DEPARTMENT OF ECONOMIC AND SOCIAL AFFAIRS
STATISTICS DIVISION
UNITED NATIONS

System of Environmental Economic Accounting

System of Environmental-Economic Accounting 2012 –Experimental Ecosystem Accounting Revision

First Global Consultation on:

Chapter 3: Spatial units for Ecosystem Accounting

Chapter 4: Accounting for Ecosystem Extent

Chapter 5: Accounting for Ecosystem Condition

Comments Form

Deadline for responses: 30 April 2020
Send responses to: seea@un.org

Name:	Dennis Fixler*
Organization & country:	Bureau of Economic Analysis, United States

*With comments and contributions from Ken Bagstad (kjbagstad@usgs.gov), Julie Hass (jlhass@gmail.com), Charles Rhodes (charlesrrhodes@gmail.com), and Scott Wentland (scott.wentland@bea.gov)

The comment form has been designed to facilitate the analysis of comments. There are nine guiding questions in the form, please respond to the questions in the indicated boxes below. To submit responses please save this document and send it as an attachment to the following e-mail address: seea@un.org.

All documents can be also found on the SEEA EEA Revision website at: https://seea.un.org/content/seea-experimental-ecosystem-accounting-revision

In case you have any questions or have issues with accessing the documents, please contact us at seea@un.org

Preface

Thank you for the opportunity to review these chapters and participate in the global consultation. We have carefully reviewed the chapters and our comments below can be categorized in two ways: 1) specific, technical comments on the draft contents and pertinent to the questions below, and 2) broader, more fundamental issues. The former comments tangibly provide ways for the authors of the manual to improve the manual incrementally, while the latter offer more foundational feedback that call into question serious issues with chapters' content (see, for example, our comments in questions 7 through 9). We hope that this set of comments will be helpful in further revisions of the manual.

Question 1: Do you have any comments on the definition and description of ecosystem assets and ecosystem accounting areas and the associated measurement boundaries and treatments?

1. As a general comment on terms, the use of "SEEA" in the text is confusing. It does not appear to be a reference to SEEA Central Framework but is rather a reference to the Ecosystem Accounting which has been called SEEA Experimental Ecosystem Accounts. The use of "SEEA" in the text appears similar to the way "SNA" is used, but there is no confusion when using SNA, whereas the principles, system boundaries, etc. are very different from SEEA-CF to the SEEA-EEA. Therefore, the use of "SEEA" alone does not definitively reference a certain set of principles, treatments, and boundaries. This needs to be changed throughout the revised SEEA EEA draft chapters to make it very clear that these are referring to the SEEA-EEA principles, system boundaries, etc. When the reference is to the SEEA Central Framework, this should be clearly stated in the text.
2. In Chapter 3, page 3, paragraphs 3.10 and 3.11, a principle may be applied in conflicting ways. Beginning with a 2-D description of extent, the air above and the subsoil below are included within that EA/ET. Not being a spatial accounts specialist, one could arrive at this conclusion independently, overturning a key element in early US EPA's ecosystem service classification work by spatial area. However, in reading further there seems to be a direct conflict with the last sentence in 3.11. Considering the non-bio layers of atmosphere above an ET to be a potentially separate ET may not be consistent. It would help to offer an example of when that distinction may prove useful. There is currently no "higher atmospheric air" component in the ET breakdowns in Table 3.3. A strict reading of the IUCN from Level 1 down to Level 6 (Keith et al. 2020, footnote link on p10) has an Air biome, but it is not clear that this could be divided down to Level 3 (it is implied in the text, being deleted in the figure for cleaner conceptual lines within the figure). Level 3 is the ecosystem functional groups (EFGs) that will be the backbone of ecosystem accounting. So if the air above an ET is not an infinite column (past the biozone), and there is no "air" ET type in the ET classification summaries, then reference in 3.11 to relevant air pollution (above the biozone) seems not to fit in the condition and ecosystem services accounts? This would be a problem, as it would leave certain human impacts on biological processes and resulting ecosystem services flows invisible in accounts designed to appreciate them.
3. §3.5 provides a definition of an Ecosystem asset (EA), but only in Annex 3.1 is it stated that that these are equivalent to a biotope. It is stated "A biotope is a topographic unit and can be considered to be equivalent with Ecosystem Asset." (Annex 3.1, page 17 last sentence in first paragraph). It is important

when establishing the terminology to be used in ecosystem accounting that existing terminology that is equivalent is clearly identified in the main text. Consider moving this explanation into the main text so this equivalency in terminology between these two fields is clear.

