

Comment form for 1st Review Phase of the Deliverable 3c) Fast-track methodological assessment on scenarios and models Chapter 2 ‘Decision-making’

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Miglana Zhiyanski (MZ)

Jasper Montana (JM)

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Gautam Talukdar (GT)

Audrey Coreau (AC)

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Minna Kaljonen (MK)

Nr	Chapter/ Section	From page	From line	Till page	Till line	Comment	Reviewer Initials	What was done with the comment
1.	2.1.2	5	7	7	18	My concern is that the perspective of stakeholders is missing. Public vs private polciy & decison-making processes are very different. One key parameter should be “to whom do the models and their outputs speak to?”. Right now, my perception is that only public policy-makers are targeted.	Joel Houdet (JH)	It is true that many of the ‘decision maker’ references seem mostly targeted at public decision makers. We have, however, with increased emphasis on participatory

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								approaches, and though incorporation in the decision context of the 'sector', we have partially addressed this concern.
2.	2.2					If my previous comment is taken into account, I believe other lessons from the private sectors could be learned / discussed (e.g. business models related to risks and planning which imbed some environmental or ES factors)	Joel Houdet (JH)	There are a few private sector examples in the text (e.g. 'shell oil'), but the focus is more on public sector issues.
3.	2	2	28	3	1	It is clear that structured decision-making process can be aided by scenarios and models. Is it possible to use scenarios and models in unstructured decision-making process? What are the strengths of unstructured decision-making process in biodiversity and ecosystem services? One of the reasons to apply scenarios and models can be the attribute of uncertainty of decisions discussed in page 5.	Tianbao Qin (TQ)	This chapter is about decision support – which implies some sort of structure. Some of the case studies we present would be considered by some to be less structured, but we haven't addressed totally ad-hoc decisions.
4.	2	3	10	3	15	The link between this chapter and chapter 6 is not discussed here.	Tianbao Qin (TQ)	Fixed.
5.	2	7	37	27	34	12 approaches are discussed in this section. The relationships among them are complex. Some are concrete techniques, while some are programmes designed to analyze scenarios or models. It will be better if these approaches are described on the basis of a consistent basement.	Tianbao Qin (TQ)	Now three categories.
6.	2	8	1	8	13	This approach can be a useful tool in certain cases. But case studies for applying this approach are not provided.	Tianbao Qin (TQ)	This section is background theory to the other sections in which we describe applications
7.	2	9	9	9	17	This approach is not a type of methods of using scenarios and models per se. In addition, A case study about benefit-cost analysis is not given. And the discussion about the strengths and disadvantages of this approach is insufficient.	Tianbao Qin (TQ)	WE have boosted the discussion about strengths and weaknesses. We were not able to provide case studies

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								for each approach due to space constraints.
8.	2	9	39	10	2	Goal programming is different from linear programming and stochastic dynamic programming. More detailed description of goal programming can be offered, including its strengths and weaknesses.	Tianbao Qin (TQ)	Due to space constraints, a more detailed description could not be added.
9.	2	13	2	14	2	The strengths and drawbacks of adaptive management are not provided.	Tianbao Qin (TQ)	Now added and see table 2.4 – overview of strengths and weaknesses
10.	2	27	36	30	42	They are analyses to the documented approaches about scenarios and models. Structurally speaking, they are independent of the 12 approaches.	Tianbao Qin (TQ)	Mostly removed. We now focus on the role of scenarios and models in the decision support methods used. Leaving the actual descriptions of scenarios and models to later chapters.
11.	2	29	3	29	18	The explanation for this figure can be put into the main text of this chapter.	Tianbao Qin (TQ)	We'd prefer the figure was totally self-explanatory.
12.	2	37	23	46	24	Uncertainty is one of the challenges of using scenarios and models. Are there any other challenges?	Tianbao Qin (TQ)	Now expanded significantly.
13.	2	37	26	38	4	This is about implications of uncertainty, but it is not stated clearly. This section can be used as an introduction to methods dealing with uncertainty in scenarios and models in decision-making.	Tianbao Qin (TQ)	Uncertainty section completely reconfigured.
14.	2	38	7	38	31	The introduction to sources of uncertainty is vague. This can be shortened for there is detailed description in the following parts.	Tianbao Qin (TQ)	Removed.
15.	2	42	12	42	30	The authors can classify the types of technical approaches to dealing with uncertainty in decision making.	Tianbao Qin (TQ)	Done. Described but not classified <i>per se</i> . Classification scheme out of scope.
16.	2	42	12	46	24	2.4.3 to 2.4.5 are about methods of making decisions when there is uncertainty. This should be stated before this part.	Tianbao Qin (TQ)	New section addressing this.
17.	2	46	39	46	39	After this paragraph, the summary of the types of approaches and their interaction with policy-making should be explained.	Tianbao Qin (TQ)	We now touch on cross-scale issue throughout.

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18.	2	1	19	1	12	Awkward sentence: Settings in which formal decision support using models and scenarios can play a part	Kelly Heber Dunning (KHD)	Removed.
19.						“A huge number of decision support protocols now exist that have been used in a wide variety of decision contexts, utilizing a wide variety of biodiversity and ecosystem service models and 25 scenarios. On reviewing a large number of decision processes, we find that the bulk of documented applications of formal decision support approaches are undertaken at local-national scales.” I think there needs to be some piece by piece editorializing, where we are told up front what scale the authors see as being desirable and at which scale that the varying phases of the public policy-making process apply to what’s being said (implementation versus agenda setting for example).	Kelly Heber Dunning (KHD)	We have identified that there is no right scale for modelling or decision making in any of the phases of the policy cycle. We have provided examples at all scales. Hopefully figure 2.2 now helps.
20.	2	1				“We also find that a key ingredient for successful application of structured decision support, models and scenarios is the dedication and continuity of involvement of decision support facilitators and modelers.” So things do not get implemented or changed because there aren’t enough modelers with technical capacity? Are we ignoring stakeholder participation in this section? Maybe say so to let reader know it is coming later.	Kelly Heber Dunning (KHD)	We’re pretty clear right from the start that this is just one of the many problems.
21.		4	39	4	40	There is also a lot published that suggests that phase iii of this model rarely happens in practice.	Kelly Heber Dunning (KHD)	Agreed.
22.		10	5	10	7	Define it before listing its criticisms, or just be more clear, this definition is too long and hard to follow.	Kelly Heber Dunning (KHD)	Done.
23.						<p>General comments:</p> <ul style="list-style-type: none"> • scenario planning is given the most attention compared to the rest, some like MCDA feel short changed and breezed over. I think each needs a few examples to show where they’ve been tried and list some details on their outcomes. • While the case studies are nice, and lend 3-D detail to the list of literature review style definitions, I would argue that splicing shorter case studies while you introduce each separate method would work better for your readers/ • Some methods have strengths and weaknesses enumerated and some do not, this makes it seem a little bit cobbled together • The 2.2.12 section says that a range of methods was discussed from 	Kelly Heber Dunning (KHD)	<p>An example is now provided, however, space constraints prevent further elaboration.</p> <p>We believe the case studies boxes break up the text... Allow people to skirt over example material if they’re looking for a particular method.</p>

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						extremely participatory and so on, I would argue that a lot of participatory and deliberative methods were not discussed in the same way that other methods were and some, like consensus building or group valuation were missing or tucked away in case boxes.		Strengths and weaknesses now explicitly provided for each. SEA, Delphi, Structured Decision Making, MSE are all potentially participatory and most examples provided are. We just don't have space for them all as stated at the front of the section.
24.		2	5	2	10	The sentence “b The knowledge gain...” is not clear and well understandable	Miglana Zhiyanski (MZ)	Re-worded.
25.		2	14	2	14	“....solutions to these problems ” or “...to them ”	Miglana Zhiyanski (MZ)	Re-worded.
26.		2	36	47	45	Cited authors should follow the same patterns accepted in the whole materials. Please, check and correct italic part, points, commas, and &.	Miglana Zhiyanski (MZ)	Issue resolved by Technical Support Unit.
27.		3	10	3	10	Decision – making (below in the text on some places the decision-making is written without dash)	Miglana Zhiyanski (MZ)	Yes. We're using the rule that when it's a noun it gets no hyphen, when it's an adjective (decision-making process) it gets one.
28.		9	33	9	35	The sentence “For example...”) needs of redaction in order to be more informative and clear.	Miglana Zhiyanski (MZ)	Done.
29.		13	24	13	25	Fig. 2.2.6. has bad quality and needs of improvements	Miglana Zhiyanski (MZ)	Issue resolved by Technical Support Unit.
30.		21	5	21	5	“De Oliveira and Butteworth 2004.)” Remove the point within the brackets	Miglana Zhiyanski	Done.

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							(MZ)	
31.		25	31	25	31	“ the strengths of ITP lies” – remove “s” in strengths	Miglana Zhiyanski (MZ)	Done.
32.		28	11	28	11	Madagascan should be Madagascar	Miglana Zhiyanski (MZ)	Done.
33.		33	44	33	44	“..(...planning of protected areas)”	Miglana Zhiyanski (MZ)	Section removed.
34.		34	44	34	44	“...that addresses” should be “...that address”	Miglana Zhiyanski (MZ)	Section removed.
35.		44	10	44	11	“By contrast graphics has the....” – the sentence is not clearly informative. Needs of editing.	Miglana Zhiyanski (MZ)	Altered.
36.		44	30	44	30	“Proctor and Drechsler (2006) gives...” – remove s	Miglana Zhiyanski (MZ)	Section removed.
37.		2		47		The whole chapter is well developed, but the information in some of the sub-chapters could be shortened with focus on the main topics outlined.	Miglana Zhiyanski (MZ)	Whole document is now 25% shorter with more figures.
38.	2	-	-	-	-	<p>This chapter recognises the unstructured nature of many decisions and provides some literature to show that this approach may not be ideal. It follows with a review of some more formal decision making approaches and then highlights the role that modelling and scenario approaches can play within these.</p> <p>While this structure provides a sense of logic if the aim of the chapter is simply as stated to “inform... about the possibilities and opportunities” (P3L1-3) of models and scenarios and promote the use of more formal decision making approaches. However, it does not fully tackle the issue of understanding real world policy making; how biodiversity models and scenarios are perceived by policy makers; how from a policy perspective they are used, or not-used, in decision-making contexts; and what opportunities this might present.</p> <p>As such, it seems that the overall positionality of the chapter could be revised to focus a little less on the promotion of models, scenarios and formalised decision making, and more on the decision making landscape as it is, including its unstructured parts, and thus to examine the position and potential for models and scenarios to develop within it.</p>	Jasper Montana (JM)	We have chosen to stick with the more documentary approach of highlighting what works well, and what is available, rather than a more theoretical view on what the problem is with current/ad-hoc decision making and where the opportunities are.

