Table 4.2 - No.2: The reference to Gitay et al 2001 needs to be re-checked as an electronic search of this reference failed to find any reference to Dryandra or to forests in Western Australia. (Government of Australia)	A as the original source could not be located this entry was deleted
G-4-441	A	45	1	45	55	Table 4.2 - No.2: Authors should explain what the risk is in the statement "Risk extinctions….". (Government of Australia)	A - term removed
G-4-442	A	45	1	45	55	Table 4.2 - No.17: This finding should be deleted. Quoted ΔTglob for total Arctic sea ice loss in summer is inconsistent with WG1 Chapter 10 (e.g., Fig. 10.3.11) and multi-model analysis of Arzel et al (2006). Results from the latter suggest ΔTglob of around 3.4°C appropriate for 50% chance of total loss. (Government of Australia)	Entry is now consistent with Arzel and WG1
G-4-443	A	45	1	45	55	Table 4.2 - No.14: The source should be 4 (not 5). In addition the authors should state that the finding that the Bowerbird will be functionally extinct, is their own conclusion from the finding of 50% habitat loss. (Government of Australia)	A - citation corrected, entry now only refers to habitat loss
G-4-444	A	45	1	45	55	Table 4.2 - No.11: The original article in Nature 427:145-148 should be cited for Thomas et al. The Williams et al 2003 (Kr28???, Wi155???) paper also does not have a 1.7C increase result as indicated in this table. The other values given for this entry number are also not in this paper. The authors need to review their use of this source. In addition the authors need to review this overall finding as it overstates extinction risk and uses small samples. (Government of Australia)	A -Both citations are given, temperatures have been corrected, information provided is as presented in the literature
G-4-445	A	45	1	45	9	Table 4.2 - Most of the projected impacts for the Australian region are based on use of BIOCLIM (a bioclimatical modelling system) with input temperature (and occasionally rainfall) from climate change scenarios, this should be noted. In particular the authors should note that very little is generally known about how climate truly influences Australian species distributions and how much of the observed distribution of species truly represents climate constraints and how much is driven by other factors, such as species-species competition, habitat fragmentation, land-use changes, etc. (Government of Australia)	A -The same is true for all bioclimatic models and a more general statement to that degree appears in the accompanying text.

G-4-446	A	45	1	46	55	Table 4.2 - No.40: Δtglob seems to be too low to trigger a complete loss of the alpine zone in Australia. Authors should review to ensure there is underpinning research for this. (Government of Australia)	A - temperature corrected, the rest follows from the literature
G-4-447	A	45	1	46	55	Table 4.2 - No.28: The original article in Nature 427:145-148 should be cited for Thomas et al. In addition the temperature range should be reviewed. In the paper these extinction rates apply to the mid-range scenario which is 1.8 to 2.0C. (Government of Australia)	A - temperature corrected, the rest follows from the literature. Note that the baseline used in the literature is the 1961-1990 mean and as explained in the notes to the table the derived change relative to
G-4-448	A	45	1	46	55	Table 4.2 - No.26, 47, 49: The original article in Nature 427:145-148 should be cited for Thomas et al. The authors should review their citation of Thomas et al. and Beaumont and Hughes. The risk statements are too categorical - where Thomas et al. is quoted the butterflies are extinct, where Beaumont and Hughes is quoted it is a range loss – it is based in the same work. (Government of Australia)	A - as all are authors in Thomas then assumption is they agree on the language in their own paper
G-4-449	A	45	1	47	55	Table 4.2 - No.62: Percentages given are highly dependent on the rainfall scenario chosen, therefore suggest a range of habitat reductions should be given. More generally the authors should be clear that rainfall in many assessments does not greatly affect the bioclimatic envelope as much as temperature. This is so for Brereton et al. (1995, Victorian vertebrates) and Williams et al. (Wi155???) (2003; Far North Queensland vertebrates) – these relationships between the bioclimatic envelope are very robust but the links between temp and extinction are not necessarily so robust. (Government of Australia)	A - This is captured, where available from the literature, in the new entries in the caption
G-4-450	A	45	1	47	55	Table 4.2 - No.50: The authors should explain why this entry is a repeat of entry number 44 but with a higher temperature. (Government of Australia)	A - entries corrected
G-4-451	A	45	1	47	55	Table 4.2 - No.49: In Table 1 of Beaumont and Hughes (2002) global mean annual temperature change (2.6C) was used to get Australian increase (2.1 – 3.9C), so the calculated value in IPCC Table 4.2 should be 2.6 not 2.9C. (Government of Australia)	R - the 2.6C to which you refer is relative to a 1961-1990 baseline whereas in the table we use a pre-industrial baseline. Conversions are explained in caption.
