

Comment form for 2nd Review Phase of IPBES Deliverable 3c) Fast-track methodological assessment on scenarios and models Chapter 3 ‘Drivers’

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Luc Doyen

Louise Ann Gallagher

German government

Ralf Doering

Diego Pacheco

Brian Kastl

Nº	Chapter	From page	From line	Till page	Till line	Comment	Reviewer Full Name	What was done with the comment
1	3	General				As with the other chapters that I reviewed, this is very thought provoking and a strong piece. My congratulations to the authors. Unlike chapters 7 and 8, I haven't been able to consider it in detail.	Andrew Wade, UK government	Many thanks
2	3	General				I agree that expert approaches are useful and valuable, but a limitation that is not clear in the key findings, is that they are not process-based and therefore extrapolation into the future based on this knowledge is difficult.	Andrew Wade, UK government	Here expert approaches refers to defining narrative storylines rather than quantifying drivers. The nature of the application of expert approaches is clear throughout the text.

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3	3	General				It is difficult to separate the individual effects of multiple pressures on ecosystems and therefore Bayesian Belief Networks are limited because they represent a single link between driver and effect, whereas observation also includes the combined effect of multiple drivers on a response. Given this it is difficult to ensure that the functional links in Bayesian Belief Networks are representative.	Andrew Wade, UK government	BBN can include driver interactions as well as the combined effects of multiple drivers. As a general comment it is not clear where this should be addressed in the chapter. Further, the chapter emphasizes the role of feedbacks and synergies between multiple drivers.
4	3	General				Overall: Some repetition in the chapter but overall a very good read.	Shane Orchard	Many thanks. Repetition removed.
5	3	General				In general, content is OK but not always easy to read. Would benefit from a copy editor or any English editor going through it.	Paula A Harrison	The authors have attempted to strike a fine balance between readability and an accurate portrayal of the scientific literature. The chapter has been vetted by multiple native English researchers.
6	3	General				Chapters 2; 3; 4; 5; 6; 8: The issue of dealing with uncertainty in models and scenarios (identifying, managing, communicating) is considered in almost every chapter in an explicit and broader part (see 2.3.4, 2.4.3, 3.5, 4.6, 5.5, 6.5, 8.2.3) This causes overlaps in content. Moreover, chapter-specific aspects of uncertainty are difficult to identify. We propose to deal with general aspects of uncertainty only in one or two chapters. The chapter-specific aspects of uncertainty might be additionally described in other relevant chapters. You may also wish to consider analysing the language used in the IPCC when discussing uncertainty and elaborating further steps in dealing with uncertainty. The IPCC uses qualitative “levels of confidence (comprised of “levels of evidence and agreement”) and quantitative “levels of likelihood”, if possible. Please see https://www.ipcc.ch/pdf/supporting-material/uncertainty-guidance-note.pdf . Such terminology might also be helpful for IPBES.	Germany	Uncertainty was not addressed at length in this chapter as other chapters had already provided a comprehensive treatment.
7	3	General				Chapters 2; 3; 4; 5: Chapter 3, 4 and 5 treat general aspects (importance, types etc.) of models and scenarios. This causes redundancies and inconsistencies. The given conceptualisations should be adjusted and common aspects should be placed together (e.g. in chapt 2).	Germany	The treatment of scenarios and models in this chapter is limited to their relevance to BES drivers.
8	3	General				According to the description of contents in chapt. 1 (see p.	Germany	Due to the breadth of the indirect and

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		al				131) chapt. 3 is dedicated to the building of scenarios and models of indirect and direct drivers and to the modelling of consequences of indirect driver scenarios for direct drivers. But: The description of indirect and direct drivers has been separated between the subchapters 3.3 and 3.4, and there is not much emphasis put on the links between them. Furthermore, the direct drivers outlined in 3.4 contain links to ecosystem processes (e.g. see the introduction of 3.4, p. 328) – an issue that is expected to be part of chap. 4.		direct drivers sections, separate subsections were preferable. We feel that some overlap with chapter 4 is not only unavoidable but preferable to properly transition into the next chapter.
9	3	General	0	0	0	General comment: this chapter is very unclear	David Cooper	-
10	3	General	0	0	0	General: even though there are findings and recommendations to move away from existing scenarios, including the IPCC SSP and RCPs, there is no in-depth discussion of why? What are the limitations. GBO-4 (and TS78) do point out problems with RCP2.6 and land use change. This is also illustrated by Newbold et al (2015) in Nature. Note also some potential confusion arising from what appears to be inconsistent use of the “RCP” in the IPCC report: (Note that in the IPCC reports, the term “RCP X.X” is used sometimes to refer to a scenario that achieves X.X W/m2, and sometimes to refer to the specific mix of actions (pathways) for getting there).	David Cooper	This topic (whether to construct IPBES-specific scenarios) is currently under debate. Current scenarios (e.g., CC related) are not capable of encompassing all dynamics associated with BES. Our argument is to take the IPCC driver scenarios as initial reference points and then depart into BES specific extensions. However, IPBES might also look into new driver scenarios as SSPs are incremental middle of the road baselines which most likely do not span the entire band of uncertainty. In addition, IPBES will have to innovate for short term driver scenarios as SSPs are not informative for 2020/2030 policy assessments.
11	3	General				General: The chapter opens with key findings- and this sentence: Expert-based and participatory methodological approaches represent a different set of tools with respective advantages and disadvantages contingent on the temporal and spatial scale as well as the nature of the epistemological approach under consideration (3.2.1). This opening key finding does not really draw the reader in; a simplification has been suggested in the comments table provided. Some reviewers were in praise of this chapter as a thought provoking and strong piece. The chapter contains useful information, but it is not accessible, sentences are too long and complicated, and language could be simplified.	UK Government	The key findings are ordered according to their placement in the body of the chapter. The opening sentence is found at the beginning of section 3.1. ID and DD are defined in 3.1.1 according to definitions in previous assessments (MEA 2005; GBO-4 2014). Examples that are covered in this chapter are also explicitly stated. Style will be standardized across all

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						<p>As with other chapters, key findings and recommendations should carry messages for policy makers- others have been using models and scenarios at various stages of the policy cycle (for example, a, b, c), to address direct and indirect drivers of change. This has shown benefits of x, y, z. Successful modelling depends on l, m, n. Recommendation- to make better use of models and scenarios for this purpose, we need actions o, p, q.</p> <p>The chapter title is: ‘Building scenarios and models of [indirect 1 and direct] drivers of change in 2 biodiversity and ecosystems’ - but it does not address how this is done, or the different policy areas involved. This is spread around a bit in C1-3, but never quite identifies them.. It would be good to identify some common policy links that apply to all IPBES members- eg energy, food security, water management, planning and development, fisheries. If biodiversity and ecosystems polices are not embedded in these other areas, then the type of integrated modelling favoured will not be picked up- or put the other way around, modelling and scenarios can help embed consideration of biodiversity and ecosystems. There was little mention of natural capital, although there were a few paras on economic assessments. Evidence to promote using models and scenarios to manage natural capital sustainably could be more strongly emphasised, it imparts a sense of value.</p> <p>As with comments on other chapters, it would benefit from a short front piece, explaining aims, methods and intended audience. Findings must be distinctly evidence based, and recommendations should be about possible actions to increase model and scenario uses. In places, recommendations are muddled in with the evidence. It is important to demonstrate the evidence and reserve recommendations for that part of the document. There are places where the authors make a judgement based on the literature that they have reviewed, so it is not always easy to tell a summary of the evidence from a judgment.</p> <p>The simplified policy cycle in C1 and C2 seems to have disappeared (eg agenda setting, becomes proactive policy assessment) and we have several versions of policy cycle when models/ scenarios can be applied- this needs to be consistent- so adapt figures/ words from the literature to</p>		<p>chapters by the TSU.</p> <p>The level of citation is consistent, if not more than, that in other chapters in this deliverable. We will look into additional citations for sections 3.2 and 3.3 however the chapter already exceeds the space limitations in its current version.</p> <p>This chapter contains aspects of both the social sciences (e.g., indirect drivers) and the physical sciences (e.g., direct drivers), leading to some change in content as well as style across the chapter.</p> <p>The policy cycle is now harmonized with Chapter 2, agenda setting is used.</p> <p>Nonessential ‘however’s have been cut and replaced with although. Therefore is used 8 times, now reduced to 7. Above and below have been removed.</p> <p>Due to the number of appearances, we feel that BES should be retained. We are open to reverting to the full name according to TSU style suggestions.</p> <p>Sensitivity studies would pertain to Chapter 4.</p> <p>Ad 5. There is more and more mature literature on the SRES driver scenarios – thus our choice to focus more on those. In the grander scheme there is little difference between SRES and SSP basic driver scenarios. Both are middle of the road scenarios painting a picture of rather small and time consistent changes in growth rates. Mitigation scenarios</p>

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						<p>match or you will confuse readers and the chapters together will lack punch.</p> <p>Greater use could be made of summary tables, for models, scenarios, indirect and direct drivers. For example, the section on direct drivers goes into a lot of detail for each one. I don't think we doubt whether they have an impact, so this section should focus on how they can be incorporated into models and scenarios- perhaps a table of drivers, models and scenarios that incorporated them, advantages, disadvantages and an evidence column with the references. The information is there, it is just not very accessible, and we probably do not need all the detail about the impacts of direct drivers, just how they are used in modelling and scenarios. It would take quite a bit of work, if someone had to quickly pull main information from this document to impress on policy makers the usefulness of models.</p> <p>Lessons learnt and way forward, S 3.5 p 336 is very unclear if it is good practice recommendations or main findings supported by the evidence to make uses of models and scenarios in policy making more trustworthy- or whether it is guidance for IPBES to promote their uses. It is also text heavy and would be better as a few bullets-a list of 'this is what we found that would improve model and scenario applications in policy making'.</p> <p>This chapter <u>assumes</u> that policy does not take much interest in modelling- but we do- see AQUA book. Other governments have similar guidance for QA and using models that probably did not turn up in your literature search. This is where IPBES could help identify commonalities and weaknesses, and where they could seek policy maker support. See also http://neat.ecosystemsknowledge.net/. Is IPBES going to make something like this?</p> <ol style="list-style-type: none"> 1. There were many instances where references were not cited. The chapter looks like it has a long reference list, but it isn't anywhere sufficient for a review of this kind. The IPCC runs up on average 1 citation per sentence. This problem is worst in sections 3.2 and 3.3. 2. There was no sufficient definition of terms – especially indirect & drivers given that the whole 		<p>based on SRES baselines were also performed back thenin SSP context they are the RCPs, except that some RCPs were predefined.....</p> <p>Ad 6. In 3.2.3 we define modelling as qualitative and quantitative. Thus when we use the term modelling in the direct/indirect driver section we mean both types. We have added this notion at the beginning of the ID section.</p>

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						<p>chapter is devoted to them. This is especially disappointing given that there is whole subsection that claims to define the terms. Instead it just gives some caveats on the approaches used to define them. Its shouldn't be too hard at least give some illustrative examples. Currently this is all hidden in Fig 3.1 (that prints out a bit illegibly for me)</p> <ol style="list-style-type: none"> 3. The section on scenario design ended up a bit fluffy. There is a really useful diagram (Fig 3.3) but little use of it. 4. There is a strong emphasis on section 3.2 on developing "narrative storylines". There was no acknowledgement that simple sensitivity studies can be really helpful – these are "what happens if I twiddle this knob?" or one that is used often in the climate impacts realm is "what if the temperature increases by 2oC" 5. From the IPCC scenario perspective, the section specifically on it (box 3.5) was correct. But the earlier discussion of them (in section 3.2) missed the opportunity to discuss how they have been shaped by the policy and have become more goal-seeking (by adopting a route to world than doesn't exceed 2oC after Copenhagen agreement). In fact, the earlier discussion seemed to focus too much on presenting the SRES scenarios (and their approach) as an ideal - despite that being 15 years ago and the approach being altered because it was too long-winded. 6. The section on scenarios and model construction involved a lot about participatory and local/indigenous knowledge (and therefore implies qualitative modelling of the flowchart ilk to me). This was completely missing from the direct/indirect drivers section which was solely quantitative computer-based modelling. 7. It therefore reads like social scientists (predominantly economists) wrote the first section, whilst the direct drivers were written by physical scientists (which seemed much more rigorous to me as a physicist). There should be more integration of the two communities. 		

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						<p>Style notes- the use of the word assessment- when referring to applying models, or as an assessment of the evidence on models and scenarios, or other uses such as Environmental Impact Assessments needs to be used consistently. Are model outputs ‘assessments’ or a form of analysis? Some are projections and some are hind casting to see how things changed and interacted.</p> <p>BES needs to be changed to biodiversity and ecosystem services.</p> <p><i>Et al.</i> italics</p> <p>Cut all ‘however’, ‘therefore’, and extra adjectives. Avoid repeating what has already been written in previous sections.</p> <p>Shorten paragraph lengths- cut them up and use simple sentences.</p> <p>Avoid use of ‘above’ and ‘below’- refer to the section number.</p>		
12	3					<p>General comments – No examples where cited on invasive species ravaging the wetlands of Nigeria particularly the Mangrove. Lot of research had been done on it and published in leading peer review journals. Invasive species such as <i>Nypa palm</i> is massively ravaging mangroves of the Niger Delta which is the largest delta and wetlands in Africa and the third largest in the world.</p>	Michael Uwagbae	Space considerations precluded a comprehensive treatment of invasive species.
13	3	301-346	-	-	-	<p>General comment.</p> <p>The expertise and professional input in this deliverable 3 (C) is of high scientific caliber reflecting the authors in-depth understanding of types and process of building scenarios and models that provide policy support tools and methodologies in biodiversity management and provision of ecosystems services. The scientific engagement in the construction of scenarios and models of change in biodiversity and ecosystems (Chapter.3) is recommendable and provided useful high level scientific constructs that are applicable for policy and decision support systems and directions. The methodological assessment of scenarios and models of drivers of change in biodiversity and ecosystems explicitly provide the knowledge and skills in scenarios and model building useful for biodiversity and ecosystems assessments. The types of scenarios and the process of building scenarios for biodiversity assessment in this deliverable provide an in-depth understanding of the usefulness of scenarios in</p>	Maarifa Ali Mwakumanya	Many thanks

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						supporting assessments and their applicability in aiding decision support systems. The process of development of models of drivers of change in biodiversity and ecosystems is explicit and the authors have displayed high level conceptualization and demystification of the process of model building. This process, no doubt, provide a detailed understanding of the functionality of models in explaining and predicting futuristic scenarios. The scenarios and models of direct and indirect drivers in biodiversity and ecosystems are detailed to provide simplistic means of comprehension of the implication of the drivers to biodiversity and ecosystems change to policy and decision makers. However, the authors posed challenges to the scientific fraternity to build scenarios and models to provide decision support tools that are unique in providing policy and decision support for the unique myriad of challenges of biodiversity and ecosystems management for the better of humanity and other organisms.		
14	3	301	14			How do we know if formal modelling is “necessary”? Wouldn’t “applicable” “desirable” or “relevant” be better words?	Chris Brierley, UK government	Changed to desirable
15	3	301	30			I don't what Ex-ante and Ex-post means as yet. In fact, it is only really defined after 14 pages. Referring to them as being for proactive and reactive/retrospective policy creation makes the terms more understandable.	Chris Brierley, UK government	We now provide alternative names at first use and refer to the relevant section.
16	3	301		End		General This chapter on drivers seems to contain a great deal of material that is generic to scenarios and models rather than specific to drivers. I think it is up to the Co-chairs of the assessment to consider whether this material belongs here or should be treated in generic introductory chapters.	Mark Lonsdale	-
17	3	301				The front section of Ch 8 (Findings and Recommendations) prvides a useful model for editing Ch 3 for greater clarity.	Mark Lonsdale	These have been edited
18	3	301	22	301	23	I also think that the chapter needs a good general edit to address the wordiness. It is not easy to do via thiscomment form, but, as an example, line 22 to 23 on page 301 says “Choice of scenario typology (exploratory or goal seeking) or assessment is highly contingent on the policy–cycle decision – making context (3.2.2).” This is a very opaque sentence for an introductory paragraph. The text is full of sentences like this that are quite mystifying for non-	Mark Lonsdale	This has been a topic of frequent discussion with the conclusion that the targeted audience contains both specialists and non-specialists. We have attempted to strike a balance.