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39.	2	1	34	1	38	As per Comment 1, this paragraph suggests that there is “a lack of appreciation” for the “potential” of structured decision making with models and scenarios. Greater analysis of this issue from a “high-level decision makers” perspective using empirical research from social scientific and political science literature would be welcome and would provide a more robust understanding to frame the rest of the chapter.	Jasper Montana (JM)	Unfortunately we were not able to secure a co-author with the relevant expertise (and time) to provide this perspective.
40.	2	2	14	2	16	Revise wording. The current wording suggests a technocratic framing of environmental issues. Social scientists have demonstrated that responses to environmental issues often involve complex interactions of human behaviours, practices and preferences (see for example Hulme and Mahony 2010) and not just “technical and management solutions”. (Hulme M. and Mahony M. (2010) Climate change: What do we know about the IPCC? Progress in Physical Geography 34, 705-718.)	Jasper Montana (JM)	Wording revised.
41.	2	28	4	28	18	This section notes that there is a mismatch between the theoretical potential of models, scenarios and formal decision approaches and a small number of documented case studies of their successful application. It speculates on potential causes, but does not yet examine the literature. Further review and development of this section drawing from, and identifying gaps in, the social science literature would be beneficial.	Jasper Montana (JM)	We have expanded our discussion of the mismatch between potential and applications in section 2.6
42.	2	29	26	29	29	As highlighted above, this sentence and the chapter more broadly could benefit from a repositioning from the explicit promotion of formal and structured approaches to decision making that seeks to “overcome” the “political, cultural and practical impediments”, to one that understands how models and scenarios can develop within the political, cultural and practical landscape of decision making. This would move away from a linear model approach to science and policy and embrace a more integrated approach to developing models and scenarios for biodiversity.	Jasper Montana (JM)	We have repositioned somewhat from the original draft by providing more emphasis on the role of participatory approaches and deliberative approaches to help overcome some barriers.
43.	2	-	-	-	-	Although graphical representation of model and scenario outputs are briefly discussed with regards to uncertainty (P44L10-18), a much more extensive assessment of the role of visual communication of model and scenarios in their use within decision making contexts and success or failure of previous assessments would be valuable (see for example McInerney et al. 2014). This could lead to a more thorough response to the aim identified for this chapter in the scoping document that includes: “Developing a strategy for communicating scenarios and models to stakeholders” IPBES/2/16/Add.4, P6	Jasper Montana (JM)	We have added some relevant text and this reference to We have left the role of communicating uncertainty about models and scenarios to chapters

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						(McInerny, G J, Chen, M, Freeman, R, Gavaghan, D, Meyer, M, Rowland, F, Spiegelhalter, D. J, Stefaner, M, Tessarolo, G, and Hortal, J. (2014). Information visualization in science and policy: engaging users and avoiding bias. Trends in Ecology & Evolution. 29. 148-157. DOI : 10.1016/j.tree.2014.01.003)		3, 4, and 5.
44.	2	3	15	3	17	The introduction states that the chapter will address the IPBES Deliverable 4c on Policy Support Tools and Methodologies, however this is not yet addressed in the chapter.	Jasper Montana (JM)	We provide the recommendation that 4C refer to our decision context typology and decision support approach evaluation.
45.	2					<p>General comments</p> <p>Near-term drivers – applied conservation monitoring in the short term – Large infrastructure or oil and gas projects and companies are reluctant to enter into long-term biodiversity actions that require applied research. They wish to see their: on-site habitat restoration and enhancement works; and offset schemes in relation to residual impacts to deliver no net loss within 10 years or so, otherwise BAP actions can become unwieldy in providing an unintended legacy.</p> <p>Thus being able to apply hierarchical indicators or indices that are standard, would be beneficial. This is possible in the UK with National Vegetation Classification (NVC) and the conversion to offsetable ‘equivalent’ habitat when necessary. It also works on the European Union scale with the European Nature Information System (EUNIS) habitat classification system of the European Environment Agency. However, on much of the African continent for example, the use and application of habitat classification systems are dependent on either the project lender, the company or a mixture of both.</p> <p>The second aspect to ensuring no net loss or net gain of biodiversity (a requirement also expected within upcoming EU no net loss directive legislation), after habitat per se or using habitat as a proxy, involves the species of flora and fauna themselves and the importance of the particular population / range that they are in on a local, regional and global scale. International Finance Corporation Performance Standard 6 (IFC PS6) provides an overview and somewhat detailed approach to this, however it is not prescriptive in any one approach but rather citing ‘best practice’ to be used.</p> <p>External drivers and cumulative impacts are largely quietly ignored as not being directly due to the project. E.g. in-migration (planned and unplanned) due to a new on-shore oil production facility requires an alternative and enhanced management interventions as compared with the standard ESIA mitigation actions</p>	Richard Sobey (RS)	Interesting points. From what I can glean from the comments – I believe that we have identified strategic environmental assessment (SEA) as a key tool for dealing with cumulative impacts and synergistic impacts between projects and across sectors. However, unfortunately, we have identified that SEA currently rarely uses state of the art modelling to support assessments. Lifting and applying standards of SEA are a recommendation of this report.

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						<p>which at best will have only separately considered socio-economic impacts and not in conjunction with ecological impact. [These scenario and model level drivers of people and habitat pressure need to be given far stronger multiplier impacts within such indices / scenarios/models etc, and also considered in an integral fashion in a cumulative way over space and time. This is not done pro-actively, but rather for case-study mining projects retrospectively. Thus the use of GIS to progressive map over space and time and present ‘critical pressure habitat mapping’ is a must. Habitat loss and fragmentation at the minimum over 5, 20 and 50 year time frame need to be shown – but analysis needs to be sensitive enough to separate out the causes.</p> <p>See Ecological landscape units (ELUs) and habitat sensitivity rating – understandable and could be mapped overtime. With a limited number of ELUs, could use IFC / standard sensitivity based on IUCN (high, mod, low, neg) for species and habitat per se. Then can see on a higher scale as well the impact</p> <p>It this grouping of vegetation or habitat classes into a limited number of recognised Ecological Landscape Units that is required to biome or sub-biome level</p> <p>Drivers are not usually national legislation planning consents, but rather lender’s standards – Equator Principles Association adherence to international ‘best practice guidance – IFC, EIB, EBRD, ADB etc If EPA members are not required as lenders then industry standards often apply – self regulatory – International Petroleum Industry Environmental Conservation Association IPECEA, Mining ICMM? Cross Sector Biodiversity Initiative (CSBI) etc.</p>		
46.	9	9	9	18		<p>Section 2.2.3 – inherent difficulties in considering economic value of biodiversity of intrinsic value. Natural capital accounting in the UK status – Natural Capital Committee - The state of natural capital: protecting and improving natural capital for prosperity and wellbeing - third report to the Economic Affairs Committee. Natural Capital Committee, Nobel House, 17 Smith Square, London, SW1P 3JR (Report available on the internet at: https://nebula.wsimg.com/17ce16211194bfe53215bb754444686d?AccessKeyId=68F83A8E994328D64D3D&disposition=0&alloworigin=1) 2015</p>	Richard Sobey (RS)	<p>Discussed in the cost-benefit analysis section of 2.3.2.1.</p> <p>We are reporting on existing frameworks that could potentially improve prioritization as mentioned in your comment. However, it is beyond our remit to provide our own frameworks or</p>

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						<p>Synopsis from report - Presents a framework for prioritising investments in natural capital, which considers: how much natural capital is needed; how levels for benefits and assets might be determined; the aspects of natural capital which are at greatest risk from poor use or management; and how the foundations and approach to prioritisation fit together to inform an investment programme for natural capital. Considers the investments in natural capital which offer the greatest economic return</p> <p>In other words valuing biodiversity is some way off, especially for ecosystem services</p>		pick winners given the diversity of decision contexts we identify.
47.	2	13	2	13	2	Section 2.2.6 Adaptive management – the IFC conformance guidelines (2012) advocate, where there is a residual impact on natural or critical habitat, then a Biodiversity Action Plan should be produced. One could say that most BAPs that go beyond simple monitoring employ adaptive management techniques – especially where the monitoring indicates that no net loss or net gain is not going to be achieved, then adaptive solutions are required	Richard Sobey (RS)	Agreed.
48.	2	6	21			2.2.10 SEA – whilst SEA is designed to assess policies, plans and programmes over time and therefore by default cumulative impacts. At the project level, EIA assessment often separately ‘tag’ on a cumulative impact chapter mainly assessing spatial associations, and not focus on temporal impacts, which would require more than basic EIA techniques (as ecological surveys often only cover 1 year, during the baseline period and not even over two consecutive similar seasons. Let alone providing a longer time frame scenario. Thus impacts are often considered pre-construction and construction phases, but interest peters out thereafter, unless specific commitments can be carried through into the relevant Environmental and Social management plans, which would for example include longer term monitoring and other necessary biodiversity actions	Richard Sobey (RS)	Yes, we now better integrate discussion of SEA and environmental impact assessment (EIA).
49.	2	14	22			<p>SEA – present text ‘The Convention on Biological Diversity (Article 6b and Article 14) encourages the use of SEA in its implementation (without making it a specific requirement). The Paris 15 Declaration calls for the development of common approaches to environmental assessment generally, and to SEA specifically (www.oecd.org/dac).’</p> <p>Reviewer comment maybe put as a footnote – Under the OECD ‘Common Approaches’ (2012) for Environmental and Social Impact Assessment (ESIA) / Due Diligence of projects funded by export credit agencies and in particular those in Category A (higher impact on environment), SEA is not a requirement. It is also not within the Equator Principles Association guidance for commercial funders that adhere to IFC Performance standard 6 on biodiversity (except concerning RAMSAR sites). Whereas it is recommended as you say for ‘development assistance’ projects – see DAC Guidelines Applying SEA – Good Practice for Development Cooperation.</p>	Richard Sobey (RS)	Convention on Biodiversity SEA text now included.

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						So whilst large oil and gas concessions or mines may be at the project level, al be it very large, they often have medium to long term time frames until decommissioning, so should be assessed strategically		
50.	2	25	23	29	29	Integrated Territorial planning needs more prominence as an achievable method that is user friendly in its understanding and usefulness of application. – landscape ecology models with species population dynamics overlaid with human territorial disturbance. The advantage is partly much of the work can be achieved via desk study and GIS and then tweaked as new information arises or changes over time. For large projects that cover parts of ecoregions (e.g a mountain range) where for example an number of oil concessions are to be active (presently the artic oil exploration would be a good example, but it should also apply to deserts and extended protected areas – where despite ‘no adverse use’ clauses in their constitutions are present, national governments still approve projects.	Richard Sobey (RS)	We have maintained the integrated territorial planning (ITP) section despite the fact that documentation is sparse. We believe the prominence it is given is commensurate with its prevalence of application.
51.		25	13	25	15	Discussion of link between a landscape scale approach to offsetting of residual impacts of projects could be mentioned here. So far offsetting metrics are far from standardised, if they ever should be. For offsetting metrics and mechanisms, higher level principles of ‘like for like’ (in-kind) for habitat replacement and ‘out-of-kind’ approaches based more on species-based methods need better definition, but the point is to what extent can multivariate analysis or territorial planning for instance be used to measure biodiversity losses so that ‘no net loss’ can be demonstrated, if not to the level of ‘net gain’. There is also the issue / method of ‘trading-up’.	Richard Sobey (RS)	This is a major question in applied ecology and environmental management, but beyond the scope of this report.
52.		25	18	25	19	See above – as part of same discussion – continued This chapter on decision-making tools does not yet provide any direction of how models, scenarios etc could be applied better in the new field of biodiversity offsetting, indeed furthermore both the IFC PS6 standard for biodiversity and the EU’s new ‘no net loss’ initiative (as part of EU Biodiversity Strategy 2020, target 2, Action 7b) both expect or require metrics for not only biodiversity losses but also ecosystem services. Metrics for biodiversity offsetting have been prepared (AECOM/ARUP for the UK government High Speed 2 train line from Birmingham to London) and being piloted (UK Defra pilots begun in 2011); and for ecosystem services offsetting - One UK DEFRA project is attempting measurement – (Multi-habitat ecosystem accounts with a set of indicators for habitat / ecosystem condition - selected to reflect changes in the ecosystem capacity to deliver ecosystem services (with expected annual update) – use existing datasets- by Exeter University/ AECOM)	Richard Sobey (RS)	Offsetting is a particular policy. Our aim is to identify approaches to support policy development and improvement. We do not wish to get into a long discussion about offsetting per se in this report... though I agree that it is a policy area in serious need of evaluation and review!