G-4-452	A	45	1	47	55	Table 4.2 - No.44: The original article in Nature 427:145-148 should be cited for Thomas et al. (Government of Australia)	A - However, it is (source #1)
G-4-453	A	45	1	48	13	Table 4.2 -The Williams et al. (2003) work should have a high degree of confidence attached because it has also been compared to distributions of species restricted by warmer Holocene temperatures, i.e. it has the supporting evidence to establish that the risk can be attributed. (Government of Australia)	A
G-4-454	A	45	1	48	13	Table 4.2 should be reworked and reduced in size. The table title/summary is even difficult to understand. The temperature changes in column 2 appear arbitrary --- do the authors have published evidence that a precise 3.1º change in temperature will lead to a loss of 66% of the animals in the Kruger preserve or that a 3.3º increase in temperature will lead to and extinction of 24-59% of the mammals in south Africa? The authors need to review each entry in this table and delete all but those that they can unequivocally support with the peer-reviewed literature. An alternative would be to rename the table something like "Examples of impacts projected by independent studies and modeling efforts", rather than take each at face value and present them as if they were the IPCC authors' scientific consensus.	Entries in the table come from the peer-reviewed literature (with a recognition that many Government reports are also extensively peer-reviewed). The 0.1 precision comes from the need to match to baselines. However, whenever possible a range of temperatures is now given. Text in the table matches that of the original authors as much as possible given page limits. Caption provides substantially more information about the material in the table.

						What does the symbol M represent in the next to the last column on the left? The table could detract greatly from the IPCC process if it is not supportable and comprehensible. (Government of USA)	
G-4-455	A	45	1	48	13	Table 4.2 - This table is likely to feature in discussions of impacts and so each impact needs to be firmly based on the science and free of inconsistency with other parts of the IPCC AR4 or other parts of the literature. On some individual items, this appears not to be the case. Further, the table suffers generally from the appearance of categorical statements (e.g., about extinction) where a probabilistic assessment would seem more appropriate. (Government of Australia)	Statements on extinction follow assessments of the original authors, not the IPCC author team. Many entries have been corrected based on either newer literature, WG1 AR4 findings, etc.
G-4-456	A	45	1	48	13	Table 4.2 - The authors should remind readers of the difference between pre-industrial and post 1990 (0.7°C) temperature change and need to include definitions of the symbols M, E, CS, H2, H3, etc. (Government of Australia)	A
G-4-457	A	45	1	48	13	Table 4.2 - References to Thomas et al (2004): This paper provides that when a climate envelope is exceeded then a species is committed to extinction, however, it should be noted that this merely points to the risk of extinction based on the climatic profile of the current distribution. The authors will need some further lines of evidence to establish whether the risk of species extinction can be attributed with high confidence. In addition, where Thomas et al. (2004) uses primary sources those should be used in the table. (Government of Australia)	A - more information on bioclimatic uncertainty is in the text. The source column now lists both the Thomas paper and the primary sources which were also consulted for delta T and underlying information
G-4-458	A	45	1	48	13	Table 4.2 - References to Hughes et al (1996): This paper explicitly states “the data presented in this paper should not be considered as predicting either the future distributions or the survival or extinction of particular eucalypt species. Rather, they should be considered as giving a sense of the magnitude of the problems that future climate change may pose for this flora”. (Government of Australia)	A - extinction risk deleted