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						specialists, which is who we are writing for. The authors need to get a clearer idea of who they are writing for.		
19	3	301	11			“represent a different set of tools” – reword as “ each represent a different set of tools”	Mark Lonsdale	added
20	3	301	1			General comment – there is little or no discussion in this chapter on how countries can gradually build better decision support tools into their practices at all levels of society. This document shouldn’t just be geared for the IPBES work programme deliverables or countries with sufficient capability and capacity. A clear plan for capacity development is needed . Further there needs to be recognition that different cultures and knowledge holders will choose different tools that align closely with their mode of information sharing and analysis. A technocentric approach will not fit all. The recommendations should include a hieraracy of tools that “gently” guide capability development in the use of scenarios and models and grows the ability of countries to negage in thir use for better decision making.	Geoff Hicks	Chapter 7 focuses on capacity building.
21	3	301	32	301	36	This is true, but does it belong in this chapter? It seems better placed in Chapter 1 or elsewhere, as this chapter is focussed on models of drivers of change, rather than integrating models.	Derek Tittensor	We feel that some discussion of integrating models is necessary given the nature of BES drivers.
22	3	301	11	301	31	Reads as a discrete choice between expert-based vs. participatory; exploratory vs. goal-seeking. Word “ideal” is not really appropriate. Some indication that they can be usefully combined would be good.	Paula A Harrison	Ideal replaced with advantageous
23	3	301	19	301	21	Local ecological knowledge is valuable when assessing drivers at local spatial scales, as a complement to other expert-based methodologies, particularly within the context of assessment resource and time constraints of enhance assessment resource and the effective time.	Marina Rosales Benites de Franco	This is addressed
24	3	301	16	302	3	‘Scale’ is a vague term, requiring the reader to comprehend the essence of a model, rather than any real spatial boundaries. E.g., the realised area of ‘local scale’ can vary greatly, depending on the relative position(s) of topographic/political boundaries and the spatial resolution & extent of the underlying model layers and study area. ‘Global scale’ is one extent, but can contain varying levels of information, depending on resolution. As political	Anna Carter	Spatial scale has been approved for use throughout the deliverable

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						boundaries shift, the social definition of ‘scale’ can also vary. Drivers act simultaneously on multiple ‘scales.’ I would urge the authors to replace ‘spatial scale’ with the terms ‘spatial resolution’ and ‘spatial extent’ throughout the manuscript.		
25	3	301	10	302	41	The KF are very difficult to understand. Each statement should really be able to stand on its own, but there also needs to be some logical thread running through them. Many are in gobbledegook! There is a disconnect between the title of the chapter and KF. They are not really ready for line by line review.	David Cooper	This might be a correct assessment, but it is the best possible outcome from many rounds of iterations among authors and other chapters.
26	3	301	11	301	13	“a different set...” – different to what?; “contingent on ...” what are you trying to say here? “epistemological approach ...” again, what are you trying to say here?	David Cooper	reworded
27	3	301	11	301	21	Perhaps we are overemphasizing this dichotomy? Also lack of clarity between “expert” versus “local” and data (and formal modeling) based versus (expert-)judgement based (and “workshop” modeling)	David Cooper	This elaborated upon in their respective sections.
28	3	301	22	301	31	Note typography different from SPM and Chapter 2	David Cooper	‘goal-seeking’ was ultimately approved.
29	3	301	27	301	27	“... inappropriate”. This statement is too absolute.	David Cooper	Changed to “not ideal”
30	3	301	11		13	Simplify! Change to: There are two methodological approaches to using models and scenarios: 1) Expert-based and 2) participator. They represent a different set of tools with respective advantages and disadvantages that depend on the temporal and spatial scale as well as the nature of the investigation or policy questions to which they are applied (3.2.1).	UK Government	Simplified
31	3	301	29	1	29	consensus on desired goals and pathways to such goals (the goal can be multi-attribute or multi-functional mixing ecological and economic objectives for instance)	Luc Doyen	changed
32	3	301	36	1	36	I will add the sentence “Complex models can co-exist with more stylized and simplified models. Stylized models can be useful to identify simple tipping and reference points. The account of uncertainties in the models is crucial for their validity.”	Luc Doyen	added
33	3	302	1			Indirect versus direct has not been defined yet. Nor it is necessary to define in this sentence. Also impacts chapter title.	Chris Brierley, UK government	Concepts are defined within their respective sections as well as in a glossary.

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34	3	302	4			Indirect versus direct has not been defined yet. Rephrase sentence to say driver interact.	Chris Brierley, UK government	They are defined
35	3	302	10			2 types of scenario are used in this sentence, but with no explanation of their differences.	Chris Brierley, UK government	See respective sections.
36	3	302	12			Do you really always need to tailor models? Shouldn't it be "often need" instead.	Chris Brierley, UK government	Changed to often need
37	3	302	16			This seems an unnecessary plea for new models. Some assessments have already been done – are they therefore wrong?	Chris Brierley, UK government	Models and scenarios by definition have a probability of zero to be right or true. Our assessment is that models need to be fit for purpose.
38	3	302	23			How do we know if formal modelling is "necessary"? Wouldn't "applicable" "desirable" or "relevant" be better words?	Chris Brierley, UK government	"advantageous" used
39	3	302	36		37	This seems a big task. Can you summarise the reason in a sentence, to justify such a demand?	Chris Brierley, UK government	expanded
40	3	302	30			Tools to integrate across scales – what are these tools that the K&D TF is supposed to facilitate? Are they software? What would facilitating them look like? I ask because if this going to be a useful recommendation it will have to be incorporated into K&D TF workplan but I just don't understand it.	Mark Lonsdale	Tools indeed exist for a few combinations of numerical models. This topic merits a separate chapter.
41	3	302	12	302	16	Bold finding is OK, but non-bold text seems to relate to a different point (that has already been discussed in chapter 2) rather than expanding on the main finding.	Paula A Harrison	Correct, but unfortunately irreparable at this stage. Some redundancy should be OK.
42	3	302	4	302	6	The indirect drivers should be listed, particularly line 5, where the word <i>certain indirect driver</i> ... This should be elaborate to show the linkages. Statements left hanging like this could be technically misleading	Michael Uwagbae	The sentence provides a link to the relevant section.
43	3	302	10	302	12	I find this statement too absolute, and potentially disabling. So we say that IPBES< and countries, should sue scenarios, but the existing ones are inappropriate! As far as I can see, it is not supported by the main text.	David Cooper	Well, this is an assessment and what is written reflects what the authors thought.
44	3	302	17	302	41	The first and third key recommendations are redundant – they merely repeat the KF.	David Cooper	Findings reflect our objective assessment while recommendation reflect our advice moving forward based on these findings
45	3	302	36	302	41	This recommendation is too absolute. As far as I can see, it is not supported by the main text. Better to stress the need	David Cooper	Please note that a few authors of this chapter are also in the IPCC. One of the

No	Chapter	From page	From line	Till page	Till line	Comment	Reviewer Full Name	What was done with the comment
						for cooperation between those working in IPCC and IPBES		CLAs has directed SSP and RCP modelling. Note that cooperation necessitates significant resources and realistically these will not be available to the scenario community to do a proper job.
46	3	302	28	302	35	Supporting ideas fails to provide enough materials to the thesis. For example, how to invest in development of the modelling of drivers?	Dandan Yu	-
47	3	302	1	302	9	The whole paragraph sounds very abstract	Luc Doyen	Adressed.
48	3	303	6	303	9	The 'reality' of the Anthropocene is not universally accepted. This sentence should reflect that point. E.g. insert 'some' before 'scientists'	Gary Kass, UK government	inserted
49	3	303	35	303	40	Direct drivers are dynamic over both space and time	Gary Kass, UK government	Spatial added
50	3	303	3			Remove "Until human activities started to change the earth's surface, leading to considerable impacts". This ignores substantial other early human impacts, such as large mammal extinctions in Americas thousands of years ago. And it isn't really a necessary subclause	Chris Brierley, UK government	Sentence rephrased
51	3	303	6		9	I can't help but wonder why does the name of the geological Epoch matter to this assessment? You could remove this whole sentence without undermining IPBES. Surely you just will rile up climate opponents without gaining anything to the document.	Chris Brierley, UK government	We feel that it is important to emphasize that the current state is qualitatively different from the past.
52	3	303	16		23	You need to give the section numbers or page references for this sort of index paragraph.	Chris Brierley, UK government	We are referencing entire chapters of the deliverable
53	3	303	25			You haven't really defined what driver scenarios are yet (as opposed to other scenarios). Can't you use plainer language?	Chris Brierley, UK government	"Driver scenarios" is clearly defined as scenarios of drivers.
54	3	303	24	304	1	There is not actually a definition of indirect drivers in this section, despite the section name. The closest you get is a poorly-worded sentence on line 30. I think you're trying to define indirect drivers as human-related stuff. Nor is there a definition of direct drivers for that matter, but the term is a little easier to understand. How come this section on definition has no reference to the peer-reviewed literature?	Chris Brierley, UK government	Driver scenarios are a basic component in models depicting biodiversity and ecosystem change. Indirect drivers are drivers that operate diffusely by altering and influencing direct drivers as well as other indirect drivers (also referred to as "underlying causes") (MEA 2005; GBO-4 2014). Understanding the role of indirect drivers is vital to understanding

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								biodiversity and ecosystem change at the direct driver level. Indeed, indirect drivers frequently have primacy within the causal framework linking drivers to biodiversity and ecosystem change. For indirect drivers economic, demographic, sociocultural, governmental and institutional, and technological influences are considered. Direct drivers (natural and anthropogenic) are drivers that unequivocally influence biodiversity and ecosystem processes (also referred to as “pressures”) (MEA 2005; GBO-4 2014). This assessment will specifically examine the following direct drivers: land use change (LUC), climate change and pollution, natural resource use and exploitation, and invasive species.
55	3	303	35			What does this sentence mean? Are you saying that whether something is considered direct or indirect depends on the timescale? Also where is the reference?	Chris Brierley, UK government	Removed. Discussions of endogeneity/exogeneity from a previous draft were removed. This was the remnants of that discussion.
56	3	303	36			Isn't this second sentence counter to the first in the paragraph?	Chris Brierley, UK government	See above
57	3	303	38		40	Are you saying that the drivers should be included in the model with this sentence. In which don't they stop being drivers and rather become part of the system, with other factors becoming the inputs to the model (i.e. drivers)	Chris Brierley, UK government	We are saying that direct drivers result in impacts that frequently feed back into the system in the form of indirect drivers (i.e., anthropogenic assets).
58	3	303	13			“As such” can be deleted	Mark Lonsdale	deleted
59	3	303	19			Ex ante and ex post assessments – define these jargon terms at point of first use.	Mark Lonsdale	Defined sooner
60	3	303	22			Delete “the state of the art in”	Mark Lonsdale	deleted
61	3	303	35			“is contingent on” = depends on	Mark Lonsdale	correct
62	3	303	24			These definitions could be much clearer and more succinct (see Rounsevell et al. (2010). A conceptual framework to assess the effects of environmental change on ecosystem	Paula A Harrison	Classification of drivers into endogenous and exogenous categories in a previous draft was removed and this framework

Nº	Chapter	From page	From line	Till page	Till line	Comment	Reviewer Full Name	What was done with the comment
						services. Biodiversity and Conservation, 19: 2823-2842.		was approved by a consensus
63	3.1	303	1	303	1	For the sake of clarity the term “conceptual framework” should only be used when the IPBES Conceptual Framework is meant.	Germany	Changed to chapter overview
64	3.1.1	303	25	303	34	Simple definition of direct and indirect drivers is required. You could add more about drivers of changes and need brief explanation (definition) on direct and indirect drivers, main drivers of biodiversity	Nazirul Islam	More explicitly defined
65	3	303	2	303	2	Replace ‘adapted’ with ‘responded’ to avoid clashes with terminology describing evolutionary drivers that act at the population level.	Anna Carter	replaced
66	3	303	41	303	41	Does ‘higher spatial and temporal scales’ equate to lower resolution/larger extent? Unclear.	Anna Carter	various
67	3	303	5	303		Line 5 – statement “ <i>Drivers associated with human activities (anthropogenic drivers)</i> ” This anthropogenic drivers should also be listed as this section is the introduction of the chapter. The non-listing of these anthropogenic drivers keeps a reader discouraged at first site.	Michael Uwagbae	The next section covers the introduction of drivers
68	3	303	30	303	31	Technically influences of indirect drivers are considered to do what? What does the consideration do? This statement is hanging.	Michael Uwagbae	Rephrased
69	3	303	33	303	34	Add citation to Salafsky et al. 2008 Conserv Biol, which provides a classification of direct drivers.	Thomas Brooks	This is included in section 3.4
70	3	303	1	305	2	Do we need a CF for this chapter or a unifying one for the whole report?	David Cooper	Chapter overview
71	3	303	2	303	9	Do we need this para, given the dispute over the “Anthropocene”?	David Cooper	We feel that it is important to emphasize that the current state is qualitatively different from the past.
72	3	303	24	304	2	It is evident that biodiversity can only be protected in protected areas that make up ecosystems. Protected areas face threats from growing. At this point they are less resilient and more vulnerable to tipping points from which they move from one state to another that is less diversified.	Ludunge Elias Abdullah	This comment is outside the scope of the chapter
73	3	303	6	303	9	Technically the Anthropocene has not (yet) been accepted as a new geological epoch	UK Government	We feel that it is important to emphasize that the current state is qualitatively different from the past.
74	3	303	25			You haven’t really defined what driver scenarios are yet (as opposed to other scenarios). Can’t you use plainer language?	UK Government	changed
75	3	303	30	303	31	I suggest to use the words “public policies” instead of	Luc Doyen	Changed to governance and institutional.

