

External review of the first order draft of the land degradation and restoration assessment

30 May - 11 July 2016

Chapter 5

Reviewer Name	Chapter	From Page (start)	From Line (start)	To Page (end)	To Line (end)	Comment	Author Responses (from Chapter 5)
LI Qingfeng	0	0	general comment on FOD LDRA			1, The Report in overall is too academia, too detailed in scientific exploration and descriptions. In consideration of the principal aim "to facilitate the implementation of the National ... and the "Inter-governmental" nature of the organization, the Report has to be more "publicly explicit", rather than "scientifically complicated". If the Report is to be read by the policy makers, and to draw attentions from the public, the content is to be simplified and the volume greatly reduced, one third is more than enough.	In the chapter revision these points are taken into account. The content was simplified wherever possible.
LI Qingfeng	0	0	general comment on FOD LDRA			2, An Executive Summary and a List of Acronymns and Abbreviations are necessary.	An executive summary and a list of Acronymns and Abbreviations has been added to the document
German government	0	0	general comment on FOD LDRA			We believe that the first order draft of the IPBES thematic assessment on Land Degradation and Restoration generally has a comprehensive and scientifically sound structure and we congratulate the authors for this achievement. This is a <i>first order draft</i> however, and, therefore, we hope that our comments will be useful for the further development and maturing of this assessment so that in the <i>second order draft</i> scientifically strong and comprehensive key messages can emerge. We very much look forward to the <i>second order draft</i> of this important assessment.	Thank you
German government	0	0	general comment on FOD LDRA			We request the co-chairs of this assessment to ensure that the general comments listed for this assessment are made available to the CLAs and LAs of all 8 chapters. Reason: Cross-referencing between the 8 chapters of the FOD sections by chapter authors should help to (1) avoid repetition; (2) use the same terminology/definitions, (c) strengthen the logical connection between the 8 chapters and, thus, (d) strengthen the overall storyline of the assessment.	1) In the Second Author Meeting (SAM) in Bonn chapter boundaries were defined; 2) glossary has been made; 3) common drivers and ES were addressed from different chapter perspectives . The general comments have been distributed to all chapters and revisions have been made by chapters as stated above.
German government	0	0	general comment on FOD LDRA			It needs to be critically highlighted that chapter 1 needs to provide a sound basis on the scope of this assessment and on the key definitions/terminology used throughout the 8 chapters. This should help to develop a strong storyline throughout the chapters. Chapter 8 on decision support should reflect more strongly on the findings of the previous chapters and also discuss policy support tools. Currently, chapter 8 remains quite general. All in all, the chapter authors should analyse the findings of the other chapters of the assessment and cross-reference to these. As we are discussing a thematic assessment which should also add value to the IPBES global assessment (D2c), we strongly encourage the authors of the 8 chapters to also analyse the relevant findings emerging from the four regional IPBES assessments.	Cross-chapter references are included in chapter 5. Broader set of decision support tools are included and policy instruments synthesized. We have read the FOD of the Regional assessments.
German government	0	0	general comment on FOD LDRA			A major cross-cutting issue throughout the document is that land degradation and restoration are being "lumped" too much together , without considering that each of these measures has different drivers, processes etc. Discussing both aspects separately and with a stronger biodiversity and ecosystems perspective would add value to the document.	We have introduced and clarified the difference and changed the text where appropriate (eg not avoiding LDR, but avoiding LD and stimulating R)
German government	0	0	general comment on FOD LDRA			The assessment should provide balanced scientific-based opinions and not overemphasize certain opinions, thereby possibly paying less attention to other perspectives. Therefore, the arguments in a chapter should not build just around one or two opinion-based citations.	We used mutple sources but looked spacifically for data/evidence-based references, not for opinions or perspectives.
German government	0	0	general comment on FOD LDRA			Please ensure that all 8 chapters will start with an executive summary that includes a list of key messages and their degrees of confidences, based on the Platform's confidence framework in the Platform's guide on assessments (IPBES/4/INF/9). Such key messages will be extremely relevant for the user groups of this assessment and most certainly for identifying policy options.	OK. An executive summary where the key messages are highlighted and the degree of confidence indicated has been included.
German government	0	0	general comment on FOD LDRA			Provide an annex for this assessment that lists all the acronyms, abbreviations and key terms (including their definitions) used in the assessment.	We have added a list of abbreviations and glossary items. Key terms used by many chapters were also defined in Chapter 1
German government	0	0	general comment on FOD LDRA			Ensure consistency in the wording and the use of the key terms provided in section 1.1.2 throughout the document (all 8 chapters) of this assessment. Please also ensure that the wording of definitions provided in section 1.1.2 corresponds to the wording of these definitions as outlined in Decision 3/1, Annex VIII.	We have added a list of abbreviations and the full glossary at the end of the report.
German government	0	0	general comment on FOD LDRA			Ensure that perscriptive language is not used.	Text has been checked for prescriptive language and replaced with "if...then" phrasing.
German government	0	0	general comment on FOD LDRA			In the further development of the assessment report, please also refer to other IPBES work programme items that are thematically linked to this assessment (e.g. "capacity development (D1a/b)"; "indigeneous and local knowledge (D1c); "regional assessments (D2b)"; "global assessment (D2c)"; "pollination, pollination and food production (D3a)"; "scenarios and modeling (D3c)"; "policy support tools (D4c)".	Cross-reference to the IPBES policy support tools has been made.
German government	0	0	general comment on FOD LDRA			Regarding chapter 1 and in chapter 8: highlight the relevance of the LDR assessment for the Strategic Plan for Biodiversity 2011–2020 / Aichi Targets (specifically goal 15), and the SDGs (and especially SDG 15).	The Aichi targets and the SDG were discussed in relevant sections of CH5.

German government	0	0	general comment on FOD LDRA	Outline in chapter 1 and in chapter 8, how the land degradation and restoration assessment will deliver to/support the IPBES global assessment on biodiversity and ecosystem services (D2c).	No specific action taken in the chapter text. Chapter 1 deals with overarching issues, such as this one.
German government	0	0	general comment on FOD LDRA	The terms "sustainable land use" and "sustainable land management" are somewhat being used interchangeably. Please check the definitions of both terms and if necessary, please align the use of these terms accordingly throughout the assessment report (all 8 chapters).	Included and used as defined in the glossary
German government	0	0	general comment on FOD LDRA	Throughout the document the terms "reduction" and "mitigation" are being used. Please provide information about the technical difference between both terms.	This has been addressed in the glossary and used as such
German government	0	0	general comment on FOD LDRA	Regarding figures, tables, photos/images: Ensure in the <i>second order draft</i> and the associated SPM that the quality of all visual materials should be high .	Visual materials have been improved to the best quality possible through using a specialized cartographer to redraw the figures and obtaining high quality photos.
German government	0	0	general comment on FOD LDRA	Information and data targetting the same or similar issues (e.g. on urbanisation/global extent of land degradation, deforestation rates ...), are outlined in the various chapters of the report, partly by referring to different statistical sources. We strongly encourage you to develop comprehensive chapters-spanning tables and figures on similar issues in order to align information throughout the 8 chapters so that strong key messages can emerge.	A set of cross chapter drivers, trends is used, including policy instruments.
German government	0	0	general comment on FOD LDRA	Ensure for all 8 chapters that data and other facts (numbers, percentages, statements, citations) are provided with at least one reference.	References have been provided.
German government	0	0	general comment on FOD LDRA	Not all references cited in the text are to be found in the reference lists of the chapters. Please critically cross-check.	All reference material has been added to the referece manager to ensure correct citations.
German government	0	0	general comment on FOD LDRA	We have acknowledged that professional language editing will be taken care of at a later stage. We have therefore restricted ourselves to providing comments only on the thematic contents of each chapter. Therefore, please ensure that language editing is taken care of.	Text has been fully editing for the final draft .
Hamid Custovic (SPI)	0	0	general comment on FOD LDRA	Perhaps excusable in a FOD, but the majority of the text needs substantial editing to improve English expression and ensure clarity.	Although text will be edited is a later stage, initial editing has been carried out by the coordinating lead authors to ensure readability of the chapter
Hamid Custovic (SPI)	0	0	general comment on FOD LDRA	The document length should be substantially reduced, so that it is readable for the intended audience of policy-makers. Delete the text that does not relate directly to the topic of assessment of land degradation. Condense the explanatory text and provide references for further detail.	We aimed to be as concise as possible in the chapter revisions.
Hamid Custovic (SPI)	0	0	general comment on FOD LDRA	The report title is misleading. The assessment is not about land degradation but rather about biodiversity loss, because land degradation has been defined here as "processes that cause biodiversity loss and loss of ecosystem functions and services". Ideally the title should be reworded to reflect the content.	Title used was given to us in the Scoping Document, which was approved by IPBES Plenary (please see annex VIII to Decision IPBES-3/1). We are not in the position to change the title.
Hamid Custovic (SPI)	0	0	general comment on FOD LDRA	We encourage the authors to elaborate on how land degradation/restoration can seamlessly integrate agriculture, ecosystems services and biodiversity.	This has been addressed in the final version of the assessment report.
Hamid Custovic (SPI)	0	0	general comment on FOD LDRA	It would be helpful if the report used the language of DPSIR; this could help to minimise the repetition between chapters, if authors can recognise that for example chapter 4 should be confined to pressure and state, and not also discuss drivers (ch3) and impacts (on ecosystems - Ch 5), and human responses (ch 6).	The assessment is build around DPSIR. Chapter 6 and part of 8 addresses the response part. Drivers, Pressures, State, Impact Response
Hamid Custovic (SPI)	0	0	general comment on FOD LDRA	Not all references cited can be found in the reference list. This needs to be taken care of.	All literature has been added to the referece manager to ensure correct citations.
Hamid Custovic (SPI)	0	0	general comment on FOD LDRA	The second order draft should include key messages and their level of confidence. This is currently lacking.	Executive summary has been developed, including level of confidence
Hamid Custovic (SPI)	0	0	general comment on FOD LDRA	Some item are repeated on introduction of different chapters.	OK. Some overlap in intro is OK, as long as being dealt with from a specific chapter angle.