G-4-459	A	45	1	48	55	Table 4.2 - No.84: Entry number 84 should be deleted as it incorrectly repeats the information at 76. The authors should also note that findings such as this assumes that affected species have not adapted and have not altered their range. (Government of Australia)	A
G-4-460	A	45	1	48	55	Table 4.2 - No.79: The authors should review the use of this paper as it does not have a 4.2C increase result (only contains 1, 3.5, 5 and 7 degree celsius increases). The paper does not give the impacts listed in the table. Same for entries 83 and 85. (Government of Australia)	A entries improved, but note that the 1,3.5, 5 and 7 are local temperature increases. Caption now explains how these upscaled to global temperature changes. For the higher temperatures, upscaling is based on maps from WGI AR4. For the highest
G-4-461	A	45	1	48	55	Table 4.2 - No.76: The authors should state the extinction risk of the 73% of eucalypt species displaced from their current range). (Government of Australia)	A
G-4-462	A	45	1	48	55	Table 4.2 - No.70: Incorrect interpretation for point 70 – 53% of species at southern boundary exposed to warmer temperatures than currently at northern boundary – does not imply 50% are out of range bounds in Southern Hemisphere. (Government of Australia)	N - however, paper specifies that at 3C local bioclimatic limits of 53% were completely exceeded with no overlap

G-4-463	A	45	1	48	13	In "Table 4.2", add reference to the MONARCH project which projects impacts on species and habitats in Britain and Ireland. 'Harrison, P.A., Berry, P.M. and Dawson, T.P. (Eds.) (2001). Climate Change and Nature Conservation in Britain and Ireland: Modelling Natural Resource Responses to Climate Change (the MONARCH project). UKCIP Technical Report, Oxford'. (Government of UK)	A
G-4-464	A	45	1	49	52	Explain the meaning of the colors used in Table 4.2 and figure 4.5. Furthermore the table should become partly part of the TS. (Government of Germany)	A - though colors removed from table
G-4-465	A	45	6	45	6	Insert "Hare, 2003 and" before "Warren, 2006" as the paper by Warren builds on the Review by Hare (as acknowledged in the Warren paper). Citation: 'Hare,B (2003) Assessment of Knowledge on Impacts of Climate Change – Contribution to the Specification of Art. 2 of the UNFCCC: Impacts on Ecosystems, Food Production, Water and Socio-economic System. Expertise for the WBGU Special Report „Climate Protection Strategies for the 21st Century: Kyoto and Beyond“.' Available at http://www.wbgu.de/wbgu_sn2003_ex01.pdf (Government of Germany)	N - Table 4.2 draws on the work of Warren, Thomas, Hughes, etc. and Warren's work independently reviewed the literature cited by Hare, Hughes, Thomas, etc., as is often the case in a review and in science, and then expended substantially beyond that, especially in terms of upscaling and downscaling and additions to the database. Chapter authors started from Warren's work, not Hare's in building this table and citation recognizes that fact. In reviews that authors of this chapter have published we have listed those who come before as is only proper. There is inevitably overlap, that is the way that science works - it builds
G-4-466	A	45		49		Table 4.2. and Fig. 4.5. It is difficult to read the black text from the boxes with dark red background. (Government of Finland)	A
G-4-467	A	45				Table 4.2. and biome sections (4.4) conclude with impacts as function of ΔT - is this wise? (Government of Finland)	A - removed from biome sections
G-4-468	A	45				Table 4.2 - The terms 'loss of reefs' and 'functionally extinct' need to be defined and related to each other in terms of scale of effect. 'Loss of reefs' could readily be interpreted as more serious than 'functionally extinct', for example, yet the table suggests the opposite. (Government of Australia)	A - terminology modified
G-4-469	A	45				Somewhere the Chapter needs to describe meaning of term 'functional extinction' used in Table 4.2 (as distinct from 'extinction'). (Government of Australia)	A - term is no longer used
G-4-470	A	48	1	48	13	The source list for "Table 4.2" is incomplete; it contains only sources 1 to 44 (45 to 85 are missing). (Government of UK)	The source (reference) is in the LAST column. The first number 1-85 is only for the map and figure.