4. Regarding Figures 3.2 and 3.3; Annex 3.3:(a) Figure 3.2: Label in area EA1(EA1) should be EA1(ET1) – this same area in Figure 3.3 is correctly labelled.(b) Annex 3.3, §5, last sentence, clearly states, "...to ensure that all grid cells are of the same size." However, in Figure 3.3, Row 5 is a different size. Is this a typo or is this something else not explained in the text?
5. While there is some discussion of aggregation, it is often matter of fact and with a focus on physical aggregation and various layers. But, this is a fundamental issue in economic accounting for the SNA and should have greater attention in this chapter, particularly as it relates to monetary aggregation. Para 3.16 states: "Within one country different EAA may be delineated for different purposes and hence EAA may overlap, i.e. each EAA would contain common EAs. However, the accounts for each EAA will be discrete and no double-counting is implied. Nonetheless, aggregation of EAA should only occur where the boundaries are not overlapping."

   What are examples where there is no overlap? Is this the rule or the exception for ecosystem assets/services? And, when there is overlap, how do we aggregate to national and subnational levels where we avoid key economic issues of double-counting for the monetary accounting of ecosystem assets and services? Overall, much of the spatial discussion focuses on the appropriate accounting of the physical ecosystem accounts, while the challenge becomes far more difficult and in need of guidance when it involves aggregating monetary accounts.

Question 2. Do you have any comments on the use of the IUCN Global Ecosystem Typology as the SEEA Ecosystem Type Reference Classification?

1. §3.40 states that national classifications are recommended, but that if no national Ecosystem asset classification system exists, then the IUCN Global Ecosystem Typology (IUCN GET) can be used or a new classification can be established. But for international reporting and comparison the SEEA Ecosystem type reference should be used – as shown in Table 3.3. In essence, the adoption of the IUCN GET for the first 3 levels can be problematic for the official statistics world.

   The finalized IUCN classification has only been published in Feb 2020 and has not been thoroughly tested for the purpose of creating environmental-economic accounts. The IUCN website specifically states that this system will be revised: "Ensuring the divulgation of the typology among researchers will promote testing and refinements, which will be incorporated into subsequent versions and extension to local levels." Source: https://iucnrle.org/blog/tipolog%C3%ADa-global-de-ecosistemas/.

   Adapting a draft classification into a statistical manual is not a good idea, especially since this is the core structure of the ecosystem accounts. This classification system is not under the auspices of the official statistical system and can be changed at any time to fit the needs of this private organization –

without any consultation from the UNSD or UNCEEA. The IUCN has trade marked its Red List of Threatened Species – and it would be expected that the IUCN GET would also be trademarked. What would this mean in terms of cost to official national statistical offices and the UN to use this trademarked material? It is also under IUCN copyright.

To not have control over the classification and to potentially have to pay to use it or to use data based on this system is against the principles of classification systems in official statistics. Please see The IUCN Red List Terms and Conditions of Use: https://www.iucnredlist.org/terms/terms-of-use#3.%20No%20Commercial%20Use

It is possible that publishing the classification in a manual could mean that copies of the manual could not be sold in the case of a copyright dispute, and technically neither could copies of reports that use the classification in some circumstances. This assumes that this Terms and Conditions of Use which currently applies to the Red List of Species will also apply to the Red List of Ecosystems – especially as the policy is called "Red List Terms and Conditions of Use" and is clearly not specific to the Red List of Species. Also, since the IUCN materials are under copyright, (their policy specifically states: "The IUCN Red List contains copyrighted material and/or other proprietary information and thus, IUCN Red List Data are protected by intellectual property agreements and copyright laws and regulations worldwide.") copying and/or changing the classification system would potentially be a breach of copyright.