				<p>Considering IPBES' role as the interface between science and policy, we consider it critical that the reports clearly communicate the key findings, implications and recommendations within chapters so that they can be readily used by policy makers. To assist this there may be value in the chapters having a uniform structure, similar to that in the Executive Summary of the IPCC Chapters. In addition to including an executive summary, the following headers might help focus the authors' attention to ensuring their chapters are targeted to policy-makers as opposed to an academic audience:</p> <ul style="list-style-type: none"> – Executive Summary 1. Key Findings 2. Critical Implications 3. Gaps in Knowledge and Data 4. Recommendations 5. FAQ 	
Peter Onorato	0	0	general comment on FOD LDRA	A clear and consistent structure, along with key findings and recommendations, could be of great benefit to policy makers.	All chapters have an executive summary. SPM addresses all other elements presented.
Peter Onorato	0	0	general comment on FOD LDRA	some of the Chapters (particularly Chapter 2) competing scientific views on certain issues are presented, almost debate-like, one after another. While it's important to understand the current state of the science, we do not think that IPBES Assessment Reports should be used as a platform to advance contested academic theories as this diminishes the report's ability to be a clear and concise communication document. In order to best bridge the gap between science and policy, and to provide policymakers with clear guidance, Assessment Reports should present the latest knowledge and make recommendations based on this. Policy makers generally don't have the depth of knowledge to balance contested scientific theories and will rely on IPBES' work to clearly identify the best policy options available	Our assessment will highlight contested ideas/findings, and report those using the IPBES Confidence terms. The arguments presented in this draft were significantly reviewed, edited and reduced in the subsequent versions of the report
Peter Onorato	0	0	general comment on FOD LDRA	The SDGs constitute the new global paradigm for sustainable development. As such, we consider there to be value in drawing more links between the SDGs and IPBES' work within the reports. Again, this will help policymakers effectively prosecute the case for improved biodiversity policies, and help identify where clear links exist between biodiversity policy and other issues including development and broader environmental outcomes, strengthening the case for biodiversity policy priorities.	Relevant SDGs have been addressed in a synthesis table Section 8.4. and also features strongly in SPM.
Ayman Batisha	0	0	general comment on FOD LDRA	The entire report should be homogenously arranged, logically build and fully integrated with no inconsistency, disharmony or overlapping within its chapters and sections. The titles of chapters and sections are generally too long to be professional.	This was addressed at the Second Author meeting; portions off text were exchanged or deleted to eliminate unnecessary overlap. Section titles were also edited to reduce length.
Ayman Batisha	0	0	general comment on FOD LDRA	Number of sections still requires more work and careful revision. As examples, in Chapter 1, There should be more sections to clarify 1.2 What constitutes Success in the restoration of degraded land?; 1.3.1.1 until 1.3.1.5 should be corrected; in Chapter 2, the classification of Natural and social science and the law, Human sciences, and Social inequities should be justified (or correct); in Chapter 3, how "3.6. Food security through tackling land degradation" is related with the direct and indirect drivers of land degradation and restoration; in Chapter 4, most of sections deals with multiple drivers and Key Human Drivers, although the reader expect that "the status and trends of land degradation and restoration and associated changes in biodiversity and ecosystem functions" will be analyzed; in Chapter 5, the reader expect that there are some sort of comparisons between the case of land degradation and the case of land restoration; in Chapter 6, Responses to avoid land degradation and restore degraded land, the reader expect that there is an Environmental assessment evaluation and a full Economic and financial mechanisms, how can it be applied in the mentioned Case studies and how he/she can estimate the total cost in his/her Case study; in Chapter 7, Issues not being raised include how soft computing techniques such as Fuzzy Logic and Neural Networks can develop scenarios of how land degradation and restoration could evolve in both Near-term and Long-term; in Chapter 8, the reader expect that there a focus on soft computing techniques, and the possible application in the fields of the decision support systems used to address land degradation and restoration based on a well-defined Environmental indicators.	The full assessment has gone through multiple revision rounds and streamlining across chapters. Better linkages between chapters have been developed in the final draft.
Ayman Batisha	0	0	general comment on FOD LDRA	The entire report should be homogenous and integrated with no interference within its chapters and sections. As a quick example, the first section in Chapters 1, 5 & 6 is Introduction; whereas in Chapter 2 is Executive summary: Key Messages; in Chapter 3 is Purpose and value of chapter; in Chapter 4 is Introduction to the degradation process; in Chapter 7 is Table of Content, Executive Summary (Key policy messages), At the global level, At the local level (only where different from global messages); and in Chapter 8 is Executive Summary. Similarly, the end section in Chapter 1 is 1.3 Case studies of successful land restoration; in Chapter 2 is Conclusions - Working with perceptions as a policy tool; in Chapter 3 is 3.7 References Cited; in Chapter 4 is 4.6 Conclusions, 4.7 Glossary, 4.8 References; in Chapter 5 is 5.5 Remaining Challenges; in Chapter 6 is 6.4.4.2 Case studies, 6.5 References; in Chapter 7 is 7.4.4 New approaches: Visioning LDR for Sustainable Futures; and in Chapter 8 is 8.4.3 Identify and prioritize responses to reduce trade-offs and/or enhance synergies to address land degradation and/or develop restoration.	The full assessment has gone through multiple revision rounds and streamlining across chapters. Consistent structuring across chapters has been developed as well.
Ayman Batisha	0	0	general comment on FOD LDRA	Numbers of topics still require work and revision, as examples, please compare "3.3.6 Fire regime change" with "4.3.6 Fire regime change", and "6.3.1.5 Fire regime change", also, compare "3.4 Climate change as a threat multiplier of degradation drivers", with "4.2 Cross cutting degradation processes common to multiple drivers", and "6.3.1.10 Climate change as a threat multiplier".	The full assessment has gone through multiple rounds of revisions by authors and co-chairs. Please see the final draft of the assessment.

Ayman Batisha	0	0	general comment on FOD LDRA	<p>There should be examples/chapter to clarify how the biogeochemical cycle (carbon, oxygen, nitrogen, phosphorus, sulfur, calcium, rock and water etc.) through both biotic (biosphere) and abiotic (atmosphere, hydrosphere, and lithosphere) compartments of Earth can cause land degradation and restoration. Special attention should be emphasized to the human-caused cycle of atrazine, which may affect certain species. Land degradation and restoration should be assessed in the light of Global Changes; Global Warming; Global Sea Level Rise, and Global Ocean. Land degradation and restoration should be assessed into two categories which operates at different time scales: the biological – physical, (Near-term) and the geological, (Long-term). Land restoration opportunities, planning, economics, implementation constraints, and limits should be defined.</p>	The biophysical aspects are described in detail in Ch4.
Ayman Batisha	0	0	general comment on FOD LDRA	<p>Assessment on land degradation and restoration should emphasize on multiple Land-use Categories; Forest Land, Cropland, Grassland, Wetlands, Peatlands, Settlements, and most important and significant Arid and Semi-arid land. Assessment on land degradation and restoration should emphasize on Policy Oriented Research. Human Settlements, Industry, and Infrastructure in both Urban and Rural Areas should be surveyed. Cross-cutting issues such that Agriculture, Water, Energy, Industrial Processes, CO2 Transport, Injection and Geological Storage, Waste Generation, Composition, Incineration, Treatment, Discharge, Disposal and Management should be focused.</p>	We have discussed the relevant decision making strategies for as many landuse categories as we can including Rangeland, cropland, forest, wetland and built-up areas
Ayman Batisha	0	0	general comment on FOD LDRA	<p>Research related to the Science of land degradation and restoration should be emphasized on. Assessment on land degradation and restoration generally deal with multiple meanings of fuzzy concepts, so it is strongly recommended to add chapter/section to provide General Guidance to the subject of how applying fuzzy concepts in the context of land degradation and restoration using soft computing techniques. The scope of soft computing covers the areas of Fuzzy Logic, Neural Networks, Chaos Theory, Evolutionary Computing, Rough Sets, Ant Colony, Immunological Computing, Particle Swarm, Wavelet, Probabilistic Computing, Hybrid Methods and other similar techniques to address real world complexities achieving tractability, robustness and low cost solution. The chapter may be devoted to effective approaches to Data Collection; dealing with Uncertainties; Methodological and efficient technique Choice; Time Series Consistency Identification of Key Categories, and Quality Assurance/Quality Control and Verification. The application areas of soft computing include but are not limited to Detection and Attribution of land degradation: from Global to Regional and local, land degradation Projections and Predictability (Near-term and Long-term). Land degradation Phenomena and its relevance for future Global and Climate Change. Detection and attribution of observed and multi-sector degradation, emergent risks, key vulnerabilities, and opportunities should be addressed. Land degradation and restoration should be assessed in the light of statistical analysis and levels of confidence.</p>	Thank you for this comment. You present a valid point, but it is not relevant for Chapter 5, under the agreed upon scoping. Chapter 2 provides further details on "fuzzy concepts"
Ayman Batisha	0	0	general comment on FOD LDRA	<p>Atlas of Global, Regional and local land degradation and restoration Existing, Projections and Predictability should be annexed.</p>	We tried to integrate all relevant information within the body of the text, so as to not overload the final report with extensive back matter.
Anna Luise	0	0	general comment on FOD LDRA	<p>The Chapters are disomogenous. Their structure is different as well as the degree of deepening of the topics which, in general, remains too weak. Some general concepts and the conceptual framework itself are repeated too many times with no real added value in the various Chapters. Even if all concepts should be based on sound scientific data and information, too many references could generate some confusion. The report should take into consideration its utilisation, among all, in policy making processes, and adopt an appropriate language. Some overlapping, for example for Chapter 7 and 8. On the contrary, some citations are disomogenous.</p>	We solved inappropriate overlap between chapters and within chapters for the final draft.
Chenu Claire	Chapter 5	0	0	<p>General comment: In general I found this section well structured, with sections relevant. That not only ecosystem services but also human well being is considered and well developed in the chapter is noteworthy. The connection with chapter 4 is not obvious and should be developed.</p>	We are working with the Chapter 4 authors to improve coordination in content between chapters.
Chenu Claire	Chapter 5	0	0	<p>General comment: Not all ecosystem services are covered (e.g. erosion, regulation of wastes, ..) but this is OK. I was expecting though some kind of quantitative estimate or at least general synthesis (e.g. stable, decreasing, increasing..), but I realize that this is not attainable within the time scale of such evaluation. A general table would be welcome to liaise with chapter 4. Two comments:</p>	Chapter 5 has been reorganized around specific measures of human well-being (i.e. food security). For each of these measures we have identified how land degradation impacts these various quality of life measure via changes in most impact nature's benefits.
Chenu Claire	Chapter 5	0	0	<p>General comment: 1- The time frame is not presented and not obvious from the text. It is probably defined in the introduction of the whole report but not given here. Are trends examined from the start of agriculture or for the last century or the last 3 decades ?</p>	In Chapter 5 SOD we are using the agreed upon baselines concepts for current state (2012), index state (1992), reference (1800-1950) & desired state (context dependent)
Chenu Claire	Chapter 5	0	0	<p>General comment: 2- changes in ecosystem services can be broadly ascribed to (i) changes in land use (deforestation essentially, but also urbanization, development of agriculture at the expense of prairies or wetlands) and (ii) intensification of a given land use (intensification of agriculture, pasture degradation, forestry management..). It could make the sections clearer to differentiate the two (the text often goes from one to another at the sentence scale). It would also make the liaison with chapter 4 more evident.</p>	Thank you. We have restructured our chapter and subdivided it now into different dimensions of quality of life. In the new food security section, we have adapted the subsection according to your suggestion. Under land use and land cover change, we subdivided the section into deforestation and clearance of native vegetation and land use and management intensification, but have added soil and water degradation as a third subsection given its importance for food production.
Wang Jun	Chapter 5	0	0	<p>General: Suggested that support services are added,such as soil nutrients cycle and wildlife habitat.</p>	Chapter 5 has been reorganized around specific measures of human well-being (i.e. food security). For each of these measures we have identified how land degradation impacts these various quality of life measure via changes in most impact nature's benefits.