G-4-471	A	49	22	49	52	Need to explain what dotted line model scenarios mean. (Government of Australia)	A
G-4-472	A	50	2	50	2	Opening phrase could be interpreted as policy prescriptive. Sentence would be sharpened by dropping phrase. (Government of Australia)	A
G-4-473	A	50	2	50	2	Comment: "way of life" could be replaced by phrase "life style" (Government of Finland)	A
G-4-474	A	50	3	50	4	Too much material in the citation, remove. (Government of Switzerland)	A

G-4-475	A	50	5	50	5	How can an ecosystem (per se) be "disrupted"? This is an extremely fuzzy statement that should be written more precisley, or it should be removed. (Government of Switzerland)	A N
G-4-476	A	50	11	50	11	Here, and also elsewhere, it is necessary to specify what aspect of biodiversity is meant - calling it "species richness" is fine, but what taxonomic groups are meant? Usually, this is vascular plants or birds or mammals or so; hence it is not species richness per se, but the richness of certain groups. Please make this clear throughout what groups have been considered. (Government of Switzerland)	A N
G-4-477	A	50	19	50	19	Replace "a stronger" by "a still stronger". (Government of Switzerland)	Text removed N
G-4-478	A	50	25	50	25	Comment: write " tropical biodiversity hotspots" instead of hotspots for biodiversity in the tropics" (Government of Finland)	Text removed N
G-4-479	A	50	29	50	31	Comment: correct "In summary.. might be less affected by climate change than by land use change." (Government of Finland)	Text removed A
G-4-480	A	50	33	50	33	I do not follow here - a 44% risk of a terrestrial carbon source (of what magnitude?) does not at all have to imply a "world-wide decline of forests". (Government of Switzerland)	A - Text substantially rewritten
G-4-481	A	50	33	50	33	Comment: correct "..decline of forests and suggest that climate change…" (Government of Finland)	A - Text substantially rewritten
G-4-482	A	50	42	50	48	These lines include a highly important scientific message and should be included in the SPM. (Government of Finland)	A
G-4-483	A	50	45	50	45	Comment: replace phrase "behavior" with "functioning" (Government of Finland)	A N
G-4-484	A	51	2	51	2	Comment: remove word "undergo" after word "ecosystems" (Government of Finland)	N
G-4-485	A	51	11	51	11	Comment: remove word "undergo" after word "ecosystems" (Government of Finland)	N
G-4-486	A	51	15	51	15	Comment: delete word globally and substantial (Government of Finland)	N
G-4-487	A	51	18	51	21	it is unclear what do numbers in first column of lines 2-5 mean? (Government of Germany)	N
G-4-488	A	51	25	51	44	Comment: text should be shortened here. Correct: "Many efforts have been made to estimate.. ..Reid et al. 2005), (Re105???) but so far the estimates range from unknown or invaluable to 38 x 1012 USD/a which is… GNP of 31 x 1012 USD/a (2000 levels)." After correction delete unnecessary references from the reference list also. (Government of Finland)	A
G-4-489	A	51	26			Incorrect order of the publication year of the references (Government of Korea)	A
G-4-490	A	51	31			Recent estimation with GUMBO model of ecosystems services values was 4.5 times higher than GWP (Constanza R., Boumans R., Sahagian D. 2003. A new approach to global, dynamic modeling of integrated human in natural systems. Global Change Newsletter 54: 9-12. (Government of Poland)	N - However, this was a very simple model and these early results don't seem to be comparable
G-4-491	A	51	34	51	34	Comment: add word that after phrase "some argue"	A

						(Government of Finland)	
G-4-492	A	51	36	51	36	"ecosystems will continue their decline, and the planet's ecological health is at stake": This is poetry rather than science; ecosystems do not have a will to decide whether they want to continue "their decline" or not... And what is the planet's ecological health anyway? Please improve or omit this text. (Government of Switzerland)	A
G-4-493	A	51	42	51	43	The issue here appears to be whether one wants to maximize the present value or to achieve a long-term sustainable use of the natural capital, NOT to achieve "a measure of sustainability" - a measure (or index) of sustainability is at a different level than sustainability itself. (Government of Switzerland)	A
G-4-494	A	52	18	52	18	Comment: delete word greatly (Government of Finland)	Done
G-4-495	A	52	20	52	22	Comment: delete sentence "The following section discusses… of climate change." and rephrase (Government of Finland)	rephrased and a clear definition of adaptation added
G-4-496	A	52	25	54	25	Comments to adaptation strategies: In general, to "reduce and manage other stresses sounds good, but it is too less concrete. Which stresses are meant? Please insert something like "anthropogenic deposition" since theses are the factors which really reduce the resilience of the ecosystems. The reaction of trees to climate stress is enhanced in the last decades, due to the depletion of nutrients. "to manage" means in last consequence, that a continuous input is necessary, to maintain favourable conditions to reduce the consequences of climate change. This seems not very practically. The history shows, that too much anthropogenic impacts are mostly destructive to ecosystems. It is implied here, that it is possible to manage the consequences of climate change. This is to doubt. The reduction of climate change must be the main measure. (Government of Germany)	Examples of stresses are listed.
G-4-497	A	52	27	55	24	This section should be rewritten taking into account Ecosystem Approach to Conservation of Biological Diversity. Presented version is outdated. (Government of Poland)	Text changed and improved
G-4-498	A	52	27		44	Add that modern approach to nature protection use win-win type of strategy. It is obligatory also to indicate that IUCN propose new approach to nature protection that is the Ecosystem Approach to Conservation of Biological Diversity. This strategy can be characterised as “a strategy for management of land, water and living resources that promotes conservation and sustainable use in an equitable way” (Smith R. D., Maltby E. 2003. Using the ecosystem approach to implement the convention on biological diversity. IUCN – the World Conservation Union, Gland: 118 pp.). (Government of Poland)	Included
G-4-499	A	52	30	52	31	Comment: delete sentence "There are many opportunities to achive this". (Government of Finland)	Rephrased and put in context.