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53.		General comment				The context of chapter is clear. 1. The authors may discuss about data sources, data quality and validation of models to deal with uncertainty. 2. A paragraph on Generalised Linear Models may be helpful.	Gautam Talukdar (GT)	We are discussing general approaches, not particular data sources. We're leaving the specific treatment of model types to chapters 3, 4, and 5.
54.	2.2.5.1	10	25	10	27	May rewrite the sentence as it is repeated in 2.2.5.2 Analytic Hierachy Process line number 26 to 29; page numner 11	Gautam Talukdar (GT)	Good pick up. However, we're happy for this point to be reinforced in two places. It is an important point that applied to all of these multi criteria methods.
55.	2.3.1.4	33	44	34	10	Landscape approach is being advocated in all studies now therefore it may be elaborated further. Within it corridors may also be emphasized and the tools for modelling them i.e. graph theory, least cost path, etc.	Gautam Talukdar (GT)	We do discuss scale, and some of the benefits of operating at multiple (interacting) scales during assessment. However, we prefer not to list all the scales and have to document modelling approaches relevant at each. See chapters 4 and 5.
56.	2	2	27	2	45	This section could also comment on the advantages of meetings and of deliberative discussion for 1/making decisions and 2/ build knowledge. Even researchers in their research daily activities have successful meetings to design research project or to collectively analyse the results. Group dynamics are not only "negative", they can also be very positive to make biodiversity count and to progress towards a better understanding of a given issue.	Audrey Coreau (AC)	Good point. We touch on the benefit of deliberative and participatory approaches throughout.
57.	2	3	19	3	27	It is not clear for me what is the context of the analysis of "strengths and weaknesses". Is it strength and weaknesses to improve biodiversity and ecosystem services? to make science count into decision making? to generate new knowledge?	Audrey Coreau (AC)	No, simply which aspects of decision making context can these methods accommodate and how well. See new

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								tables 2.4 and 2.5.
58.	2	3	28	30	42	The organisation of this section is unclear. You have a list of methods. But methods for what? If these are methods to articulate knowledge and decision making, a lot of them are missing. You have listed only formalised tools currently used by <u>scientists</u> . This need 1/ some organisation of the ideas and 2/ a widening of the perspective about what makes a science-policy interface successful (according to a particular objective, that can be normative or procedural) , using a clear framework to organise the ideas.	Audrey Coreau (AC)	We have classed methods according to broad families and discussed how well each of the (sample of) methods addresses particular decision contexts. We acknowledge that this is a sample of the total number of methods used in practice.
59.	2	4	1	4	32	References are missing from political science to explain what is policy, and from management science to explain planning and management. Same remark for the “political cycle”. For instance Sabatier. 2012. Understanding and influencing the policy process Martinet, 2010. Strategic planning, strategic management, strategic foresight: The seminal work of H. Igor Ansoff	Audrey Coreau (AC)	We are aware that there is a large volume of work out there on policy. We acknowledge up front that we do not set out to review that literature. We seek to provide a very broad overview on tools and approaches that can help environmental decision makers navigate the different parts of the policy cycle.
60.	2	9	10	9	17	This section is rather short. You could have a look to Laurans et al. 2013 (Use of ecosystem services economic valuation for decision making: Questioning a literature blindspot) Or to Mermet et al. ”Tools for what trade”. (http://www.afd.fr/webdav/site/afd/shared/PUBLICATIONS/RECHERCHE/Scientifiques/A-savoir/25-VA-A-Savoir.pdf)	Audrey Coreau (AC)	It is surprising how few case studies of cost benefit analysis in environmental decisions are documented in the literature. This may be partly due to the drawbacks identified in our chapter.
61.	2	21	6	23	20	Environmental assessment (or evaluation) can take different forms. SEA is only	Audrey	We have tried to

Nr	Chapter	From page	From line	Till page	Till line	Comment	Reviewer Initials	What was done with the comment
						<p>one formalized way to make such assessments. Would it be possible to enlarge the perspective?</p> <p>See for instance Leroy et Mermet 2012. Delivering on environmental commitments? Guidelines and evaluation framework for an "on-board" approach</p> <p>Mermet et al. 2010 Concern-focused evaluation for ambiguous and conflicting politics: an approach from the environmental field</p>	Coreau (AC)	indicate in the SEA/EIA section that 'assessment' is a general and widespread activity. We have added the references you provide, but will not have space to expand further.
62.	2	3	28	30	42	<p>General comment. Futures studies is a large field, not only scenarios are used. Why such literature to articulate knowledge and decision has not been included in the review (for example vision exercises, horizon scanning, etc.)?</p> <p>See for instance Treyer et al. 2002 At the interface between scenario building and mathematical modelling within the dynamics of a future studies programme. Discussions and considerations emerging from the World Water Vision.</p> <p>Sutherland et al. 2011. Methods for collaboratively identifying research priorities and emerging issues in science and policy</p> <p>Miller and Rossel. 2012. Future studies and weak signals: A critical survey</p> <p>Bell. 2003. Foundations of futures studies: History, purposes and knowledge (New Edition).</p> <p>EEA. http://www.eea.europa.eu/publications/blossom</p>	Audrey Coreau (AC)	Yes, good point. This is now acknowledged in the uncertainty section with numerous new references. We have not provided a new section for each of the relevant methods, however, due to space constraints.
63.	2	28	4	28	18	<p>The lack of references about scenarios may be due to:</p> <p>1/ less publications, because scenarios are often published in grey literature and not in academic literature</p> <p>2/ publications in journals that are not ecology journals and may be more difficult to access to (see for instance <u>Futures</u>)</p>	Audrey Coreau (AC)	Yes, we have attempted to add more reference to scenarios in the revised version
64.	2	29	3	29	18	<p>Figure 2.2.14. The arrows make me think that it would be "best" to be global, sequential decisions and multi-objectives. Is this what you want to show? I am not sure that it is the case for all environmental issues.</p>	Audrey Coreau (AC)	Absolutely not. Caveat added.
65.	2	30	11	30	18	<p>See all the literature in Futures studies and you will find some examples of scenarios being used in complex systems. This is one of the aims of futures studies to be able to deal with such complexity.</p> <p>See for instance</p> <p>Zellmer et al. 2006. The nature of ecological complexity: a protocol for building the narrative</p> <p>Allen et al. 2005. The loss of narrative</p>	Audrey Coreau (AC)	Yes. Acknowledged. We have softened the language around the absence of good examples of scenario analysis. Our box on SEA utilizes scenario and the early sections on policy agenda setting also include several scenario

Nr	Chapter	From page	From line	Till page	Till line	Comment	Reviewer Initials	What was done with the comment
								analyses.
66.	2	31	1	36	7	This whole section is only about models, and not about scenarios. Why?	Audrey Coreau (AC)	This section has been removed, partly for that reason. Discussion about scenarios and models is left to chapters 3, 4, and 5.
67.	2	33	43	34	10	Planning protected areas is not necessarily a “landscape level” approach. Most protected areas are designed to protect one or several <u>species</u> . Which is then the relevant ecological unit to deal with in models and scenarios (even if this implies to study its different habitats at a landscape level).	Audrey Coreau (AC)	Agreed. Deleted.
68.	2	36	29	36	31	Futures studies and scenario planning are also ways to do cross scale linkages	Audrey Coreau (AC)	True. But they are not more adapted to this purpose than any other method. The degree to which cross-scale issues are addressed is more about how modelling is conducted.
69.	2	38	28	38	29	Scientific knowledge in some cases bring more uncertainties than it resolves. Models are there to reduce uncertainties, but scenarios are built to explore and organize uncertainties. See for instance Bennett and Zurek. 2005. Chapter 15: Integrating epistemologies through scenarios Biggs et al. 2007. Linking futures across scales: a dialog on multiscale scenarios	Audrey Coreau (AC)	Agreed. Points adopted to text. Biggs et al. cited.
70.	2	44	20	46	24	Participatory deliberative decision-making process is described as a way to deal with uncertainties. This is right. But this is not the only important characteristic of participatory deliberative decision-making (it is also very useful to include local knowledge, to express the right issue at stake about biodiversity and ecosystem services preservation, to make stakeholders engage in a new process, etc.). Where will all this be described in the document? Moreover, scenarios and future studies, be they participatory or expert exercises, are a way to deal with uncertainties. Participation of stakeholders is not a necessary condition (see Mermet – étudier les ecologies futures, or futures studies literature).	Audrey Coreau (AC)	The point about participation is now better integrated through the text and in the key recommendations.
71.	2					Overall very useful, informative chapter	Hans Keune (HK)	Thank you.

Nr	Chapter	From page	From line	Till page	Till line	Comment	Reviewer Initials	What was done with the comment
72.	2					Same comment as wrt Ch 1: two main groups of paradigms for decision support and model building can be distinguished and included for clarification, traditional and alternative paradigms, based e.g. on Rosenhead J. editor (1989), Rational Analysis for a Problematic World. Problem Structuring Methods for Complexity, Uncertainty and Conflict. West Sussex, England; John Wiley & Sons.	Hans Keune (HK)	I'm afraid we have taken a different taxonomy. We were seeking only a decision support taxonomy, not including modelling and scenario – they have their own in different chapters.
73.	2					Same comment as wrt Ch 1: following from the previous comment, how does this deliverable explicitly take into account the deliverable on divers conceptualizations of valuation?	Hans Keune (HK)	We could not take the deliverable on valuation on board in this chapter, as it was beyond the scope, as well as because of time lags.
74.	2					Same comment as wrt Ch 1: based on all comparative methodological information, one might expect a methodological decision support protocol, or the announcement of the need to develop one: how can decision makers (and their supporters) choose the right methods, based on a well-structured and well-informed methodological decision making protocol, allowing to be transparent on assumptions and preferences, on pros and cons, both methodologically and practically, regarding their preferred method or methods.	Hans Keune (HK)	We can't make categorical recommendations across all decision contexts. We have a table on strengths and weaknesses and a table on which approaches deal with which methods in different ways.
75.	2					Same comment as wrt Ch 1: how will technical/expert support of the context specific method development and application and evaluation concretely be organized?	Hans Keune (HK)	That is an IPBES plenary question.
76.	2					Why are Group Decision Support Systems not mentioned?	Hans Keune (HK)	Participatory processes, MCDA, etc. are all potentially group decision support.
	2	10		12		Why are participatory MCDA approaches not mentioned explicitly?	Hans Keune (HK)	They are.
77.	2	10		12		Why are Rank-based methods not mentioned? They differ from MAVT in that they use ordinal scale instead of cardinal scale and ask participant to provide a rank order of the alternatives (What is the most important criterion for you,	Hans Keune (HK)	Outranking, which is a rank-based method, is explicitly

Nr	Chapter	From page	From line	Till page	Till line	Comment	Reviewer Initials	What was done with the comment
						second most important, etc.) This approach requires less cognitive effort from the participants but it also loses some information about the relative importance of the criteria. Software, which is based on ranking of options on an ordinal scale, is AURORA (de Keyser and Springael, 2009).		mentioned.
78.	2	16		17		Why are MCDA approaches labeled as technocratic? Like with all approaches it all depends on how you orchestrate them, who is involved in method design and use, to what extent is it used in a participatory group decision making or decision support or advice fashion?	Hans Keune (HK)	We've softened the language here.
79.	2	37		46		The complexity terms ignorance and ambiguity could be explicitly integrated	Hans Keune (HK)	We're deferring to other IPBES groups for an uncertainty taxonomy, who are working with Regan et al. 2001, I believe.
80.	2	5	42			Replace "dependant" by "dependent"	Michel De Lara (MDL)	Done.
81.	2	7	37			In this paragraph, I would add that a typical difficulty is selecting a probability distribution for the possible outcomes.	Michel De Lara (MDL)	Trying to keep it low tech – at least to start with.
82.	2	8	3			Is the word "expected" taken in the sense of "mathematical expectation" or in the sense of "possible outcome"? I suggest to replace "Multiple values imply multiple objectives each requiring estimates of expected consequence" by "Multiple values imply multiple objectives, requiring estimates of the joint distribution".	Michel De Lara (MDL)	Too hard for most people to understand that. We have deleted 'expected' so it is now just estimates of consequences.
83.	2	9	16		17	What does this sentence mean: "In addition, the impact of discounting over time becomes more difficult when dealing with future scenarios."? Does it mean that discounting raises delicate issues when dealing with long term environmental impacts?	Michel De Lara (MDL)	Sentence has been deleted.
84.	2	9	24			Why distinguish LP and SDP in particular? It would be more interesting to recall the framing of an optimisation problem, with decision set, objective and constraints. And then, point out that, depending on the characteristics of the problem (linear, convex, smooth or non-smooth, dynamic or not, deterministic or under uncertainty, etc.), there are classes of resolution methods.	Michel De Lara (MDL)	Linear and stochastic dynamic programming are used as illustrative examples of optimisation methods, for readers unfamiliar with the

