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

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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

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?

We support the definition and description of ecosystem accounting areas (EEAs).

Comments on the definition and treatment of ecosystem assets (EAs)

- Our main concern in Chapter 3 is that there is too much focus on delineating EAs as individual spatial units, and a sequential order is implied in first delineating EAs and then aggregating them to derive ecosystem types (ETs), i.e. EAs are treated as a required "route" to accounting for ETs.
- Combined with this, there is emphasis on compiling data for EAs. It may in some cases be true that ecosystem extent accounts record changes for each individual EA within an EAA, but our experience in South Africa is that in practice data are compiled for BSUs or ETs, not for individual EAs.
- Below we have provided comments on specific paragraphs followed by a more general description of our approach in South Africa as it relates to these issues, with an example from the terrestrial realm.

Comments on specific paragraphs related to these concerns:

Paragraph 3.6: "EAs play a key role in ecosystem accounting. They are the statistical units for ecosystem accounting, i.e. the entities about which information is sought *and about which statistics are ultimately compiled*. This includes information concerning their extent, condition, the services they provide and their monetary value." (emphasis added)
In our experience, data are compiled for BSUs and statistics are compiled for ETs, not individual EAs.

Paragraph 3.17: This paragraph seems to be a bit ambiguous about whether the data need necessarily be compiled for each EA.

Paragraph 3.20: "Commonly, accounts for a single EAA (for example, a country) are presented in tabular form by grouping together multiple EA of the same ET."
Our experience is that in practice this is achieved by summing all the BSUs for a particular ET, not by grouping EAs together.

Paragraph 3.22: "…Hence, EAs should be delineated based on various ecological characteristics such as …"
Our experience is that in the first instance it is ETs that are delineated based on a range of characteristics, not EAs. Individual EAs need not be delineated.

Section 3.3 deals with "Delineating and classifying ecosystem assets".
Paragraph 3.23 deals with principles for delineating EAs.
We suggest that the principles listed in this paragraph apply in the first instance to delineating ETs. There may then be an optional step of delineating individual EAs within each ET. It is potentially confusing to present these principles first for EAs rather than ETs.

Paragraph 3.24 states that “It is expected that occurrence and extent of EAs will change over time… recording this is the focus of ecosystem accounting.”
Our comment again is that recording occurrence and extent of individual EAs has not been the focus in our experience. And, as 3.17 states “…an ecosystem extent account would show the changing total area of each ET, not the changing area of each individual EA”. This point from paragraph 3.17 is important to emphasise, also in Chapter 4.

Paragraph 3.48: “For the compilation of ecosystem accounts at national or sub-national level it is expected that the delineation of EA at EFG level, or the equivalent level within a national classification, will be appropriate for the compilation of accounts.”
The EFG level is still quite broad for national ecosystem accounts – many countries may want to compile accounts at lower levels of the GET hierarchy, perhaps summarising the accounts to EFG level for national reporting. Perhaps more importantly, it's the delineation of ETs that would in the first instance happen at EFG level (or finer), rather than the delineation of EAs. One could then identify EAs within each of those ETs.

Section 3.4.1 deals with “Delineation of ecosystem assets in practice”.
This section is confusing to us. We think it mixes delineation of ETs and delineation of EAs. In practice, ETs are usually delineated first. In some cases this is done at a broad scale by combining a range of data layers (example Sayre et al 2020 World Terrestrial Ecosystems). It can also be done at the national level. Ideally such a top-down approach would be combined with a bottom-up approach involving on-the-ground mapping and more detailed point data that can verify the top-down data (as explained in para 3.51).
Then BSUs are tagged as belonging to a particular ET. (If a BSU straddles more than one ET, the majority ET would usually be assigned to that BSU.)
Then adjacent BSUs of the same type *could* in principle be grouped to form EAs – but as explained we have found that this is not an essential step for developing ecosystem accounts.
The same applies for rivers mapped as linear features, where ETs are identified based on a range of factors, and then individual river reaches (each of which constitutes a BSU) can be assigned to a river ET. River EAs could in principle be identified by combining contiguous river reaches of the same ET, but need not be (and have not been in South Africa’s river ecosystem accounts).
So BSUs come in after ETs have been mapped. There is no need to have BSUs in order to map ETs. And grouping BSUs into individual EAs is not essential.