Nº	Chapt er	From page	From line	Till page	Till line	Comment	Reviewer Full Name	What was done with the comment
						“governmental and institutional” to emphasize the management dimensions		We do not feel that public policies sufficiently capture the breadth of this driver
76	3	304	16	304	16	Insert ‘either separately or together,’ after ‘scales’	Gary Kass, UK government	added
77	3	304	29	304	29	Insert ‘attempt to’ before ‘integrate’	Gary Kass, UK government	Integration is taking place, not solely attempted
78	3	304	1			Surely the statement that anthropogenic assets are necessary for a high quality of life is subjective and depends on whose life and what the baseline is and also the region. I would go for “contribute to” as a less controversial alternative.	Chris Brierley, UK government	changed
79	3	304	12		15	This sentence is really unwieldy. I would divide into 3: one for expert, one for participatory and one for stating their respective advantages. This also would allow for some references to be cited.	Chris Brierley, UK government	We do not believe that the sentence is unwieldy.
80	3	304	21			I’m not sure why you’ve gone from indirect vs direct instead say underlying and proximal causes.	Chris Brierley, UK government	“Direct and indirect” is consistent with past assessments and other terminology has been eschewed to avoid confusion.
81	3	304	25			Specificity is not a proper word.	Chris Brierley, UK government	“specificity” is a noun recognized by official dictionaries.
82	3	304	27			“unforeseen externalities” is jargon. Try giving an example – maybe even a citation.	Chris Brierley, UK government	Changed to impacts. This statement has a citation.
83	3	304	29			Firstly, you have two instances of integrate in this sentence, which is poor style. But more importantly, “integrate” has a technical meaning in computer modelling – namely to move forward in time. This is not what you mean here. Try “combine”.	Chris Brierley, UK government	We are unable to find the sentence being referenced. We believe that integrate as used throughout this chapter will be understood as intended by the authors.
84	3	304	3			There is only one conceptual framework in IPBES. Here the authors have devised their own that traverses similar territory. I am at a loss here to know what to do - they really need to recast this whole section in terms of the IPBES CF, or at the very least call fig 3.1 something else than Conceptual Framework.	Mark Lonsdale	Changed to chapter overview
85	3.1.2	304	5			In figure 2.1 the policy cycle is described as “Review & agenda setting”, “Policy design” and “Implementation”. Maybe set also a reference directly to figure 2.1	Werner Rolf	Harmonized with Chapter 2
86	3.1.2	304	3	304	3	For the sake of clarity the term “conceptual framework”	Germany	Changed to chapter overview

No	Chapter	From page	From line	Till page	Till line	Comment	Reviewer Full Name	What was done with the comment
						should only be used when the IPBES Conceptual Framework is meant.		
87	3.1.2	304	19	304	19	For the sake of clarity the term “conceptual framework” should only be used when the IPBES Conceptual Framework is meant.	Germany	Changed to chapter overview
88	3	304	9	304	10	<p>inclusion a framework for micro scenarios and ecosystem based approach (see fig.1 Sara Sozzo framework)</p> <p style="background-color: yellow;">Micro-scenarios and Ecosystem services b</p> <p>Sara Sozzo, WEEC member - University of Turin, DISAFA, Largo Paolo Braccini 2, 10095, Gr...</p>	Sara Sozzo	To be considered in further developments
89	3.1.2	304	9	304	9	Selection/choice of word “departure” in the sentence has made it very crucial to scan the gist for the reader or expert (if not highly professional)	Nazirul Islam	The use of departure is clear from the context.
90	3.1.2	304	16	304	16	It would be more easy to understand the meaning of sentence if the word “scales” has little explanation (administrative/biophysical etc)	Nazirul Islam	This is defined in a previous chapter.
91	3.1.2	304	4	304	17	How would decision affected by policy cycles	Nazirul Islam	-
92	3	304	20	304	30	The concept of scale, here, is meaningless without an underlying definition of resolution. Similarly, ‘high level of	Anna Carter	This is defined in a previous chapter.

Nº	Chapter	From page	From line	Till page	Till line	Comment	Reviewer Full Name	What was done with the comment
						detail' is relative to an undefined resolution		
93	3	304	1			high quality of life? Should be human well being?	UK Government	changed
94	3	304	4		5	make sure these policy uses match those in Chapter 2-ie not eventual review, Planning , management'	UK Government	Harmonized with chapter 2
95	3	304	8		10	simplify sentence	UK Government	-
96	3	304	14			full stop after knowledge, new sentence	UK Government	The current sentence effectively contrasts the two approaches.
97	3	304	19			figure is a bit fuzzy on screen	UK Government	Figure has been redrawn in high resolution
98	3	304	21			I'm not sure why you've gone from indirect vs direct instead say underlying and proximal causes.	UK Government	Comment 80
99	3	304	29			For regional assessments, global scale assessment models are often required to account for the influence of distant drivers on the region, while regional models are used to add more regional specificity and detail to the simulations. Reference?!	UK Government	Referenced
100	3	305	1	305	2	Line 2 should include the types of variables used, types of relationship described and how these relationships are described. The statement should not end with <i>system studied</i> .	Michael Uwagbae	Changed to system under consideration
101	3	305	2	305	2	Insert 'Inevitably, though., no models, no matter how well coupled or integrated, can be wholly comprehensive and hence their predictive power is ultimately limited. As such, all modelling should be treated with caution and modellers and users alike should avoid thinking of models as black-boxes that reveal true answers. As the old adage in geography goes, the map is not the territory. So it is with models...the model is not the system.	Gary Kass, UK government	The entire deliverable is cautious in recognizing the limitations of models. We don't feel this should be highlighted here.
102	3	305	9	305	9	Insert 'it should be noted here that such approaches are rarely exclusive and mixed methods approaches are possible and indeed, often more appropriate to real-world decision-contexts.'	Gary Kass, UK government	added
103	3	305	26	305	26	It is important here to show that participatory methods do not necessarily seek nor create consensus among participants. They may indeed explicitly avoid consensus and seek only to map out the range of views that exist among the participants.	Gary Kass, UK government	added
104	3	305	14			Despite being 5 pages in, this is the first real reference (I would remove the Crutzen Anthropocene definition). And it	Chris Brierley, UK	The chapter is heavily cited from the first section and has more citations than most

Nº	Chapt er	From page	From line	Till page	Till line	Comment	Reviewer Full Name	What was done with the comment
						defines the term expert.	government	of the other chapters
105	3	305	15			Fig 3.2 has a variety of categories - one of which is expert. So do you think this is really helps describe all experts?	Chris Brierley, UK government	See accompanying text.
106	3	305	19		28	This paragraph does not include a definition or example of a participatory approach	Chris Brierley, UK government	Examples in section on participatory approaches
107	3	305	11	305	18	Very laboured description of an expert.	Mark Lonsdale	-
108	3	305	10			Section 3.2.1 talks at length about expert-based and participatory approaches and we then have two long sections on these two approaches at 3.2.1.1 and 3.2.1.2. I suggest reducing 3.2.1 to a sentence to introduce the two subsections.	Mark Lonsdale	These sections have been reduced
109	3.2.1	305	31	306	4	If – as described in line 31 – experts can also be stakeholders – an opinion we strongly support – differentiating between experts and stakeholders (see line 2) sounds paradox and needs clarification. It may be more helpful to differentiate between contributors and users.	Germany	This classification is well-known within the field
110	3.2	305	1	318	30	Most parts of section 3.2 do not specifically refer to the relationship between direct and indirect drivers, but rather represent general aspects of models and scenarios - which could be better integrated in chapt. 1 or 2?	Germany	Noted and revised,
111	3	305	3	315	32	All this text on methodological approaches needs to be reviewed alongside material in earlier chapters to ensure consistency and reduce redundancy. Perhaps it would be helpful to treat scenarios and models separately. Figure 3.3 provides yet another scheme,	David Cooper	Undertaken during the last meeting, many sections were moved or deleted. Figure 3.3 was retained and harmonized with other sections
112	3	305	10	307	42	Threats change the state of biodiversity and the ecosystem. Hence we must reduce them, despite various changes in the way in which or addresses by managers of protected areas. This is how we must agree: - Identify threats to biodiversity by defining a conceptual model showing how threats impact the components of biodiversity. - Stakeholders can play a key role in the threat assessments contributing to analyze the underlying causes of threats and goods between the key components of biodiversity and estimating the cumulative effects of threats. - The prioritization of threats based on their total	Ludunge Elias Abdullah	-

№	Chapter	From page	From line	Till page	Till line	Comment	Reviewer Full Name	What was done with the comment
						<p>contribution to the force of biodiversity leads to assess the relative scope and severity of a threat on the key elements of biodiversity. They can be classified and prioritized according to their impact, intensity and urgency.</p> <p>- Mapping the distribution and intensity of threats prioritized in a land- or married in order to obtain better spatial understanding of how threats can have impacts on biodiversity elements.</p> <p>- Analysis of maps and results of the evaluation threats once one has identified and prioritized threats, developed a conceptual model and analyzes the distribution and threat levels of authority.</p> <p>- This is the experts and stakeholders to review and analyze all the results that may lead them to think about these actions and strategies needed to reduce threats.</p> <p>- Development and implementation of an action plan for preventing and reducing threats during which one must take into account the factors for prioritizing high-risk areas, conservation action planning, taking into account available resources and taking into account restoration problems.</p> <p>Right now or main types of actions, namely:</p> <p>a) Regulations, when involved the national and local authorities, strategies that focus on changes in rules can be a powerful force for reducing threats including creating positive financial incentives, strengthening of initiations negative as taxes and fines and the development of new laws and new regulations that increase protection.</p> <p>b) The management improvement, as the strengthening of laws and monitoring of activities in or around protected areas to have a major impact on reducing threats. Management actions include definition of the border, the change of local community resources management practices.</p> <p>c) The major and alternative livelihood, such as those based on nature tourism or harvesting of forest products with the reducing threats. Microfinance and formations constituting incentives.</p> <p>d) Raising awareness of the local community is essential.</p>		

№	Chapter	From page	From line	Till page	Till line	Comment	Reviewer Full Name	What was done with the comment
						<p>These strategies that focus on communication, education and awareness to help make it clear to members of the local Aboriginal community and to be able to understand the impacts of their behavior, to take into account the importance of biodiversity and to know alternatives and options using resources in and around protected areas.</p> <p>- Monitor changes in the status and trends of threats to manage appropriately.</p> <p>This step is more important and more difficult in the proposed reduction of threats, in other words monitoring the status and threat trends that determines whether the strategy is permanent.</p> <p>Planners must consider whether the threats vary in their severity or their geographical area after conservation strategies. If it happened that at this stage nothing is done, or should think of insufficient resources, lack of long-term involvement of the inadequate understanding of the importance of monitoring in an adaptive management cycle.</p> <p>But we must develop a monitoring plan for this step. It is a plan that identifies indicators that can be collected and measured at regular intervals to determine the effectiveness of each preservative action. It is the most critical step to enable adaptive management.</p> <p>Planners periodically evaluate their investments to whether or not the actions work and be able to be redirected if necessary scarce resources. All monitoring plans are a little different, but share basic attributes, which are:</p> <p>a) clear: it must have clear elements on the expected results based on actions. It is up to stakeholders to decide the final outcome in developing this action.</p> <p>b) results oriented: the monitoring plan must have mayens see if a solution can achieve the desired results. Decide the need to be able to learn what works and what does not, and why not.</p> <p>c) Liability: The monitoring plan should assign responsibility to those who invest in protected areas, government agencies, external donors or community members. If the measures are relevant and quantifiable, they provide donors with the results of the best means of communication.</p> <p>d) Accessibility: The monitoring plan must include the</p>		

№	Chapter	From page	From line	Till page	Till line	Comment	Reviewer Full Name	What was done with the comment
						<p>methods available and the selected methods should be as consistent with the capacity and resource constraints in protected areas.</p> <p>e) Transparency: the monitoring plan be transparent and easy to understand because the results are clearly communicated. When this plan is transparent, it facilitates adaptive management by creating feedback for policymakers = the advantage is that it can help generate support for the monitoring process.</p> <p>At this stage, it takes action to prevent threats, they are taken away by order of 15 work program on protected areas of the Convention on Biological Diversity:</p> <ul style="list-style-type: none"> - Apply environmental impact assessment to plans and projects affecting protected areas. - Develop approaches to liability and redress measures. - Restore and rehabilitate environmentally protected areas. - Check the risks associated with invasive species in protected areas. - Develop regulations and ensure their application to halt the illegal exploitation of resources. <p>Relying more on the environmental impact assessment, it is for me an opportunity to insist that the governing self - manage to violate this rule when saving escapes the notice or knowledge of local and indigenous community and / or civil society. But it should be noted that this conduct has eight steps, namely:</p> <ol style="list-style-type: none"> 1) Selecting an EE coordinator 2) Conduct a broad impact analysis. 3) Conducting a baseline study to identify data needs. 4) Identification of potential measures of alternation. 5) Conduct an analysis of costs and benefits. 6) Recommended players (alternatives). 7) Monitoring the clear decision process 8) Conducting post implementation audits. 		
113	3	305	4		5	change to: Stakeholders and other people are normally involved in scenario setting and model development, and in choices of scenarios and types of models or tools used to suit their particular situation or question.	UK Government	Parties captures the broader communities involved
114	3	305	16			delete 'below', change 'right' to generalised/scientific	UK Government	changed

Nº	Chapt er	From page	From line	Till page	Till line	Comment	Reviewer Full Name	What was done with the comment
115	3	305	17			delete 'below'	UK Government	deleted
116	3	305	23			Reference?!	UK Government	Sentence deleted
117	3	305	26			delete 'key'	UK Government	deleted
118	3	305	28			change lefts side to local/traditional knowledge	UK Government	changed
119	3	305	31			delete Here it is important to note that	UK Government	deleted
120	3	305	33			delete indeed	UK Government	deleted
121	3	306	4			Firstly this sentence needs a reference. Secondly is it really an adequate generalization? I do not know if global-scale models will suffer the same experiential problem.	Chris Brierley, UK government	We believe that experiential knowledge which affects all stakeholders including scientists impacts scenario and model construction at all levels.
122	3	306	6		11	I don't know how more simple sensitivity style scenarios (such as the 1% per year CO2 increase used in the first IPCC report) fit into this framework. I don't think they do and so I wonder if you're being too complicated.	Chris Brierley, UK government	We do know what is being referred to here.
123	3	306	6	307	6	This section is not sure whether it's dealing with scenarios or models. The first paragraph talks about making scenarios. The second one just about making models and the third one jumps back to making scenarios. There is no explicit discussion that this is the case, with the implication they are all concentrating on the same topic.	Chris Brierley, UK government	The distinction between scenarios and models is articulated in chapter 1. We are consistent with Chapter 1 and refer to each accordingly.
124	3	306				Box 3.1: Delphi technique already described in chapter 2. As a minimum there should be cross-referencing. However, it would be better to have one overall description in just one chapter which others then refer to and expand on its application for their own topic.	Paula A Harrison	Cross-referencing added, the Delphi technique is important to both section
125	3	306	18	306	20	In the text is not clear how expert-based approaches solve the expert subjectivity.	Noelia C. Calamari	Box 3.1 on the Delphi technique provides one approach to dealing with expert subjectivity
126	3	306	20	306	22	I suggest to link this sentence with the content in Box 3.1	Noelia C. Calamari	linked
127	3	306	27			tell us what Bayesian models are	UK Government	Bayesian removed
128	3	307	7			Section 3.2.1.2 Some recent examples of participatory approaches for use in modelling are Kok et al., European participatory scenario development: strengthening the link	UK Government	Kok et al. added