Nr	Chapter	From page	From line	Till page	Till line	Comment	Reviewer Initials	What was done with the comment
								area. We have however, adopted some of the content of the comment indicating that the framing and characteristics of the problem define the class of method used.
85.	2	9	26			It is not true that LP is restricted to static relationships. LP can accommodate dynamic relationships between variables at different time steps, as long as they are linear.	Michel De Lara (MDL)	'Static' removed.
86.	2	9	39		40	This sentence is unintelligible... "naive binary logic of a step funtion"? What does this mean? Every optimization problem relies on the assumption that to each decision one attributes a "value". One can disagree with such a view, but this has nothing to do with LP or SDP, and nothing to do with "naive binary logic of a step funtion".	Michel De Lara (MDL)	Naïve binary logic removed. Agreed was a distraction.
87.	2	9	43			The "multi-dimensional distance to the goal set" is an objective function, that should suffer the same obscure criticism of "naive binary logic of a step funtion"... There is no miracle: when you optimize, you deal with an objective function (or criterion, or value). I have no room here to develop, but optimizers use constraints to deal with so-called "multi-criteria".	Michel De Lara (MDL)	Using constraints is a fairly limited way to address multiple criteria because you have to set a hard constraint on a particular outcome. So you're not identifying trade-offs and dealing with them at all.
88.		10	14			So, MAVT just mixes different critera into a single one (necessary for optimization) by using weights. As said, the difficulty is in selecting the weights. I do not understand why linearity (summing weighted criteria) is accepted here without a blink, whereas above the non-linearity of "ecosystemic relationships" is stressed.	Michel De Lara (MDL)	The implicit linearity assumption in MCDA weights is now acknowledged.
89.		11	2			Why speak of "risk neutral" when there is no notion of "risk" in the sense of outcomes with a probability distribution? Risk neutral has a specific sense in economics.	Michel De Lara (MDL)	Amended, to add clarity and qualification.
90.		11	4			As far as I understand, AHP is a technique to elicit an objective function. I think that this difficult issue should be stressed earlier. Eliciting a criterion (that is, attaching a value to a decision) is a delicate issue that underpins most of MCDA approaches (except those relying on Pareto optimality I guess).	Michel De Lara (MDL)	I think we stress throughout this section that eliciting an objective function is a delicate

Nr	Chapter	From page	From line	Till page	Till line	Comment	Reviewer Initials	What was done with the comment
								issue, susceptible to human biases and frailties.
91.		11	21		22	I am not sure that the independence axiom in VNM theory (that deals with compound lotteries) has to do with the fact of extending the decision set.	Michel De Lara (MDL)	Good point. Amended (with change of reference to clarify relevance to preferences among sure things rather than lotteries).
92.		14	5		7	I find it weird that the notion of scenario covers three notions. In Control Theory, I suspect that these notions correspond to 1/ “scenarios”/”pathways”/”chronicles” (as sequences of uncertainties, external to control) 2/ “outputs” produced by a given strategy/policy/decision rule/feedback 3/ strategy/policy/decision rule/feedback solution of a certain target problem.	Michel De Lara (MDL)	Possibly. Not sure what to do with this.
93.		17	23			No “s” in stakeholder(s)	Michel De Lara (MDL)	Done.
94.		39	4			“Stochastic” uncertainty has a well defined meaning, where the set of scenarios is equipped with a probability distribution (not to mention sigma-field).	Michel De Lara (MDL)	We’re using the definition provided by Regan et al. 2001
95.		42	13		17	SDP relies on a key Markovian assumption that may hamper practical applications when the state is large (curse of dimensionality). Stochastic programming (SP) should be mentioned. SP is, historically, an extension of LP (but not SDP as is written in the Chapter).	Michel De Lara (MDL)	Adopted.
96.		45	22			I suggest to suppress “i.e., stochastic uncertainty”.	Michel De Lara (MDL)	Done.
97.	2	1	11	1	12	This is not very clear: what do you intend for “explicitly environmental decisions”? the positive or negative externalities on the environment?	Carolina Collaro (CC)	Done.
98.	2	1	17	1	18	on the decision and scale context . Infact, we develop.. It could be clearer giving immediately the input of the very important scale issue.	Carolina Collaro (CC)	We have re-ordered this section.
99.	2	3	35	3	36	Please clarify what do you mean as “environmental decision”	Carolina Collaro (CC)	We have noted that most decisions are made by people without regards to environmental issue. Therefore – an environmental

Nr	Chapter	From page	From line	Till page	Till line	Comment	Reviewer Initials	What was done with the comment
								decision is one in which environmental considerations are explicit.
100	2	4	19	4	20	Planning takes care of the future configuration of a territory until a certain time lapse, generally established by law or local and regional regulations. What is determined with the planning is the future desirable asset of the territory .	Carolina Collaro (CC)	I think this is covered by the current text (shared objectives).
101	2	4	22	4	22	In place of “ a range of criteria” it could be better to write: an established number of functional use's destinations . That gives the complexity of the planning operations	Carolina Collaro (CC)	Not sure I agree with this. Range of criteria is pretty clear.
102	2	4	24	4	25	This point is to be deepened. To what extent ecosystem services have been considered in the planning? I think very little, generally speaking. Another alternative would be offering readers a greater number of references supporting what is claimed	Carolina Collaro (CC)	Point softened throughout. Section removed.
103	2	7	1	7	1	It would be interesting to insert a definition of governance, taken from the authors opinions and references	Carolina Collaro (CC)	Definitions covered in a glossary developed by the Technical Support Unit
104	2	7	14	7	14	Please, consider to insert after: In the emainder of this chapter... the number of the relative paragraph	Carolina Collaro (CC)	Not sure what this means.
105	2	15	13	24	15	At the indicators level, it could be useful to point to the Sustainable Development Goals of the Post-2015 Agenda and relative operationalizations and targets, useful to construct new scenarios .	Carolina Collaro (CC)	We now have many references to global targets and indicators.
106	2	36	41	41	36	The Remote Sensing is a very viable technology to map ecosystem services. Nowadays, this technology has the advantage of being more and more affordable, even giving the ability to map the largest territorial extensions and furthermore makes possible the transmission of data in otherwise inaccessible areas.	Carolina Collaro (CC)	Agreed. But I'm not sure it really fits here.
107	2	10	10	10	12	The sentence “separation of the task of causal judgment from the task of articulating value judgment” is not entirely clear. I suggest to define what the two different judgments mean.	Davide Geneletti (DG)	Done.
108	2	10	5	10	10	I think this section would benefit from an overview of MCDA, i.e. a paragraph or two that describe the overall purpose and rationale of MCDA, before introducing the different MCDA methodologies (presented in the sub-subsequent sub-sections). A profile of MCDA to support ecosystem services assessment that could be referred to can be found here:	Davide Geneletti (DG)	Done.

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						http://www.aboutvalues.net/data/method_navigator/values_method_profile_multi_criteria_analysis.pdf		
109	2	21	6	23	29	The SEA section could be improved, and make more relevant to the readership, by adding some references and excerpt of recent work on the integration of ecosystem services into SEA. For example: <ul style="list-style-type: none"> - UNEP (2014). Integrating Ecosystem Services in Strategic Environmental Assessment: A guide for practitioners. Available at: http://www.proecoserv.org/information-hub-test/guideline.html - Geneletti, D. (2011) Reasons and options for integrating ecosystem services in strategic environmental assessment of spatial planning. International Journal of Biodiversity Science, Ecosystem Services & Management 7(3), 143-149. 	Davide Geneletti (DG)	WE have expanded the SEA section to the point where it receives much more attention than the others. We're reticent to expand further. Happy for Technical Support Unit to adjudicate.
110	2	38	5	42	40	Sections 2.4.2 and 2.4.3 are quite technical compared to other sections of the chapter. They would benefit from overviews in more accessible language.	Davide Geneletti (DG)	This has been attempted throughout.
111	2	all				I think this chapter offers a very comprehensive and informative review. The only suggestion I would make is better coordination with the following chapters on specific linkage/impact modeling to avoid redundant discussions of the same issue in different chapters.	Wei Zhang (WZ)	Done.
112	1	5	15			There should be one or two sentences to underline the link the uncertainty character of environmental decisions and the complexity of the different changing factors that can influence those decisions (spatial and temporal scales, social and cultural complexity, ecosystem and geographic domain, governance system)	Estelle Mawal A. Mbassa (EMM)	Done.
113	1	4				Any concept should be developed in a different paragraph (policy, planning, management)	Estelle Mawal A. Mbassa (EMM)	Section removed.
114	2	7, 8, 9, 10				There are examples of methodological paradigms and frameworks of scenarios and models and some others have no examples or illustrations which is quite important on this technical issue (2.2. 1., 2.2.3, 2.24)	Estelle Mawal A. Mbassa (EMM)	Unfortunately we were not able to provide detailed examples of each approach – or even to mention the full range of approaches. A restriction of the assessment.
115	2	27-29				Are we still enumerating the methodological paradigms and framework? If not the structure should be different. Maybe a different chapter 2.2.3 on evaluation of	Estelle Mawal A.	Done. Structure changed.

Nr	Chapter	From page	From line	Till page	Till line	Comment	Reviewer Initials	What was done with the comment
						the methods and 2.2.3. 1: lessons learnt; 2.2.3.2: taxonomy of decision, 2.2.3.3: the role of scenarios and models in the decision making	Mbassa (EMM)	
116	4	38-41				Only one example or illustrations with biodiversity aspects. As environmental factors are dynamic, the uncertainty character should be highlight with some illustrations to underline the need of a particular attention in order to reduce risk and to choose the better decision.	Estelle Mawal A. Mbassa (EMM)	SEA, structured decision making and adaptive management each address a particular aspect of biodiversity.
117	5	46	26, 27			Keys challenges, opportunities and strategies or better integration of scenarios and models in policy, planning and management. This is link to challenges of biodiversity keeping in mind the vision. How can scenarios and models be used in the different stapes and diferents levels of the implementation of keys objectives the Biodiversity convention? By which policy planning and management instruments / tools identified? This chapter should be more developed in order to point those challenges, opportunities and strategies where the scenarios and models can be used.	Estelle Mawal A. Mbassa (EMM)	Addressed in a variety of ways.
118	2	1	31			“auspiciously”? Maybe meant to be “conspicuously”?	Thomas Brooks (TB)	Yes. Done.
119	2	1	34	1	39	I am very surprised to see the authors’ claim that lack of analysis skills, and lack of appreciation by decision-makers, are bigger impediments than lack of data (I do agree that they are bigger problems than lack of models), and – although I have only anecdotal evidence – am not convinced by it. I hope that the authors provide strong evidence in Section 2.2 to support this assertion.	Thomas Brooks (TB)	Claim softened. All big problems. No rank order.
120	2	4	19			I recommend just citing the MA here, for which a reasonable case can be made for it having had a key role.	Thomas Brooks (TB)	Done.
121	2	14	3	15	44	Seems odd to include “Scenario planning” here as one of 12 of these low-level subheadings of different kinds of decision support approaches, when the entire assessment is meant to be about scenarios (and modeling).	Thomas Brooks (TB)	It does. But scenario planning is a decision support approach no grander than any of the others listed at this level. The fact that it focuses on ‘scenarios’ (rather than models, as many of the other methods) - a key