Paragraph 3.53: “To apply a BSU technique, each BSU is attributed with data on relevant characteristics that are relevant in distinguishing between EAs of different types. One way of considering this is that over the entire EAA each characteristic is mapped at the BSU level to establish a data layer for that characteristic.”
We find this paragraph confusing. At the simplest level one just needs to attribute each BSU to its ET. ETs are likely to be mapped "outside" the accounting system, and there's no need to burden the accounts with all of the underlying data layers that went into mapping the ETs. For example, the map of terrestrial ETs (vegetation types in the South African context) would be linked directly to the BSU layer, rather than trying to link all the different layers that went into developing the vegetation map to the BSU layer. In any case these various different layers would have gone through an expert sense-making filter in order to delineate meaningful ETs (as per para 3.51) without which they aren't particularly useful in themselves.

Paragraph 3.54
Does 3.54 imply that one would assign a combination of data on land cover, climate, and landforms to the BSU, and then use this and additional attributes to identify ETs? As explained above, in South Africa, the ETs were delineated first, and then overlayed with the BSU and each BSU cell was assigned to an ET. This may not always be the case but perhaps it needs to be clarified that this might be the case (perhaps even more commonly the case).

(Further detailed comments provided in sticky notes on para 3.49 – 3.54 in the pdf copy of Chapter 3.)

Comments more broadly on the issue of delineating EAs and compiling data for EAs
(Comments here are also relevant to part of Chapter 4. We have provided this additional narrative because we feel this is a fundamental issue, and we suspect that the approach we've used is not unique to South Africa. We considered putting this narrative into an appendix but it seemed simpler just to keep it all in one place, even though it makes our response to this question very long.)

- In practice, we have not delineated individual EAs for South Africa's ecosystem accounts, and we have not compiled data at the level of EAs. Although EAs are a useful conceptual construct, it has not been necessary for us to delineate them spatially in the ecosystem asset accounts we have produced (land accounts, terrestrial ecosystem accounts and river accounts) and we do not envisage that it will be necessary in upcoming accounts for wetlands and for marine ecosystems.
- Indeed the opposite is true – it would be unworkable for us to delineate individual EAs at the national level, provincial level or even district level. The only examples we could think of where we might actually delineate EAs is for very small EEAs (e.g. small municipalities, tiny sub-catchments, individual protected areas, an individual company's land holdings), but these would be exceptions rather than the general rule, and even in these cases the delineation of EAs would have been preceded by the delineation of ETs.
- Our approach in practice is to delineate ETs as a starting point, and then assign BSUs to ETs i.e. one of the GIS attributes of each BSU is its ET. In theory it would then be possible to group adjacent BSUs of the same ET to form EAs, but in practice this would result in overwhelming numbers of EAs and computational challenges. Further, the number of EAs would proliferate over time as the landscape becomes more intensively used and individual natural or semi-natural EAs are broken up into pieces as parts of them are converted to new EAs that belong to anthropogenic ETs. It is not clear to us how one would deal with recording information for EAs that are more and more numerous in each accounting period. An example of this proliferation in the number of EAs over time is provided below.
- For the ecosystem services accounts led by Jane Turpie as part of the NCA&VES project, as far as we are aware the production of ES is modelled based on BSUs and then aggregated by ET (at biome level). However, we are not familiar in detail with the methods Jane has used.

Example of the relationship between ETs and EAs in the terrestrial realm in South Africa:
In the terrestrial realm in South Africa there are 458 ETs, identified and mapped as part of the National Ecosystem Classification System. These ETs are represented in a National Vegetation Map, which consists of more than 48 000 polygons that collectively cover the whole land area of the country. The 458 ETs and their constituent polygons are delineated based on the estimated

historical extent of each ET, i.e. the historical extent of each ET usually consists of a large number of pieces – an average of around 100 per ET, but with a wide range from 1 for some ETs to more than 1000 for ETs that are naturally highly fragmented in the South African context (such as forests). Each of these ~48 000 polygons based on historical extent of an ET could be considered to be an EA in the baseline year for the account (~1750). However, most ETs have become increasingly fragmented over time as portions of them have been converted to intensive land uses (such as croplands or urban areas), resulting in probably hundreds of thousands of individual EAs in more recent years. An extreme example from a group of ETs in one part of South Africa is provided below, which now consist of over 18 000 fragments (EAs) as opposed to a few hundred historically, but the same would apply to varying degrees to most other ETs in South Africa.