2. A related concern is that at this point there is a current lack of 1) global spatial data for IUCN GETs and 2) a "cookbook" for a country to produce its own GET data using its own national datasets as inputs (understanding that national ecosystem type data can be used, but may not be available everywhere, so some countries may want to "build their own" along the lines of GET). If both of these products are being developed, this should help move GET from the theoretical realm toward application and would be an important prerequisite toward its global adoption in the SEEA EEA. However, a detailed review of the IUCN GET reveals several errors or inconsistencies that should be resolved before its widespread use in ecosystem accounting.

   Notably: 1) "Young rocky pavement, lava flows, and screes" are included as a subclass of "Shrubland & shrubby woodland". Reading the Keith et al. 2020 manual it is clear that these are included here because shrubs are expected to be the dominant (if very sparse) vegetation these recently colonized surfaces. But a subclass must fit within the confines of its parent class, and few ecologists would describe new rock surfaces with a few very scattered shrubs as a "shrubland". So either the parent class should be renamed and redefined to include "sparse vegetation with shrubs", or "Young rocky pavement" could be moved into a new level 2 category like "bare earth/rock-dominated terrestrial systems", along with "Polar-alpine cliff, scree, outcrop, and lava flow". 2) A similar problem exists with placing "Temperate woodland" as a subclass of "Savanna and grassland" and not within "Temperate-boreal forests & woodland". Temperate woodlands should either be moved to a subclass of Temperate-boreal forests & woodland or renamed and placed within a rescoped savanna/grassland (and the Temperate-boreal forests class renamed to exclude woodlands). Finally, 3) Keith et al. 2020 mislabels Artificial Freshwater as Artificial Wetland. These sorts of consistency

problems are important to address within a rigorously developed hierarchical typology, and similar problems need to be avoided when levels 4-6 classes become available for use in ecosystem accounting.

3. The IUCN scheme is not hierarchical – specifically, level 5 does not go into level 4, and both Level 5 ***and*** Level 4 go directly into Level 3. This is not how hierarchical classifications work in the official statistical system. The Eurostat definition specifically states that the categories are "mutually exclusive" – which is NOT the case in this classification system. There are also several Biome which are considered in 2 or 3 different realms.

   "A statistical classification or nomenclature is an exhaustive and structured set of mutually exclusive and well-described categories, often presented in a hierarchy that is reflected by the numeric or alphabetical codes assigned to them, used to standardize concepts and compile statistical data." Source: Eurostat (https://ec.europa.eu/eurostat/data/classifications)

   In addition, there has been no guidance developed on how to use this IUCN classification system in the context of developing environmental-economic accounts for ecosystems. This classification has not been tested for the purpose of using it in for developing SEEA-EEA accounts. The plans of the UNCEEA work program clearly state that this is planned for 2020-2021. Until the IUCN GET has been thoroughly tested, it would be unwise to approve it for a statistical manual.

4. Page 6, 3.3.2, notes 1-D and 2-D measures. An issue raised at international meetings on this topic should be echoed here: 3-D can matter – ecosystems that are similar in many aspects, perhaps appearing nearly identical from a satellite, could have different biological profiles and resiliency based on elevation. This concept is not addressed here.

5. Page 11, Table 3.3: As a summary of around 20 ETs this looks attractive and manageable as a level that can be disaggregated on demand. However, a focus on ecosystem services characterized by their location and use suggests that category T7 is likely far too wide for ecosystem services tables, because "Intensive land-use systems" includes every large and immediate human influence, from croplands to dense urban areas. More gradations may be extremely useful to describing specific ecosystem service flows.

6. In Annex 3.2, the breakout of T7 to four sub-categories remains largely inadequate for matching to the breakdowns that the US NCA working group has published for ecosystem accounts, or for any ET typology/classification that traces ecosystem services to ecosystem units (all ES SUTs must). To be clear, the T7 (a-d list) does not adequately break out the ecosystem unit types within the "intensive land-use" set, where most ecosystem services appropriate for the ecosystem services supply and use tables will certainly derive from these specific areas. This lack of categories for some of the most prevalent EAs is problematic and needs to be better developed.