G-4-500	A	52	36	52	36	Comment: remove colon after word although (Government of Finland)	Done
G-4-501	A	52	48	53	4	Some of these statements need to be reworded so that they are not perceived as policy prescriptive. For example, “reserves should be protected” and that “decisions have to be made” should be reworded. (Government of USA)	Done, by adding for example and can.

G-4-502	A	53	1	53	2	Why is it that natural ecosystems "or" nature reserves "are not adaptable"? Should the sentence imply that no adaptation measures can be taken because these areas are under strict protection? Fine so, but then why "natural ecosystems"? And why "or" (and not "and")? This needs to be cleaned up to become meaningful. (Government of Switzerland)	Sentence deleted. Adaptation explained in the introduction of the section.
G-4-503	A	53	1	53	2	Why are natural ecosystems and nature reserves "not adaptable"? Whilst it is unlikely that current species distributions and compositions will be maintained as climate changes, both may adapt naturally (eg species movements changing ecosystem composition and function) and/or through human interventions (eg altering reserve management practices to increase resilience and accommodate change). (Government of UK)	Sentence deleted. Adaptation explained in the introduction of the section.
G-4-504	A	53	5	53	5	How can reserves be protected from "unusual droughts"? More importantly, though, how are we to define "unusual"? Anything that hasn't happened since written records are available? Last 100 years? Last 1000, 10000 years? This statement is too fuzzy to be meaningful. (Government of Switzerland)	Sentence indeed interpretable in multiple ways. Sentence deleted and sentence before rephrased to make point more concrete.
G-4-505	A	53	7	53	8	Comment: combine sentences: "Strategies to cope.. management plans, but this is unfortenately rarely the case" (Government of Finland)	Done
G-4-506	A	53	8	53	9	Comment: combine sentences and rephrase the latter part for instance: "Adaptation in ecosystems..and financing, which has been only recently widely recognized" (Government of Finland)	Done
G-4-507	A	53	20	53	33	give more explanation to table 4.6 which is not referenced in the text of 4.6.1.Does it mean, for instance, that there is no migration possible beyond 5 °C temperature change? Furthermore the temparature changes given there are far above what is discuused in the text and in table 4.2. We know already that it is not only the change but also the speed of the change which influences essentially the impact. there is no information with regard to the period in which the changes expected to take place, clarify. (Government of Germany)	is done now.
G-4-508	A	53	44			Replace "establishment of corridors" with "development of more permeable landscapes with greater ecological connectivity". (Government of UK)	Done
G-4-509	A	53	47	53	47	Comment: term "prescribed fire" should be replaced with term "controlled burning" (Government of Finland)	Done
G-4-510	A	54	47			Incorrect order of the publication year of the references (Government of Korea)	Changed
G-4-511	A	55	3	55	3	Comment: replace word "extents" with word "extends" (Government of Finland)	Done
G-4-512	A	55	16	55	24	Section 4.6.4 is policy prescriptive and provides little substantive information. This section should be deleted. (Government of Australia)	Section makes an important point. Section rephrased.
G-4-513	A	55	18	55	24	the text is more about the mutual supportive impacts of actions in one area(here CCD) to other areas (FCCC) but not about about interactions with other policies and policy implications, add text from following chapter page 55-56, lines 40 -2 to this chapter or delete the whole chapter.	Rephrased and broadened.