Nr	Chapter	From page	From line	Till page	Till line	Comment	Reviewer Initials	What was done with the comment
								theme in the assessment – does not mean it is the <i>only</i> approach that incorporates scenarios.
122	2	28	14	28	16	I would have thought that a major additional constraint is the paucity of the underlying data.	Thomas Brooks (TB)	Agreed. Added.
123	2	29	3	29	18	Circles 3, 4, and 6 do not appear to be labeled in Fig 2.2.14.	Thomas Brooks (TB)	Fixed.
124	2	29	23	29	24	Most of these are scientific papers, not “applications of modelling and scenario analysis in policy agenda setting”. The only one which should really be cited here is SCBD GBO4 2014.	Thomas Brooks (TB)	Done.
125	2	30				Some words are jumbled in this line.	Thomas Brooks (TB)	Yes. Many. Deleted.
126	2	31	8			I think that it is hard to justify a “landscape” (a human construct) as a scale of ecological organization; in addition this introduces confusing inconsistency with CBD usage of genetic, species, and ecosystem levels of biodiversity. Delete “landscape” here, and also the corresponding top row from Fig 2.3.1.	Thomas Brooks (TB)	Agreed. Removed.
127	2	31	14	31	15	This is debateable. E.O. Wilson (in “The Diversity of Life”) and many others make the case that species are the fundamental unit of biodiversity. This might be best addressed by adding “some consider that” after “because on Line 14.	Thomas Brooks (TB)	Section removed as out of scope.
128	2	31	25			Add “Risk of collapse” into the box for “Ecosystems” and “Composition” in Fig 2.3.1.	Thomas Brooks (TB)	Box removed. Out of scope.
129	2	31	25			Add “Extinction risk” into the box for “Species” and “Composition” in Fig 2.3.1.	Thomas Brooks (TB)	This figure has been removed.
130	2	32	36			This sentence is rather unclear. Certainly, species-based approaches are important for ecosystem conservation (as flagships). However, they are even more important for species conservation per se! So maybe add text to read “...applied to species conservation it its own right, as well as as flagships to conserve...”.	Thomas Brooks (TB)	Removed.
131	2	33	15			A paragraph needs to be added here to discuss the IUCN Red List Categories and Criteria, which have rigorous scientific underpinning (Mace & Lande 1991 Conserv Biol, Akçakaya et al. 2001 Conserv Biol, de Grammont & Cuarón 2006 Conserv Biol, Mace et al. 2008 Conserv Biol), clear application at national levels (Gardenfors et al. 2001 Conserv Biol, Miller et al. 2007 Conserv Biol, Zamin et al. 2010 Conserv Biol), and numerous applications for decision support in policy	Thomas Brooks (TB)	IUCN red-listing is indeed an important assessment process, however, we were unable to find a place in the

Nr	Chapter	From page	From line	Till page	Till line	Comment	Reviewer Initials	What was done with the comment
						and practice (Rodrigues et al. 2001 TREE), and which has been applied to assess extinction risk for >70,000 species (with repeat assessments spanning the last three decades for many of these). One of the Red List criteria (the “E criterion”) is based on extinction models (e.g., PVA) directly, while the other four are based on threshold approaches. (Box 6.1 in Chapter 6 gives a good example of why this approach is so important to reflect here.)		document in which to make specific reference to red-listing as a decision process utilizing models and scenarios.
132	2	33	35	33	41	Nicholson et al. 2012 PLoS ONE discuss species indicators, and so surely this paragraph belongs under Section 2.3.1.2, not 2.3.1.3? Also, while Nicholson et al. is a nice example, there are many much stronger references for the derivation of Red List Indices from the Red List, e.g., Butchart et al. 2004 PLoS Biol, Butchart et al. 2005 Phil Trans R Soc Lond B, Hoffmann et al. 2010 Science, Butchart et al. 2012 PLoS ONE, which should be discussed and cited in this paragraph as well as Nicholson et al.	Thomas Brooks (TB)	Reference removed and paragraph repositioned.
133	2	33	42			A paragraph needs to be added here to discuss the emerging Categories and Criteria for the Red List of Ecosystems, citing in particular Keith et al. 2013 PLoS ONE, as well as the Boitini et al. 2014 Conserv Lett critique of this.	Thomas Brooks (TB)	Section removed as much of the information was available in other sections and space was limited.
134	2	33	44	34	10	This paragraph is all about species, and should be moved up into Section 2.3.1.2. As noted above, surely “Landscape” is a scale of human rather than ecological organization? – so the subheading 2.3.1.4 can be removed. (Alternatively, subsections to discuss different scales at which people divide space could be added into Section 2.3.2. This would include subsections on sites, landscapes, countries, etc.)	Thomas Brooks (TB)	Section removed.
135	2	34	28	34	29	I don’t think that any of these examples are solely or even primarily caused by failure to consider scale, and there are many examples of poor environmental decision-making where social and ecological scales align. I would change “examples of devastating outcomes of” to read “all exacerbated by”.	Thomas Brooks (TB)	Section removed.
136	2	34	26			It would be valuable to add a sentence here reading something like “Much conservation attention is focused at the site level (Eken et al. 2004 BioScience) at which individual areas are protected, safeguarded, and managed (Watson et al. 2014 Science); complemented by management at the landscape level (Sanderson et al. 2002 BioScience, Boyd et al. 2007 Conserv Lett).”	Thomas Brooks (TB)	Section removed.
137	2	36	14	36	15	Sentence seems to be jumbled.	Thomas Brooks (TB)	Section removed.
138	2	36	18			Change “the landscape’s” to “biodiversity’s” – this point applies across levels of ecological organization.	Thomas Brooks (TB)	Section removed

Nr	Chapter	From page	From line	Till page	Till line	Comment	Reviewer Initials	What was done with the comment
139	2	36	23			Change “landscapes” to “arenas” or similar – again, this is not just about “landscapes”.	Thomas Brooks (TB)	Section removed.
140	2	36	29	36	41	This paragraph seems out of place. Don’t these methods of decision-support (PRA etc) belong up in Section 2.2 as an additional section alongside the other 11 covered there?	Thomas Brooks (TB)	Section removed.
141	2	36	26	37	2	Another key reference for this Section 2.4.1 is Akçakaya et al. 2001 Conserv Biol.	Thomas Brooks (TB)	Section removed.
142	2	38	3			Box 2.4.1. <i>Gadus morhua</i> is assessed as “Vulnerable” by IUCN (http://www.iucnredlist.org/details/full/8784/0), not “critically endangered”, as in fact accurately reported by Hutchings (2000) Nature.	Thomas Brooks (TB)	Box removed.
143	2	38	3			Include scientific names for all species mentioned throughout, to avoid any possible confusion.	Thomas Brooks (TB)	Done.
144	2	42	12	42	41	The material in this Section 2.4.3, again, seems to belong up in the description of different approaches in Section 2.2 (apparently mostly 2.2.4).	Thomas Brooks (TB)	Agreed.
145	2	44	20	46	24	Again, shouldn’t these approaches be described in Section 2.2? I think that some work will be important to tighten up the structure of this chapter.	Thomas Brooks (TB)	Done.
146	2	5		7		We completely agreed with what is said in chapter 2.1.2 concerning the spatial/temporal scale, the social/cultural complexity etc.	Charlotte Simon (CS)	Thank you.
147	2	28	20	30	42	When going through the document, I found weird to have to those chapters under “2.2 lessons learnt from application of established methodological paradigms and frameworks of scenarios and models”. Indeed the chapter 2.2 is presenting different types of models and scenarios as well as their advantages and disadvantages, while 2.2.14 and 2.2.15 is already more progressing on the reflection concerning their link with policy making.	Charlotte Simon (CS)	Tried to reduce emphasis on models and scenarios (later chapters) – rather, we are setting the decision/policy making context for those chapters.
148	2	47	15	47	15	This is a more general comment: I think it would be interesting the present a graph at the end of the chapters summarizing the different steps from the “problems to be solved” until the “policy formulation” resolving this issue by using models/scenarios systems. However, I would see two possibilities for presenting such graph. Either the scenarios/models already exist and policy makers have to “pick” one depending on the drivers to be changed or the decision to be taken OR a scenario/model need to be created in order to formulation policies based on sepcific issues.	Charlotte Simon (CS)	The overall deliverable framework addresses this link.

Nr	Chapter	From page	From line	Till page	Till line	Comment	Reviewer Initials	What was done with the comment
149	2	1	1	60	50	Firstly as a general comment I would like to say that the entire chapter is far too long, with detail that might not be needed in such a chapter, and repetitiveness. In addition I think that sections covered in other chapters are also perhaps described here, and I suggest the entire chapter could be shortened by editing long sections (which I will comment on below), and being aware of sections already covered in other chapters.	Karen Kirkman (KK)	Length now 75% of FOD. Repetition was explicitly addressed in revisions.
150		1	1	60	50	Overall, this is an impressive piece of work. I think the framework presented is a valuable one for understanding the place of scenarios and models in decision-making. The scholarship is outstanding; I was impressed with the depth of review of the literature.	Mike Runge (MCR)	Thank you.
151		1	1	60	50	As this is a first order draft, the text is understandably choppy. It's clear that different authors wrote different sections, as the level of detail and the tone are heterogeneous across sections. For the most part, my comments do not otherwise discuss the exposition, as I assume that is the focus of later revision and reviews.	Mike Runge (MCR)	Yes.
152		1	10	2	26	I thought the key messages were not clearly articulated. The chapters opens with a lot of dense text and technical language. The key messages should be in plainer language and should succinctly outline each section.	Mike Runge (MCR)	Substantially changed.
153		1	10	1	21	This first summary is confusing, and the entire paragraph is not clear. I would reword this section.	Karen Kirkman (KK)	Done.
154		1	36	1	40	This is to me the essence of why models are not used more frequently, yet this section is not really described in detail in Section 2.2 In addition, other aspects, such as technical knowledge of policy makers, understanding the value of models, political agendas, opposing agendas, etc, are not discussed in any detail. I would suggest that the "Lack of appreciation" needs to be unpacked more.	Karen Kirkman (KK)	We have attempted to unpack the reasons a bit more (capacity, training, poor communication by modellers, etc.)
155		3	5	3	8	Although the role and types of models are discussed in detail, this chapter does not make many suggestions for changes that will result in more models being used. It would be great if solutions were presented more than a mere reference to the problems. But perhaps this is in other chapters?	Karen Kirkman (KK)	The aim was to set the decision support/policy scene – document some good examples. Recommendations are necessarily fairly broad given the broad context of decision making.
156		3		7		Chapter 2.1 should set a framework for assessing the use of scenarios and models in decision-making. The framework should set the analytical basis for the comparison of different approaches and experiments. It should provide tools by which their contribution to different decision-making contexts could be explored and assessed.	Minna Kaljonen (MK)	Subsequent revisions attempted to provide more explicit analysis of the 'how and where