Question 3. Do you have any comments on the recording of changes in ecosystem extent and ecosystem condition, including the recording of ecosystem conversions, as described in chapters 4 and 5?

1. §4.10 clearly acknowledges that there will be national ecosystem type classifications – and that a correspondence between the national and the IUCN GET system will be needed. A major concern is the lack of categories under T7 Intensive land-use systems. Here there are only 4 Ecosystem Functional Groups: T7.1 Annual croplands, T7.2 Sown pastures and fields, T7.3 Plantations, T7.4 Urban ecosystems. Not all human settlements are considered 'urban' – in fact when land accounts have been undertaken, several urban, suburban, rural categories were needed. Collapsing all of these into one category will not be adequate, particularly as much of a country's monetary value of these ecosystem assets and benefits to ecosystem services reside precisely where the people are – in residential areas of varying gradations.

2. The flow-through examples that span the three stages (promised for later versions) would certainly be helpful, or even a discussion of why simple examples may be difficult to generate or were challenging enough to prevent inclusion in this draft.

Question 4. Do you have any comments on the three-stage approach to accounting for ecosystem condition, including the aggregation of condition variables and indicators?

1. Section 5.3.3 Ecosystem condition indicator account. The use of the terms variable and indicator are not clear. When does a variable become an indicator? This is not clear in the text. Finally, in Annex 5.3 it states that an indicator has a normative interpretation. Not all indicators have a normative interpretation – so that is something that is being assumed in this context? In Table 5.4, column 2 is labelled as 'indicators' – but these could just as well be variables?
   In Annex 5.3 page 25, middle large paragraph – Normative interpretations very much differ whether you ask someone from industry or an environmental activist group. What is normative in one set of people is not normative in another. So which perspective is going to be used?

2. The descriptions of the function and communication of output at each stage were straightforward, where only the indicators are likely to be attractive to most policy makers, but the accounts at lower stages can inform as research inputs for scientists looking for ecological condition markers (over time). This seemed congruent with primary theory of how the ecosystem accounts may be informative (the known figure is a pyramid with data on bottom and indicators at top). Nonetheless, examples beyond the placeholder representation in tables might reveal practical challenges to compiling that belie the elegant theory and rules laid out here. When laying out coiffed examples, it may be useful to describe known potential challenges or pitfalls, which would be particularly relevant as guidance for practical implementation purposes.

3. The progression from Table 5.4 to Table 5.5 is not very clear and the use of indicator weights is not explained very clearly. It appears that each ECT class is going to have an equal weight – which means if there are more than a single indicator for an ECT class (see example of physical state and compositional state) where there are two indicators, these need to be reduced into a single 'Sub-index' before the index values can be aggregated. To show this process more clearly, a revised Table 5.5 is provided below which includes the columns from Table 5.4, and the weights for the sub-indexes – not the components of the sub-index. Perhaps this can be helpful in illustrating the process more clearly. See the revised table at the end of this comment form.

Question 5. Do you have any comments on the description and application of the concept of reference condition and the use of both natural and anthropogenic reference conditions in accounting for ecosystem condition?

1. The intention seems to be to resolve with some clarity in at least broad guidelines for practitioners, separating the conflict into different referent types – a fairly natural state for ET not dominated by human intervention, and a known past state post-modification for the kind of ET we actually tend to see and interact with, except for remote vacations and nature programs.

2. Given the challenge of establishing a uniform global reference condition and the variety of options that are proposed, an option that could be included for future evaluation: the start of the remote sensing era. This is a highly practical suggestion, without explicit theoretical backing, but points out that it is going to be extremely hard to quantify certain reference levels without RS data. In a way it's another take on "earliest data available" in "historical reference condition" (chapter 5, pp. 29). This could theoretically be 1972 – though few large-scale RS products are available using RS imagery from the 70s and 80s. It might currently be 1992, the first-year global time series land cover data are available. While far from a panacea, this is a practical consideration that could be included in Annex 5.5 of Chapter 5.