Patricia Balvanera	Chapter 5	0	0	0	0	<p>This chapter provides a very interesting revision of the mechanistic links between degradation and the supply, delivery or demand on services, but I missed more data on such trends. I suppose a typology of the types of land degradation (and types of restoration) is available elsewhere in the assessment. Maybe such a typology could be used here to provide a more systematic overview of how different types of degradation or restoration have differential impacts on the different services and the processes associated to their supply, delivery or demand. I wonder what is the time frame of the assessment. Degradation from the onset of human civilization? or that within the last 100 years after industrial revolution or after the 50's when exponential population growth and resource use occurred. I am surprised by the limited emphasis on the degradation of soils on the supply of services.</p>	<p>We reference the typology of change developed in Chapter 3 when necessary. With regards to time frame we are using the agreed upon baseline concepts for current state (2012), index state (1992), reference (1800-1950) & desired state (context dependent) in the SOD</p>
Déborah Oliveira	Chapter 5	0	0			<p>General comment: The chapter is extremely well structured, following a logical reasoning. However, there should be a topic (or at least a paragraph) about the relationship between indigenous people and the environment, not only regarding the crops, but also regarding their sacred rituals.</p>	<p>Thank you. We have included the impacts on indigenous people, for instance, in the new food security section, where we emphasize the role of traditional and culturally important food as major component of livelihood for local people.</p>
Hamid Custovic (SPI)	Chapter 5	0	0			<p>General comment: Chapter 5 currently provides a catalogue of ecosystem services. We encourage the authors to strengthen the assessment of changes in ecosystem services resulting from land degradation and restoration.</p>	<p>Chapter 5 has been reorganized around specific measures of human well-being (i.e. food security). For each of these measures we have identified how land degradation impacts these various quality of life measures via changes in most important nature's benefits. We think this has improved our assessment of LDR linked changes in nature's benefits.</p>
German government	Chapter 5	0	0			<p>General comment: The first pages of this chapter indicate a strong focus of this chapter on ecosystem functions and ecosystem services. In fact, the term "biodiversity" is not once mentioned in the sections "5.1 Introduction", "5.2.1 Food" and "5.2.2 Medicinal resources". Please include the "biodiversity" right from the start in the discussion.</p>	<p>In the new introduction we introduce both biodiversity & nature's benefits.</p>
German government	Chapter 5	0	0			<p>General comment: Provide cross-references especially to chapters 3 and 4, where similar issues regarding the degradation of ecosystem functions are discussed in order to ensure alignment in the arguments throughout the assessment.</p>	<p>We are working with the Chapter 3 & 4 authors to improve coordination in content between chapters.</p>
German government	Chapter 5	0	0			<p>General comment on section 5.2.3.2 "Restoration": Based on the definitions provided for "restoration" and "rehabilitation" in section 1.1.2 (see Figure 1.1.), consider "rehabilitation" measures in the discussions of this section as well.</p>	<p>Thank you. We are working to increase discussion/examples of restorations as well as rehabilitation in the SOD and ensure they are used properly.</p>
Markus Giger	Chapter 5	2	0	2		<p>Under provisioning services food, medicinal plants, freshwater and biomass are mentioned. What about other agricultural products such as cotton and other fibres, rubber, wood (not for biomass), and many other products such as flowers, dye and others? Also the production of feed for animals might deserve a sub-chapter.</p> <p>For overcoming gaps, suggesting the following points for this chapter: · Human-Environment Interaction (HEI) pathway for land management; · Human action impact on natural capital; · The role of institutions, technology and knowledge in improving policy for natural resources rights and in promoting sustainable development; · The impact of climate change on migration and conflict; · The reflection of biophysical and socio-economic factors on landscapes, and the interaction of one set of factors upon the other; and · Leverage points to improve Land Quality Management System (LQMS).</p>	<p>The food section is focused on food production & security specifically, so non-food crops are not discussed there. However, the poverty & livelihoods section generally covers the livelihood effects of changes in non-food crops, as you suggest.</p>
M. Y. Yazdandoost	Chapter 5	2	52	27	1035		<p>We believe our new chapter structure focused on specific measures of human well-being (i.e. food security). For each of these measures we have identified how land degradation impacts these various quality of life measures via changes in most important nature's benefits touches on the majority of points raised. It also allows for an increase in roles of anthropogenic assets and governance/institutions.</p>
David Lamb	Chapter 5		70			<p>The term restoration is included in the title but is not mentioned here. Nor is it much evident in the text although it does appear in section 5.2.3.2 and is mentioned occasionally elsewhere. But its presence in 5.2.3.2 highlights its absence elsewhere. Might it be useful to have a specific restoration sub-section at the end of 5.2, 5.3 and 5.4 where it is discussed in the context of that section?</p>	<p>Thank you. We have restructured our chapter focussing primarily on the major dimensions of quality of life, such as food security, health, energy etc. In the new food security section, we have added a separate subsection on land restoration, where we explicitly describe the role of different forms of conservation agriculture, reforestation, or agroforestry.</p>
Kerstin Jantke	Chapter 5	3	73	3	75	<p>I suggest including supporting ecosystem services (i.e. soil formation, nutrient cycling) as a fourth category of ecosystem services here. Degradation and restoration affect not only provisioning, regulating and cultural services, but also supporting services. Later in the document (p. 14, line 539f.), you explicitly refer to soil formation as a service affecting other ecosystem services. Therefore, it might be more congruent to include supporting services right at the beginning.</p>	<p>Chapter 5 has been reorganized around specific measures of human well-being (i.e. food security). For each of these measures we have identified how land degradation impacts these various quality of life measures via changes in most important nature's benefits. In this way supporting services are addressed. These linkages are made more clear in the restructured Chapter 5 SOD.</p>
David Lamb	Chapter 5	3	79			<p>this concluding section appears to be missing (from index and text)?</p>	
Olivier Blond	Chapter 5	3	82	9	339	<p>There should be a subchapter dealing with green areas and health impact in urban areas. There are studies demonstrating direct and indirect benefits of natural areas in city centers. The main publication dealing with this is this one: Kardan O. et al, "Neighborhood greenspace and health in a large urban center.", Sci Rep. 2015 Jul 9;5:11610 - Source: http://www.nature.com/articles/srep11610#abstract and Geoffrey H. Donovan et al, "The relationship between trees and human health: evidence from the spread of the emerald ash borer.", Am J Prev Med. 2013 Feb;44(2):139-45. Proposition of subchapter to add: 5.2.x Green areas and health impact. In Toronto, Canada, Kardan O. and colleagues have reported citizens living nearby higher density of trees in their street, when compared to equivalent annual incomes, have higher health perception and suffer less cardio-metabolic conditions. Although this eco-systemic service is not increasing by itself biodiversity tremendously (non autochthon tree species may be used), it is encouraging. Another research has identified the impact of the loss of 100 million of trees in the North-East of USA, due to an invasive insect (the emerald ash borer). It was probably due to the loss of a recreation service and they demonstrated that it influenced mortality related to illness of the respiratory tract and cardio-vascular diseases (Geoffrey H. Donovan et 2013)</p>	<p>Thank you for these suggestions. We have incorporated them into section 5.4.6</p>

Olivier Blond	Chapter 5	3	82	9	339	<p>In the chapter proposed above, there should be a part dealing with the positive impact of green areas to reduce air pollutants. K.P. Beckett et al, "Urban woodlands: their role in reducing the effects of particulate pollution", Environmental Pollution 99 (1998) 347-360, Yin Shan et al, "Effects of vegetation status in urban green spaces on particle removal in a street canyon atmosphere", Acta Ecologica Sinica, 2007, 27(11), 4590–4595, Andreas D. Kappos et al, "Health effects of particles in ambient air", Int. J. Hyg. Environ. Health 207 (2004); 399 ± 407 and Sara Janhäll et al, "Review on urban vegetation and particle air pollution – Deposition and dispersion", Atmospheric Environment Volume 105, March 2015, Pages 130–137. There are several studies conducted around the world of the benefit of trees near roads in cities and measured show that the amount of air particles is significantly reduced (K. P. Beckett et al - 1998 and Y. Shan et al - 2007. These particles are associated with many diseases (respiratory, cardiac and allergic (A. D. Kappos et al - 2004). Knowing that most of these particles are anthropogenic, it is a strong argument to increase the surface of green areas near roads in cities. Furthermore, S. Janhäll et al (2015) have demonstrated that the design of green covers is important to improve more filtration of particles, a vegetal cover close to the ground with trees should have a maximum impact.</p>	<p>There are several studies conducted around the world of the benefit of trees near roads in cities and measured show that the amount of air particles is significantly reduced (K. P. Beckett et al - 1998 and Y. Shan et al - 2007. These particles are associated with many diseases (respiratory, cardiac and allergic (A. D. Kappos et al - 2004). Knowing that most of these particles are anthropogenic, it is a strong argument to increase the surface of green areas near roads in cities. Furthermore, S. Janhäll et al (2015) have demonstrated that the design of green covers is important to improve more filtration of particles, a vegetal cover close to the ground with trees should have a maximum impact.</p>
Patricia Balvanera	Chapter 5	3	82	4	136	<p>Would it be possible to document this with accompanying figures of trends and correlations between the different drivers associated to degradation and the supply or delivery of the services?</p>	<p>Thank you. We have considered to create a figure that correlates land degradation with the food security status of different countries and regions using soil degradation indicators of the GLADIS dataset and FAO food security indicators. However, we noticed two major problems with this approach. First, land degradation is highly variable between and within regions and the impacts on human well-being are strongly site-specific and depend on a large amount of factors (as mentioned in the text). Second, many impacts of land degradation on food security are masked by technological assets and international trade, for example many countries compensate production losses through degradation or water scarcity simply with increasing their imports. These major shortcomings make it practically not possible to draw a global picture of the land degradation-human well-being relationship, especially when only national statistics are available (such as the FAO indicators). Therefore we decided to better describe the different mechanisms qualitatively in the text by reference to different example regions (supported by case study boxes) instead of creating a quantitative figure, which could potentially lead to misinterpretations.</p>
Jacques Delsalle	Chapter 5	3	82	9	339	<p>Section on provisioning services do not follow CICES ecosystem services typology. Provisioning services of materials beyond medicinal resources (e.g. timber, fibers) are missing</p>	<p>Thank you. We are using the new classification of services/nature's benefits that are suggested by IPBES (not the CICES classification). We have restructured our chapter based on major aspects of quality of life/human well-being. With this new structure, we address other provisioning services (besides food and water) in different subsections related for example to energy, poverty, and human security.</p>
Gunay Erpul	Chapter 5	3	82	4	136	<p>GSP: The World Soil Charter: essential connections between human well-being and the soil</p>	<p>Thank you. We have added a subsection on soil and water degradation in the food security section of our chapter. In this subsection, we describe the role of soils for human wellbeing and the impacts of soil degradation on food security. We have included the suggested literature.</p>
Lim Li Ching	Chapter 5	3	83	4	136	<p>I find this section a little problematic, as it is rather linear in approach and does not state the urgency of the issue sufficiently or in depth. More emphasis needs to be placed on the importance of forests, healthy soils, biodiversity, et.c for food provisioning. The ecosystem functions of forests for agriculture, for example, are not just important for smallholders, but for food production globally. Green Revolution, industrial agriculture has not only had environmental impacts, but also health and social impacts, and threatens the very resource base that agriculture is dependent on.</p>	<p>Thank you. We have restructured our chapter and included an individual section on food security. In this new section, we describe in more detail the different impacts of land use change, management intensification, and soil and water degradation for different groups (e.g., developed countries, smallholder farmers, indigenous people). In different subsections, we have additionally focused more on the importance of forests, tree-based systems, and natural vegetation for food availability, nutrition, and health. Different health issues through agricultural intensification (e.g., water quality degradation and changing diets) have also been addressed and we have additionally added an extra section on land degradation and human health.</p>
John Parrotta	Chapter 5	3	83	4	136	<p>For a much fuller and robust discussion about the relationship between forest and food and nutritional security, the authors need to cite (and use!) the Collaborative Partnership on Forests' recent Global Forest Expert Panel assessment report: available at http://www.iufro.org/science/gfep/, reprinted as: Vira, B., Mansourian, S. and Wildburger, C. Forests and Food: Addressing Hunger and Nutrition across Sustainable Landscapes. Cambridge, UK: Open Book Publishers, 2015. http://dx.doi.org/10.11647/OBP.0085.</p>	<p>Thank you. In our new food security section, we have emphasized the importance of forests, tree-based systems, and other natural vegetation for food availability and looked at different groups, for instance smallholder farmers and indigenous communities. To highlight the role of forests for food security, we have added some of the findings and information from different chapters of the suggested report.</p>
Gunay Erpul	Chapter 5	3	83	3	87	<p>The connections between soils security and societal issues (food security) (McBratney, Field and Koch, 2014) (Bouma and McBratney, 2013).</p>	<p>Thank you. In our new structure, we have added a separate subsection on soil and water degradation (see also comment above). In this subsection we highlight the importance of soils/soil functions/soil security for food security, but also other essential nature's benefits.</p>