Nr	Chapter	From page	From line	Till page	Till line	Comment	Reviewer Initials	What was done with the comment
						<p>Currently a coherent framework is lacking. This should be the next step to be taken in going forward with the work. Otherwise the chapter will remain a list of issues and approaches without a capability to address the core question: how and where the different approaches could be used, and why they might fail anyway. A more analytical understanding of different decision-making contexts and different ways of using knowledge in decision-making is clearly needed in this regard.</p> <p><u>In developing such framework three issues need to be considered:</u></p> <ol style="list-style-type: none"> 1. analytical differentiation between different decision-making contexts 2. different approaches to the use of knowledge in decision-making 3. what is particular in biodiversity and ecosystem services that need to be taken into account when developing decision-making tools (discussed partly now in ch. 2.3) <p><u>Concerning point 1.</u> The analytical differentiation of decision-making context, in Chapter 2.1, is currently insufficient and messy. The Ch. 2.1 starts nicely by addressing the complexity of the issue, but the typology the authors present, unfortunately, does not offer any more solid ground. I would recommend the authors work further with the typology of decision-making contexts grounding it firmly to the policy analysis literature. One suggestion for attributes differentiating the decision-making contexts would be:</p> <ol style="list-style-type: none"> 1. policy cycle: agenda setting – design – implementation (same concepts with regards to this should be used throughout the Deliverable 3c) 2. one sector – multi sector (the various sectors already have very different traditions of using knowledge or knowledge on biodiversity, when designing and implementing policies. These contextual differences should be acknowledged. In multi-sectoral contexts the use of knowledge in decision-making, starts again from rather different premises) 3. public – private decision-making (this is a decisive division, cf. comment 1) 4. spatial scale 5. temporal scale <p><u>Concerning point 2.</u> When discussing the use of scenarios and models in decision-making one cannot avoid the ontological question: what is assumed about the ways in which knowledge is and can be used in decision-making. The authors refer to this here and there in the text, but do not treat it analytically. The issues becomes to the fore in particular in Ch 2.2., where different decision-making models are presented and analysed. Taking a more systematic approach to the underlying assumptions of different decision-making support tools would significantly improve the treatment and help to assess their possible contributions to different decision-making contexts. The basis for this should be laid out in Ch.</p>		<p>different approaches could be used' --- hence the decision context and the evaluation of different approaches under those context headings. And the assumptions/strengths/weaknesses analysis.</p> <p>All of the 'concerning point 1' comments adopted in revisions.</p> <p>'Concerning point 2': we have made significant attempts to provide background theory underpinning decision making. It appears that our foundation is more in the normative</p>

Nr	Chapter	From page	From line	Till page	Till line	Comment	Reviewer Initials	What was done with the comment
						<p>2.1 respectively. The different approaches to the use of knowledge in decision-making stem from rational decision-making theory to Mode2 science (Funtowicz & Ravetz; Nowotny), adaptive management (Berkes, Folke) and further to more radical view on performativity (Callon, Latour). I recommend the authors ground their analytical framework on the existing literature on the matter and be explicit on their approach.</p> <p><u>Concerning point 3.</u> In Chapter 2.3 the authors suddenly bring in the discussion on resilience and its understanding of the use of knowledge in decision-making. I recommend this chapter to be removed and incorporated to 2.1. and to 2.2 with relevant parts. In 2.1. the analytical question relates to the specificities of biodiversity and ecosystem services that need to be taken into account when assessing and developing the models and scenarios for decision-making. How they challenge the current decision-making structures and what own challenges arise for the use of models and scenarios from here. As important as it is to arrange knowledge for decision-making contexts as important it is to understand how precisely the new modes of knowledge and new matters of concern challenge them.</p>		corner than this reviewer based on the references recommended. However, a solid theoretical foundation it is. 'Concerning point 3': we agree that the resilience introduction is oddly placed and we have done away with this. We have avoided discussion of new modes of knowledge because we don't really know what this is.
157		3	19	3	27	This paragraph is repetitive and could possibly be deleted.	Karen Kirkman (KK)	Done.
158		4	1	5	5	The text crates the false impression that decisions are generally made in a structured way, however in reality decision-making processes more resemble the "muddling through" model than the structured, ideal process that the text describes. I would suggest adding a line or two that points to the fact that reality is far from theory.	Marta Vetier (MV)	We have attempted to be clear from the start that most decisions are ad-hoc, and not explicitly environmental decisions.
159		4	6	4	8	School example can be deleted, given the detailed explanation of "policy" is followed.	Jiyuan Liu (JYL)	Done.
160		4	19			Add the reference: Day J.W., Moersbaecher M., Pimentel D., Hall C., and Yáñez-Arancibia A. (2014), Sustainability and place: how emerging mega-trends of the 12st century will affect humans and nature at the landscape level. Ecological Engineering, 65, 33-48.	Alejandro Yáñez-Arancibia (AYA)	Given the context of the sentence, this reference did not fit.
161		4	32			Add the reference: Yáñez-Arancibia A., Day J.W., and Reyes E. (2013), Understanding the coastal ecosystem-based management approach in the Gulf of Mexico. Journal of Coastal Research, SI 65, 244-262.	Alejandro Yáñez-Arancibia (AYA)	The scope of this reference seems too narrow for the statement being

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								made.
162		6	4	6	4	Table 2.1.2. Perhaps I am missing it here, but what about economic impacts?	Karen Kirkman (KK)	They're not really a 'differentiating' decision context because economics is in every human decision.
163		6	32			Add the reference: Yáñez-Arancibia A., Day J.W., and Reyes E. (2013), Understanding the coastal ecosystem-based management approach in the Gulf of Mexico. Journal of Coastal Research, SI 65, 244-262.	Alejandro Yáñez-Arancibia (AYA)	The scope of this reference seems too narrow for the statement being made.
164		7	1	7	12	What about discussing the impact of weighting to make decisions under governance? Often the political agenda has a higher weighting than the model outcomes, and irrespective of the model, it will still not swing decisions because of other agendas.	Karen Kirkman (KK)	We do discuss political agendas in the barriers section (2.6).
165		7		30		2.2 is now a very long chapter. Is all this detail on different models and tools needed? I recommend a more coherent treatment of the different approaches in line with the framework laid out in the ch. 2.1. - What they assume about the use of knowledge and the nature of decision-making? - In what kind of decision-making contexts they have been used? - The practical examples are nice and usefull. The different approaches relying on same ontological frameworks could also grouped together in order to highlight their contextual applicability better. The reader would also like to know how the different approaches presented here were chosen. How the election was made, what were the methodological tools for doing that? Ch. 2.2.13 can be removed all together. I recommend only one synthesising chapter in the end of the chapter 2.2. The box in page 29 is a nice start for this. The synthesis need to be discussed in lines with the framework outlined in Ch. 2.1.	Minna Kaljonen (MK)	We have attempted to address the 'what they assume, what decision context was used' questions. We went for a broader grouping as the ontologies seemed too difficult to disentangle in the more integrative methods. Different aspects of synthesis were teased out in the last three major sections.
166		7	17	27	34	The whole section 2.2 needs to become more consistent. - Boxes with concrete examples of application of the discussed tool are very helpful, I would suggest to ensure all tools are supplemented with concrete examples - Strength and weaknesses of some tools are discussed which is welcome. It would be good to have it added to all - The described tools are useful in different stages of the policy cycle, I would suggest to make it more explicit which section they fit into	Marta Vetier (MV)	Space constraints preclude first recommendation. Attempted strengths/weaknesses throughout policy cycle context recorded.
167		7	17	7	17	General comment. The various models are each discussed in section 2.2, but what	Karen	Strengths and

Nr	Chapter	From page	From line	Till page	Till line	Comment	Reviewer Initials	What was done with the comment
						I miss is some statement at each, which simply points out strengths and weaknesses (was done for some, but not others), and also what the successful implementation and use of each at policy or management level was if possible.	Kirkman (KK)	weaknesses added in new table and in each text.
168		7	20	19	22	This part introduced nine methods for decision-making in diverse, planning and management contexts. However, readers cannot find the advantage and disadvantage of the models, and do not know the application rules of these methods, including how to choose the methods for different scales and objectives.	Jiyuan Liu (JYL)	Done.
169		7	20	30	42	Section 2.2, overall. There was an inconsistent structure to the subsections; the level of detail varied considerably; not all subsections included a case study as promised (p. 7, line 31).	Mike Runge (MCR)	Structure of section 2.2 has been reworked to improve clarity and consistency. The wording has been changed to reflect that there aren't case studies for each subsection.
170		7	20	30	42	I'd suggest reorganizing Section 2.2 a little bit. The first set of tools (2.2.1 through 2.2.6) are bona fide tools from the decision analysis literature, which apply to certain classes of problems. The remainder of the tools are, in essence, different "brands" of decision-support—collections of more primary tools coupled with facilitation processes—that were again developed with certain kinds of problems in mind. I think it would be useful to distinguish the primary decision-analysis tools from the higher-order processes for employing them.	Mike Runge (MCR)	Most of these recommendations have been adopted. Language now reflects this distinction between the primary tools and the more integrative, and multi-faceted processes.
171		7	20	7	35	I would try to shorten this section.	Karen Kirkman (KK)	Done.
172		7	37	8	13	Section 2.2.1. This is an inadequate treatment of a huge literature on risk analysis. Some of the seminal texts on risk analysis for natural resource management problems (e.g., Burgman's text) are not cited. It would be useful to note that these tools are needed anytime there is uncertainty that cannot be reduced, that is, when decisions have to be made in the face of risk.	Mike Runge (MCR)	Burgman cited. Suggestion to expand partially adopted.
173		7	40	27	35	In section 2.2, those models and methods are described one by one in details. However, there are no logistic relationship within the models, which make this parts not only takes up too many pages, but also difficult to be understood because the characteristics and advantages do not be summarized. It is better if the models and methods are cataloged into few types and organized from simple to complex according to the dimensions described in Table 2.1.2—policy scale,	Jiyuan Liu (JYL)	More attempt now made to summarise.

Nr	Chapter	From page	From line	Till page	Till line	Comment	Reviewer Initials	What was done with the comment
						cultural context, geography, flows, temporal dynamics, and decision process.		
174		8	10	8	13	I would consider deleting this paragraph. It is repetitive and already discussed below.	Karen Kirkman (KK)	Done.
175		8	23	8	29	These sentences seem out of place in this section.	Mike Runge (MCR)	Removed.
176		8	30	8	35	Table 2.2.2 is not clearly described, what does A1, A2, ...A6 mean? How the 'low', 'high' etc. was decided?	Jiyuan Liu (JYL)	Now clearly explained.
177		9	9	9	17	Section 2.2.3. Again, a huge topic with a robust literature that is not given suitable treatment. Note that, as is, there is a lot of detailed jargon that goes unexplained ("welfare economics", "non-market impacts", "stated preferences", "revealed preferences", "discounting", etc.) These are all very important concepts and deserve more in depth treatment. This section needs to be re-envisioned.	Mike Runge (MCR)	The section has been expanded slightly in line with space constraints.
178		9	10	9	17	Very little weight is given to cost-benefit analysis, despite the fact that this might be one of the decision-support tools that decision-makers are most familiar with. I would suggest to expand section 2.2.3 more, so that it gets similar details as the other tools.	Marta Vetier (MV)	As above, the section has been expanded slightly in line with space constraints.
179		9	10	9	17	Session"2.2.3 Benefit-cost analysis", it's better to change into "Cost-benefit analysis" –CBA which is commonly used. It is recommended to add "Cost-effectiveness analysis", which is being increasingly considered as an important method for the evaluation of the consequences of the input especially for these which cannot be valued through market approach.	Jiyuan Liu (JYL)	Done.
180		9	14	9	17	The BIOMOT project (biomot.eu) lists some more weaknesses that economic valuation has. These could be added to the text.	Marta Vetier (MV)	We think the weaknesses of valuation are adequately addressed already.
181		9	19	10	2	Section 2.2.4. It would be useful to explain that LP and SDP are single-objective optimizations. They can accommodate additional objectives only as constraints.	Mike Runge (MCR)	Done.
182		10	5	13	3	MCDA is given disproportionately too much weight. I would suggest to cut the text and focus on its applicability to biodiversity and ecosystem services.	Marta Vetier (MV)	Multi-criteria decision analysis (MCDA) is very widely used.
183		11	2	11	2	What does SFMS stand for? It is the first time the acronym appears in the section, it would need explanation.	Marta Vetier (MV)	Removed.