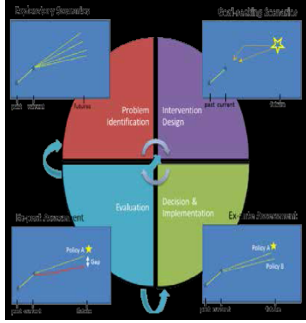
Nº	Chapter	From page	From line	Till page	Till line	Comment	Reviewer Full Name	What was done with the comment
						between stories and models. <i>Climatic Change</i> , 128(3-4): 187-200 and Gramberger, M. et al., Stakeholder integrated research (STIR): a new approach tested in climate change adaptation research <i>Climatic Change</i> , 128(3-4): 201-214.		
129	3	307	14	307	18	This paints far too a rosy picture. It fails to take account of the selection bias among participants, It also over-eggs the power of consensus building. As above, consensus is not always a goal of participatory processes. It also fails to account for the potential negotiating-stances of participants – i.e. not all participants enter into a process with altruistic motives.	Gary Kass, UK government	Section reworded
130	3	307	1		4	This sentence could easily be broken up into two.	Chris Brierley, UK government	Which sentence?
131	3	307	7		8	You need to decide whether participatory approaches or approach is correct. There is a jumping around between whether it's singular or plural.	Chris Brierley, UK government	Singular/plural depends on the context
132	3	307	15			This is begging for a reference or example to point out what gaps are avoided	Chris Brierley, UK government	deleted
133	3	307	18			Why is biodiversity in brackets as an afterthought?	Chris Brierley, UK government	Brackets removed
134	3	307	18		22	This sentence could easily be broken up into two.	Chris Brierley, UK government	Common vision of the future removed
135	3	307	19			Who suffers from the insufficient understanding of relevant issues? Is it the experts or the participants or both? I'm not sure – a reference would help clear this up.	Chris Brierley, UK government	clarified
136	3	307	22			I think domain should be plural. Again a reference seems necessary.	Chris Brierley, UK government	References in the subsequent paragraphs
137	3	307	25		39	This whole paragraph reads as a summary of realtor Briot et al. 2007. If there are more studies, please cite them.	Chris Brierley, UK government	See previous responses to the number of citations
138	3	307	30			Draw seems an odd word choice	Chris Brierley, UK government	construct
139	3	307	35			Why are you formulating scenarios rather than say pathways or policies for conservation	Chris Brierley, UK government	rephrased

Nº	Chapter	From page	From line	Till page	Till line	Comment	Reviewer Full Name	What was done with the comment
140	3	307	38			Mainstream is a noun. It shouldn't be converted into a verb	Chris Brierley, UK government	"to mainstream" is a verb recognized by official dictionaries.
141	3	307	40			This first sentence would read more easily if the "when identifying drivers of change in their important" clause is slightly later. I was surprised there was no citation to back the claim up.	Chris Brierley, UK government	simplified
142	3.2.1.2	307	33	307	39	Maybe this statement could be underpinned by a reference (f.i. of a case study)? "The key advantages of such an approach consists of..."	Werner Rolf	removed
143	3	307	7	307	7	<p>Include the following:</p> <p>3.2.1.2 Indigenous-based knowledge approaches.</p> <p>Holistic, indigenous, and local knowledge-based methods aim to capture holistic values about peoples and nature whilst internalizing principles and ethical values about Mother Earth and 'Living-well' of indigenous and local knowledge systems. Holistic, indigenous, and local knowledge methods can be applied with indigenous ancestral territories and local communities, and in broader governance scenarios (national and subnational) where rights of indigenous peoples and local communities and the principles or rights of Mother Earth are fully recognized in legal frameworks.</p> <p>Indigenous and local knowledge approaches to valuation are more likely to characterize and evaluate ecosystem benefits as gifts of Mother Earth subject to cultural norms and beliefs and inter-generational responsibilities, particularly for communities living within their ancestral territories. These approaches assume there are unique characteristics of indigenous and local communities interactions with nature that require specific understanding attuned to their world views and realities. The non-separation between nature and culture that is often but not exclusively true for indigenous peoples makes valuation for indigenous peoples a unique process, in which economic, social, cultural, spiritual, historical, and ecological aspects are inter-dependent parts of holistic systems of life (Illescas, 2007, Medina, 2014). Valuation in this context is place based and may not be</p>	Diego Pacheco	Reference to ILK added

Nº	Chapter	From page	From line	Till page	Till line	Comment	Reviewer Full Name	What was done with the comment
						suitable to generalize to other people or places. Local and indigenous language terms can be used to design the relevant local and indigenous knowledge concepts that valuations should follow (such as reciprocity, cultural aspirations, positive benefit to communities, fostering enduring relationships) as well as to measure how spiritual and cultural connections are expressed at individual and collective levels. Indigenous valuation approaches can also enable greater capacity for informed longer term decision-making of indigenous communities in ecosystems. Examples of indigenous valuation models include the Cultural Health Index (CHI), Māori Wetland Indicators and the Mauri Assessment model from New Zealand, the “Indicators for Living Well” in Bolivia, the “Plans of Life” model from the Amazon region and the Coast Salish Indigenous Health Indicators from the US and Canada.		
144	3	307	6	307	6	I suggest to do here a table with the different approaches and their advantages and disadvantages oriented to biodiversity and ecosystem services	Noelia C. Calamari	Participatory vs expert-based? Comment is unclear
145	3.2.1.2	307	18	307	24	Need to explain who and how many are to participate, how they are different (identification of stakeholder) are important questions which need to answer explicitly.	Nazirul Islam	Unclear what is being requested here.
146	3	307	28	307	31	Need to use abbreviations? Will these terms come up subsequently to a great extent? ...since ‘RPG’ is already a weapon. Also other seemingly extraneous use of abbreviations/acronyms throughout.	Anna Carter	removed
147	3	307	25	307	39	In this paragraph, the companion modeling (ComMod) approach should be explicitly mentioned => Etienne M. (Ed) 2014. Companion Modelling. A Participatory Approach to Support Sustainable Development. Springer On coupling multi-agent system and role-playing games, a seminal reference to be included is: “Bousquet F., Barreteau O., D’Aquino P., Etienne M., Boissau S., Aubert S., Le Page C., Babin D., Castella J.-C. 2002. Multi-agent systems and role games: collective learning processes for ecosystem management. In: Complexity and ecosystem management. The theory and practice of multi-agent systems, M.A. Janssen (Ed.). Cheltenham: Edward Elgar Publishing, 248-285.”	Christophe Le Page	“Bousquet F., Barreteau O., D’Aquino P., Etienne M., Boissau S., Aubert S., Le Page C., Babin D., Castella J.-C. 2002. Multi-agent systems and role games: collective learning processes for ecosystem management. In: Complexity and ecosystem management. The theory and practice of multi-agent systems, M.A. Janssen (Ed.). Cheltenham: Edward Elgar Publishing, 248-285.” Added
148	3	307	1			assessments' you mean asking environmental questions?	UK Government	We cannot find the section being referred to.

Nº	Chapter	From page	From line	Till page	Till line	Comment	Reviewer Full Name	What was done with the comment
149	3	307	4			delete 'here'	UK Government	deleted
150	3	308	15			I'd recommend "scoring the impact from a given risk independent from the likelihood" as this is the terminology used in say the Davos Risk reports (http://reports.weforum.org/global-risks-2015/top-10-infographics/)	Chris Brierley, UK government	This section has been cut
151	3	308	21			"issues". Have we jumped or does this mean "risks" as in the paragraph above	Chris Brierley, UK government	This section has been cut
152	3	308	25			To tie in with the risks discussion of the text, should the description of Objective in Table 3.1 read "what are risk are you trying to reduce/avoid?"	Chris Brierley, UK government	This section has been cut
153	3	308	25			Table 3.1 too fish centric, could generalize.	Jason Link	This section has been cut
154	3	309	10	309	10	Insert 'set of' before 'constructed'; replace 'future' with 'futures'	Gary Kass, UK government	changed
155	3	309	1		3	This claim feels like it needs a reference	Chris Brierley, UK government	This is cut
156	3	309	13		16	I seem to be missing a formal definition of a "scenario". I thought that it was a specific set of drivers (such as say a representative concentration pathway) that was a scenario - rather than being is an input into a a scenario	Chris Brierley, UK government	Scenarios are defined in Chapter 1: Plausible alternative future situations based on a particular set of assumptions. Scenarios are associated with lower certainty than projections, forecasts or predictions. For example, socio-economic scenarios are frequently based on storylines describing several alternative, plausible trajectories of population growth, economic growth and per capita consumption, among other things. These are commonly coupled with projections of impacts on biodiversity and ecosystem services based on more quantitative models. The term "scenarios" is sometimes used to describe the outcomes of socio-economic scenarios coupled with models of impacts, owing to the high uncertainty associated with the socio-economic

No	Chapter	From page	From line	Till page	Till line	Comment	Reviewer Full Name	What was done with the comment
								trajectories.
157	3	309	17		18	This sentence seems to exclude the sensitivity style scenarios that are the first step in exploratory work. Things like “what is the biodiversity to a 2oC warming?”	Chris Brierley, UK government	Correct, we now refer only to exploratory scenarios
158	3	309	21		23	It is true that the IPCC developed storylines scenarios and their underpinning. However the IPCC dropped this approach in the most recent assessment, because it proved a bit unwieldy. (see later comments about Box 3.5)	Chris Brierley, UK government	Correct, now only earlier IPCC assessments are referred to.
159	3	309	24		26	Considering that storyline-based scenarios were dropped for more goal-orientated ones in the last report, this sentence and its references somewhat outdated.	Chris Brierley, UK government	This statement is still relevant.
160	3	309	27			Is IPBES really the correct place for “an extensive history of scenario building” (even in chapter 2)? Perhaps a relevant review should be cited.	Chris Brierley, UK government	Review cited
161	3	309	2			Why specify the fishing industry?	Mark Lonsdale	deleted
162	3	309	27	309	27	An extensive history of scenario building is beyond the scope of this paper (this chapter or this deliverable!!!!).	Gunay Erpul	We agree
163	3.2.2	309	8	315	32	It appears that ex-ante and ex-post assessment is systematically classified just beside explorative and normative scenario, which is not true. This of course becomes clear from the text but may confuse readers which are not familiar with this topic. Maybe it would be less confusing by restructuring this part. Ex-ante /Ex-post assessment should be clear understood as evaluation methods using scenario techniques rather instead (see also page 315, line 6/7: “...as variations..” .	Werner Rolf	Chapter 1 will now clarify in greater detail
164	3	309		313		Scale is a considerable factor during scenario construction. In large scale, we could employ existing scenarios to avoid data format problem. In local scale, we could build new scenarios to describe the unique situation.	Zhao Zhiping	Spatial scale is mentioned throughout the chapter
165	3	309	7	309	7	broadened in particular into an Ecological Economic Risk Assessments	Luc Doyen	cut
166	3	310	1			Table 3.2 contains the first real discussion of what Ex-post and Ex-ante assessments are, and even then this is coincidental.	Chris Brierley, UK government	Ex-ante and ex-post are now defined earlier in the document
167	3	310	4	311	6	This discussion of exploratory scenarios does not really seem to allow for idealised scenarios, such as the (pretty arbitrary) 1% per year CO2 increase used in the first IPCC report. This is even despite this precise scenario being	Chris Brierley, UK government	CC is a direct driver of biodiversity and not an outcome within the context of IPBES

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						discussed in the section. It had no underlying storyline or stakeholders – it is just an easy test to apply to a climate model. I feel this sort of scenario – that is necessary to identify which factors the system is sensitive to – have been completely neglected in the whole chapter.		
168	3	310				Table 3.2. Lots of overlap with Chapter 2	Paula A Harrison	Noted and revised
169	3	310	1	310	1	<p>Replace by the following figure</p> <div style="display: flex; align-items: center; justify-content: center;"> <div style="margin-right: 20px;"> <p>SCIENTIFIC SCENARIOS AND MODELS</p> </div>  <div style="margin-left: 20px;"> <p>ILK SCENARIOS AND MODELS</p> </div> </div>	Diego Pacheco	ILK scenarios are included within the scenario framework
170	3.2.2	310	1	310	2	Insert Diseases management system in Tabel 3.2.	Sara Sozzo	We feel this is beyond the scope of this chapter

№	Chapter	From page	From line	Till page	Till line	Comment	Reviewer Full Name	What was done with the comment						
						<table border="1"> <thead> <tr> <th data-bbox="716 250 934 428">Scenarios approaches</th> <th data-bbox="934 250 1152 428">Brief Summary</th> <th data-bbox="1152 250 1325 428">Type of Policy Making/Decision Making Objective</th> </tr> </thead> <tbody> <tr> <td data-bbox="716 428 934 878">Exploratory scenarios (descriptive scenarios)</td> <td data-bbox="934 428 1152 878">Is important measurement of diseases and correlated decreases of biodiversity</td> <td data-bbox="1152 428 1325 878">Diseases Management syst</td> </tr> </tbody> </table>	Scenarios approaches	Brief Summary	Type of Policy Making/Decision Making Objective	Exploratory scenarios (descriptive scenarios)	Is important measurement of diseases and correlated decreases of biodiversity	Diseases Management syst		
Scenarios approaches	Brief Summary	Type of Policy Making/Decision Making Objective												
Exploratory scenarios (descriptive scenarios)	Is important measurement of diseases and correlated decreases of biodiversity	Diseases Management syst												
171	3	310	16			<p>Now that there was threat assessment, the following role is to ecosystem restoration and remediation. This restoration is central to maintaining and improving ecosystem resilience to climate change and other global changes.</p> <p>To lead to resilience, we must assess climate threats at the landscape level, system-level and site-level. The threats, it is usually a wide range of logging, plantations and agriculture, poaching, overfishing, recreation invasive species and fire dams and altered hydrological regimes and pollution.</p> <p>How to assess these threats?</p> <p>Evaluation of threats at landscapes: it is a systematic conservation element in wide areas including not only protected areas, buffer zones and corridors of connectivity, but a full range of other uses of the space. The goal is to identify the most threatened ecosystems and seeking protection and evaluate patterns of households within protected area systems.</p> <p>Evaluations threats in systems: they are conducted in</p>	Ludunge Elias Abdullah	-						

№	Chapter	From page	From line	Till page	Till line	Comment	Reviewer Full Name	What was done with the comment
						<p>protected area systems as evacuation management efficiency elements focusing on threats to protected areas within national systems or sub - national. The aim is to identify the most present threats and the most threatened protected areas in the whole system.</p> <p>Site-level threats assessment: they are conducted as part of the management planning process or evaluating the effectiveness of management. They include a list of threats within the protected area. The most detailed assessments include a ranking of the extent and severity of a range of threats based on their impact on a subset of key elements of biodiversity. This is to allow identification of threats with significant impacts on biodiversity in a particular area.</p> <p>It is also to remember that this assessment of threats has a number of weaknesses such as generality, not a description of impacts, not to include ecosystem services, not to consider the synergies and not to take into account the future patterns.</p> <p>The protected area, so that it provides the ecosystem services needed, it must be comprehensive and ecologically representative. How do I know that it fulfills these conditions? The procedure can only be that of conducting an evaluation of ecological deficiencies is an analysis of the extent to which key elements of biodiversity (species, natural communities and ecological systems) are sufficiently represented in the areas network Protected. The assessment also allows to identify the key elements of biodiversity that are under - represented in the protected areas network and informs exactly the most important sites planners to protect.</p> <p>Didnt assess deficiencies leads to risks such as not to use resources efficiently, decreasing opportunities, change of references and that decisions will not be considered transparent.</p> <p>It is a process that can reduce conflict and lead a support society.</p> <p>The demand to follow to conduct the evaluation of deficiencies involves</p> <ul style="list-style-type: none"> - The creation of a deficiency assessment team. - The identification of necessary stakeholders. - The gathering of existing information. - The establishment of a data management system - The development of a work plan 		