Shiping Wang	Chapter 5	3	84	4	136	It should focus on how deforestation and cropland and grassland degradation affects food provision, and similar for restoration. However, the effects of restoration how to affect food provision is overlooked.	Thank you. We have restructured our chapter and added a new section on food security. In this section, we have focussed in different subsections more in depth on the importance of natural vegetation and forests for local food provision and nutrition (e.g., for smallholders and indigenous groups). Additionally, we have added another subsection on restoration (including for example conservation agriculture, multifunctional farming, and tree-based systems such as agroforestry) and describe their role for food security and other nature's benefits.
Adonia Kamuksa Bintoor	Chapter 5	3	88	3	89	Under food, note that although Amazonia has rich natural resources and has experienced the largest clearing of tropical forest biome worldwide in an effort to increase food production, the residents have remained food insecure. This is attributed to degradation of natural resources and biodiversity loss due to deforestation, poor pasture management and poor methods/practices of agriculture (Ortiz et al., 2013).	Thank you. We have added this issue to the new food security section. In this section we describe in more detail the impacts of land degradation, especially deforestation and agricultural intensification on different groups, such as smallholder farmers and indigenous people. We have highlighted that many of the local people still suffer food insecurity and have used different examples from the suggested report as well as other literature.
Penny van Oosterzee	Chapter 5	3	95	3	97	This statement has been taken out of context and misrepresents the article by Fisher. The decline stated here is for one group of Aboriginal people that inhabited desert environments, not the whole of Australia. Land clearing and loss of native vegetation is not a factor here since there is no forest. The article does in fact not talk about forests at all! There was a major decline in animals hunted but the decline in plants species used was due to invasive species, changed fire practices and the fact that the people stopped hunting and gathering after being forced into communities. White invasion was shocking for Aboriginal people but this sort of misrepresentation will not help and could demean IPBES.	Thank you. This paragraph was intended to report impacts on local (indigenous) populations through deforestation and clearance of native vegetation including also other natural habitats besides forests. But we agree that the statement, in the way it was written, could be misinterpreted. In our new food security section, we have clarified that clearance of vegetation does not only imply forests, but also other habitats. We have rewritten our statement and described the impacts on the Aboriginal communities in a more general way, and then gave the Martu people as one example. We highlighted that the loss of wildlife food sources was a combination of different factors including your information. We have additionally added more examples on the loss of wildlife food sources and its impacts on local communities from other world regions.
Gunay Erpul	Chapter 5	3	98	3	109	Deforestation and loss of carbon from the soil (soil microbial communities) in regard to food (Crowther et al., 2014) (Guo and Gifford, 2002; Murty et al., 2002).	Thank you. In our new food security section (see comments above), we have added a subsection on soil degradation that describes the importance of soils for food security. In this subsection, we have added the loss of soil carbon and biota through soil degradation using the suggested literature.
Penny van Oosterzee	Chapter 5	3	100			Foley et al's article has a strong message not really brought out in this section. They say, quite clearly, that clearing for agriculture in the tropics should cease given the dubious gains.	Thank you. We have restructured our chapter and describe in the new food security section the role of deforestation for food provision in more detail. In this section we highlight that the recent deforestation did not contribute much to global food security, while at the same time, it shows negative consequences on the food security for local people. We have used different examples to emphasize that deforestation now has often more negative impacts on food security than benefits.
Penny van Oosterzee	Chapter 5	3	101			Can we have an estimate of the population here that do not have sufficient food?	Yes. We have added an example of the Amazon basin for which the UNEP estimated that about one third of the population were in food insecurity. At the beginning of our new food security section, we have also provided an overview of the global distribution of hunger and malnutrition.
Jacques Delsalle	Chapter 5	3	110	4	122	the impact of soil degradation through loss of soil organic matter and soil biodiversity, on provisioning services could be further elaborated. The report could develop this section showing the impact of changes in land cover, land use and land management on soil productivity, covering the wide range of bio-climatic regions	Thank you. We have restructured our chapter and added a separate section on food security. We have added three subsections describing the role of land use and land cover change on food security, namely deforestation and clearance of native vegetation, land use and management intensification, and soil and water degradation. In these subsections, primarily in the latter, we describe now in more detail how the different forms of degradation affect soil resources and what are the implication on food production. We present the impacts on different regions (e.g., developed and developing countries) and different population groups (e.g., smallholder farmers, indigenous groups) by providing different examples. However, due to the complexity of the soil-food security relationship and the large global and local variability, the entire range of bioclimatic regions could not be covered.
Peter Onorato	Chapter 5	3	112	4	113	However, intensive agricultural production has had a clear negative environmental impacts, such as degradation of soil	Thank you. Sentence has been corrected.
Adonia Kamuksa Bintoor	Chapter 5	4	122	4	123	To address the issue of food production, food security and conservation, a new model of agriculture based on diversification of farms and farming landscapes, optimising biodiversity and stimulating the interaction between different species is proposed (IPES- Food, 2016). From uniformity to diversity: A paradigm shift from industrial agriculture to diversified agro-ecological systems. International Panel of Experts on Sustainable Food Production.	Thank you. We have restructured our chapter and in the new food security section, we have added a subsection on restoration. In this subsection, we describe for example the role of conservation agriculture, multifunctional farming, and crop diversification for food security. We have added the information given in the suggested report.

Gunay Erpul	Chapter 5	4	123	4	136	Soil processes in ecosystem service assessments (Brauman et al., 2007; Compton et al., 2011), (De Groot, Wilson and Boumans, 2002; Robinson et al., 2013) (Boyd and Banzhaf, 2007).	Thank you. We have added in our new food security section the impacts of soil and water degradation on food security and human wellbeing. Here we have also highlighted the importance of soils for other nature's benefits (besides food provision) using the suggested articles.
Gunay Erpul	Chapter 5	4	123	4	136	Impacts of nitrogen on ecosystem services (ES), on the economy and on human well-being (Birch et al., 2010; Compton et al., 2011; van Grinsven et al., 2013) (Vitousek et al., 2009).	Thank you. We have included the impacts of soil fertility in different subsections of the food security section. We have also added the impacts of water pollution through nitrogen on health and societal costs using the suggested literature. Thank you. In our new structure of the food security section, we have focussed more on the impacts of land degradation on poor populations, for example smallholder farmers or indigenous groups in several subsections (e.g., land use and land cover change, globalization, and climate change). Additionally, we have added information on malnutrition and inadequate diets due to land degradation. In the first part of the food security section, we also present an overview on the status of food insecurity and hunger including the impacts on children.
María Silvina Lobo Poblet	Chapter 5	4	124	4	126	it would be interesting to note that the most affected populations are poor. Also indicate the negative consequences of a poor diet to growth, especially in children.	
María Silvina Lobo Poblet	Chapter 5	4	131	4	134	There should be more examples of agricultural activity in South America where this activity occupies an important place. For example, in the case of Argentina in the production of oil, soy stands with 61,400 tons while in cereals maize stands with 33,800 tons (campaign by the Ministry of Agriculture's Nation during 2014-2015) . To read the full report: http://www.agroindustria.gov.ar/dimeagro/granos/Informe-semanal-cultivos.pdf Would it be possible to document this interesting revision with accompanying figures of trends through time or current conditions across space, and correlations between the different drivers associated to degradation and the supply or delivery of the services?. Would it be possible to provide synthesis tables? Is a more systematic revision possible for the case of medicinal resources? Conservation of medicinal resources such as Devil's Claw (<i>Hapogophyllum procumbens</i>) provide income for communities especially women. Mogotsi, K.K., Kanego, A., Sebele, N., Kgaswane, M., and Gabaitse, H. (2006) New Opportunities for Combating Desertification in Botswana: Women in Action for Sustainable Land and Natural Resources Management. http://www.iydd.org/documents/NOTCDIB.pdf .	Thank you. We have added more information on the Amazon region in our new food security section. We describe in more detail the impacts of deforestation and agricultural intensification on rural communities, for instance, smallholders and indigenous groups that are primarily negatively affected by these activities. We have added different examples in the text and separate boxes. Thank you for this suggestion. In the updated draft, we have incorporated a figure from Jones et al. 2012 that summarizes some of the spatial and pathway-based trends in environment-related disease pathways. We think these will be of interest.
Patricia Balvanera	Chapter 5	4	137	7	262	Based on the survey among local communities around Machiara National Park, availability of medicinal resources critically dropped in this area, with 91% of respondents stating that medicinal plants were hardly available (43%) or unavailable (48%) in 2010, as compared to 89% who stated that those plants were easily found in 1980s (Cochard and Dar 2014). This is anecdotal information - not sure that it adds to the point before it about deforestation in Pakistan - suggest deletion	Thank you for this example, we have incorporated it into our discussion in section 5.4.5.
Wame L. Hambira	Chapter 5	4	138	4	152		
Peter Onorato	Chapter 5	4	141	4	145		Thank you for this comment; however, we disagree with the characterization of this information as 'anecdotal' - in fact, it is survey data. We have substantially revised this section, however, so we hope that its improved version will be more satisfactory. These sentences have been changed in SOD. New versions no longer imply Hong Kong is separate from China.
Yuxue Pan	Chapter 5	4	151	4	152	The highest share of these imports are concentrated in Hong Kong in China, followed by USA, Germany and Japan.	These sentences have been changed in SOD. New versions no longer imply Hong Kong is separate from China.
Yuxue Pan	Chapter 5	4	152	4	152	The sentence "Export is led by China, Hong Kong, India and Mexico." should be revised into "Export is led by China, India and Mexico." Because Hong Kong belongs to China.	
María Silvina Lobo Poblet	Chapter 5	5	162	5	197	There should define the environmental services which these ecosystems provide to big cities and the negative effects due to urban expansion. Also mention examples of representative wetlands near urban areas. For example, Delta Biosphere Reserve Parana (RBDelta) has 88,624 ha and is located 40 km of Buenos Aires city. It stretches along 2nd and 3rd Section Delta Islands under the jurisdiction Bonaerense of the Partido de San Fernando, Buenos Aires Province and is part since 2000 of the World Network Biosphere Reserves MaB - UNESCO. Also integrates Reserve Network Biosphere Argentina.	We agree - in the SOD draft we have included more specific information on the ecosystem services provided by wetlands in urban areas.
Royal C. Gardner	Chapter 5	5	163	6	165	A very clear (and appropriate) statement on the importance of freshwater systems including wetlands.	Thank you
Adonia Kamuksa Bintooro	Chapter 5	5	183	5	184	Wiyo et al., 2015 indicate that there is a strong linkage between deforestation in upstream areas, water shortage and power shortages in urban areas of Malawi. Wiyo, K. A., Fiwa, K. & Mwase, W. (2015). Solving deforestation, protecting and managing key water catchments in Malawi using smart public and private partnership. J. Sust. Dev. 8:251-261. Mountain ecosystems are important areas of biodiversity conservation and securing riversheds as water towers. Rwenzori mountains act as a permanent source of R. Nile. However, the mountains are currently experiencing land pressure due to high human population density, forest clearance and agriculture WWF, 2007). Water towers of Eastern Africa: Policy, issues and vision for community based protection and management of montane forests. WWF- East Africa Regional Programme Office, Nairobi, Kenya.	Thank you for the example. We have included this evidence in the SOD
Adonia Kamuksa Bintooro	Chapter 5	5	186	5	187		Thank you for this suggestion. We have restructured our chapter quite significantly since the FOD; as such, our chapter no longer addresses drivers or status of land degradation. We have referred Chapter 4 (status and trends) for them to use if it applies to their text.
Royal C. Gardner Samuel	Chapter 5	5	188	5	191	Here are the data from Davidson that can be used in earlier chapters.	We are unsure which other chapter / sub-section is being referred to in this comment. This comment should be referred to the appropriate chapter authors.
Nshutiyayesu	Chapter 5	6	201	6	208	This paragraph would fit better just after line 172	Thank you for this comment. The entire chapter has been extensively restructured, and we believe that the flow is better throughout.
Beverley Wemple	Chapter 5	6	217	6	217	in phrase "...Zika virus is linked to the its ..." delete word "the"	Thank you, this has been corrected in SOD
Gunay Erpul	Chapter 5	6	220	6	226	Irrigation with wastewater may conserve fresh water resources (Sato et al., 2013).	Thank you for the comment.