3. The chapter implies that this work would need to be described and determined by ecologists and is not work for the statistical office. This approach is an accepted approach in ecological measurement – but the establishment of the reference state as well and evaluations with regards to the reference state are the challenge. Annex 5.5 provides an overview of the different options for establishing natural reference conditions and anthropocentric reference conditions. This table gives an evaluation of the different methods listing strengths and weaknesses. Some actual examples and references to these different approaches would be helpful. There is no advice related to which approach to use – and since this is very critical it would be expected that some specific advice would be given.

4. How to determine the reference state for the intensive land-use systems – agriculture and human settlements ("urban" in the classification) – is rather problematic. These types of areas are often converted from one type of ecosystem to these more intensive uses – so is the 'reference state' what was

there before the conversion to these intensive uses? It is unlikely that they will be converted back. This topic was not covered in the text at all and seems relevant since these types of areas will be a focus in the accounts.

Question 6. Do you have any comments on Ecosystem Condition Typology for organising characteristics, data and indicators about ecosystem condition?

1. These need much more description to understand what is included and excluded in the categories, and how certain boundaries can be distinguished. This needs to be included as a detailed annex to the guidelines – and Annex 5.2 is not good enough.

2. One area that seems somewhat underdeveloped is the question of where we place metrics that cannot quite meet the criteria for inclusion in supply and use tables. This is an area pointed out in Warnell et al. 2020 with a number of examples (https://www.sciencedirect.com/science/article/abs/pii/S2212041620300413) Granted, this paper was published extremely recently so there is no way its ideas could have influenced the current draft. The correct placement could be as functional state characteristics, but it would be beneficial to more explicitly say so.

Question 7. Do you have any other comments on Chapter 3?

1. The title of the chapter reveals much about the way the chapter is written, but it raises a foundational question about for whom should the chapter be written? Our understanding of the role of the SEEA is that the EEA is supposed to be part of the SEEA suite to serve as complements to the SNA. This means that asset definitions, valuations, spatial units, and so on should be linkable to the SNA and the scope should be in some way connected. That is, Ecological Economics is the not the same as National Income Accounting; and, to the extent that these can be bridged by environmental *economic* accounting seems to be the initial intent of this suite of accounts. The chapter would be well served to better bridge the economic relevance of the spatial unit discussion.

   One way to do this would be to set out the spatial unit needed for Economic Ecosystem Accounting. Granted there should be some overlap, but, to the extent that this is *economic accounting*, the focus should be more on how a country might set up an economically meaningful spatial unit that could better complement the corresponding SNA accounts, rather than a pure standalone ecosystem accounting. Accordingly, much of the material in the body of the chapter does not advance this purpose and could be relegated as additions to the Annexes already there. Even so, a fundamental question is unanswered in Chapter 3: How should a spatial unit correspond to an economically meaningful unit. Some reference is made to the analogy with an establishment

for EA. That is fine; but, then how does that translate into a spatial concept that serves as a helpful complement to spatial units within the SNA?

Part of the problem is that there is too much of a technical ecological discussion and the focus on economics and the needs of national accounts is lost. For example, it is imperative for there to be mutual exclusivity between spatial units—both for the asset and the attending service flow. This is alluded to and assumed to be feasible, which is a strong assumption; but, numerical examples (or instances where an NSO has implemented this at a national level) would help clarify how mutual exclusivity could work to avoid double-counting problems that the SNA focuses on.

2. Paragraphs 3.32 & 3.33: It may be worth noting that mosaic ecosystem types appear more frequently when an analysis is conducted at moderate to coarse resolution (because fine resolution analysis tends to distinguish smaller, more homogeneous grid cells). Alternatively, this may be a technical detail better suited for e.g., the biophysical modelling guidance.

3. Paragraph 3.37: Are subterranean ecosystems included? These do generate some ecosystem services, such as pest control provided by bats. Since these are not included as ecosystems, it is uncertain how these would be attributed. Then again, from the national scope they are likely to be relatively small for most countries, but for some countries it may be quite relevant.