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						With specific regard to stakeholders, they must be potential sectors and interests that may be important to involve deficiencies in the evaluation process. Finally, the ecological deficiencies assessment process leads to strategies to improve the network of protected areas, based on the results. Specific actions can be for example the creation of a new protected area, the expansion of an existing reserve and the change in governance and / or management category.		
172	3	310	1			Policy/decision making does not match very well to policy application sin C2- e.g. policy prescriptions is 'management', proactive policy assessment is 'setting agenda? Need to be consistent- adapt this to fit the IBES simplified framework and C1 and 2.	UK Government	We are now consistent with other chapters of this deliverable
173	3	310	14			delete 'here'	UK Government	deleted
174	3	311	11	311	14	This should reflect the point that business will never be 'as usual' as things always change. A more helpful description is 'under current policy assumptions' as this allows for a 'natural' evolution	Gary Kass, UK government	In the absence of policy change, "business-as-usual" or baseline scenarios represent a future with no major interventions or paradigm shifts in the functioning of a system. However, the term "business-as-usual" may be misleading in the policy-making process because exploratory scenarios can also describe futures that bifurcate at some point (an example might be uptake or rejection of a new technology) or that make some assumptions about the functioning of a system.
175	3	311	18	311	18	Reference might usefully be made to the Dutch Environmental Assessment Agency (PBL) and their use of normative scenarios to set out a range of different 'perspectives' (visions) for nature (see Nature Outlook)	Gary Kass, UK government	We agree, this is indeed a relevant project. However, the work has not yet been published so we cannot refer to it yet
176	3	311	19	311	19	This section should be prefaced as an example of only one way to build exploratory scenarios...the one cited uses 2-axes approach that picks only two dimensions of uncertainty. More recent experience has indicated that this is not helpful as it tends to generate extreme and less subtle	Gary Kass, UK government	This has been placed in a box as an example

No	Chapter	From page	From line	Till page	Till line	Comment	Reviewer Full Name	What was done with the comment
						scenarios than are usefull. The UK National Ecosystem Assessment (Ch 25) is a good source of insight on the limitations of this approach and the benefits of a multi-dimensional approach.		
177	3	311	3			This paragraph is missing a word at the front to describe the scenario approaches. Exploratory? Or Several?	Chris Brierley, UK government	clarified
178	3	311	6			The IPCC scenarios are not “normally applied” at a global scale. They only make sense when driving global-scale models.	Chris Brierley, UK government	rephrased
179	3	311	7			Downscaling has not been defined.	Chris Brierley, UK government	defined
180	3	311	14		16	An unnecessarily long sentence. It also needs “more common in environmental studies than ...”	Chris Brierley, UK government	modified
181	3	311				Fig 3.3 is impenetrable. If it is needed, it needs a detailed legend.	Mark Lonsdale	Figure has been simplified
182	3	311	19	311	26	A more generic set of steps would be more useful with the case study in a box (following the skypc of chapter 2)	Paula A Harrison	Revised as suggested.
183	3.2.2.1	311	1	311	2	Fig. 3.3 gives a kind of an overall view of the linkages between scenarios and the policy cycle. It contributes to a basic conceptualization that is also relevant for the following chapters, and therefore should be placed and explained in chapt. 2. (see also comment above)	Germany	This figure serves to highlight scenario options at various points in the policy cycle, rather than illustrating the policy cycle.
184	3	311	2			policy cycle and match with C1 and 2, e.g. identifying the problem is agenda setting. Need consistency, adapt figure.	UK Government	Harmonized
185	3	311	19			BD= biodiversity	UK Government	check
186	3	312	13			Would the IPCC’s RCP2.6 scenario that defines a route that does not exceed a climate change of 2oC not count as a goal-seeking scenario?	Chris Brierley, UK government	Correct
187	3	312	33			The assessment of environmental impacts is a recommended process to drive before the infrastructure project implementation may affect the environment in this case for the following specific cases, biodiversity. The development is still qualified as a threat to biodiversity. The result of this evaluation allows decision makers to make the decision, but also promotes sustainable development. Conducting assessment comes after a strategic environmental assessment followed by steps such as:	Ludunge Elias Abdullah	-

№	Chapter	From page	From line	Till page	Till line	Comment	Reviewer Full Name	What was done with the comment
						<p>- The preliminary study where you have to make sure whether or not the project requires an environmental assessment;</p> <p>- The definition of the scope of impacts that identifies key issues to study in more detail. This is the stage we get to prepare terms of reference for the evaluation. At this stage again, we must involve the public. UNEP, in its training manual on Environmental Impact Assessment, gives us a systematic approach for planning a public involvement program by committing to address the following issues:</p> <p>a) What public should be involved? identify the public concerned and affected, taking note of the most important constraints to which their involvement is subject</p> <p>b) What type of public involvement and what scope is appropriate - to ensure that these characteristics are proportionate to the results and the EIA objectives.</p> <p>c) How the public must be involved there - Identify techniques that are appropriate to that objective.</p> <p>d) When and where to involve the public? - Establish a plan and schedule related to the processes involved.</p> <p>e) How do the results of public involvement will it be used in the EIA process and decision making - describe the mechanism of analysis and consideration of public input and setting up information flow to those directly affected.</p> <p>f) What resources are needed or available for the implementation of the public involvement program? - Establish a report stating the reflections mentioned above regarding requirements for budget, time and staff.</p> <p>- Assessment and evaluation of impacts and development of alternatives to which impacts should be analyzed.</p> <p>- Reducing and managing impacts in order to find alternatives, to enhance beneficial impacts, avoid and reduce negative impacts or reducing them and ensure that residual adverse impacts are limited to an acceptable level.</p> <p>- The combined ratio of an environmental and social management plan. This report must be submitted to public quality control in several ways.</p> <p>- The decision which may be that the refusal or authorization.</p> <p>- Compliance The environmental audit is done during the execution of the project following the decision, the control is</p>		

Nº	Chapter	From page	From line	Till page	Till line	Comment	Reviewer Full Name	What was done with the comment
						to be maintained in the moral of the evaluation report and environmental management plan. At this stage as public involvement is required.		
188	3	312	14		15	simplify, and use the policy application terms in C1 and 2.	UK Government	simplified
189	3	312	3	312	3	Add parenthesis for the Caribbean example	Luc Doyen	added
190	3	312	24	312	24	In terms of achievable targets	Luc Doyen	check
191	3	313	21	313	21	Another approach is to use ‘wind-tunelling’ whereby the goals being sought are ‘tested’ in the exploratory scenarios used in an analytical mode to identify risks and opprtunities based on an understanding of relative risk appetite and thus enable iterative design of the goals or indeed to help identify interventions that could reduce the chances of ‘bad’ scenarios and increase the chances of ‘good’ scenarios coming about. (see also section 3.2.2.3)	Gary Kass, UK government	Agree, but one example as already be noted.
192	3	313	14		16	This sentence about pareto outcomes seems overly technical.	Chris Brierley, UK government	Less technical now
193	3	313				Box 3.2 – perhaps need to expand to show how the Zonation outputs were used to inform the question.	Shane Orchard	Expanded
187	3	313	2		4	move to start of section. All of these sections could benefit from having a couple of lines about what the approach is useful and less useful for, in terms of [policy and decision making.	UK Government	moved
188	3	313	10			add improve understanding of ecological functions and environmental interactions	UK Government	We disagree as most optimization techniques are not able to do this.
189	3	313	1	313	1	Instead of environmental damage, I propose biodiversity loss, maximal ecosystem service or maximal economic income	Luc Doyen	changed
190	3	313	19	313	19	Instead of optimised, I suggest desirable	Luc Doyen	changed
191	3	313	19	313	19	After scarce. In that respect, the use of co-viability scenarios and models at large and ecosystem scales as in Cissé et al. (2013), Gourguet et al. (2013) or Hardy et al. (2013) for fisheries and marine biodiversity or Mouysset et al. (2014) for land-use and terrestrial biodiversity is original and informative. The basic idea underpinning viability approach is to limit the bio-economic risks and vulnerabilities of a socio-ecosystem through a set of ecological and socio-economic constraints	Luc Doyen	Although we appreciate the suggestions these models are not backcasting approaches as we here refer to.

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						to satisfy throughout time. By doing this, the approach conveys informations in terms of both transients and asymptotics as well as sustainable management or policies. Doyen L., Cissé A., Gourguet S. Mouysset L., Hardy P.-Y., Béné C., F. Blanchard, Jiguet F., Pereau J.-C., Thébaud O. 2013. Ecological-economic modelling for the sustainable management of biodiversité, Computational Management Science, December 2013, Volume 10, Issue 4, pp 353-364 DeLara M. & Luc Doyen, 2008, Sustainable Management of Natural Resources, Mathematical Models and Methods, Environmental Science and Engineering, Springer, http://link.springer.com/book/10.1007%2F978-3-540-79074-7		
192	3	314	6			Reference?!	Chris Brierley, UK government	Reference added
193	3	314	12		14	This sentence defines what an ex-ante assessment is. As such I think it would be better to have it before you describe the use of them.	Chris Brierley, UK government	Ex-ante now defined earlier
194	3	314	21		24	I couldn't suppress a nagging question that an ex-ante assessment is a variant of an exploratory scenario with an indirect driver (i.e. a policy)	Chris Brierley, UK government	True, but now the distinction is better outlined
195	3	314	32			In the key findings you state that scenarios exist on multiple timeframes. Why are you being prescriptive now?	Chris Brierley, UK government	The focus here is on the intervention design phase which places greater importance on a more immediate temporal scale for specific policies.
196	3	314				What is the reason for the colour shading behind the lines in Figure 3.4? It is somewhat distracting and should perhaps be removed. Furthermore, additional information should be provided to enable this figure to stand alone. For example, it is not clear which species are being referred to. And what is the difference between the present time and future (2040) lines? Is it the date of PA instigation?	Derek Tittensor	removed
197	3	314	8			Section 3.2.2.3 has strong overlaps with Chapter 2. Cut down and cross-reference, then keep focus in chapter 3 on indirect/direct drivers and how to build scenarios for such assessments.	Paula A Harrison	Sections have been redistributed
198	3.2.2.3	314	9	314	16	I think there should be direct explanation of ex-ante assessment e.g., evaluation of policy alternative in terms of their estimated consequences (prior to implementation); ex-post assessment- policy impact assessment evaluate the	Nazirul Islam	Examples now provided

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						consequences of policies. Other examples and explanation easy to understand		
199	3.2.2.2	314	1	314	6	Source of Fig. 3.4? Should be included in the figure legend even if it belongs to Box 3.2	Jens Mutke	added
200	3	314	9			delete key	UK Government	deleted
201	3	315	8			I think you should first define ex-post assessment, before discussing how it's relevant	Chris Brierley, UK government	Now defined earlier
202	3	315	15			I accept the claim in this sentence about unforeseen externalities but I couldn't help but feel you best have an example or a reference to back it up	Chris Brierley, UK government	referenced
203	3	315	21		26	Forest loss is a really useful example of what you mean but is not written as if it's just an example. These sentence are more written as if they're the whole thing	Chris Brierley, UK government	"for example" added
204	3	315	34		38	You try to describe a variety of model typologies in a few sentences. I wonder if a schematic/table (akin to fig3.3 for scenarios) would be more helpful	Chris Brierley, UK government	Model typology is now included in chapter 1
205	3	315	38			The implication here is that all biodiversity models simulate some of the economy. Surely there are several that concentrate solely on biology/ecology.	Chris Brierley, UK government	The impacts of direct drivers on biodiversity are dealt with in Chapter 4.
206	3	315	39	316	3	Is this not just a discussion of economic models, not all BES models? I don't mind that but just be explicit about that at the outset.	Chris Brierley, UK government	rephrased
207	3	315	14	315	17	Further, due to the inherent complexity of the environment-policy and its management nexus, enactment of environmental policies may result in unforeseen externalities that run counter to the original goals or encourage counterproductive behaviour such as rebound effects.	Marina Rosales Benites de Franco	Externalities are addressed
208	3	315	19	315	20	I strongly agree with this stamen, but I suggest a little change However, in many cases it is advisable and important to distinguish the effects of the implemented policy or management scheme from the autonomous developments.	Marina Rosales Benites de Franco	Important added
209	3	315	23	315	26	I strongly agree with this, I think it is vital and crucial for the protected areas. Hence, I suggest the following change:	Marina Rosales Benites de	should

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						However, such straightforward evaluations may be biased by the different locations of protected and unprotected natural areas that heavily impact the risk of deforestation (Joppa & Pfaff 2010). Under such conditions more sophisticated techniques for ex-post assessment may should be applied that are able to distinguish the influence of such confounding factors on the monitored impacts.	Franco	
210	3.2.3	315	34	316		How are model tested	Nazirul Islam	Dealt with in Chapter 8
211	3	315		318		Biogeochemical models deserve more attentions due to stronge scientific basis and accurate simulation results.	Zhao Zhiping	Space limitations preclude additional material
212	3	315	8	315	26	Hoffmann et al. (2010) Science and (2015) Conserv Biol are other good examples here.	Thomas Brooks	Good suggestion. After line 20 we have added the reference: Hoffmann M, Duckworth JW, Holmes K, Mallon DP, Rodrigues ASL, Stuart SN. 2015. The difference conservation makes to extinction risk of the world's ungulates. Conservation Biology:n/a-n/a.
213	3	315	5		7	is recommendation, and not a referenced finding.	UK Government	We do not feel this is a recommendation
214	3	315	32	315	32	It seems to me that this paragraph dedicated to ex ante/expost evaluation should mention the so-called management strategy evaluation (MSE) for fisheries because the adaptive methods and prospects of MSE are really closed to those described in the paragraph. See for instance Sainsbury, K.J., Punt, A.E. and Smith, A.D.M. 2000. Design of operational management strategies for achieving fishery ecosystem objectives. ICES Journal of Marine Science, 57: 731–741 and O. Thébaud, Smith T. Doyen L., Planque B. Lample M., Mahevas S., Quaas M., Mullon C., Vermard Y., Innes J. 2013. Building ecological-economic models and scenarios of marine resource systems: workshop report. Marine Policy, Volume 43, January 2014, Pages 382–386	Luc Doyen	This chapter is already reference heavy
215	3	316	3	316	3	It might be worth just reminding the reader here that regardless of typologies of methods and modelling approaches, that any model is only ever an incomplete representation of reality and hence should always be treated with caution; its outputs not ascribed disproptrtionate strength.	Gary Kass, UK government	Agree, see answer to earlier comments

Nº	Chapt er	From page	From line	Till page	Till line	Comment	Reviewer Full Name	What was done with the comment
216	3	316	5			I associate 'emulate' with a particular statistical technique. Is that really what you mean here?	Chris Brierley, UK government	Changed to simulate
217	3	316	22			Personally long-term would be better than long-run. As a modeler I associate a long run as a simulation that is integrated over many model-years.	Chris Brierley, UK government	changed
218	3	316	26			The GPG does not apply to all model drivers and some of these are more audit processes aren't they.	Chris Brierley, UK government	Yes this is correct it does not apply to all model drivers and here we show GPG as an example of GHG accounting. However, it can be argued that the basic principles can be generalized.
219	3	316	34			What is meant by "scenarios of key driver scenarios"? Recursive	Chris Brierley, UK government	typo
220	3	316	25	316	31	The section on 'good modelling practice' seems like it belongs in a separate box.	Derek Tittensor	Thank you for the suggestion, we decided to devote a section to it.
221	3	316	4			Section 3.2.3.1: A table providing an overview of the different modelling methods, the indirect/direct drivers, and example models/references would be useful. Text in this section seems to overemphasize GDP models.	Paula A Harrison	Chapter 1 will provide a general typology of models
222	3	316	4	316	24	Biodiversity and agriculture have very complex relationships justified by the diversity of life constitutes both the basis for agricultural production, but may represent a fear for agriculture to manage such as pests, weeds, predators , competition with wildlife etc. Similarly, agriculture contributes to biological diversity in the selection of breeds and varieties, creation of landscape structures that constitute the particular inhabitants and the other side it reduced by negative impacts for biodiversity of some and agricultural practices. Some agricultural practices, too intensive or not respecting environmental standards, are responsible for soil degradation and loss of biodiversity on earth. Also, plowing, which are common and particularly deep, intensive use of fertilizers and pesticides, desiccation, flooding, fires disrupt soil organisms, such as macro-, meso fauna, microorganisms reduce the stage organic matter, the main energy source for ground dwellers, by upsetting the structure, aeration, capacity, texture, pH or soil composition, altering its operation. There are other agricultural practices that maintain and	Ludunge Elias Abdullah	This comment is outside the scope of the chapter