Example of the proliferation in the number of EAs over time in the terrestrial realm:
Some of the most threatened ETs in South Africa are renosterveld ETs in the south western Cape lowlands (renosterveld makes up part of the Fynbos biome – a species rich shrubland) – see map below. Most of these renosterveld ETs consist in the National Vegetation Map of less than 100 polygons each, i.e. historically they were made up of relatively few EAs. Now, more than 18 000 remnants of natural vegetation, many of them smaller than one hectare in size, are scattered throughout this region (Von Hase et al 2003). Each one of these fragments would, conceptually, be an EA (although those smaller than 1 ha could be subsumed in the surrounding cropland EAs). Instead of accounting for each of these individual EAs, we account for the ETs in this region. Currently our terrestrial ecosystem accounts provide an Ecosystem Extent Index (EEI) for each ET. The EEI for these renosterveld ETs is very low, reflecting the fact that very little of their historical extent remains intact. In future when we develop an Ecosystem Condition Index, the high degree of fragmentation of these ETs would be one indicator that would feed into the ECI for each of these ETs. But at no stage in the ecosystem extent account or ecosystem condition account would there be an attempt to delineate and record data at the level of EAs.

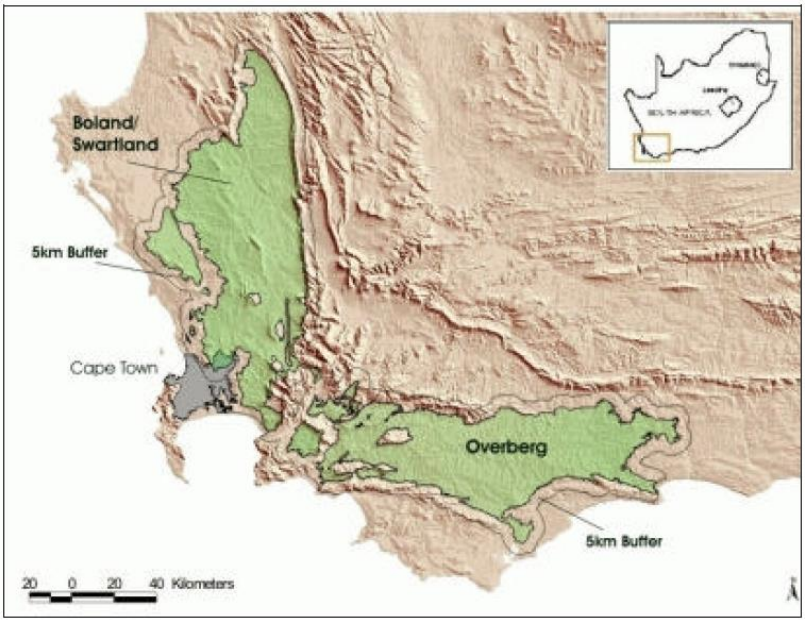

Figure 1. The lowland areas of the South Western Cape are characterised by renosterveld vegetation (rough historical extent shown in green), which makes up part of the Fynbos biome. These renosterveld ETs have been largely converted to croplands and consisted of more than 18 000 fragments by the early 2000s. (Source: Von Hase et al 2003)

Von Hase, A., Rouget, M., Maze, K. & Helme, A. 2003. A Fine-Scale Conservation Plan for Cape Lowlands Renosterveld: Technical Report. September 2003. Botanical Society of South Africa, Cape Town. 103 pp.
[This was a systematic conservation plan aimed at identifying which of the remaining 18 000 fragments of these ETs should be prioritised for conservation interventions, e.g. those fragments that were larger and in better connected clusters.]

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

We support the use of the IUCN Global Ecosystem Typology as the SEEA reference classification for ecosystem types.

South Africa's national ecosystem types in our National Ecosystem Classification Systems align with level 6 of the GET, and could in principle be grouped to ecosystem functional groups that could be cross-walked to level 3 of the GET. We will test this over the coming months, starting with the terrestrial realm.