Samuel Nshutiyayesu	Chapter 5	6	226	6	227	There should be an introductory statement for the next sub-sections (refer to section 5.4.4)	Thank you for this comment. The entire chapter has been extensively restructured, and we believe that the flow is better throughout.
Royal C. Gardner	Chapter 5	7	245	7	249	In the discussion about waterborne diseases, it may be useful to note Horwitz, P., Finlayson, M. and Weinstein, P. 2012. Healthy wetlands, healthy people: a review of wetlands and human health interactions. Ramsar Technical Report No. 6. Secretariat of the Ramsar Convention on Wetlands, Gland, Switzerland, & The World Health Organization, Geneva, Switzerland. http://www.ramsar.org/sites/default/files/documents/pdf/lib/rtr6-health.pdf	Thank you for this reference. We have incorporated it into the SOD in sections 5.1.1 and 5.4.4.
Beverley Wemple	Chapter 5	7	249	7	252	Suggest breaking this sentence beginning "Agricultural land use ..." into two sentences. Change "high concentration of agricultural chemicals" in first sentence to "high concentrations of nutrients, including nitrate ..(and add that high nitrate concentrations lead to eutrophication of coastal waters and estuaries) and phosphorus, which leads to eutrophication of freshwater lakes and rivers. Follow this with another sentence on agricultural chemicals such as pesticides and herbicides.	Thank you for this comment. The section has been extensively restructured.
Gunay Erpul	Chapter 5	7	255	7	262	Deterioration of the soil structure and to loss of soil function and surface water quality (Steinfeld et al., 2006).	Thank you for these references. We have worked to incorporate them into SOD.
Gunay Erpul	Chapter 5	7	255	7	262	Soil water quality (Kendy et al., 2003); Biofuel production and water quality (Delucchi, 2011).	Thank you for these references. We have worked to incorporate them into SOD.
Gunay Erpul	Chapter 5	7	255	7	262	Loss of water quality due to erosion and sediment movement (Viglizzo and Frank, 2006; Viglizzo and Jobbagy, 2010).	Thank you for these references. We have worked to incorporate them into SOD.
Penny van Oosterzee	Chapter 5	7	263			Surely there is more to say on this? This seems very inadequate. The structure is quite strange and relates probably to the role of restoration on water related ecosystem services. I suggest to rather have two major separate sections, one on the effects of degradation on these services and one on the effects of restoration on them. This section is quite poor given the fantastic meta-analysis already available on the impacts of restoration on ecosystem services by Rey-Benayas among others, as for example the paper by Meli et al on water-related services from wetlands	Thank you for this comment. The section has been extensively restructured.
Patricia Balvanera	Chapter 5	7	263	8	288	There should be a definition of environmental functions of wetlands and the main benefits of restoration to mitigate environmental impacts of big cities.	We agree - in the SOD draft we have included more information addressing this.
María Silvina Lobo Poblet	Chapter 5	7	264	7	268	An important message, clearly stated.	Thank you.
Royal C. Gardner	Chapter 5	7	264	7	268	It is very frustrating when the references aren't listed. This is a common issue throughout and needs to be rectified. IPBES has asked reviewers to devote their time and the least that should happen is that references are listed since they are the basis of IPBES chapters..	Reference lists are included in the SOD
Penny van Oosterzee	Chapter 5	7	266			Section 4.2 not necessary to talk about the degradation process in scientific details, a definition is sufficient for this report.	Apologies if we have misunderstood (and please clarify if so), but we believe that this comment was intended for the chapter 4 authors.
LI Qingfeng	Chapter 5	14	267	24	585	The chapter restoration needs to include the main mechanisms of restoration and what are the consequences - the examples are interesting but I would expect more detailed info which can be also used for a more understandable extrapolation for various soil types, regions, landuse systems etc.	Thank you. We have included restoration into some of the new subsections in our chapter. The food security section, for instance, now contains a separate subsection on land restoration, where different examples of conservation agriculture, reforestation networks, or agroforestry are described in the text supported by a case study box on smallholder farming.
Rainer Horn (ITPS)	Chapter 5	7	268			In sentence ending "... inferred by the cost of land degradation." I would add also that the absence of monitoring, especially in developing regions, prevents us from being able to document effectiveness of these restoration practices	We agree. The restructuring of the SOD has changed this sentence but we have included this idea in the revision.
Beverley Wemple	Chapter 5	7	274	7	274	Eutrophication (Schindler, Hecky and McCullough, 2012), (Alexander et al., 2008); Impact of agricultural land management on water quality (Clearwater et al., 2015) (Brodie et al., 2013).	Thank you for these references. We have worked to incorporate them into SOD.
Gunay Erpul	Chapter 5	7	282	7	282	most biomass loss is probably caused by forests being cleared for agriculture (see 353, 402, 531) rather than in a search for energy?	Agreed. In SOD, biomass sub-section has been reduced and incorporated into a section on energy security.
David Lamb	Chapter 5		289			Strange. I think a revision of the role of biomass in general is not the target of this assessment but rather the impacts of the different kinds of land degradation on the supply and delivery of services. While some of the patterns describe here are relevant to such endeavor they need to be highlighted as such.	The way energy (including biomass) is treated in the SOD has changed substantial. We now have section addressing energy security in general in which biomass energy is addressed.
Patricia Balvanera	Chapter 5	8	289	9	339	By looking at the topic discussed under this section, I suggest that the title of this subsection should be "Biomass energy".	Section title has been revised in SOD.
Kani ISIK	Chapter 5	8	289	9	339	Soils and the nutrient cycle and biomass energy (Vitousek and Matson, 1993) (Scharleman et al., 2014).	The nutrient cycle (including SOM estimates) is dealt with in a different section, and does not have direct bearing on this section. SOM and C cycles is dealt with in more detail in Ch4. I decided to not include these references.
Gunay Erpul	Chapter 5	8	289	9	339	C stored in biomass (Carré et al., 2010; EU, 2004; Hiederer et al., 2010) (Ruesch and Gibbs, 2008).	The focus is more how LDR affects biomass, as to the exact carbon content. The SOD takes a different view on climate change - it is dealt with at a higher level, leaving the remainder of the document to focus on more direct links between biomass and LDR.
Gunay Erpul	Chapter 5	8	289	9	339	Large amounts of biomass removed by crop harvesting and deforestation (Cavelier et al., 1999; von Uexküll and Mutert, 1995).	I could not source the Cavalier reference. The other reference deals with acidic soils, and options for rehabilitation. These concepts are now treated comprehensively as part of land restoration in support of food security, and the potential for biomass in biofuels has been added as a new section in the SOD
Gunay Erpul	Chapter 5	8	289	9	339	Biomass burning, carbon capture and storage (Reis et al., 2012; RoTAP, 2012; Aherne and Posch, 2013).	See next point on biomass burning. CCS is a mitigation response, and not a land restoration action, or a degradation risk. CCS is still a very young technology, and in my mind, not yet viable at scales that matter.

Gunay Erpul	Chapter 5	8	289	9	339	Carbonaceous aerosol emission and biomass burning (Forster et al., 2007), (Ramana et al., 2010), (Takemura et al., 2002) (Kaufman et al., 2002), (Monks et al., 2009), (Damoah et al., 2006; Petzold et al., 2007).	Fire is one the drivers of degradation, and the emissions thereof is important for public health. However, it is not a direct consequence of LDR, and hence we only focus on LD-health-energy links in the SOD. We do refer to work on incomplete combustion of biomass, and the health consequence for indoor air pollution.
Penny van Oosterzee	Chapter 5	8	318			Why write "are still valid today" mean. Of course it is valid today. Regarding the issue of improving 'local energy security', refer also to the discussions in chapter 4 (page 53, lines 1459-1466) on the following aspect: " <i>recent renewed research focus in the sector, and a move away from considering woodfuel as a "dirty fuel".</i> "	We agree. Sentence changed.
German government	Chapter 5	9	329	9	336		Thank you - the new section on biomass and biofuels refers to the costs and benefits of wood fuel.
Chenu Claire	Chapter 5		341			I missed here a definition of the regulating service at the start of the section: climate regulation at the global scale via C sequestration in biomass (forests) and soils, and by N2O or methane emissions, climate regulation at the local scale (due to evapotranspiration, wind halting ect) and atmospheric composition regulation (NH3, NOx., particles).	This is a good point; however, we have restructured the chapter substantially in this draft so as to focus more fully on ecosystem services and human quality of life. Chapter 5 no longer include any explicit discussion of carbon or nitrogen cycles (chapter 4 includes more of this information).
Patricia Balvanera	Chapter 5	9	341	11	452	I found this section being a very interesting summary of the key processes related to degradation and climate and atmospheric quality regulation but think more is needed on documenting the trends through time and across space	This has been removed from the chapter; we have restructured the chapter substantially in this draft so as to focus more fully on ecosystem services and human quality of life. Chapter 5 no longer include any explicit discussion of carbon or nitrogen cycles (chapter 4 includes more of this information).
Kani ISIK	Chapter 5	9	341	11	452	Section Title is "Atmospheric composition and climate regulation". However, only C cycle and N cycle are mentioned here. Greenhouse gases, greenhouse effects due to atmospheric gases, human causes... also need to be discussed in this subsection.	This has been removed from the chapter; we have restructured the chapter substantially in this draft so as to focus more fully on ecosystem services and human quality of life. Chapter 5 no longer include any explicit discussion of carbon or nitrogen cycles (chapter 4 includes more of this information).
Dong-Gill Kim	Chapter 5	9	341	11		I found this section (5.3.1) was entitled as "Atmospheric composition and climate regulation". However, throughout the chapter, general understanding on carbon and nitrogen dynamics through land-use change and land degradation was introduced. How land degradation and restoration affect greenhouse gases carbon dioxide, methane and nitrous oxide and climate change were barely mentioned. I thought the draft would be very informative if the effect of land degradation and restoration on greenhouse gas emissions. There are some useful references and I shared the most recent one for your information: Kim and Kirschbaum, (2015)-The effect of land-use change on the net exchange rates of greenhouse gases: A compilation of estimates.	This is a good point; however, we have restructured the chapter substantially in this draft so as to focus more fully on ecosystem services and human quality of life. Chapter 5 no longer include any explicit discussion of carbon or nitrogen cycles (chapter 4 includes more of this information).
Dong-Gill Kim	Chapter 5	9	341	11	452	Citation errors: different citation styles were used through the chapter 5.3.1 the sand and dust from drylands, such as sandstorm, should be considered as a service in regulating services. The sand and dust can provide nutrients to the soils in the continent and to the algae in the ocean, which is very important for the earth's material cycle.	Fixed in SOD
Bo Wu	Chapter 5	9	341	15			Good point. Point added to section 5.3.2.4 of revised draft.
Shiping Wang	Chapter 5	9	342	11	452	The intents are to discuss the effects of degradation and restoration how to affect atmospheric composition and climate regulation. However, few are related to greenhouse gases emission and carbon sequestration. In construct, most of the contents focus on soil processes which should be mechanisms of GHGs emission and feedback for climate regulations. Therefore, logic is needed to be adjusted.	This is a good point; however, this material is no longer in the chapter. We have restructured the chapter substantially in this draft so as to focus more fully on ecosystem services and human quality of life. Chapter 5 no longer include any explicit discussion of carbon or nitrogen cycles (chapter 4 includes more of this information).
Gunay Erpul	Chapter 5	9	342	11	452	Organic C stored in soil (Batjes, 1996), (Tarnocai et al., 2009),	Thank you for the references; however, this material has been removed from the chapter. We have restructured the chapter substantially in this draft so as to focus more fully on ecosystem services and human quality of life. Chapter 5 no longer include any explicit discussion of carbon or nitrogen cycles (chapter 4 includes more of this information).
Gunay Erpul	Chapter 5	9	342	11	452	Increasing soil organic matter to promote long term soil fertility (Lugato, Berti and Giardini, 2006).	We agree. We have added this idea to section 5.2.3.2 on how use of nitrogen fixing Acacia can increase grain yield in Africa.
Gunay Erpul	Chapter 5	9	342	11	452	Over-use of nitrogen chemical fertilizers and organic matter decomposition (Ju et al., 2009; Tian et al., 2012).	Great references. We have reviewed them and added the points they emphasize in section 5.3.2.4 on soil and water degradation. Additional material can be found in 5.8.3
Gunay Erpul	Chapter 5	9	342	11	452	Management changes C inputs (Smith, 2004, 2012). Land use intensity and associated soil organic matter loss (Gardi, Jeffery and Saltelli, 2013), and biodiversity loss (Bloemers et al., 1997; Eggleton et al., 2002; Dlamini and Haynes, 2004), (Mulder et al., 2005; Postma-Blaauw et al., 2010; De Vries et al., 2013) and Haynes, 2004), (Ayuke et al., 2011).	Thank you for the references; however, this material has been removed from the chapter. We have restructured the chapter substantially in this draft so as to focus more fully on ecosystem services and human quality of life. Chapter 5 no longer include any explicit discussion of carbon or nitrogen cycles (chapter 4 includes more of this information).
Gunay Erpul	Chapter 5	9	342	11	452	Land degradation and soil organic matter (Oldeman, Hakkeling and Sombroek, 1991), (Smith, 2008), (Hooper et al., 2006), Lal (2006), Ringius (2002), Zivin and Lipper (2008) and Tieszen, Tappan and Toure (2004), (Woomer, Toure and Sall, 2004; Tschakert, Khouma and Sene, 2004; Liu et al., 2014),	Great references. We have reviewed them and added the settlement they emphasize in section 5.3.2.4 on soil and water degradation. Additional material can be found in 5.8.3
Gunay Erpul	Chapter 5	9	342	11	452		Great references. We have reviewed them and added the settlement they emphasize in section 5.3.2.4 on soil and water degradation. Additional material can be found in 5.8.3
Penny van Oosterzee	Chapter 5	9	344			So is this paragraph only about soils? There is nothing in the section about vegetation.	These sections have been restructured in the SOD. The new section on Food Security discusses in depth the relationship between soil health and crops as an important component of nature's benefits.