№	Chapter	From page	From line	Till page	Till line	Comment	Reviewer Full Name	What was done with the comment
223	3	316	25	317	27	<p>restore soil biodiversity.</p> <p>The relationship between protected areas, the cradle of biodiversity and climate change should lead us to promote resilience in the management of protected areas. Protected areas are part of a global approach based on the adaptation of ecosystems to climate change. This approach is based on ecosystems and means that using biodiversity and ecosystem services as part of a comprehensive adaptation strategy to help people to the adverse effects of climate change. The approach has advantages, provides many co-benefits for biodiversity conservation, adaptation to climate change and socio-economic benefits.</p> <p>By integrating climate considerations in protected areas is beneficial for the simple reason that it is a cost / effectiveness, efficient and effective for adaptation to climate change, while simultaneously completing multiple societal benefits.</p> <p>Adaptation to climate includes two main aspects, the ability of humans to understand, predict and respond appropriately to climate change impacts to allow biodiversity to adapt and the ability of biodiversity and ecosystems intact to allow humans to adapt to climate change taxes.</p> <p>Basing ourselves on a hundred journal articles over 22 years, the following elements are the most frequently cited recommendations for climate change adaptation.</p> <ol style="list-style-type: none"> 1) Increasing connectivity between protected areas of land and seascapes; 2) Integrating climate change into national planning exercises; 3) Mitigate other threats, mainly invasive alien species and fragmentation; 4) To study the responses of species to climate change and manage them accordingly; 5) Increase the number and area of protected areas; 6) Plan to broader scales to improve inter-agency coordination; 7) Practice adaptive management with basic monitoring programs in place; 8) Create and manage buffer zones around protected areas; 9) Create large ecological reserves surrounded by land uses 	Ludunge Elias Abdullah	This comment is outside the scope of the chapter

№	Chapter	From page	From line	Till page	Till line	Comment	Reviewer Full Name	What was done with the comment
						<p>that are compatible;</p> <p>10) Adopt long-term timetables for planning and management</p> <p>11) Extend the genetic and species diversity in efforts to restore and forestry to replace the gene pool.</p> <p>12) Protect shelters and initiate long-term studies on the responses of species to climate change.</p> <p>13) Represents cash in over a protected area in the landscape and seascape.</p> <p>14) Improve the management of protected areas (for example, follow the best management practices, the flexible zoning, etc.)</p> <p>15) Anticipate surprises, unexpected thresholds and tipping points in species and ecosystem responses to climate change;</p> <p>16) Optimize the layout and definition of protected areas for Resilience</p> <p>Source Heller, N. Zavaleta, E.2009 Biodiversity Management in the Face of climate change; A Review of 22 years of Recommendations. Biological Conservation,</p> <p>As for mitigation ie st to influence an ecosystem either releasing or storing carbon and manage protected areas for climate mitigation to ensure that ecosystems are a net sink of carbon.</p> <p>Human actions, combined with the physical effects of climate change and other threats can result in an ecosystem switches between a net carbon source and a net sink of carbon.</p> <p>Managers of protected areas must begin to consider how their actions will affect the overall capacity of an ecosystem to be resilient to climate impacts, and whether or not their shares increase or decrease resilience.</p> <p>Planning, meanwhile, in addition to adaptation, mitigation and resilience to climate, should consider connectivity and correct the connectivity that extends the habitat for a wide variety of species, allowing migration species and maintains the variability of isolated populations.</p> <p>The connectivity between protected areas is widely recognized as important to enable species to change their</p>		

Nº	Chapter	From page	From line	Till page	Till line	Comment	Reviewer Full Name	What was done with the comment
						distributions in response to climate change Improving connectivity is a response to climate change adaptation. There is another very important aspect as to what concerns the improvement of the climate resilience of the network of protected areas by incorporating climate issues in establishing transboundary protected areas and regional networks. Transboundary protected areas allow species to change their distribution areas over time; they also allow natural processes to occur at larger scales, such as migration requirement interconnected protected areas; they increase the viability of populations, they reduce the synergistic threats; they increase the reproductive success; they increase the likelihood of protected areas using climate refuges; they develop the diversity of the gene pool of populations (source; Protected Areas for the 21st Century)		
224	3	316	4	316	24	3.2.3.1. Modelling methods – really helpful to have a clear Table on the pros/cond/uses of each of these methods, instead fo a rather random list. Possibly along the lines of TCCCA (line 28)	UK Government	Unfortunately space limitations do not allow for another table
225	3	316	32		42	A lot of criticism, and no references to back it up.	UK Government	This is our assessment of the current state. See previous responses regarding the level of citation.
226	3	316	34			not quite true, governments do take an interested and do create guidance- see our AQUA book at https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/416478/aqua_book_final_web.pdf . This is where IPBES would ned to influence policy- find out what they have been doing for using models and scenarios for government use and where they can help.	UK Government	“mainly” added
227	3	316	42			BES= biodiversity and ecosystem services	UK Government	yes
228	3	317	37	317	37	Insert ‘attempt to’ integrate.	Gary Kass, UK government	See earlier answer
229	3	317	11	317	16	I wonder if the combined exploratory/goal-seeking scenario combination akin to the RCPs of the IPCC would be a solution to this problem.	Chris Brierley, UK government	It is not clear what is to be addressed
230	3.2.3.	317	1	317	7	Difficult to scan for Asian. Need simple sentence. Words	Nazirul	It is not clear what is to be addressed

Nº	Chapt er	From page	From line	Till page	Till line	Comment	Reviewer Full Name	What was done with the comment
	1					selection in sentences excellent but sentence standard to native English speaking audiences	Islam	
231	3	317	1		16	shorten, delete opinions, or substantiate statements with references. This is not a constructive argument.	UK Government	Text was slightly adapted to take opinions out, but assessment pieces still remain. For many assessment arguments it is hard to find citations such as the fact that some of the IAMs have millions of equations and constraints.
232	3	317	4		27	Pull out, this is a recommendation about good practice that could be part of a key recommendation	UK Government	Good argument. However, we decided to leave the GPG text where it is!
233	3	318	42	318	42	Insert ‘as these are strong drivers of value sets and decision-frameworks that affect behaviours’ after ‘management’.	Gary Kass, UK government	inserted
234	3	318	33	318	33	Section 3.3 could benefit from some consideration of how indirect drivers play out around values and decision-frameworks	Gary Kass, UK government	Added
235	3	318	1			There appears a word missing before models in this sentence. Is it ‘gridbox’?	Chris Brierley, UK government	reworded
236	3	318	3		5	The process you described in the previous paragraph might be better described as “one-way coupling” rather than “loose coupling” as information only flows in one direction. This would mean you may be able to lose the clause “where only limited information is exchanged between the models”	Chris Brierley, UK government	In the literature ‘loose coupling’ is a more common term. We have clarified by: ‘loose coupling (often one-way coupling)’ but retained the notion that only limited information is exchanged as in one-way coupling also a lot of information can be exchanged depending on the implementation
237	3	318	8		15	You don’t mention nor hint at the disadvantages of IAMs at this point.	Chris Brierley, UK government	Elaborated upon in 3.5
238	3	318	22			“applications...applied to” needs revising	Chris Brierley, UK government	revised
239	3	318	26			Replacing “non-linear dynamics” with “complexity” might make this more readable.	Chris Brierley, UK government	We prefer to keep the more specific ‘non-linear’ as complex models are not necessary non-linear and the statement is especially relevant to non-linear dynamics
240	3	318	33			It wasn’t until here that I started to understand what was meant by “indirect” drivers. A further definition and intro paragraph would help (with economy in section, technology	Chris Brierley, UK government	See previous responses

Nº	Chapter	From page	From line	Till page	Till line	Comment	Reviewer Full Name	What was done with the comment
						in section ...)		
241	3	318	37			“through subsequent” should read “with subsequent”	Chris Brierley, UK government	Addressed
242	3	318	8	318	22	Add references for examples of global IAMs and regional IAMs (e.g. Harrison et al. (2015) Assessing cross-sectoral climate change impacts, vulnerability and adaptation: An Introduction to the CLIMSAVE project. Climatic Change, 128: 153-167. DOI 10.1007/s10584-015-1324-3) as has been done for other types of coupled models.	Paula A Harrison	added
243	3	318	28	318	30	This is a key point. Also if you compare the same models run independently and as part of a system the results show than the stand alone models either over- or under-estimate outcomes as a result of missing important system interactions.	Paula A Harrison	Agree, strengthened by: ‘...full system to identify the role of system interactions’.
244	3	318				Sections 3.3 and 3.4: This is the strength of this chapter; other sections should be cut down so that the reader gets to this much sooner. I’d almost given up before getting here!	Paula A Harrison	The method sections have been reduced.
245	3	318	1	318	2	I suggest to explain that idea through a concrete example. In Argentine we are working with bird responses to loss and fragmentation of habitat (native forest) and potential impacts of future land use change scenarios on bird populations	Noelia C. Calamari	The current quantity of case studies is sufficient given limited space.
246	3.3	318	4	316	24	May be insertion in briefly on how do model work will make more easy to understand.	Nazirul Islam	Comment unclear
247	3	318	16	318	16	The information/uncertainty contained in a ‘regional scale’ model is no different from a ‘global scale’ model unless the spatial resolution of the regional-scale model is explicitly higher	Anna Carter	Clarified by rephrasing ‘...direct drivers taking stock of the knowledge about region-specific interactions and data availability’
248	3	318	40	318	40	Add “and other” to read “electronic and other waste” – it is not just an issue of electronics.	Thomas Brooks	added
249	3	318	14		15	move to start of section.	UK Government	moved
250	3	318	16	318	22	A good example of an integrated model is the CLIMSAVE IAP for Europe. We had a Special Issue of Climatic Change, 128(3) and many of the papers are relevant to this Deliverable. An overview is in Harrison, P.A., Holman, I.P. and Berry, P.M. (2015) Assessing cross-sectorial climate change impacts, vulnerability and adaptation: an	UK Government	Reference added

Nº	Chapter	From page	From line	Till page	Till line	Comment	Reviewer Full Name	What was done with the comment
						introduction to the CLIMSAVE project. Climatic Change, 128(3-4): 153-167.		
251	3	319	26			There is a lot of discussion about the Rubicode Project. What is this and what the references?	Chris Brierley, UK government	Anastasopoulou, S., Chobotová, V., Dawson, T., Kluvankova-Oravska, T. & Rounsevell, M. (2009). Identifying and assessing socio-economic and environmental drivers that affect ecosystems and their services. Rubicode Project: Rationalising Biodiversity Conservation in Dynamic Ecosystems. Institute for European Environmental Policy.
252	3	319	1	321	10	Any references to the peer-reviewed literature are completely lacking in this subsection	Chris Brierley, UK government	revised
253	3	320	6			What does “Those scenarios” refer back to?	Chris Brierley, UK government	reworded
254	3	320	14			“According to IEEP (2009)”. IEEP is not in the reference list, but I also wondered you need them to interpret the OECD thoughts and have not cited the OECD directly.	Chris Brierley, UK government	removed
255	3	320	20		25	This paragraph discusses in detail two scenarios that haven’t been mentioned in this chapter before nor since. Why?	Chris Brierley, UK government	removed
256	3	320				Table 3.4 – what is the range of the star rating in col 3 and what do the levels actually mean? As far as I can see they all have equal level of reference of Economy as an indirect driver except coastal which is somewhat less; why?	Mark Lonsdale	Table removed
257	3	320	1	320	4	Table 3.4 - the table produced by EU Rubicode published in 2009 from analysis done in 2007-2008 is outdated by now considering the rapid explosion of scenario analysis done in the last 5 years in particular. Interesting approach but will need to be updated to show the reality in terms of N° of studies by theme	Sandra Luque	Table removed
258	3	321	5		10	This categorization of models would benefit from a table in this report – rather than a reference to table in another report. I suspect that the IEEP table will summarize models that are a decade old now.	Chris Brierley, UK government	Table removed
259	3	321	12			What is gained by the “In concert with other indirect drivers” clause?	Chris Brierley, UK government	This emphasizes that the effect of demography is highly heterogeneous according to the economic,

No	Chapter	From page	From line	Till page	Till line	Comment	Reviewer Full Name	What was done with the comment
								technological, governmental, and sociocultural characteristics of a population.
260	3	321	13	321	14	Line 3 – 14 reads – “ <i>population distribution and age-structure exert significant anthropomorphic pressures on direct drivers of biodiversity and ecosystem change</i> ”. But technically all these take place under certain conditions which includes the level of impoverishment of the population. This scenario mostly holds sway in developing economies as against developed economies	Michael Uwagbae	This statement is prefaced by: “In concert with other indirect drivers”
261	3	321	27		30	Please give the references to these reports.	Chris Brierley, UK government	added
262	3	321	31		33	Projection/s occurs 4 times in this sentence – sometimes in plural and sometimes not. Rephrasing may help.	Chris Brierley, UK government	Good catch
263	3	321	17	321	17	Here I also should include "improve food distribution strategies"	Noelia C. Calamari	This is true but not immediately relevant to the direct impact on LUC.
264	3	321				Demographics also influence the availability and price of natural resources across the world.	Boris Stipernitz	noted
265	3	321	37	321	37	The shared socio-economic Pathway should be listed.	Michael Uwagbae	We do not feel that listing the titles of the narratives is necessary.
266	3	322	1		3	I can not see how this figure relates to biodiversity or ecosystem services. I don't think it is needed	Chris Brierley, UK government	Removed
267	3	322				Fig 3.5 – why this figure? Why India? What does this show us?	Mark Lonsdale	removed
268	3	322	2			Figure 3.5 impossible to read.	Jason Link	removed
269	3	322	13	323	41	In this section a little more emphasis could have been placed on IPBES-ILK approach.	Gunay Erpul	ILK references added
270	3	323	1		4	Is the aggregation of sociocultural factors into BES models a feasible/practical request?	Chris Brierley, UK government	I do not think so although gains are being made in this area. This section has been expanded from previous versions in part due to feedback that the role of sociocultural heterogeneities was not being properly represented.
271	3	323	4			“Complex” has a scientific meaning. I believe you intend to say “complicated” instead.	Chris Brierley, UK government	We believe that complex is the more appropriate term here, both in terms of systems theory (emergent properties, number of components) as well as