Paragraph 4.49 says that it is recommended that compilation of ecosystem accounts be undertaken at the ecosystem functional group (EFG) level (level 3 of the GET). Level 3 is still quite broad for national ecosystem accounts. We suggest: "at the EFG level or finer". If national ecosystem accounts use a lower level (4, 5 or 6) it is easy for them to be aggregated to level 3.
This also applies in Chapter 3, which mentions developing national ecosystem accounts at level 3 in a couple of places – we suggest changing this to "level 3 or finer" in all cases.

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?

Comments on recording changes in extent and condition
(These comments build on our comments on Chapter 3.)

Paragraph 4.1 on page 1 of Chapter 4 states that "A common starting point for ecosystem accounting is the *organization of information on the extent of different ecosystem assets (EAs)* within a country or other ecosystem accounting area (EAA), and how that extent is changing over time. This information is summarised in an ecosystem extent account." (emphasis added)

Paragraph 5.1 on page 1 of Chapter 5 states that "A central feature of ecosystem accounting is its *organization of biophysical information on the condition of different ecosystem assets (EAs)* within an ecosystem accounting area (EAA). The ecosystem condition account provides insight about the *characteristics and quality of EAs and how they have changed*. …" (emphasis added)

In practice, organising information on EAs has not been the starting point of the ecosystem extent accounts we have done in South Africa for terrestrial and river ecosystems, or for the condition

accounts we have done for river ecosystems. *Our starting point has been organising information by BSU rather than EA.*
In practice we bypass EAs in constructing the accounts. We record information for BSUs, never for EAs, even in the detailed spreadsheets that underpin the accounts. The information for BSUs is aggregated directly to ETs. We would not ever list every single EA and tracks its extent and condition over time.

Paragraph 5.42 says that there is no expectation that all individual EAs should be presented in a tabular form in the accounts, but there does seem to be an expectation that data for the accounts would be gathered and stored at the level of individual EAs. For example, paragraph 5.41 says "It is recommended that the condition variables are recorded for each EA to ensure full reliability and transparency of the ecosystem condition accounts." Our feeling is that this reliability and transparency can be achieved by recording information (such as condition variables, but also other information) for each BSU, and does not necessarily require data to be recorded per EA.

At their most detailed level, our accounting tables are structured by ET. In the case of terrestrial ecosystem accounts there are 458 ETs, so the finest level accounting outputs are tables that provide information for all 458 ETs. These are of course aggregated for to a smaller number of higher level ETs for presenting the accounts. For land accounts, the finest level of accounting output is for 72 land cover classes, the most detailed level of classes in our National Land Cover map, aggregated for presentation of the accounts to broader land cover classes at various nested tiers.

In theory it would be possible to ask one's GIS software to identify contiguous BSUs of the same ET and to construct a spatial layer of EAs, each uniquely numbered in order to make a spreadsheet with their extent and condition, but this wasn't required for us to develop our accounts. It would also have been enormously time-consuming and computationally challenging, and would have resulted in an overwhelming amount of information with no particular value-add for either extent or condition accounts. Also, in each accounting period the number of EAs would increase (as individual EAs are broken into non-contiguous bits by conversion from natural to intensive land uses), which we think would lead to challenges in constructing spreadsheets that track changes in EAs across multiple accounting periods.

This bypassing of EAs in practice may not be the case if BSUs are defined by polygons in a vector data layer, but we feel fairly certain it would be the case whenever BSUs are defined as a grid (raster data) (except maybe in very small countries).

As noted in our comments on Chapter 3 above, it may be useful to delineate EAs in specific cases where an account is being developed for a small EEA, such as a protected area or the land holdings of an individual company. But this would be the exception, and could be done just for that EEA without being done for the whole country.

Paragraph 4.6 on page 1 of Chapter 4 states that "An ecosystem extent account records the areas, and changes in areas, of <u>all</u> the EAs within an EEA" (emphasis added).
Following from our comments above and on Question 1, the word "all" here is critical, as it is important not to require that the extent account records the change in area of <u>each</u> EA within an EEA.

Paragraph 4.25 states that "Presentation of this information [on changes in extent over time] *requires detailed data that records the location of individual EAs* and how they have changed." (emphasis added)
Again, our experience is that it is not essential to record the location of individual EAs over time. Rather, presentation of changes in extent over time requires detailed data that records changes in the ET associated with each BSU and how this has changed over time.