Dong-Gill Kim	Chapter 5	9	348	9	349	Need citation	Agreed; however, this text has been removed from the (extensively restructured) revised chapter.
Dong-Gill Kim	Chapter 5	9	364	9	364	Suggest to change 'carbon dioxide emission'.	Thank you; however, this text has been removed.
Penny van Oosterzee	Chapter 5	9	366			The reality is that most carbon markets in the world do not include carbon farming. See this website for a breakdown of schemes: https://icapcarbonaction.com/	Thank you for the reference; however, this material has been removed from the chapter. We have restructured the chapter substantially in this draft so as to focus more fully on ecosystem services and human quality of life. Chapter 5 no longer include any explicit discussion of carbon or nitrogen cycles (chapter 4 includes more of this information).
Beverley Wemple	Chapter 5	10	367	11	452	Section on N is very good, but perhaps too much detail and no attention given to phosphorus. Given the rate of eutrophication of inland waters (where P is generally the limiting nutrient, I suggest adding some detail on P to this section. To shorten section on N (if needed) I think you could combine or eliminate some details in paragraphs between lines 420-434.	This is a good point; however, we have restructured the chapter substantially in this draft so as to focus more fully on ecosystem services and human quality of life. We no longer include any explicit discussion of nutrient cycling in chapter 5 (chapter 4 includes further discussion of soil processes).
Dong-Gill Kim	Chapter 5	10	367	10	371	Very long sentence; out of scope- this chapter should focus on "Atmospheric composition and climate regulation". There is a section on N biogeochemical cycles (2 pages), which is not well positioned here: it does not deal with climate change, nor with how some forms of N alter air quality (NH3..), but of the availability of N as a nutrient. It concerns what would be a "supporting service" in the MEA classification and is indeed very important. The section contains up-to date literature, but it should be deleted from this section. I do not see clearly where it should be positioned and parts of the information should be transferred to chapter 4.	Agreed on your assessment. This text has been removed from the revised version (in a fairly extensive restructuring).
Chenu Claire	Chapter 5		367		L475		Thank you, this is a good point. Most of this material has indeed been transferred to Chapter 4.
D. Pennock (ITPS)	Chapter 5	10	367	11	452	These section is well cited, but is not focused on atmospheric composition and climate regulation (as the title on l. 341 states). There is almost no mention of N2O, which is the critical N gas for climate regulation.	This is a good point; however, we have restructured the chapter substantially in this draft so as to focus more fully on ecosystem services and human quality of life. Chapter 5 no longer include any explicit discussion of carbon or nitrogen cycles (chapter 4 includes more of this information).
Dong-Gill Kim	Chapter 5	10	372	10	376	Very long sentence; grammatically wrong	Agreed on your assessment. This text has been removed from the revised version (in a fairly extensive restructuring).
Dong-Gill Kim	Chapter 5	10	390	10	402	Out of scope- this chapter should focus on "Atmospheric composition and climate regulation". Please mention how land degradation affects greenhouse gas nitrous oxide emissions.	This has been removed from the chapter; we have restructured the chapter substantially in this draft so as to focus more fully on ecosystem services and human quality of life. Chapter 5 no longer include any explicit discussion of carbon or nitrogen cycles (chapter 4 includes more of this information).
Dong-Gill Kim	Chapter 5	10	408			Change 'soil nitroge' to 'soil N'	This has been removed from the chapter; we have restructured the chapter substantially in this draft so as to focus more fully on ecosystem services and human quality of life. Chapter 5 no longer include any explicit discussion of carbon or nitrogen cycles (chapter 4 includes more of this information).
Dong-Gill Kim	Chapter 5	10	425			What NO stands for? Maybe nitric oxide?	This has been removed from the chapter; we have restructured the chapter substantially in this draft so as to focus more fully on ecosystem services and human quality of life. Chapter 5 no longer include any explicit discussion of carbon or nitrogen cycles (chapter 4 includes more of this information).
Déborah Oliveira	Chapter 5	11	431	11	434	There should be an specification of the kind of herbivory, as the cited author did (in this case, it's by domesticated animals). Moreover, this topic should be improved.	This is a good point; however, this material is no longer in the chapter. We have restructured the chapter substantially in this draft so as to focus more fully on ecosystem services and human quality of life, and the reference to herbivory has been removed.
Dong-Gill Kim	Chapter 5	10	446	10	452	Out of scope- this chapter should focus on "Atmospheric composition and climate regulation" as one of gegulating services.	This has been removed from the chapter; we have restructured the chapter substantially in this draft so as to focus more fully on ecosystem services and human quality of life. Chapter 5 no longer include any explicit discussion of carbon or nitrogen cycles (chapter 4 includes more of this information).
Royal C. Gardner	Chapter 5	12	453	13	525	This synthesis report may be useful for this section: https://www.cbd.int/doc/meetings/sbstta/sbstta-20/information/sbstta-20-inf-02-en.pdf	Thanks, EbA is an interesting topic. Several land restoration options that are consistent with EbA principles are dealt with in the SOD, but land restoration as defined in this assessment, is not an adaptation option by definition.
Patricia Balvanera	Chapter 5	11	453	13	525	Very interesting though I wonder if more trends for the different topics through time and accross space could be documented	Adaptation might be a consequence, but it is not the focus of our work.
Adonia Kamuksa Bintoora	Chapter 5	12	475	12	476	climate change is expected in future to affect the U. S. forest location, productivity and composition as well as making them more susceptible to pests and diseases (rustad et al., 2012; Shugart, et al., 2003). Rustad, L., Campbell, J., Dukes, J. S., Huntington, T., Lambert, K. F., mohan, J., rodenhouse, N. (2012). Changing Climate, changing forests: The impact of climate change on forests of the Northeastern United States and Eastern Canada. United States Department of Agriculture. Shugart, H., Sedjo, R. & Sohngen, B. (2003). Forests and global climate change: potential impact on U. s. forest resources.	Thank you. Research on human development and energy consumption time series is referenced extensively in the SOD
							Thank you. The structure of the entire draft has changed quite a lot (after consultation with reviewers) and we do longer deal directly with climate change impacts as a driver of degradation in this chapter.

Lim Li Ching	Chapter 5	13	526	14	572	Agroecological practices such as composting, mulching, manuring and green manuring, rotations that leave crop residues, etc. can restore and build soil organic matter and improve conditions for soil biota, with positive impacts.	Thank you. In our new section on food security, we have added a subsection that describes the impacts of land restoration on food provision. In this subsection, we describe different forms of conservation agriculture and agroecological practices and their positive impacts on soil and water resources. We have highlighted that these practices show improvements for various nature's benefits (e.g., regulating benefits) and can substantially contribute to food security.
Chenu Claire	Chapter 5		526			5.3.3 Soil and sediment In fact the section only discusses soil (which is fine, given the multiple ecosystem services provided by soils).	Thank you. We have restructured our chapter and added more sections on different aspects of quality of life such as impacts on health, energy, water, and human security. In those sections, also other resources and nature's benefits are covered. In the new food security section, we focus besides deforestation and intensification primarily on soil and water resources because they play a critical role for food provision.
Chenu Claire	Chapter 5	13	526			5.3.3 Soil and sediment The regulating service is the "regulation of formation and composition of soil" (see CICES classification) sometimes also termed "regulation of soil quality". Here the section mentions soil formation (a natural process) and soil protection (the result of natural processes and human action) on the same level. I would rather put the emphasis on the regulation of soil quality (soil quality being its ability to perform its functions). No reference is made to the recent FAO-ITPS "Status of world soil resources", which is an outstanding report.	Thank you. We have used the new classification of nature's benefits that was recently suggested by IPBES (not CICES). However, we have restructured our chapter and focus now more on the major dimensions of quality of life and do not explicitly use the nature's benefits as headings anymore. In the new food security section, for instance, we now highlight the importance of soil functions and services for food provision. In this section we describe the role of soil quality in more detail with a separate subsection on soil and water degradation. To this subsection, we have also added some of the findings of the suggested FAO report. Thanks.
Patricia Balvanera	Chapter 5	13	526	14	571	Very relevant information but again could be complemented with synthesis tables or figures showing such trends	Thank you. Yes, we have considered to create a figure that shows the relationship between soil degradation and food security (see comment above) in our new food security section. But due to the high variability and complexity of this relationship (as mentioned in the text), we decided for a qualitative description in the text only, because the results of such a global figure would be highly uncertain and involve the risk of misinterpretation and wrong conclusions.
Hamid Custovic (SPI)	Chapter 5	13	526			Soil and sediment is not a process. Rework.	Thank you. We have restructured our chapter. In the new section on food security we have replaced soil and sediment with a subsection called soil and water degradation.
Gunay Erpul	Chapter 5	13	526	13	526	(Biggelaar et al., 2003): global mean rates of erosion	Thank you. In the new food security section we have added a subsection on soil and water degradation. In this subsection, we state the average global erosion rates using the suggested article as well as other literature.
Rainer Horn (ITPS)	Chapter 5	13	527	14	571	In this whole chapter there is no info about the great sensitivity to soil degradation e.g. in volcanic ash soils (Andosols) due to clear cutting etc which are really irreversible processes as can be seen from the failing agriculture like reforestation after the 2nd. rotation-maybe it is needed to define in this chapter more detailed the sensitivity differences between mineral or organic parent materials.	Thank you. We have restructured our chapter and added a new subsection under food security that describes in more detail the impacts of soil degradation on food production using several examples from different world regions. However, due to the page limit it was not possible to integrate the large variability of the different soil types and their sensitivity to degradation although this would have been very interesting. Instead we have added a statement saying that the soil degradation-yield relationship is highly dependent on local soil conditions and their resilience. We have added the volcanic ash soils as an example.
Gunay Erpul	Chapter 5	13	529	13	529	(Ravi et al., 2010): Soil erosion as the most widespread form of land degradation in drylands (87%).	Thank you. We have added this information including the suggested article to the soil and water degradation subsection under food security.
Gunay Erpul	Chapter 5	13	536	13	536	Clearance of vegetation (Delgado et al., 1999; Seré and Steinfeld, 1996), (Hansen et al., 2013).	Thank you. We have included the suggested literature in different subsections in the new food security section. Here we describe in more detail the impacts on deforestation and vegetation loss on soils and the implications for food security.
Gunay Erpul	Chapter 5	14	552	14	553	Status of soil erosion (Doetterl, Van Oost and Six, 2012; Van Oost et al., 2007).	Thank you. We have added a subsection on soil and water degradation under food security. In this subsection, we also present global average erosion rates and the relationship with crop productivity. We have used the suggested literature and other sources as references.