Nº	Chapter	From page	From line	Till page	Till line	Comment	Reviewer Full Name	What was done with the comment
								general language use.
272	3	323	7		21	This discussion/criticism is surely only relevant to a certain stage in the policy cycle and doesn't apply to all (most) scenarios.	Chris Brierley, UK government	Criticism tempered.
273	3	324	6		9	The definition of Gupta & Pahl-Wostl is described in detail. Is this the definition adopted here? If so, be explicit about that.	Chris Brierley, UK government	There is a single sentence with a citation. We feel that this implicit adoption of the definition is sufficient and keeping with the general tone of this chapter.
	3	324	19			A call out to box 3.3 would be a helpful example to cite here.	Chris Brierley, UK government	added
274	3	324	1	325	40	Awareness raising and capacity building on BES in the governance and institutions could be revisited here.	Gunay Erpul	This is primarily within the scope of Chapter 7.
275	3	324	11	324	13	Moreover, in order to respond to a dynamic socioecological system, robust environmental governance will entail substantial dialogue between scientists, policymakers, enterprises, and the public; I think the item 3.3.4 Governance & Institutions is an item very clear and very deep. I completely agree with this.	Marina Rosales Benites de Franco	modified
276	3	324	24	324	24	Include race as an example along with ethnicity (or, truly, more important than 'ethnicity')	Anna Carter	added
277	3	325	11			Impacts of what on humans? Natural hazards?	Chris Brierley, UK government	clarified
278	3	325	23		27	Split into two sentences for comprehension.	Chris Brierley, UK government	split
279	3	325	33			Plural verbs.	Chris Brierley, UK government	corrected
280	3	325	35	325	40	The future application of the current ecosystem services approach will need to involve a more critical focus on environmental governance, transparency and participation as well as a consideration of the great uncertainties prevailing at various spatial and temporal scales (Paavola & Hubacek 2013). A more thorough understanding of how ecosystems and ecosystems services are governed will be crucial and vital to ensuring that socio-ecological systems are sustainably managed in the context of socioeconomic and environmental change.	Marina Rosales Benites de Franco	Transparency added

No	Chapter	From page	From line	Till page	Till line	Comment	Reviewer Full Name	What was done with the comment
281	3	326	11	326	11	Insert 'all' before 'ecosystem services'	Gary Kass, UK government	added
282	3	326	2			Is technological change not a driver for biodiversity? Only ES is mentioned.	Chris Brierley, UK government	added
283	3	326	15			Primary driver -> dominant cause. Would read better	Chris Brierley, UK government	changed
284	3	326	19			Extensification is jargon that is easy to avoid.	Chris Brierley, UK government	The concept is used three times, with an explanation at the first usage.
285	3	326	26			100-110% increase seems rather precise. Why not try "doubling"	Chris Brierley, UK government	changed
286	3	326	35			"Further," -> "A focus on"	Chris Brierley, UK government	changed
287	3	326	1	328	6	The role of technology on LUC through sectors other than agriculture, e.g. coal mining, could be an issue. Or are those issued under direct drivers?	Gunay Erpul	Unfortunately space limitations require us to limit our detailed discussion to agriculture
288	3	326	24			Tilman. A more update reference would be FAO, 2010 The Second report on the State of the World's Plant Genetic Resources for Food and Agriculture.	UK Government	added
289	3	327				Box 3.4 has a lot of text; suggest including a figure/image as well.	Derek Tittensor	Unfortunately we are at our space limit for the chapter
290	3	327	8	327	8	Please, would you explain how crop production affect the landscape simplification?	Noelia C. Calamari	Perhaps you are referring to the role of industrial farming and monocultures on genetic diversity? We have been cautioned at this point that the chapter is agriculture heavy so we prefer not to add material here.
291	3	327	6	327	7	Potential to mention the effects of patented monocultures on the economic self-sufficiency of agricultural regions	Anna Carter	This is beyond the scope of the chapter
292	3	328	1			These two sentences could be written more generously to other scientists: The role of technology trends in LUC modelling applications is typically implemented exogenously due to the relative paucity of information on the relationship between R&D and technological change. Such decoupling	Chris Brierley, UK government	moderated

No	Chapter	From page	From line	Till page	Till line	Comment	Reviewer Full Name	What was done with the comment
						of the assumptions about technological change from model dynamics can result in an underestimation of technological change that is most problematic in long-term projections (Dietrich <i>et al.</i> 2014).		
293	3	328	8			Do this report actually only consider anthropogenic drivers? Is there any movement or necessity to build resilience to natural drivers?	Chris Brierley, UK government	We have limited the purview of this chapter to anthropogenic drivers.
294	3	328	8		14	I think section 3.3 on indirect drivers needs an intro paragraph just like this.	Chris Brierley, UK government	Introductory paragraph added
295	3	328				Sect 3.4 – I felt the need here for some reference to relative importance of different drivers of biodiversity loss e.g. IUCN	Mark Lonsdale	Driver tables with various elements are now included. However, “Relative importance” was not included due to the complete lack of consensus on the subject.
296	3	328				Section 3.4.1 needs a paragraph on habitat modification due to fisheries etc in the marine environment (for example, through bottom-trawling, a substantial impact that has been likened to clear-cutting, e.g. Watling <i>et al.</i> 1998 Conservation Biology)	Derek Tittensor	added
297	3	328	34	328	40	Also Harrison <i>et al.</i> (2015). Cross-sectoral impacts of climate change and socio-economic change for multiple European land- and water-based sectors. Climatic Change, 128: 279-292, DOI 10.1007/s10584-014-1239-4	Paula A Harrison	We feel that a reference is here not needed and we already have references to the Harrison work included earlier.
298	3	328	15	336	26	In that section the authors describe direct threats to biodiversity but the title that contains is "Scenarios and models of direct drives". As a reader I would expect that the authors discuss and comment details of scenarios and models rather than a descriptive list of threats	Noelia C. Calamari	Scenarios and models are discussed
299	3	328	17	328	19	Habitat modification is mostly a result of LUC, usually related with weak legislation, either induced by human action or a result of changes in the physical determinants of the habitat, e.g. due to changes in hydrology or climate.	Marina Rosales Benites de Franco	We feel that the suggested change puts too much emphasis on one driver and is basically part of the mentioned human action. No change made.
300	3	328		328		Ecosystem is the basis for inhabiting of species, and the methodology of simulation of ecosystem structure and function are relatively mature. It is worth of considerration during scenarios and models employing.	Zhao Zhiping	We agree but feel that we have covered this aspect sufficiently. Land use change is a direct driver of ecosystem structure and function.
301	3.4.1	328	15	328	25	All statements in this paragraph are correct – but at the same time important in the political context and maybe politically inconvenient for some stakeholders. Thus, there should be	Jens Mutke	Reference in line 20 updated, that paper is now published.

Nº	Chapter	From page	From line	Till page	Till line	Comment	Reviewer Full Name	What was done with the comment
						some references to scientific studies supporting these statements with real data.		
302	3	328	15	329	11	3.4.1. Land use change See DINAMICA EGO www.csr.ufmg.br/dinamica to provide insights into tools developed from high level researchers in Brazil in answer to secanorio building needs	Sandra Luque	We have added some additional references on page 328 in line 28: van Vliet, J., Hurkens, J., White, R., & van Delden, H. (2012). An activity-based cellular automaton model to simulate land-use dynamics. Environment and Planning-Part B, 39(2), 198. Verburg, P. H., Tabeau, A., & Hatna, E. (2013). Assessing spatial uncertainties of land allocation using a scenario approach and sensitivity analysis: a study for land use in Europe. Journal of environmental management, 127, S132-S144.
303	3	328	15	329	11	Soil health is a function of its ability to provide basic services to support plants and help to stabilize the nutrients, water, carbon and gas cycles, soil health is largely linked to biodiversity ground. When agriculture is employment too pesticides such as pesticides and herbicides, the consequences are that these products are toxic to wildlife and flora of the soil and can contaminate the environment. This means they are likely to bring a significant change in the biological composition of the soil and their functions by causing the loss of some species.	Ludunge Elias Abdullah	This comment is outside the scope of the chapter
304	3	328			326	Very long and detailed accounts of pressures/ direct drivers that could be shortened and made more accessible by using a table- driver- impact- model /scenario example- reference. The purpose of the chapter is in uses of models and scenarios not describing the impacts of drivers themselves. It is very easy to get absorbed in that!	UK Government	We disagree, the part on land use change on this page is already rather short for such an important driver
305	3	328	25			Add : reduction of vegetation cover due to large mining exploitation	Voahangy Raharimalala	changed: (e.g., deforestation) into (e.g., deforestation or mining)
306	3	329	3		5	The sentence would benefit from a little bit of rephrasing for readability	Chris Brierley, UK government	Change into 'Spatial patterns of land use change are calculated using either simple land allocation algorithms based on land suitability or more complex routines that account for competition between alternative land uses (Asselen & Verburg

No	Chapter	From page	From line	Till page	Till line	Comment	Reviewer Full Name	What was done with the comment
								2013)
307	3	329	13		24	The rest of the section on direct drivers does well with its references, but this segment needs some evidence.	Chris Brierley, UK government	Land degradation was removed as it will be the focus of a separate deliverable. This is alluded to in the text.
308	3	329	39			This statement about starting from the GHG emissions is not correct. The construction of the recent RCP climate driver scenarios started with the radiative forcings in 2100 that they are named for (e.g. 8.5 W/m ²). The SRES started with socioeconomic and the older one 1%/yr starts with GHG concentrations. The aerosol forcings are also critical and not even mentioned in this report.	Chris Brierley, UK government	This is correct and we changed the text accordingly. Aerosols are technically part of the emission scenarios.
309	3	329	42			Technically, an RCP scenario does not have any output variable – rather it is the consistent specification of the input variables.	Chris Brierley, UK government	This is correct and we adjusted the text!
310	3	329	12	329	32	Along with land degradation, land restoration could have been also touched especially in terms of scenarios for decision making when high costs are involved in restoration. Also, land degradation neutralization (UNCCD) could be a scenario approach for LDR.	Gunay Erpul	This is a large topic of discussion that is beyond the purview of this deliverable and will be covered in detail in a separate deliverable.
311	3.4.2.	329	35	329	35	In this sentence sea level rising, change in ocean circulation, high ocean acidity resulting from carbon dioxide absorption may be included.	Nazirul Islam	Ocean acidification added
312	3	329	36	329	36	High acidity could affect marine environment	Nazirul Islam	Ocean acidification added
313	3.4.2	329	35	329	35	You may include about circulation pattern of ocean which will affect aquatic food web/acidification of ocean and it after death of shelled organisms and corals	Nazirul Islam	Ocean acidification added
314	3.4.2	329	36	329	38	At least for plants, it seems that pure temperature rise is not the entire story, but the interaction of thermal energy and water balance (compare e.g. Fig 1 in J.H.Sommer et al. 2010 Proc. R. Soc. B) “Multi-variate models of the relationship between contemporary water-energy dynamics and regional richness of land plants on a global scale predict strong decline of plant diversity in most tropical and subtropical regions.”	Jens Mutke	We do not expand upon the current statement.
315	3	329	13	329	32	Land Degradation The concept of land degradation is very incomplete. For instance in forest is a crucial concept : Definition (FAO, ITTO): The reduction of the capacity of a forest to provide goods and services caused by human disturbances <ul style="list-style-type: none"> ▪ Forest degradation affects ~100 M ha of forest per 	Sandra Luque	Land degradation has been removed due to space constraints and thematic deliverable devoted explicitly to this topic

No	Chapter	From page	From line	Till page	Till line	Comment	Reviewer Full Name	What was done with the comment
						<p>year (FAO2006)</p> <ul style="list-style-type: none"> ▪ More than 400 Millions ha of natural tropical forests are under permanent timber estate (Blaser 2011) <p>Action forest degradation as degradation of others biomes needs to be considered within Land Degradation in this context</p>		
316	3	329	12	329	32	I think that the section talking about "Land Degradation" is not suitable because this section does not seem to connect with the context.	Dandan Yu	Land degradation has been removed due to space constraints and thematic deliverable devoted explicitly to this topic
317	3	329	12	329	32	<p>Soil degradation knows three types, namely erosion under the action of runoff and water; erosion under the action of the wind; chemical degradation, including the loss of nutrients; salinization, pollution and acidification; physical degradation, including soil compaction, waterlogging of irrigated areas, silting and subsidence.</p> <p>In Africa, land degradation has its causes in the exploitation of wooded areas for domestic uses, such as firewood, construction, fencing etc. this phenomenon is directly related to demographic factors, to which the supply of domestic energy is always dependent on forest production. ^</p> <p>Deforestation is very dominant in many African countries, but in most other countries fall short of its average incidence in Africa, 13.5% of the degraded area.</p> <p>Overgrazing is also a cause of decay, but it has an impact that is different from one country to another.</p> <p>Agricultural practice on a fragile soil, reduction of fallow without compensatory fertilization, not adequate irrigation, the uncontrolled use of bush fire for clearing and diversion of water for irrigation courses are also major causes of soil degradation.</p>	Ludunge Elias Abdullah	This comment is outside the scope of the chapter
318	3	329	34	330	24	<p>Everyone knows that climate change is the result of air pollution which designates " the introduction into the atmosphere by man, directly or indirectly, of substances or energy having a harmful effect such as to endanger the human health, harm living resources and ecosystems, damage to material property and impair or interfere with amenities and other legitimate uses of the environment, the term " air pollutants " being heard in the same direction "</p> <p>(Source: Convention on Long-Range Transboundary Air Pollution, Nov. 13, 1979, section 1 (a) the area of these</p>	Ludunge Elias Abdullah	This comment is outside the scope of the chapter

№	Chapter	From page	From line	Till page	Till line	Comment	Reviewer Full Name	What was done with the comment
						<p>pollutants " classic " as sulfur oxide (SO₂) , nitrous oxide (NO₂), hydrocarbons and carbon monoxide and suspended particles. The course on international environmental law, "the atmosphere, fresh water and soil" informed us that metal particles can cause serious pollution, such as cadmium, copper, mercury, zinc and lead. The course also emphasizes that the chemical elements in the atmosphere can react with each other. The best known example is the ozone and other photochemical elements that form the base of the atmosphere from emissions of NO_x and hydrocarbon in contact with sunlight when the atmospheric pressure is high.</p> <p>The pollution affects rivers of the planet. It should be noted that the ecological balance of the earth is based on a system in which each element is interdependent, each party ecosystem affects everything, such as air pollution has an impact on pollution water and soil, and vice versa. Thus 80% of water pollution is due to land pollution, which it behooves us to resort to concentrated effort to reduce the current forms of pollution caused by industry, transport, agriculture and domestic waste.</p> <p>Wastewater industries causing dieback streams. According to UNESCO 70% of waste generated by industries are directly thrown into the water, without being processed. The contaminant agriculture is the source of water pollution.</p>		
319	3	329	1	329	11	Many land use model also do not cope well with semi-natural habitats (e.g. they are often dealt with in a very aggregated manner) and these are of course important for biodiversity and ecosystem services.	UK Government	We agree, however, this section is not going into such detail and mentioning this would This comment has been addressed make the text out of balance
320	3	330	1		6	The English in these sentences is a little clunky.	Chris Brierley, UK government	Made less clunky
321	3	330	7		31	<p>Whilst what is said in this box is true, I feel that it fails to bring across some of the important lessons learnt by the IPCC scenario process:</p> <ol style="list-style-type: none"> 1. The SRES approach of scenario creation is a very long process, which means that its near term forecasts were outdated even before the report was 	Chris Brierley, UK government	I agree to these lessons in principle. Ad2. Yes, scenarios by definition have a probability of zero. The probability business in population and technology scenarios is a sign of poorly understood science.