						(Government of Germany)	
G-4-514	A	55	29	55	29	Comment: delete the first sentence in the paragraph (Government of Finland)	Done
G-4-515	A	55	29		33	Expand on demographic pressures. (Government of Poland)	Reference added
G-4-516	A	55	30	55	30	Comment: replace word "these" with "natural" (Government of Finland)	Done
G-4-517	A	55	33	55	34	Replace "However, it has" by "They have" (the new sentence provides no contrast whatsoever to the preceding one). (Government of Switzerland)	Done
G-4-518	A	55	37	55	37	Comment: replace word "would" with phrase "can ultimately" (Government of Finland)	Done
G-4-519	A	56	14	56	14	Separate the words "service" and "beacuase" (Government of Canada)	Done
G-4-520	A	56	14	56	14	Comment: add space between words "services" and "because" (Government of Finland)	Done
G-4-521	A	56	15	56	15	Replace "conditions between regions" with "conditions among regions" (Government of Canada)	Done
G-4-522	A	56	44	56	44	I would think it is fair to say that dryland, mediterranean and mountain regions are likely to be more vulnerable than others (cf. Huber et al. 2005 (Hu080???), Schröter et al. 2005(Schr12???, Schr14???, Schr15???)), i.e. I would suggest to add "and mountain" after "Mediterranean". (Government of Switzerland)	Done
G-4-523	A	57	7	57	8	The sentence should end after "degrading ecosystems". The following phrases are outside the ambit of the Chapter. (Government of Australia)	Last part of sentence deleted
G-4-524	A	57	15	58	17	The chapter 4.8. could be better to present as a table like the last chapter in Chapter 5, Left-hand column may list the key uncertainties and he right-hand column the research priorities to decrease these uncetainties (Government of Finland)	LA
G-4-525	A	57	15			4.8 Key uncertainties and research priorities" I recommend to insert: Integrative studies on the effects of enhanced temperature, CO2-levels, N-deposition, ozone and reduced nutrient cation availability on trees and forests. (Government of Germany)	R - We know that truly integrative studies on those effects are needed. However, many such efforts are ongoing and it seems that this is currently not the type of research needing the most support. Moreover, we conclude in our chapter that the key uncertainties require emphasis on other types of

G-4-526	A	57	17	57	19	Precipitation and possible changes in hydrological conditions have also importance in functioning of the northern ecosystems. E.g. methane emissions in the northern pealands depend even more on the hydrology than on temperature (Nykänen H., Alm J., Silvola J., Tolonen K. and Martikainen P.J. 1998. Methane fluxes on boreal peatlands of different fertility and the effect of long-term experimental lowering of the water table on flux rates. Global Biogeochemical Cycles 12: 53-69.). The same is true also for their N2O emissions (Martikainen P.J., Nykänen H., Crill P. and Silvola J. 1993. Effect of a lowered water table on nitrous oxide fluxes from northern peatlands. Nature 366 (4): 51-53.) (Government of Finland)	A - We fully agree with this point and thanks for the references. The phrasing did not try to exclude any region nor ecosystem. Only to emphasize arid and sem-arid regions, or other water limited regions.
G-4-527	A	57	17	58	17	In research priorities it is obligatory to stress importance of studies on biota (especially plant cover) influence on global climate change. For example forests influence by high evapotranspiration rate on vapour contents in atmosphere, cultivated field stimulating convection heat fluxes influence on air movement etc. (see Ryszkowski L., Kedziora A. 1995. Modification of the effects of global climate change by plant cover structure in an agricultural landscape. Geographia Polonica 65: 5-34). Those impacts are neglected in the chapter despite published papers on that topic. This neglect distort understanding dynamic system of land-atmosphere interactions. Such approach will change the value of the 4 chapter from confirmation of the TAR results to the new synthesis of the knowledge. (Government of Poland)	A partly - Many research priorities listed do stress studies on biota, including plant cover (e.g. point 2). The mentioned effects and processes are reviewed in our chapter using more recent literature than the cited one. Unless we face exceptional circumstances, we assume that the TAR has already reviewed such research. Moreover, the primary focus of this chapter is not that of land-atmosphere interactions, although we fully agree with the reviewer, that many of these are key to understanding impacts on ecosystems. We have also improved the text under bullet 3 to account for the concerns re dynamic interactions between vegetation and atmosphere.