						<p>Extra information: The sector of organic agriculture is the largest food industry showing growth. Between 1995 and 2000 it has tripled the total area of organic land in Europe and the United States (FAO). In 2012 the countries with the most organic agricultural land were Australia (12 million hectares), Argentina (3.6 million hectares) and the US (2.2 million hectares) (Ministry of Agriculture and Fisheries, 2014). However, the countries with the highest number of organic producers are India, Uganda and Mexico, although they have smaller surface. To read the full report: Producción Orgánica en Aregtina y en el Mundo, Octubre de 2014. Ministerio de Agricultura, Ganadería y Pesca: http://www.minagri.gob.ar/site/ganaderia/bovinos/02- Informacion%20sectorial/02=Informes/_archivos/000005=Produccion%20org%C3%A1nica/000005-%20Produccion%20org%C3%A1nica%202014.pdf Conceptos y temas generales de agricultura orgánica, Depósito de documentos de la FAO: http://www.fao.org/docrep/005/y4137s/y4137s03.htm#fn4</p>	<p>Thank you. We have added a new subsection on land restoration under the new food security section. In this subsection, we describe different forms of conservation agriculture and agroecological measures including organic farming and their role for food security. We have added your information and the suggested report describing the global dimensions of organic farming to the text.</p>
María Silvina Lobo Poblet	Chapter 5	14	554	14	557		
Gunay Erpul	Chapter 5	14	554	14	557	Management techniques and soil erosion (Pansak et al., 2008); Conservation tillage (Montgomery, 2007), (Palm et al., 2014) (Pimentel et al., 1995; Troeh, Hobbs and Donahue, 1991); Economic benefits of conserving soil (Hellerstein, 2010)..	<p>Thank you. We have added a subsection on land restoration to the new food security section. Here we describe the different forms of conservation agriculture, including conservation tillage and other practices and their implications for soil services and food production. We have included the suggested articles.</p>
Gunay Erpul	Chapter 5	14	558	14	571	Some historical contexts (Young, 1994).	<p>Thank you. We have included some of the findings of this report to the soil and water degradation subsection under food security.</p>
Gunay Erpul	Chapter 5	14	566	14	567	The crop yield/soil erosion relationship and off-site impacts of erosion (Steffen et al., 2015).	<p>Thank you. We have added the relationship between soil degradation and crop yield to the subsection on soil and water degradation under food security using several other literature examples as references. However, it should be noted that the degradation-yield relationship is highly variable and depends on many different factors primarily resilience of the soils (has been also stated in the text).</p>
Gunay Erpul	Chapter 5	14	566	14	567	Socio-economic causes of soil erosion (Jimoh, 2000), (Global HarvestChoice, 2011), (Van der Merwe, 1995), (Scotney and Dijkhuis, 1990), (De Villiers et al., 2002); Negative nutrient balances (Gray, 2005).	<p>Thank you. These articles are very interesting. However, we have not included them as the underlying causes and drivers of soil degradation are beyond the scope of this chapter. We focus primarily on the impacts of degradation on the different dimensions of quality of life. Drivers and causes are more related to chapter 3 (direct and indirect drivers) and 4 (status and trends).</p>
German government	Chapter 5	14	568	14	571	Include concrete examples, how local and/or traditional knowlege help to manage soils sustainably and achieve higher yields.	<p>Thank you. We have restructured our chapter and added a new section on food security. In this section we included a subsection on land restoration where we describe for example the role of resource-conservation agriculture, agroforestry, and reforestation networks for food security. In this subsection we show more details and examples with literature from different regions, for instance Sub-Saharan Africa and South America. We have highlighted the importance of smallholder farmers and their traditional production practices in a separate box, where we provide more concrete examples on how these production systems affect nature's benefits and how they can contribute to food security.</p>
Patricia Balvanera	Chapter 5	14	572	15	610	Would it be possible/desirable to emphasize how is this section different from the pollination assessment? Is it possible to show trends in degradation and its consequences on the service?	<p>We have restructured this chapter for the SOD. The new structure is organized around nature's benefits to people (e.g. food security) and ecosystem processes (e.g. pollination) are discussed within each NBP-focused subsection. This should make the distinction with the pollination assessment clearer.</p>
German government	Chapter 5	14	572	15	610	Refer to the findings of IPBES deliverable 3(a) on thematic assessment of pollinators, pollination and food production in the section on 5.3.4 on 'Pollination'.	<p>Thank you for this comment. We have now added appropriate references to the pollination deliverable (5.3.2.2 and 5.3.3.3)</p>
Sally Valdes	Chapter 5	14	575	14	575	Non-bees can be very important, perhaps equally important. See Romina Radera,1, Ignasi Bartomeusb, Lucas A. Garibaldic,d, Michael P. D. Garratte, Brad G. Howlettf, Rachael Winfreeg,Saul A. Cunninghamh, Margaret M. Mayfieldi,j, Anthony D. Arthur k, Georg K. S. Anderssonl, Riccardo Bommarcom,Claire Brittainn, Luísa G. Carvalheiroo,p,q, Natacha P. Chacoffr, Martin H. Entlings, Benjamin Foullyya, Breno M. Freitast,Barbara Gemmill-Herrenu, Jaboury Ghazoulv, Sean R. Griffing, Caroline L. Grossa, Lina Herbertssonl, Felix Herzogw,Juliana Hipólitox, Sue Jaggara, Frank Jaukery, Alexandra-Maria Kleinz, David Kleijnaa, Smitha Krishnanv,Camila Q. Lemost, Sandra A. M. Lindströmk,bb,cc, Yael Mandelikdd,ee, Victor M. Monteiro, Warrick Nelsonf,Lovisa Nilssonl, David E. Pattemoref, Natália de O. Pereirat, Gideon Pisantydd,ee, Simon G. Pottse, Menno Reemerff,Maj Rundlöfbb, Cory S. Sheffieldgg, Jeroen Scheperrh,ii, Christof Schüeppsjj, Henrik G. Smithl,bb, Dara A. Stanleykk,ll,mm,Jane C. Stoutll,mm, Hajnalka Szentgyörgyinn,oo, Hisatomo Takipp, Carlos H. Vergaraqq, Blandina F. Vianax,and Michal Woyciechowskin. 2016. Non-bee insects are important contributors to global crop pollination. PNAS vol 113(1):146-151/pnas.1517092112	<p>Thank you for this comment. We have restructured the chapter significantly for the SOD, and it now has little discussion of specific pollinator species (and so no focus on bees)</p>

Peter Onorato	Chapter 5	15	584	15	587	Globally, there has been a decline in wild and domesticated pollinators (Potts et al., 2010). Varroa mite, Varroa destructor, is a key cause of loss of hived and feral honey bee populations, as the mite weakens honeybees and makes them susceptible to infections. It has so far spread throughout every continent other than Australia (Zhang 2000). Australia requests that the text be changed to the following. The new reference (Heersink et al. 2016) is attached: Globally, there has been a decline in wild and domesticated pollinators (Potts et al. 2010). Varroa mite, Varroa destructor is a mite that parasitises honeybees and a key cause of loss of hived and feral honey bee populations, as the mite weakens honeybees and makes them susceptible to infections. It has so far spread throughout every continent other than Australia (Heersink et al. 2016).	Thank you for this comment. We have changed the text significantly for the SOD, and in fact this text regarding varroa sp. has been removed. Agreed. However, we have removed the text from the revised chapter as the focus of the chapter as shifted. Discussion of pollination now occurs in section 5.3.4.2 & 5.3.2.2
David Lamb	Chapter 5		597			give reference to the meta analysis?	
Lim Li Ching	Chapter 5	15	599	15	610	Not just restoring native habitats, but also diversifying farming fields and landscapes through agroecological practices is important. Practices such as planting strips or corridors of glowers in the middle of crops can attract beneficial insects such as pollinators. Managing flowering weeds that can serve as a source of alternative food for beneficial insects is also an important strategy. See Nicholls and Altieri (2012). Plant biodiversity enhances bees and other insect pollinators in agroecosystems. A review. Agron. Sustain. Dev. DOI 10.1007/s13593-012-0092-y	Due to a refocussing of the chapter, direct discussion of the pollination does not occur though it is broadly discussed in the food security section.
Penny van Oosterzee	Chapter 5	15	611			There is nothing here about the impacts of disease on wildlife and biodiversity. I understand that ES are about human well being but we must discuss biodiversity too. While there is not much literature on impacts of disease on species there is some eg: Daszak, P., A. A. Cunningham, and A. D. Hyatt. 2000. Emerging Infectious Diseases of Wildlife-- Threats to Biodiversity and Human Health. Science 287:443-449; Pedersen, A. B., K. E. Jones, C. L. Nunn, and S. Altizer. 2007. Infectious Diseases and Extinction Risk in Wild Mammals. Conservation Biology 21:1269-1279.	We have restructured this chapter for the SOD and have focused on human quality of life. The point you make about disease as a driver of biodiversity loss is an important one, but we believe it would fit better in another chapter (perhaps chapter 3, "Direct and indirect drivers") The chapter has been restructured and material from this section is now found in sub-sections on Health and Food Security, respectively. Both sections now make the links with degradation more evident.
Patricia Balvanera	Chapter 5	15	611	17	669	Same observation. Very interesting but is it possible to show how this degradation has occurred?	
Gunay Erpul	Chapter 5	18	705	18	749	Soil and cultural services (European Soil Bureau Network, 2005), Sombroek et al., 2002), (FAO, 2014), (Koohafkan and Altieri, 2011), (Toland and Wessolek, 2014), (Churchman and Landa , 2014) Different soil and land management practices and cultural settings (WOCAT, 2007); Knowledge of soil and land resources (Dalal-Clayton and Dent, 2001), anthropogenic soils (Sombroek, Nachtergaele and Hebel, 1993), (Macias and Camps Arbestain, 2010).	While all good points - the empahsis in the revised chapter cultural section has shifted more to a sense of place and broader cultural implications.
Gunay Erpul	Chapter 5	18	705	18	749	I would add this publication dealing with the benefits of the walk in a natural environment, to reduce mental illnesses: Gregory N. Bratman et al, "Nature experience reduces rumination, Proc Natl Acad Sci U S A. 2015 Jul 14;112(28):8567-72 - Source: http://www.pnas.org/content/112/28/8567.full Proposition of text to add: The benefits on mental illnesses of a walk in a natural environment, rather than in a city center, have cleary been demonstrated. The authors of this Stanford University study (California, USA) have used brain imaging on healthy patients to show that rumination, a psychological term to describe a state of the mind leading sometime to depression, is significantly reduced when walking 90 minutes in a natural area.	While all good points - the empahsis in the revised chapter cultural section has shifted more to a sense of place and broader cultural implications.
Olivier Blond	Chapter 5	18	717	18	717		Thank you for this suggestion. We have incorporated it into section 5.4.6.
María Silvina Lobo Poblet	Chapter 5	18	737	18	749	Example: In January of this year an invasion of camalotes reached the shores of the City of Buenos Aires and several districts of the conurbation. Thousands of users affected its water supply, besides this species transported unusual wildlife in the area, like snakes, otters and small yacares, among others. As a precaution several districts of the affected areas suggested avoid nautical tourism as well as many of the entrances to the rides were closed to the public. The phenomenon occurs as a result of flooding on the coast and the large increase in the flow of rivers. Some organizations like Greenpeace said that the deforestation in the NOA and the NEA is one of the causes of the unusual arrival of that vegetation. http://www.clarin.com/ciudades/Invasion-camalotes-mordido-serpiente-venenosa_0_1514248746.html http://www.infobae.com/2016/01/22/1784980-advierten-que-la-deforestacion-provoco-la-invasion-camalotes/	Thank you for the example. In the second order draft, lines 2012-2029 have peer-reviewed material on the impact of invasive species on recreation / tourism activities. We were not able to find as much peer-reviewed research on camalotes, but we believe we have given this topic in general sufficient attention.
Wame L. Hambira	Chapter 5	18	737	18	749	Impact of climate change on outdoor recreation shows that indeed Nature-based Tourism is vulnerable to climate change posing a threat to economies whose GDP largely depend on naturebased tourism (...) In the Global South for example, outdoor activities such as wildlife viewing safaris, boat rides, bird watching etc are highly vulnerable to climate change (Hambira, 2011, Saarinen et al., 2012) . i. Hambira, Wame L. (2011). Screening for Climate change vulnerability in Botswana's tourism sector in the bid to explore suitable adaptation measures and policy implications: A case study of the Okavango Delta. International Journal of Tourism Policy. Vol. 4, No. 1, pp. 51-65. ii) Saarinen, J., Hambira, W., Athlopheng, J., and Manwa, H. (2012) Tourism Industry reaction to climate change in Kgalagadi South District, Botswana. Development Southern Africa, 29(2), 273-285	Thanks references have been added to section 5.4.6.1 in revised draft.
Beverley Wemple	Chapter 5	18	741	18	741	change "effect" to "affect" This section is relevant to IPBES and the assessment but more explicit links to the different world views and values of nature and nature's benefits and the way they relate to on the drivers of degradation or restoration are needed.	Sentence no longer included in SOD
Patricia Balvanera	Chapter 5	19	750	21	836	Chapter 2 of the values guide could be used to expand on the different world views, their links to the different types of values, and to the different drivers of degradation or restoration.	We have restructured this chapter for the SOD. The new introduction makes more explicit reference to differences in world views & to IPBES framing documents.

5.4.2 Spiritual, religious and/or customary benefits

In addition to the 'personal' aspects of spiritual benefits, further EXPLORE the spiritual relationship between indigenous/local communities and landscapes, e.g.