4. Paragraph 3.50: Would it be appropriate here to mention the need for collaboration with national mapping agencies, since most countries have these, and this is primarily a document for the statistical community? Obviously technical material this paragraph points to will detail further the needed interagency collaborations.

5. Annex 3.3: Paragraph 2: Quantum GIS is now known as QGIS. Paragraph 9: May be worth mentioning that such processing and storage limitations will be greater for higher resolution data in larger countries (i.e., a 10 m or finer grid may be quite possible in the Netherlands but not Brazil).

6. Regarding: "A raster-based ecosystem extent map is usually the result of an analysis of remote sensing images, whereas an ecosystem extent map based on a combination of topographic and thematic data sets will typically appear in vector format." – this is really surprising, topographic data like DEMs are nearly always raster data, and when combining them with other data, it almost always makes sense to do so in raster format. Perhaps this matches other EEA experiences, but it seems quite unusual and not a case we should promote as the norm (especially for large EAAs, where vector-based analysis may be very slow).

7. Overall, the sophistication needed by an NSO to implement these concepts is quite high. For example, paragraphs 3.53 through 3.55 set out a complex program for BSUs. Given the complexity, it is necessary to demonstrate feasibility; and, so a concrete real-world example should be provided to signal to a reader that the manual is providing meaningful guidance for practical implementation.

Question 8. Do you have any other comments on Chapter 4?

1. Given that ecosystem extent is an aspect of accounting for ecosystem assets, it is unclear why this topic deserves a separate short chapter, which could be explained in an introduction to the chapter. This introduction could also begin with a statement of what ecosystem extent means, which has a number of different meanings across literatures. Much of the chapter appears to be written for a very technical audience, as a number of paragraphs use so many abbreviations that it is impossible to understand the content. When this happens, the full name should be used so the information is understandable and clearer to a readership beyond subject specialists.

2. This chapter, like chapter 3, focuses on ecosystem accounting. Certainly, there must be some tie between ecosystem accounting and economic ecosystem accounting. The unaddressed point is whether the concepts laid out in the chapter are compatible with an economic perspective.

3. The chapter assumes that the categories in the table are practically measurable. Measuring some of the categories in the tables will be challenging in contiguous areas—How are boundaries defined? It would therefore be useful to give a numerical example based on actual data.

4. §4.11 clearly states that, «the sum of the areas of different ETs must be equal to the total area of the EAA.» It is good that this is clearly stated.

5. §4.13 bullet point 3: introduces the use of «Regression» This is not a term used in asset accounting in SNA or SEEA-CF. Is the introduction of new terminology necessary? Can it simply be labelled as Decrease or Loss?

6. Also in bullet points 2-2 and 3-2 there are statements that discuss charged issues like human activities causing climate change: «Natural expansion can be influenced by human activity, for example, the expansion of deserts due to the effects of climate change.» and «Natural expansion can be influenced by human activity for example the loss of coral reefs due to the effects of climate change.» Are these necessary for an accounting manual?

7. Table 4.2 – Having only categories here is not very helpful. Need to have an illustrative example of the principles described in section 4.2.3 and not a blank table.

8. A fundamental question that should be addressed in the introduction of the chapter is: how does this differ from the Land Cover accounts in the SEEA-CF? Explaining how these 'ecosystem extent' accounts are different from land cover accounts would be helpful to understand the need and how these fit in with existing accounts in the SEEA-CF.

Question 9. Do you have any other comments on Chapter 5?

1. Throughout all three chapters, the use of the term "SEEA" needs to be revised to "SEEA-EEA" because SEEA-CF ≠ SEEA-EEA in terms of system boundaries, valuation techniques, etc. There are no common conventions that can be labelled as "SEEA" in the same manner as the term "SNA" is used in §5.90. But at the same time, it is unclear exactly what is being referred to in Annex 5.6, Temporal perspective page 33: "ecosystem condition accounts are completely similar to SNA accounts."