Nr	Chapter	From page	From line	Till page	Till line	Comment	Reviewer Initials	What was done with the comment
184		11	32	12	11	Section 2.2.5.3. Another purpose and strength of outranking methods is that they can deal with preferential dependence, which, as noted earlier, the MAVT and related methods cannot deal with. Because preferential dependence is likely present in many real problems, this makes outranking methods attractive.	Mike Runge (MCR)	Too technical for this audience.
185		12	13	12	25	Section 2.2.5.4. I think this is a somewhat unfair treatment of MAUT. First, I think it would useful to note that MAUT is essentially a marriage of MAVT and risk analysis, allowing both the multiple-objective and the risk (utility) tools to be brought to bear on a problem. Given that many real problems contain these features, that's a good thing. It may be rare to employ this tool in its fullness, but that may be more a result of our lack of training in implementation, rather than in any limitations of the method itself. Sure, there are lots of cognitive demands on the decision-maker to employ this, but the decision-maker has to deal with multiple-objective trade-offs and risk tolerance in making the decision anyway, so why not help make those elements more explicit?	Mike Runge (MCR)	Partially adopted. The language of the subsection has been altered and softened to reflect the usefulness of the link to risk analysis that multi-criteria utility analysis (MAUT) provides. However, the point that few full examples of MAUT can be found in real world applications remains, as the authors believe this to be an accurate assertion.
186		12	26	12	26	Put this box closer to the area explaining MCDA. The box also gives unnecessary information. And does not really give any useful outcomes on success or adoption of the approach.	Karen Kirkman (KK)	Done.
187		12	27	13	3	Case Study. So, what happened? Was a decision made and implemented? What were the outcomes? Is this viewed as a success by the decision-maker and the participants?	Mike Runge (MCR)	Point about public feedback added.
188		13	28	14	1	Box 2.2.6. Change "has been working for 10 years" to "has been working since 1995". You might also note that the optimal solution to this problem is found with stochastic dynamic programming. There are also some recent papers that document how the weights have been changing over time.	Mike Runge (MCR)	Added.
189		14	3	14	18	Session "2.2.7 Scenario planning", maybe necessary to add discussion on the build-in uncertainty, and address that combination of several different models for scenario analysis are needed in order to reduce the uncertainty which may cause.	Jiyuan Liu (JYL)	Done.
190		14	3	14	3	Delete the comma between probable and futures	Jiyuan Liu (JYL)	Done.
191		14	3	14	18	How the scenarios are developed? I do not fully agree on the ways that described in this paragraph. In many cases, scenarios development need a models	Jiyuan Liu (JYL)	The manner of scenario

Nr	Chapter	From page	From line	Till page	Till line	Comment	Reviewer Initials	What was done with the comment
						projections, such as IPCC GHG emission scenarios, climate change scenarios, etc.		development is not a key theme here.
192		15	15	15	15	It is unclear, why the value judgment: “This project was ambitious” appears in the text. I would suggest to delete this judgment	Marta Vetier (MV)	Removed.
193		15	23			After the end of line 23 Add the following paragraph: The sustainability of natural and human systems in the United States in relation to energy scarcity, climate change, the loss of ecosystem services, the limitation of neoclassical economics, and human and settlement patterns will result in large challenges for modeling sustainable development coupling biodiversity, natural productivity, and resources management (Day et al. 2014). The reference is as follows: Day J.W., Moersbaeche M., Pimentel D., Hall C., and Yáñez-Arancibia A. (2014), Sustainability and place: how emerging megatrends of the 21st century will affect humans and nature at the landscape level. <i>Ecological Engineering</i> , 65, 33-48.	Alejandro Yáñez-Arancibia (AYA)	Too text heavy.
194		17	24	17	25	Is ‘consequence table’ mentioned here the same as Table 2.2.2 at page 8? In order to make the document consistent, it is always good to have the common basis for discussion.	Jiyuan Liu (JYL)	Yes.
195		21	6	24	1	2.2.10. This section is difficult. I cannot really understand from this section what this method is or <i>how it works</i> . If this section was written by someone who is very familiar with SEA, it might be useful to work with someone who is not, to translate it into language that is more accessible to a broader audience.	Mike Runge (MCR)	Strategic environmental assessment (SEA) section substantially altered.
196		21	8	21	8	Spelling mistake, correctly: Partidario (with “t” in the middle)	Marta Vetier (MV)	Done.
197		23	21	24	1	Box. The box gives no real information on if this was in fact implemented, and were the results adopted into policy.	Karen Kirkman (KK)	Case study changed.
198		24	11			At the end of line 11, Add the reference: Day and Yáñez-Arancibia (2013). The reference is as follows: Day, J.W., and Yáñez-Arancibia A. (Eds.) 2013, <i>The Gulf of Mexico Ecosystem-Based Management. The Gulf of Mexico Origin, Water, and Biota Series, Volume 4</i> . Texas A&M University Press, College Station TX. ISBN-13: 978-1-60344-765-2. 460 pp.	Alejandro Yáñez-Arancibia (AYA)	As in principle, the same message has been communicated by citing other papers already, we decided not to add the proposed reference.
199		25	9			At the end of line 9 add the reference (Yáñez-Arancibia et al. 2013). The reference is as follows:	Alejandro Yáñez-	Due to space limitations we were

Nr	Chapter	From page	From line	Till page	Till line	Comment	Reviewer Initials	What was done with the comment
						Yáñez-Arancibia A., Day J.W., and Reyes E. (2013), Understanding the coastal ecosystem-based management approach in the Gulf of Mexico. Journal of Coastal Research, SI 65, 244-262.	Arancibia (AYA)	forced to keep the number of papers limited and as above felt that the message had been communicated adequately through other citations.
200		25	11	25	19	GIS is not a recent development. I would discuss the use of GIS separately perhaps and role it plays in decision making .	Karen Kirkman (KK)	This section was removed as it wasn't deemed relevant
201		25	37	25	44	I think that another critical policy challenge with TIP is keeping the methods focused on bona fide fundamental objectives, rather than the hidden values assumptions of the GIS experts. Maps are very attractive, but they can hide an extraordinary number of values-based assumptions.	Mike Runge (MCR)	Deleted.
202		26	1	26	1	Box. Does not provide information on the outcome of the model. Was it adopted into policy, or did it effect management?	Karen Kirkman (KK)	Changed.
203		26	2	27	25	This section provides too much detail, and could be shortened.	Karen Kirkman (KK)	Deleted.
204		26	3	27	25	The so-called "The Delphi technique" described here can be used in many other cases for decision making. I would prefer to consider this specific step-wide description as an approach and implementation tool that can be generally used for scenario development and the results evaluation and assessment.	Jiyuan Liu (JYL)	We indicate that it has wide use - in scenarios, expert opinions, and decision making.
205		26				In many boxes such as box 2.2.11, it should provide some figures to help understanding, like IPCC AR5 report, instead of only text. Such boxes are important and useful	Jiyuan Liu (JYL)	Figures added to each.
206		27	26	27	34	Box. Not really useful or helpful. Commentary only. Rerword or delete.	Karen Kirkman (KK)	Deleted.
207		27	35	27	35	Beside the traditional methods mentioned in the manuscript, agent based model is going to be an efficient decision support tool for incorporating ecosystem services into land use planning by virtue of the modle have the ability to integrate human behavior and natural context into an coupled social-ecosystem model. For example, Chen, X., A. Viña, A. Shortridge, L. An, and J. Liu. 2014. Assessing the Effectiveness of Payments for Ecosystem Services: an Agent-Based Modeling Approach, Ecology & Society, DOI: 10.5751/ES-05578-190107	Jiyuan Liu (JYL)	While I agree that agent-based models are extremely useful, they are a model of human interactions with the environment – they are not a decision approach. Hopefully

Nr	Chapter	From page	From line	Till page	Till line	Comment	Reviewer Initials	What was done with the comment
								agent-based models are detailed in chapters 4 and 5.
208		27	35	27	35	I understand that Section 2.2 was not meant to be a comprehensive review of all the decision processes out there, but there is one important one that is missing: The Open Standards for Conservation (including as a particular branding the Miradi software, and also including TNC's CAP methods). This is arguably one of the most widely applied sets of methods.	Mike Runge (MCR)	Agreed. Added.
209		27	38	27	38	How do we define success? Is it an accurate outcome or action use and adoption of a model. I would suggest there is not enough thinking through why a good model is still not adopted in this chapter.	Karen Kirkman (KK)	Section significantly expanded.
210		28	9	28	18	I don't agree that there is any particular impediment to the application of formal decision analysis methods to biodiversity and ecosystem services management. I think the reason there are fewer applications than in other fields are two-fold: (1) we are simply just later to the game; and (2) until recently, we have treated environmental management problems as "science" problems, not decision problems. I think this mistaken emphasis on science as the solution to natural resource management has undermined the very important values-based aspects and led us astray for several decades. Alas.	Mike Runge (MCR)	These concerns are mostly embodied in the section on 'barriers' (2.6). Except the 'late to the game' call, which the authors are not convinced they agree with, believing the issue runs deeper than this.
211		28	20	29	30	It looks like there are similar information and context between Figure 2.2.14 (without spatial scales) here and Table 2.1.2 at page 6. Integration of these two sessions will be useful for clarify the objectives, contents and spatial coverage of the methods for decision making.	Jiyuan Liu (JYL)	Deleted.
212		28	23	28	32	This section is confusing, and could be reworded.	Karen Kirkman (KK)	Deleted.
213		29	1	29	1	Fig. 2.2.14. Please add a legend for the circles. What are the other case studies that are graphed on these axes?	Mike Runge (MCR)	Added.
214		29	28	29	29	This fact, which overrides all implementation at policy and management level is not really discussed in this chapter. What about a section on what will be needed to improve implementation, such as obtaining political buy in before a process is initiated, identifying key stakeholders and decision makers early in a process, obtaining commitment to processes, etc.	Karen Kirkman (KK)	We have identified these as barriers and provided some discussion about how to approach this (2.4-2.6) – but perhaps not into the depth this reviewer

Nr	Chapter	From page	From line	Till page	Till line	Comment	Reviewer Initials	What was done with the comment
								would like. However, space limitations prevent further discussion.
215		29	31	42	30	Session 2.2.15: could be merged with previous session 2.2.7 at page 14, or with “introduction” at page 4. In order to have a specific session about the concept, framework, and role of scenarios in ecosystem service and biodiversity conservation.	Jiyuan Liu (JYL)	Removed.
216		31	1	37	21	The section 2.3 should give some specific examples for how to model the right thing at the right scale, and how to choose the right models and scenarios for the user.	Jiyuan Liu (JYL)	Removed.
217		31		37		As it is now, chapter 2.3 does not work. It now brings in a whole new discussion on the use of knowledge in decision-making from the point of view of resilience. It is just one view on the issue that should be addressed in 2.1 and under adaptive management in 2.2. Ch. 2.3 should bring together the framework laid out in 2.1 and the various approaches presented in 2.2 and discuss further how can we develop the different decision-making tools to address the different decision-making contexts AND the specificities biodiversity and ecosystem services.	Minna Kaljonen (MK)	Removed.
218		31	4	34	10	I would suggest shortening this entire section to only the minimum.	Karen Kirkman (KK)	Done.
219		31	12	31	12	“These major attributes of biodiversity and ecosystem services...” I think the attributes referenced (composition, structure, and function) are attributes of biodiversity, not of ecosystem services. In Fig. 2.3.1, you might think about adding a column for ecosystem services, then fill in the cells with the kinds of ecosystem services that are delivered at the genetic, species, ecosystem, and landscape levels? Something like that. It just seemed that the Figure is designed to talk about biodiversity, and leaves out ecosystem services.	Mike Runge (MCR)	Removed.
220		31	25	31	25	Style of arrows in X and Y axis in Figure 2.3.1 can be changed in order to reflect different levels.	Jiyuan Liu (JYL)	Removed.
221		33	14	33	41	2.3.1.3. This is related to the previous comment. I found this section quite hard to follow. I thought this section was going to be about ecosystem composition, structure, and function. To me, the ecosystem services are a separate topic.	Mike Runge (MCR)	Removed.
222		33	33			After the period add the following paragraph: Additionally at present the four mangrove species in the Gulf of Mexico, represents a sentinel ecosystem in front of climate change impacts and a model of species redistribution colonizing the entire Gulf because of the global tropicalization of the Gulf of Mexico (Yáñez-Arancibia et al. 2014). The reference is as follows: Yáñez-Arancibia A., Day J.W., Twilley R.R., and Day R.H. (2014), Mangrove swamps: sentinel ecosystem in front of climate	Alejandro Yáñez-Arancibia (AYA)	Due to space limitations we were forced to keep the number of papers limited, and as above felt that the message had been