- Mburu and Kaguna 2016 (Kenya): Landscapes play a central role in cultural and spiritual practices for many Indigenous communities. "Traditional seeds, especially millet, played a central role in ritual practice in Tharaka as no ritual could happen without them." "Certain seeds/crops were critical during rituals and ceremonies. For instance, millet was so special that porridge made from it was used in most ceremonies. Honey was also important during ceremonies such as marriage, since a special brew made from it was used as part of materials given out during dowry settlement and drunk during the wedding ceremony." (Gathara Mburu and Sabella Kaguna (2016). Community dialogue on ILK relevant for food and water protection in Tharaka, Kenya. In: Marie Roué, Alfred Oteng-Yeboah, Peris Kariuki and Yao Adou (eds.), Indigenous and local knowledge of biodiversity and ecosystems services in Africa: Contributions to an IPBES regional assessment. UNESCO: Paris.)

- Ole Kaunga 2016 (Kenya): "Maasai ways of life and learning are directly linked to nature, culture and spirituality." They use natural resources in every aspect of their lives, from food to housing, clothing, cosmetics and healing rituals; for example, this is why certain tree species are have spiritual value and are used in rituals." "The Laikipia maasai have spiritual and traditional experts who use their special skills to understand and interpret nature and then advise the community." "The rituals and ceremonies help the community connect with nature and remember the role of nature in sustenance of life." (Johnson M. Ole Kaunga (2016). The use of Indigenous traditional knowledge for ecological and bio-diverse resource management by the Laikipia Maasai and the Samburu In: Marie Roué, Alfred Oteng-Yeboah, Peris Kariuki and Yao Adou (eds.), Indigenous and local knowledge of biodiversity and ecosystems services in Africa: Contributions to an IPBES regional assessment. UNESCO: Paris..)

- Molnar et al 2016 (Hungary): In this paper, Hungarian Herders argue that human-nature relations of the wider society should be changed. (Zsolt Molnár, L. Sáfián, J. Máté, S. Barta, D.P. Sütő, Á. Molnár and A. Varga (2016). "It Does Matter Who Leans on the Stick": Hungarian herders' perspectives on biodiversity, ecosystem services and their drivers. in: Marie Roué and Zsolt Molnár (eds.), Indigenous and local knowledge of biodiversity and ecosystems services in Europe and Central Asia: Contributions to an IPBES regional assessment. UNESCO: Paris)

- Sezdebek and Aibek 2016 (Kyrgyzstan): Landscapes have a role in healing and community well-being. "In Kyrgyzstan, The relationships between degradation and restoration and spiritual/religion/customary benefits seem to be weak. A lack of understanding how degradation and restoration affect them limit our prediction ability in the future. Similar questions are found for other parts because most of them just be generally described.

Thank you for these references. We have worked to incorporate them into SOD.

We completely agree - this section has been completely rewritten and strengthened in the second order draft.

Sentence no longer included in SOD

References have been made consistent throughout SOD

Good point - this reference has been added to a section in the second draft discussing religion as a motivation for conservation.

Thank you. We have referenced it as Paris Climate Conference where necessary

Section has been removed from revised draft. The 2nd draft discussion religion as a motivator for conservation

Thanks. Text removed from revised draft.

Agreed - rewording has occurred in revised draft

Agreed - unclear - it has been reworded in revised draft

I think it could also be good to give an example of shamanistic beliefs in which the worldview and customs presuppose many kinds of spiritual movements and transformations between humans and other beings. For example, as described in Piers Vitebsky in his book Reindeer People, the drastic change in reindeer herding management (leading in some cases to land degradation) and the repression of shamanism that went along with it, produced a strong challenge to how the current and next generations relate to nature and how they are able to manage it.

Thanks for the reference. Example has been added to the revised chapter in discussion cultural values of nature.

I wonder if existence values is the correct name for this section. It seems to be more encompassing to all economic values. Also, the search done is quite relevant but figure 5.2 would need to refer only at studies linked to the degradation or restoration of ecosystem services and figure 5.3 might be related more explicitly to the different types of degradation. I wonder how the last paragraph relates explicitly to degradation or restoration

All good points. Section on nonmaterial benefits of nature has been totally revised with existence value clearly differentiated from other values.

Agreed - revised chapter has a more nuanced treatment of existence values

Thanks. Changed in revised text.

Rephrased as suggested in revised text
These two figures have been excluded from the SOD

Douglas Nakashima	Chapter 5	19	750		
Shiping Wang	Chapter 5	19	751	21	836
Beverley Wemple	Chapter 5	19	752	19	752
Beverley Wemple	Chapter 5	19	753	19	754
Meredith Root-Bernstein	Chapter 5		760		
Royal C. Gardner	Chapter 5	19	763	19	764
David Lamb	Chapter 5		800		
Beverley Wemple	Chapter 5	20	808	20	808
Beverley Wemple	Chapter 5	21	826	21	828
Beverley Wemple	Chapter 5	21	830	21	831
Meredith Root-Bernstein	Chapter 5		833		
Patricia Balvanera	Chapter 5	21	837	23	880
Beverley Wemple	Chapter 5	21	838	21	838
Beverley Wemple	Chapter 5	21	847	21	847
Beverley Wemple David Lamb	Chapter 5 Chapter 5	21	848 854	21	849

David Lamb	Chapter 5		856			again, the title is unclear. Studies of what?	These two figures have been excluded from the SOD
Beverley Wemple	Chapter 5	22	856	857		is "biotechnologies" shown on pie graph? Symbols in legend are very small. It took me a while to relate symbols to sections of pie graph; I think because "biotechnologies" appears in legend but is either very small or not on the graph. A minor point, but phrases beginnings "turning to ... " appear 3 times in these two paragraphs. Can you use different wording for at least one of these? It seems repetitive.	These figures are no longer included
Beverley Wemple	Chapter 5	22	858	23	880		This section has been re-written and repetition has been eliminated.
Royal C. Gardner	Chapter 5	23	881	23	881	In this section it may be useful to note the messages from Horwitz, P., Finlayson, M. and Weinstein, P. 2012. Healthy wetlands, healthy people: a review of wetlands and human health interactions. Ramsar Technical Report No. 6. Secretariat of the Ramsar Convention on Wetlands, Gland, Switzerland, & The World Health Organization, Geneva, Switzerland. http://www.ramsar.org/sites/default/files/documents/pdf/lib/rtr6-health.pdf	Thank you for this example, we have incorporated it into our discussion in section 5.4.4.
Chenu Claire	Chapter 5		881			Why is the section on 5.4.4 Worldviews, nature benefits and human well-being under the general heading f « cultural services ». I do not understand. For me it is a different topic and deserves to be section 5.5.	The SOD has been restructured. Discussion of differences in worldviews is now primarily in the introduction.
Patricia Balvanera	Chapter 5	23	881	24	912	Agreed. World views are quite relevant and such a links was suggested earlier. Yet, how these related explicitly to degradation, its consequences and the drivers that underpin it might need to be much more explicitly at the core of this section	Numerous example included in new section on non-material benefits of nature - examples include Intuit peoples as well peoples of Papua New Guinea
Kani ISIK	Chapter 5	23	881	27	1023	In this section, I think one important point is lacking. That is the conflict between Ecology and Economic, both of which coming from the same root (home), but "doing harm one to the other". Which one harms which one? The debate in going on on this matter...	Agreed - revised draft discusses the tension between a neoclassical view of nature as a resource with a stock and a flow and the fact that this view is not always amendable to non-material benefit from nature.
Patricia Balvanera	Chapter 5	24	913	24	956	Interesting section that is trying to incorporate the role of different world views and knowledge sources into the issues at stake. Such ideas need to be better reflected in the title. I wonder if that is all the info that is available	The chapter has been restructured and this discussion of world views is now primarily in the chapter introduction.
Wame L. Hambira	Chapter 5	24	914	24	927	Communities even possess the indigenous knowledge for weather forecasting and have expressed the need for this knowledge to be used had in hadnd with scientific knowledge (Kolawole et al, 2014). Kolawole, O.D., Wolski, P., Ngwenya, B., & Mmopelwa ,G. (2014). Ethno-meteorology and scientific weather forecasting: small farmers and scientists' perspectives on climate variability in the Okavango Delta, Botswana. Climate Risk Management, 4-5, 43-58.	Good point - however this section has been revised to reduce the emphasis on climate change. In the introduction the reader is referred to IPCC documents for climate change specific impacts.
Rainer Horn (ITPS)	Chapter 5	24	927			The general interaction between the landuse intensification/soil degradation/climate change certainly also includes the effects of an altered climate driven water balance , yield loss and more intense mineralisation and/or reduced carbon sequestration. It is possible and needed to extend the ideas already mentioned more detailed to soil and land management systems. A modelling approach described in Hartmann et al. 2012 Soil Tillage research for the interaction : soil compaction/hydraulics/climatic effects can be used as a basis for further recommendations .	Thanks. These broad ideas are covered in the revised food security section.
Marina Rosales Benites de Franco	Chapter 5	924	927	24	24	Local communities and principally indigenous peoples, under the traditional knowledge of their ancestors possess significant capacity and adaptability to changes in ecosystems, which is often demonstrated by the diversity of agricultural practices and their extensive knowledge of specific varieties,properties for healthy, period of crops and the relation with multicrops (Polyculture is the kind of agriculture that uses multiple crops on the same surface, mimicking to some extent the diversity of natural ecosystems of herbaceous plants, and avoiding large loads on the soil of the only agricultural crops).	Good point. However, we have removed this text due a revision in structure and new focus in the chapter on key measures of human well-being.
Marina Rosales Benites de Franco	Chapter 5	928	956	24	24	I suggest that Bolivia information could be in a box.	Good point. However, we have removed this text due a revision in structure and new focus in the chapter on key measures of human well-being.
Patricia Balvanera	Chapter 5	24	957	27	1023	Intresting sections and links, I wonder how much issues related to the way decisions are taken, wether the different sets of values and world views are incorporated, or not, into decision making and the procedures used to reach these decisions are also relevant. Chapter 2, 3 and 5 of the guide provide some insights of how these could be operationalized into this assesment of land degradation. I wonder how figures 5.4 to 5.7 relate explicitly to the issues addressed here.	Excellent point - however in the revised structure of the chapter these figures have been removed.
Beverley Wemple	Chapter 5	26	990	26	990	add "of timber extracted" to "mean volume" in figure 5.4 caption	This figure is no longer included in the SOD
Beverley Wemple	Chapter 5	26	996	26	997	word "aand" on second line of caption for Figure 5.6 has an extra "a"	This figure is no longer included in the SOD
Beverley Wemple	Chapter 5	27	1002	27	1006	Move reference to Figure 5.6 to end of sentence explaining results of Miura (after "protected worldwide." on line 1006)	This figure is no longer included in the SOD
Beverley Wemple	Chapter 5	27	1027	27	2027	do you mean "the alignment between worldviews" - plural?	Yes, thank you.
Mark Schauer	Chapter 5	27	1031			you might want to include a link/citation from "ELD Initiative. (2015a). Report for policy and decision makers: Reaping economic and environmental 2521 benefits from sustainable land management. Available from www.eld-initiative.org ." as it deals with facilitating decision making for sustainable land management	Thank you for this suggestion. Because of a restructuring of our chapter, we no longer discuss decision-making frameworks for sustainable management, and do not use this particular text. For this reason, we think that Chapter 6 is a better fit for the suggestion ("Responses to avoid land degradation and restore degraded"). We have brought this comment to their attention.
German government	Chapter 5	27	1031			You might want to include a link/citation from "ELD Initiative. (2015a). Report for policy and decision makers: Reaping economic and environmental 2521 benefits from sustainable land management. Available from www.eld-initiative.org ." as it deals with facilitating decision making for sustainable land management.	Thank you for this suggestion. Because of a restructuring of our chapter, we no longer discuss decision-making frameworks for sustainable management, and do not use this particular text. For this reason, we think that Chapter 6 is a better fit for the suggestion ("Responses to avoid land degradation and restore degraded"). We have brought this comment to their attention.

Beverley Wemple	Chapter 5	27	1032	27	1033	I encourage you to add <u>education</u> to this list of necessities for sustainable management of resources.
Déborah Oliveira	Chapter 5	28	1036	40		There should be all the references in the text, and vice-versa.

Thank you for this suggestion. Because of a restructuring of our chapter, we no longer discuss decision-making frameworks for sustainable management, and do not use this particular text. For this reason, we think that Chapter 6 is a better fit for the suggestion ("Responses to avoid land degradation and restore degraded"). We have brought this comment to their attention.

Agreed. References have been checked for consistency in the SOD.