2. The language should be used tightly. For example, "ecosystem service indicators" or "indicators of ecosystem services"? If "indicators" is used in those phrases in the same way it is defined on page 5 for use in "ecosystem condition indicators" then it is a normatively-scaled condition indicator that closely relates to an ecological end-product used in an ecosystem service. No problem. However, if "ecosystem service indicator" is more loosely used to mean "ecosystem service variable" and not just a circumscribed condition metric, then this would create problems in the ES SUTs. For example ES SUTs cannot have pollination and pollinators or pollinator habitats in an account that totals these row entries.
   The problem is not that the text does this, but that there is no clear guard against that interpretation:
   p15 "biodiversity metrics can provide indicators of ecosystem services";
   p22 "Many of the characteristics that can be seen as 'ecosystem functions' can also be seen as a compositional…structural...or abiotic state descriptors..., or even as ecosystem service indicators (ES accounts). It is a good practice to avoid placing functional characteristics into this class whenever they can find a better home in another class." This could, if the text is not amended to guard against it, guide tempt or allow compilers to move pollinator habitats into ES SUTs, when only pollination goes there, or to put biodiversity as an ES SUT row in addition to the species that comprise it (and without a defense that the two are separate in ES physical quantity and additive in monetary value).

3. Why is this chapter not combined with the Extent chapter?

4. There are large differences between the treatment of extent and condition in these draft chapters and how they are treated in the current manual. The changes seem to reflect an intent to make the manual more of an ecosystem accounting manual – is this the actual intent of the authors? If so, it should be made clear in the chapters or in an annex why this shift is appropriate for the manual and why the previous approach was wrong. If not, additional guidance in the chapters or an annex to address this would be helpful. From a revision perspective, a key question to be addressed is: why is the current EEA manual treatment of these topics insufficient?

5. There seems to be little attention paid to the question of aggregation. Aside from a real related measure, it is not clear how any other measurement could be aggregated to a national level. It seems that the selection of characteristics one has in mind is separate entities.

6. Where is all the detailed description of ecosystem condition coming from? What published articles? What empirical examinations? Is the material specifically developed for the manual? What evidence is there that it is implementable? The chapter should be revised to better source these questions.

7. How does this chapter fit with Discussion Paper 2.1? That discussion paper was supposed to be an underlying source for the revision. Figure 3 in the discussion paper refers to variables and reference levels—though the variables can be objective; the reference levels are subjective. There seems to be a lot of arm waving about measurement here that would be better served by more specific examples or citations of actual implementations by NSOs. If one of the goals of the authors is for this manual not to be "experimental," these methods must be rigorously tested out in the field, so to speak.

8. Much of what is recommended in this Condition chapter is sophisticated and would require the resources of a well-funded environmental agency. Though there are some national statistical offices that have devoted resources to measuring the environment specifically, the complexity of what is being recommended seems to be more costly than most NSOs could feasibly undertake. This is precisely why concrete and detailed examples of other countries implementing the recommended methods at a national scale and at the level of detail entirely consistent with the manual would be instructive. Without this, what is theoretically appropriate for a small-scale academic study may not be implementable for an NSO for a large country, which would then require further revision to provide technical guidance for *achievable* national economic ecosystem accounts.

9. The cover note says that, "The chapters present the current advances in the concepts and methods noting that a small number of issues remains to be solved." It seems that there are not a "small number of issues" here and there are many 'notes to reviewers' that state this is still under development.

Revised Table 5.5 Ecosystem condition index account

Ecosystem Condition Type Class	**Indicator Descriptor**	**Indicator values (rescaled)**		**Indicator weight**	**Ecosystem type**	
					Index value	
		Opening value	Closing value		Opening value	Closing value
Physical state	Indicator 1					
	Indicator 2					
	Sub-index					
Chemical state	Indicator 3					
Compositional state	Indicator 4					
	Indicator 5					
	Sub-index					
Structural state	Indicator 6					
Functional State	Indicator 7					
Landscape/seascape characteristics	Indicator 8					
Ecosystem condition index					Sum ↓	Sum ↓

Areas in grey are not logical so are not to be filled in. Where Indicator values (rescaled) is taken from Table 5.4, and the weighting for the individual indicators which make up a sub-index are shown as not applicable so that the weighting of the 6 different states will be equal.