G-4-528	A	57	18	57	19	In the southern hemisphere only? What is meant here is probably "developing countries"??? (Government of Switzerland)	A - Text improved to avoid impression of exlusiveness
G-4-529	A	57	19	57	21	The material on p. 44 lines 27-28 said that migration was a key uncertainty for DGVMs; here it is upscaling and disturbances - so what is correct? (Government of Switzerland)	A - Omission corrected
G-4-530	A	57	21	57	22	This is quite true, I think, but unfortunately not at all evident from the present chapter! (Government of Switzerland)	A - Have improved chapter considerably to improve on this
G-4-531	A	57	29	57	29	add after "of ecosystems": "as well as other drivers of global environmental change such as N-deposition, pollution, fire, will interact…" (Government of Switzerland)	A

G-4-532	A	57	33	57	34	This sentence should be more clear. The potential changes in the CO2 and CH4 balances at high latitudes associated to the biogeochemical processs (biological processed mediated by soil and vegetation) should be separated from the possible release of methane hydrates which is mainly a chemical/physical process induced by thawing of permafrost. (Government of Finland)	A
G-4-533	A	57	36			Incorrect order of the publication year of the references (Government of Korea)	A
G-4-534	A	57	38	57	39	While it is true that there has been some kind of stagnation with the development of DGVMs since the TAR, I don't think this can be blamed on a lack of funding. However, I do not think that this problem should be exposed here, and thus I would suggest to write "In this context, the focus should increasingly be placed on model evaluation ('validation') rather than model comparisons per se (cf. Price et al. 2001) (Pr48???)(Pr78???). The goal is to better..." (Government of Switzerland)	A partly - It is not the intention to blame the stagnation on funding. But it seems that additional, dedicated funding is required to bring that kind of modeling closer to what is needed. We envisage a situation comparable to climate modeling research. Text partly improved
G-4-535	A	57	38	57	40	The sentence beginning "To expand such research…" might need rewording (Government of UK)	A
G-4-536	A	57	47	57	50	I suggest that the "disturbances" should include also air pollutants as interactive factors. The tropospheric ozone concentrations are still increasing and may have vast effects on vegetation. In addition acidifying pollutants, although declining in industrial coutries, continuously increase in developing countries. (Government of Finland)	A
G-4-537	A	58	10	58	10	Comment: correct misspelling in phrase "ecosystem structures" (Government of Finland)	A
G-4-538	A	58	17			Incorrect order of the publication year of the references (Government of Korea)	A
G-4-539	A	58	18	58	18	add adaptation cost research needs here, as this is mentioned in several chapters. (Government of Germany)	A
G-4-540	A	73	14			Reference needs to be corrected – author?? (Government of USA)	A

G-4-541	A	86	6	86	6	Add the reference Naiman R.J., H. Décamps and M. McClain, 2005: Riparia: Ecology, Conservation, and Management of Streamside Communities. Elsevier, Burlington, MA, 448 pp. (Government of France)	R -Book has a too narrow scope to be used in this context
G-4-1	LAT E	0				There is little information on desert and arid zones in Latin America, as it is the case of the Chaco and Patagonia ecosystems, adding to more than a million square kilometers of usable land. In this regard it is important to notice that the melting of the Patagonian glaciers and the remarkable ice shelf in Southern Patagonia, in the coming 150 to 200 years, will bring sufficient freshwater to enable the natural and managed ecosystems' displacement to the southernmost segment of Latin America. Nothing is mentioned about the extensive desert on the west coast of South America, from near the Equator to Central Chile, including Atacama, the largest hyper-drydesert.. (Government of Argentina)	A - but please give us references - our CA for South America was only a marine specialist.
G-4-2	LAT E	0				There is a repeated mention only to boreal ecosystems, when there also are austral ecosystems. This looks like a bias originating in the remarkable difference in the number of authors from developed and developing countries. (Government of Argentina)	R - in fact another referee accused us in the FOD of being southern Hemisphere biased!
G-4-3	LAT E	0				The quality of the sectoral chapters (3 to 8) looks quite diverse. However, practically all of them show the same two shortcomings. 1.- the lack of strong appeal to decision makers regarding the assumption of their country s responsibility to implement fully their commitments in respect to the performance of geophysical and biological observations and compile the necessary social, economic and related human health information to understand better the implications of climate change in their different trades. 2.- The necessity to improve cross referencing among them and with the regional chapters (Government of Argentina)	R - we cannot be policy prescriptive, A - we have cross referenced more strongly
G-4-4	LAT E	0				Section 4.4.7: Mountains, should refer the disastrous conditions for human being and ecosystems due to the rapid retreat of glaciers and the GLOFs. This is a critical problem in the Andean glaciers in the tropics. Cross reference with the regional chapters will resolve this fault. (Government of Argentina)	R - this is not an ecosystem issue, this is a WGI issue
G-4-5	LAT E	0				No cross-reference with Chapter 15: Polar Regions, left aside the Antarctic ecosystems and their role in the extensive areas of the Southern Hemisphere. The krill issue and its impact on the important fisheries of the South Atlantic and Pacific oceans, as well as the loss of Adeli penguins, in the Antarctic Peninsula. (Government of Argentina)	A - Text improved. Moreover, quite prominently Adeli penguins and similar impacts are in Table 4.1 and F4.4

G-4-6	LATE	0				It should be noted that although figure 4.1 is well developed, it looks incomplete because does not integrate the human health interlinkages with natural systems. In this regard, considering the development MEA has made on the same issue, it would be good, for many reasons, to copy that figure in chapter 4. (Government of Argentina)	R - this is not a Chapter 4 issue
G-4-7	LATE	0				It is well presented. Its structure enables the understanding by users, particularly decision makers. However, it is affected by the same shortcomings recognized as a general failure in the SOD. These are: the lack of information and research work in some developing regions (i.e. Latin America), and the faulty cross-referencing with the other chapters and the CCTs (mainly water). (Government of Argentina)	Addressed in other comments to this reveiwer
G-4-8	LATE	0				It is good to note the interesting Introduction, describing what is meant when talking about ecosystems, biological diversity, etc. (Government of Argentina)	A- thank you
G-4-9	LATE	0				In this chapter again, Section 4.4.8 miss the opportunity to call for better observations, including biological, phonological and phenometric ones and those of a social and economic nature, related to ecosystems' services. (Government of Argentina)	R - this is a chapter 1 issue
G-4-10	LATE	0				Being understood that AR4 should basically include new bibliography, it is surprising to observe references from papers from the 90s as well as a repetition of the Technical Paper on Climate change and Biodiversity, which is, in fact, TAR information, (Government of Argentina)	R - we cite a majority of refs post 2000, and in ecology it is recognised that some classic papers have a long "shelf life", and need to be cited in some instances.