No	Chapter	From page	From line	Till page	Till line	Comment	Reviewer Full Name	What was done with the comment
						<p>published.</p> <ol style="list-style-type: none"> 2. The SRES storylines were never assigned relative probabilities, but often only the middle was investigated (under the presumption it was most likely. There are four RCPs specifically for the reason. 3. The SRES scenarios did not allow for a vision of a world that stuck to the 2oC policy agreement. In this respect one could legitimately describe RCP2.6 as a goal-seeking scenario according to your earlier definition. 4. Despite their different storylines, the radiative forcings of several of the SRES were pretty similar. This meant they were bad at exploring the range of possible futures. 5. The SSPs are very much goal-seeking scenarios in that they present alternate routes to achieve the same concentration behavior. 		Ad. There were many mitigation scenarios published based on SRES storylines not only B2. Ad 5. SSPs are not goal seeking RCPs are
322	3	330				Box 3.5: see earlier comment about the IPCC TGICA (Technical Group on Scenarios for Climate and Impact Assessment) is currently producing a new report on “Use of scenario data for climate impact and adaptation assessment. They are only just producing the zero-order draft, but it might be useful to refer to this as something that the expert groups should be aware of being published in 2016.	Paula A Harrison	2016 is unfortunately beyond our cut of point of referencing literature.
323	3	330	12	330	12	What is a “National GEO”? Add citations for the UK, China, Brazil examples.	Thomas Brooks	The national variants of the Global Environmental Outlook. We spelled out all acronyms in the new version.
324	3	330	41	331	2	It is not just about improving temporal resolution but also having more transient model runs	UK Government	Agree and text was adapted.
325	3	331	1			How will this help to improve robustness of management? This statement sounds too much like a vague grant proposal claim. Either add a reference to give evidence this is possible or remove the clause. (330, 20)	Chris Brierley, UK government	Agree! Clause removed.
326	3	331	10			I’m not sure “with special reference to the Scandinavian Peregrine” is required here.	Chris Brierley, UK government	removed
327	3	332	11			I suspect ‘in the benthos’ may be beyond the readerships vocabulary. I suggest near the ocean floor” – the meaning on benthic could then be inferred from the context.	Chris Brierley, UK government	changed

No	Chapter	From page	From line	Till page	Till line	Comment	Reviewer Full Name	What was done with the comment
328	3	332				Plastic debris is also known to cause injuries and deaths of marine animals, because they either become entangled in it or eat it.	Boris Stipernitz	-
329	3	333		334		Section 3.4.1 is weighted towards bushmeat trade, with only a short paragraph on marine overexploitation. The fisheries and overexploitation aspect need more detail as there is a huge literature on the importance of these impacts.	Derek Tittensor	The bushmeat and fisheries sections are now equal in length.
330	3.4.3	333	36	333	37	Unsustainable species harvest of ornamental plants should be mentioned, as well. For example, many Cacti species are threatened by collection as ornamental plants, according to the recent IUCN redlist assessment (compare e.g. Ibisch & Mutke 2015 Schumannia 7).	Jens Mutke	Ornamental plants now added.
331	3	333	15	333	16	accumulation of petroleum molecules, e.g. doi:10.1016/j.marpolbul.2007.02.015.	Anna Carter	Comment unclear
332	3	333	7	333	9	The UNEP report on “State of the Science of Endocrine Disrupting Chemicals – 2012” would be an important citation here.	Thomas Brooks	See Bergman et al.
333	3	333	16	333	16	Add “systemic pesticides (van der Sluijs et al. 2015)” before “and others” here. The paper is open access in Environ Sci Pollution Res (http://link.springer.com/article/10.1007/s11356-014-3229-5).	Thomas Brooks	added
334	3	333	34	334	27	<p>Illegal collection of natural resources in protected areas has devastating consequences on the economic and social plans. One of the most effective rules to stop effective means to promote the sustainable exploitation and to develop measures that improve law enforcement.</p> <p>Corruption in government is one of the main factors leading to the illegal exploitation of natural resources. It is up to stakeholders and indigenous and local communities to help law enforcement and provide valuable inputs when to develop rules to combat corruption and illegal trade of resources.</p> <p>The illegal exploitation of resources is a multinational problem and the solution can only be found through cooperation between states.</p> <p>To this end we include the following:</p>	Ludunge Elias Abdullah	This comment is outside the scope of the chapter

№	Chapter	From page	From line	Till page	Till line	Comment	Reviewer Full Name	What was done with the comment
						<p>1) The sectoral interest and jurisdictional completion; the clash of stakeholders on competitive sectoral interests, including various ministries and private structures using resources;</p> <p>2) The vague laws: these ambiguous laws lead to breaks in their application playing a significant role, contributing to unsustainable management of natural resources.</p> <p>3) Lack of intersectoral communication and integrated regulations lack of communication between government agencies and technical experts.</p> <p>4) Inadequate capacity: it is the lack of necessary personnel to effectively enforce laws and monitor the protected area.</p> <p>5) Lack of data: this means that the first decisions of protected areas and planners can not develop any arguments to strengthen or reform regulations without adequate data.</p> <p>6) The development of a framework based on economic indicators: countries must achieve a balance between economic growth and environmental protection. In some cases, the pressure for economic growth overwhelms the goals of the country in terms of biodiversity protection.</p> <p>The illegal collection of natural resources in protected areas has devastating consequences economically and socially. One of the most effective ways to stop the illegal exploitation of those resources to develop effective rules to promote the sustainable exploitation and to develop measures that improve law enforcement.</p> <p>Corruption in government is a major factor leading to the illegal exploitation of natural resources. It is up to stakeholders and indigenous and local communities to help law enforcement and provide valuable inputs when to develop rules to combat corruption and illegal trade of resources.</p> <p>The illegal exploitation of resources is a multilateral problem, and the solution can only be found through cooperation between states.</p> <p>There are factors that contribute to the illegal exploitation of</p>		

Nº	Chapter	From page	From line	Till page	Till line	Comment	Reviewer Full Name	What was done with the comment
						<p>resources to this end we include the following:</p> <p>1) The sectoral and jurisdictional interest in competition: The clash of stakeholders on competitive sectoral interests, including various ministries and private structures exploiting the resources;</p> <p>2) The vague laws: these ambiguous laws lead to breaks in their application playing a significant role, contributing to unsustainable management of natural resources.</p> <p>3) Lack of communication and integrated cross sectoral regulations, lack of communication between government agencies and technical experts.</p> <p>4) inadequate capacities: it is the lack of necessary personnel to effectively enforce laws and monitor the protected area.</p> <p>5) Lack of data: which means that the decision makers of protected areas and planners can not develop good arguments for strengthening or reforming regulations without adequate data.</p> <p>6) The development of a framework based on economic indicators: countries must achieve a balance between economic growth and environmental protection. In some cases, the pressure for economic growth overwhelms the goals of the country's biodiversity protection</p>		
335	3	334	38			Two hs in Eichhornia	Mark Lonsdale	corrected
336	3	334	29	336	26	Invasives section almost entirely focused on South Africa. Should be more global in content see e.g. Mack et al 2000 BIOTIC INVASIONS: CAUSES, EPIDEMIOLOGY, GLOBAL CONSEQUENCES, AND CONTROL. Ecological Applications 10:689–710. http://dx.doi.org/10.1890/1051-0761(2000)010[0689:BICEGC]2.0.CO;2	Mark Lonsdale	Added. The focus of this section reflects the relative expertise of the chapter authors.
337	3.4.3	334	19	334	27	This paragraph mixes the global level (Pauly et al. 2002) with very local research results (e.g. Cinner & McClanahan 2006). Especially the general statement that 'markets and market demand better predict overfishing' is only valid for small scale fisheries (as Cinner & McClanahan also analysed) where no stock assessment exists and fish species are not migrate (e.g. between spawning and feeding grounds). This is not valid for large scale fisheries for which we have to apply bio-economic models. This should be made clear.	Ralf Doering	This has been clarified.
338	3	334	13	334	15	There is a general consensus among conservationists that sustainable bushmeat management and harvesting through	Marina Rosales	modified

Nº	Chapter	From page	From line	Till page	Till line	Comment	Reviewer Full Name	What was done with the comment
						better regulation is the ideal solution to overexploitation given the socioeconomic contexts in many of the affected regions	Benites de Franco	
339	3	334	29	336	40	<p>Invasive alien species are considered invasive are exotic and not local species that have been introduced, either intentionally or unintentionally, in a habitat outside their natural range.</p> <p>After the loss, invasive alien species are considered as one of the greatest threats to the stability and diversity of ecosystems within and outside protected areas. The introduction of plants, animals and invasive disease increased dramatically with the expansion of trade and mobility of people. This led to severe negative impacts and economic costs. Small Islands and freshwater ecosystems are particularly at risk.</p> <p>We must then fight the alien invasive species by the most effective method like that of actively preventing the introduction of all non-indigenous and non-indigenous species.</p> <p>Managers of protected areas can develop strategies to eradicate or control alien invasive species in protected areas, but a successful strategy must include ways of passages risk and be a part of an action on a wider scale, such as the international response. Where international regulation. exotic invasive species can cause different types of malfunctions in ecological systems and they create different financial and human costs. It is always easier to deal with the threat of invasive alien species sooner than later.</p>	Ludunge Elias Abdullah	This comment is outside the scope of the chapter
340	3	334	3.4.4			<p>Arguably invasive species also cause biotic homogenization e.g. Capinha, C., F. Essl, et al. (2015). "The dispersal of alien species redefines biogeography in the Anthropocene." <i>Science</i> 348(6240): 1248-1251, but I realise this is a debated issue.</p>	UK Government	noted
341	3.4.4	335	14	335	32	<p>You may include carbon sequestration pattern as the high density native woody species use oxygen for respiration and emit carbon dioxide in the air unlike fruit trees. Fruit trees capture atmospheric carbon and release oxygen and thud control atmospheric temperature and precipitations</p>	Nazirul Islam	Thank you for the suggestion but we are currently at our space limitation.
342	3	336	10			I missed what WIPs stands for. Perhaps you can spell it out.	Chris	Good catch

Nº	Chapter	From page	From line	Till page	Till line	Comment	Reviewer Full Name	What was done with the comment
							Brierley, UK government	
343	3.4.4	336	26	336	27	Insert Aliens Pathogens and agriculture plants diseases e.g. "In 2003, a damaging foliar disease was observed in several greenhouses located in the Liguria Region of northern Italy. More that 50% of the plants were affected." and "this is the first report of a Peronospora sp. on basil in Italy. Peronospora sp. and P. lamii were previously reported on sweet basil in Uganda" Garibaldi, A., et al. "First report of downy mildew on basil (<i>Ocimum basilicum</i>) in Italy." Plant Disease 88.3 (2004): 312-312.	Sara Sozzo	-
344	3	336	27	317	37	Evidence base for these lessons is not clear.	David Cooper	This might be true. However, this is an assessment and we as authors took the liberty to bring in own assessments into this section.
345	3	336	30			add 'impacts of' before drivers	UK Government	Here we are not discussing the impacts of drivers
346	3	336				Lessons learnt and way forward- it is not clear if this is meant to be good practice and notes for IBPES to promote model and scenario development and uses, or how this matches up to the key recommendations. It should show where scenarios/ models have been useful in policy decisions, and where this would be strengthened. It needs to convince policy people that investing in modelling, data collection, scenario building is worthwhile	UK Government	We decided to use this space to provide a critical assessment on HOW to use scenarios and modelling for drivers rather than promoting it. The promotion of the use of rigorous impact assessment needs to be done elsewhere
	1	336	337	27	37	Needs a schematic of how various types of models can work together to answer different types of questions at the different stages of the policy cycle	Louise Ann Gallagher	Given the space limitations and high price of an additional figure, the authors have decided to limit this discussion to the text.
347	3	337	2	337	2	Insert 'uncertainty accommodation through' before 'improved'	Gary Kass, UK government	added
348	3	337	5	337	5	Insert 'where data are themselves robust' after 'driven'	Gary Kass, UK government	changed
349	3	337	6	337	25	Need to reference the bias towards quantification where greater attention is paid to those model parameters for which data are available. and where either statistical models or process models can be constructed using those data...	Gary Kass, UK government	This bias is covered in section 3.3.3

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350	3	337	34	337	34	Insert 'some' before 'decisions'	Gary Kass, UK government	Changed to many
351	3	337	37	337	37	Insert 'or at least allow the transparent assessment fo relative risks and opportunities' (note: there is no a priori case that BES management strtagies should be robust under a range of scenarios...this is a normatoive not an analytical position and it's one that denies choice based on differences in risk appetite between societal groups).	Gary Kass, UK government	included
352	3	337	9			There hasn't been any previous discussion on the upscaling of local knowledge. I worry that uncertainty in the global models must be properly sampled, to see whether the local changes emerge as detectable consequences at the global scale. This sounds like a really tricky task with copious statistics. I therefore question the call for it without at least a reference to give evidence that it is worthwhile.	Chris Brierley, UK government	There are a few results and we know it is worthwhile. However, the methodologies are linkage of deterministic models as statistical down and upscaling truly would lead to copious statistics. Nonetheless there is an absolute need for two way coupling and I do not want to lose the argument simply because there is little evidence yet.
353	3	337	22		23	There wasn't any discussion of assimilation of observations within the chapter. Do you mean formal data assimilation - like with weather observations in meteorology? This often requires building adjoints of the models, although ensemble kalman filtering approaches may negate this requirement. I didn't anybody had even tried to retrospective forecasting with IAMs.	Chris Brierley, UK government	Yes I think the IAM community should learn from assimilation similar to say a CO2 measurement tower has a footprint likewise a detailed socio-economic study could have a similar role using aggregate macro-economic data. Currently I see softer assimilation techniques such as Baysian network more appropriate for some of the driver data. Again there is little in the published domain, but some modelling groups have developed such data assimilation approaches. Thus, I recommend it....
354	3	337	33	337	37	Due to the long lasting nature and irreversibility of decisions associated with BES, the current practice of operating with only one reference driver scenario should be augmented by developing multiple reference scenarios, entering decision making under uncertainty tools, which will ensure that BES management strategies and decision making can be are robusts under a wide range of driver scenarios.	Marina Rosales Benites de Franco	Do not understand the nature of this comment.
355	3	337	17	337	21	"theoretical issues" in fact, they are very politcial issues!	David Cooper	Yes I agree! Therefore the formulation of the subsequent sentence!!
356	3	337	28	337	30	"Scenarios are deterministic" is this true? I don't think so.	David	This is an interesting issue, which would

Nº	Chapt er	From page	From line	Till page	Till line	Comment	Reviewer Full Name	What was done with the comment
						Needs explanation in any case	Cooper	need a chapter by itself. What are scenarios from a statistical point of view? What are stochastic scenarios? Can measurability theory be applied to scenarios or even more practical can there be a probability be attached to a scenario? For the latter the probability of a say SSP scenario is exactly zero...if that is so what are the consequences of using scenario information? My conclusion is that deterministic here is appropriate given the level of readers understanding of probability theory.
357	3	337	29	337	32	“new sceanarios... will need to be constructed”. This may well be true, but a good case has not been made. Again need clarity on the models-scenarios distinction	David Cooper	We do not have the space to elaborate more. Argument as written seems to be clear.
358	3	344	32			Rubicode (2009) missing from the reference list	Paula A Harrison	Rubicode reference removed
359	3	344	28	344	28	invasive vertebrates, esp. rodentia?	Anna Carter	?