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						change, Gulf of Mexico. Madera y Bosques, 20, 39-75 [in Spanish and English].		communicated adequately through other citations.
223		33	43	34	10	2.3.1.4. This section doesn't yet address the topic it is purported to address. The topics in the relevant cells of Fig. 2.3.1. do address what is supposed to be in this section, but the text is off topic.	Mike Runge (MCR)	Removed.
224		34	14	34	19	This paragraph is confusing.	Karen Kirkman (KK)	Removed.
225		35	10	35	15	Pls improve the quality (colors) of the Figure 2.3.2.	Jiyuan Liu (JYL)	Done.
226		35	22	36	5	Session "2.3.2.2. Social cross-scale linkages": it is understood that little research is done on this. However, it will be useful to indicate here that what are social cross-scale and their linkages, at least by concept and classification, in order for the readers to get a basic and clear structure on this.	Jiyuan Liu (JYL)	Revised.
227		36	9	37	21	2.3.3. The content of this section does not address the title of the section. Accuracy, precision, complexity, and interpretation, and communication are not addressed. The entire section needs to be re-envisioned and rewritten. The second and third paragraphs in this section seem to be out of place.	Mike Runge (MCR)	Revised.
228		36	9	37	21	I think this section needs to be redone. Consider concentrating on the actual issues around why the model is not adopted into policy or management. See my comments under section 19 also. It is more important to unpack how to involve the correct stakeholders, decision makers, etc..	Karen Kirkman (KK)	Addressed now.
229		37		46		I liked chapter 2.4 for its coherence and the way in which it approached the issue of uncertainty in a multidimensional manner. However, as it is, it partly overlaps with the previous chapters. Hence, I wonder, should the issue of uncertainty be dealt with separately or as a dynamic part of decision-making (which it actually is). In the latter case, the issue of uncertainty (and its different constellations) should be discussed already in Ch. 2.1, where the different angles on knowledge use are dealt with. And as one aspect in assessing the different decision-making tools in 2.2. It could also form one own theme in the synthesis chapter 2.3. If an own chapter is dedicated to this matter, it should be very precise and right to the point. It should complement the previous chapters, not build a whole new treatment of the matter.	Minna Kaljonen (MK)	Overlaps addressed and section shortened.
230		38	5	38	6	2.4.2. The concept of "unknown unknowns" is never addressed	Mike Runge (MCR)	Done.
231		38	7	39	2	2.4.2. This paragraph needs considerable revision. It seems to say, "there are lots of taxonomies of uncertainty. Here's how confusing they are." And it doesn't	Mike Runge	Removed.

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						offer any clarity. Better to choose or synthesize a taxonomy you can support, then use that to organize the rest. No need to perpetuate confusion.	(MCR)	
232		38	31	39	2	That said, I don't mind the taxonomy you then offer. It's a useful one (but see comment below about linguistic uncertainty.)	Mike Runge (MCR)	Removed.
233		39	5	39	27	2.4.2.1. The only thing I'd add to this section is that stochastic (or aleatory) uncertainty is irreducible. That's an important feature for a decision-maker: you have to live with it.	Mike Runge (MCR)	Mentioned.
234		39	21	39	27	Is this paragraph necessary? This is also discussed in chapter 3 and 4.	Karen Kirkman (KK)	Removed.
235		39	29	41	6	2.4.2.2. Several comments: (1) Important to note somewhere that scientific (epistemic) uncertainty is, at least theoretically, reducible. This is important because it means we might do research before making a decision or we might do adaptive management. Might want to mention the value of information calculus (either here or later under tools, see below).	Mike Runge (MCR)	Dealt with in adaptive management section.
236		39	29	41	6	(2) I don't think I'd put linguistic uncertainty in the same category as scientific (parametric and structural) uncertainty. Yes, they're both reducible, but otherwise, the processes you use to handle them are quite different. I'd add a category for linguistic uncertainty.	Mike Runge (MCR)	Changed.
237		39	29	41	6	Is this not further described in Chapter 4? I would shorten or delete this section	Karen Kirkman (KK)	Removed.
238		41	8	42	10	2.4.2.3. I struggled a little with this category of uncertainty, at least as presented. I absolutely agree that there is another category of uncertainty—I guess I'd call it policy or values uncertainty—in which the values aspects of a decision analysis (e.g., the weights on objectives, the objectives themselves, the risk tolerance, etc.) is uncertain. Great idea to include that in a taxonomy. I think my struggle is with the Granberg et al., (2008) taxonomy. In my mind, (a) cognitive uncertainty is the same thing as scientific uncertainty, which you've already covered; (b) strategic uncertainty is really for topics where game theory is the right set of tools to employ—these are uncertainties about how the system will respond to your actions, but understanding that the system includes other actors—that's not a policy uncertainty so much as a scientific uncertainty (if you understand the system to include the social system). I think that (c) institutional uncertainty is actually part of a bigger class of issues, that could go under "decision uncertainty", regarding uncertainty in how to frame a decision (who's the decision maker, what spatial scale to tackle, what's the right institutional framework). Then, (d) normative uncertainty is definitely what I'd put in the category of policy uncertainty. So, I think I'm saying take (a) and (b) out of this section and put them into scientific uncertainty.	Mike Runge (MCR)	Yes. This has caused controversy. The Technical Support Unit has a taxonomy now, and that is what it is called.

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239		42	11	42	41	2.4.3. This needs substantial revision. First, I sure wouldn't start with SDP and POMDP, which are tools for a narrow and complicated class of problems. Rather, I would start with the distinction between tools for irreducible uncertainty (risk analysis tools) and tools for reducible uncertainty (value-of-information tools). You can add in at the end that there are tools for uncertainty in dynamic systems (SDP and POMDP); and POMDP is particular integrates both the value of information and the risk analysis pieces, but don't dwell on that. There's a lot to cover just with the basics of how risk analysis and VOI address the primary types of uncertainty. What about tools for linguistic and decision uncertainty?	Mike Runge (MCR)	Yes. Addressed/revised.
240		42	12	42	41	Session 2.4.3 describes the technical approach to reduce uncertainty in decision making, however, how to realize this is a challenge. It needs to be stressed in this session or in the following session 2.4.5.	Jiyuan Liu (JYL)	Yes.
241		42	12	42	41	In Session 2.4.3: it might be necessary to introduce how to reduce uncertainty through integrated use of different models for cross-check the results and identifying the gaps which may cause from application of a single model.	Jiyuan Liu (JYL)	Some approaches are now described; however, this is a big field so not all are able to be addressed here.
242		42	13	42	30	Technical approaches to dealing with uncertainty should mention the technological approaches to deal with models and scenarios uncertainties.	Jiyuan Liu (JYL)	Done.
243		42	42	44	18	2.4.4. There's a lot of space (3 long paragraphs) dedicated to just two papers, in essence (Peterson et al. 2013, Waedekker et al. 2008). It didn't seem like that was a comprehensive treatment of this topic. Can you condense the material on those two papers, and add in other literature on this topic?	Mike Runge (MCR)	Now one sentence.
244		44	20	46	25	The uncertainty exists in all of the scenarios and models. Could we present the probability of the uncertainty in the process of using scenarios and models for decision-making? So the probability can help the decision maker to understand the uncertainty.	Jiyuan Liu (JYL)	Yes.
245		44	20	44	40	Some technical approaches are also needed and important to deal with uncertainty in scenarios and models, besides through participatory and deliberative decision-making process.	Jiyuan Liu (JYL)	Yes. Incorporated.
246		45	11	45	14	Figure 2.4.4 can be further explained by adding scales and more approaches, etc.	Jiyuan Liu (JYL)	Yes.
247		45	12	45	14	Figure 2.4.4. I had a tough time understanding this figure and the related text. Are there meant to be two orthogonal axes (complexity and reducibility) or just one axis (as shown in the Figure)?	Mike Runge (MCR)	Removed.
248		45	16	46	24	While there are few participatory, deliberative decision-analysis processes <i>that have a branded name</i> (CAMA, DMCE), that does not mean there aren't plenty of decision-analysis processes that have been implemented in a participatory and	Mike Runge (MCR)	Removed.

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						deliberative manner. There are a very great many examples, 100s if not 1000s. They just haven't been given a name that brings attention to them. One self-serving example (Runge et al. 2011a) is already cited elsewhere in this paper. I understand that it is a huge task to try to compile and summarize such instances, but it would be worthwhile to note that, in practice, there are many such applications.		
249		46	26	47	14	2.5. This section is, indeed, incomplete. I assume the team will revisit this section in their next meeting and outline a much fuller set of key challenges and opportunities.	Mike Runge (MCR)	Done.
250		46	26	47	15	This would be the key to the chapter, but has not been completed.	Karen Kirkman (KK)	Done.
251		46	41	47	14	Scaling is an important issue which should be addressed throughout the report. For instance, from the introduction, to the scenario planning/development and modelling, etc., scale should be considered and included.	Jiyuan Liu (JYL)	We touch on it.
252		50	41			After the reference of Cumming et al. (2006), Add the following reference: Day J.W., Moersbaecher M., Pimentel D., Hall C., and Yáñez-Arancibia A. (2014), Sustainability and place: how emerging mega-trends of the 12st century will affect humans and nature at the landscape level. Ecological Engineering, 65, 33-48.	Alejandro Yáñez-Arancibia (AYA)	Due to space limitations we were forced to keep the number of papers limited, and as above felt that the message had been communicated adequately through other citations.
253		50	42			After the reference of Day et al. (2014) above indicated, Add the following reference: Day, J.W., and Yáñez-Arancibia A., Eds. (2013), The Gulf of Mexico Ecosystem-Based Management. The Gulf of Mexico Origin, Water, and Biota Series, Volume 4. Texas A&M University Press, College Station TX. ISBN-13: 978-1-60344-765-2. 460 pp.	Alejandro Yáñez-Arancibia (AYA)	Due to space limitations we were forced to keep the number of papers limited, and as above felt that the message had been communicated adequately through other citations.
254		60	48			After the reference of Zacharias and Roff (2000), Add the following reference: Yáñez-Arancibia A., Day J.W., and Reyes E. (2013), Understanding the coastal ecosystem-based management approach in the Gulf of Mexico. Journal of Coastal Research, SI 65, 244-262.	Alejandro Yáñez-Arancibia (AYA)	Due to space limitations we were forced to keep the number of papers limited, and as above felt that the message had been

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								communicated adequately through other citations.
255		60	48			After the reference of Yáñez-Arancibia et al (2013) above indicated, Add the following reference: Yáñez-Arancibia A., Day J.W., Twilley R.R., and Day R.H. (2014), Mangrove swamps: sentinel ecosystem in front of climate change, Gulf of Mexico. Madera y Bosques, 20, 39-75 [in Spanish and English].	Alejandro Yáñez-Arancibia (AYA)	Due to space limitations we were forced to keep the number of papers limited, and as above felt that the message had been communicated adequately through other citations.