G-4-11	LATE	5	4			The serving functions of natural ecosystems are not complete. For example, for deserts, there are still have fix sands and other functions; for temperate grassland, only fix carbon and soil protection function are mentioned, other functions should be supplemented, such as Ecotourism. (Government of China)	A partly - List was never to be complete (stated in the text) and moreover, our chapter does not cover all (by design, other WGII chapters). Text was improved to make all this clearer
G-4-12	LATE	18	41	19	27	Box 4.3: Although the Sahel example is very interesting, it constitutes a case study. Considering the reduction in length requested, may be this example could be eliminated, also because most relevant aspects are already mentioned within the text. (Government of Argentina)	It is not clear what interesting mean here and there are no indications where in the text is the information in the box repeated. For one thing the box symbolises the recognistion of the significancy
G-4-13	LATE	21	1	21	22	Suggest including the newest NPP data of China, supplement advances on research about the carbon budget of grassland in China and climate change. (Government of China)	R - First we cite already too much literature and then we would need a reference
G-4-14	LATE	28	47	28	48	Suggest mention the positive impacts of plantation construction on climate change. Such as, the implement of converting cultivated land into forests and so on. (Government of China)	R - This is the task of WGIII (we added a crossreference to WGIII)
G-4-15	LATE	30	48	31	34	Box 4.4: Again, considering the reduction in length requested, I suggest reducing the content of this box. The information of the first paragraph is general, a summary of what polar bear are. I think this information could be eliminated or substantially reduced, and focus the box on the information included in the second paragraph, that is the specific challenges polar bears are facing on the context of climate change.	A partly - We have shortened the box by removing the second paragraph. The reviewer's comment to focus on the second paragraph is wrong (reviewer probably meant the third). Concerning the first paragraph we retained it, since boxes should read easily and, in contrast to the rest of the chapter

						(Government of Argentina)	easily and, in contrast to the rest of the chapter, should explain in detail causal chains more fully than this is possible outside of boxes. Without this first paragraph, non biologist readers may not understand why polar bears are vulnerable to warming, except for a very general statement that the species depends on a cold climate without seeing an actual connection. Despite all these counter arguments, we have significantly shortened the box.
G-4-16	LATE	33	9	33	14	The first long sentence of this paragraph is not absolutely clear. (Government of Argentina)	re-phrased these materials (separated into several sentences, tried to improve wording within sentences).
G-4-17	LATE	33	22	33	27	The first sentences of this paragraph is not absolutely clear. (Government of Argentina)	split into two sentences plus some re-wording to improve clarity.
G-4-18	LATE	34	9	34	15	Suggest add the recent research advances about Qinghai-Tibet Platen ecosystem research, such as the research advances on experimental and simulational projection in the background of global warming. (Government of China)	Done based on materials provided by Tianxiang Luo, Institute of Tibetan Plateau Research, Chinese Academy of Sciences
G-4-19	LATE	36	34	36	34	In this line aragonite is mentioned by the first time. A short sentence explaining why this compound is important could be useful. (Government of Argentina)	Explanation added to text
G-4-20	LATE	57	17	57	30	Key uncertainties should also include the nonlinear types and change threshold of ecosystem response to complex climate system change, which deserve to be focused on and resolved. (Government of China)	A