As noted in Annex 3.3, when using "a raster-based approach ecosystem extent accounting [but not only], an EA may be composed of one or a set of BSUs (of the same ET)". However, there is no need to delineate EAs in order to aggregate information to record the areas, and changes in areas, of ETs within an EAA.

As noted in our comments for Question 1, there is a point in paragraph 3.17 that we think should be repeated in Chapter 4 – that "…an ecosystem extent account would show the changing total area of each ET, not the changing area of each individual EA". This does not come through clearly enough in Chapter 4.

Similarly to paragraph 4.6 in Chapter 4, paragraph 5.6 in Chapter 5 states that "Ecosystem condition accounts *record data on the state and functioning of EAs* within an EAA using a combination of relevant variables and indicators. The selected variables and indicators reflect changes over time in the key characteristics of *each* EA. …" (emphasis added)
Again this might be conceptually true, but it is important not to require that the condition account *must* record the condition of each EA separately. It could record the condition of each BSU (or those BSUs for which data is available, with the condition of other BSUs inferred), which could then be aggregated directly to the condition of each ET.

Comment on measuring extent of linear ETs

It would be useful for Chapter 4 to refer to the option of measuring the extent of linear EAs or ETs as length, as discussed in Section 3.3.2 in Chapter 3 with example in Table 3.2. In other words pull this through from Chapter 3 to Chapter 4.

Comment on the treatment of conversions

We support the approach taken to conversions in Chapter 4 and Chapter 5. See sticky notes in the pdf copy of Chapter 4 for a few more detailed comments.

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?

Comment on the three-stage approach to ecosystem condition accounts

Our comments for this question are based mainly on our emerging experience with applying the condition accounting structure presented in Chapter 5 retrospectively to our national river ecosystem condition accounts developed in 2014/5 as part of the ANCA project. This forms part of the UNSD's ecosystem condition testing process underway with several countries. We will also capture key points relevant to Chapter 5 through that process, which overlap with some of our comments here. Dr Jeanne Nel, who led the development of South Africa's river ecosystem accounts, is central to the testing process and contributed to these comments.

We support the idea of a staged approach to condition accounts, but we feel that two stages would suffice. Our view is that compiling data on variables should be seen as a preparatory step for developing condition accounts not as a first stage of the accounts themselves. We would see two stages:

- Accounts for indicators and/or sub-indices
- Account for an Ecological Condition Index

The current stage 1 dealing with variables is more about an organising framework for information on ecosystem condition to produce accounts-ready data. This view is based on the reasons set out below.

Accounting tables should be meaningful:
A starting point for us is that an accounting table should provide meaningful information that can be reasonably understood and interpreted by an intelligent non-specialist. Identifying variables relevant for a particular indicator or sub-index and systematically recording available data for these variables in spreadsheets or databases is a critical step for developing condition accounts, but it is unlikely to provide a meaningful accounting table. The raw data that sits behind the account should be well organised and should be available to specialists who might want to re-analyse it or use it for some other purpose (assuming there are not confidentiality or sensitivity issues e.g. for exact locations of threatened species), but the data will usually be in too raw a form to make sense of for anyone but a narrow specialist in the ET or group of ETs concerned, so there is no need to present it as an output or product in the form of an accounting table.

Data for condition variables varies enormously and is often patchy:
There is a huge amount of variation in the types of data that can be used for ecosystem condition variables, and in how the data need to be processed and compiled. This is compounded by the fact that the nature of variables themselves may differ widely between countries and ecological contexts. Also, available data for many variables will be partial or patchy. It is important to systematically note gaps to inform future data collection, but this doesn't have to be done in the form of an account.

The table structure for the variable account is overly prescriptive and often won't apply sensibly:
Our view is that the proposed structure of the table for the ecosystem condition variable account (Table 5.3 on page 12) is overly prescriptive and not the most useful for real data over time and

space. Even converting data on variables into a table at this stage might not be necessary. It takes considerable effort to compile these data in such tables (especially for thousands of BSUs or EAs, or even at ET level in some cases), and doing so would not necessarily provide meaningful information.
Data for some variables will be collected at site level, without necessarily a one-to-one link between monitoring sites, BSUs, EAs, and ETs. It is often not possible or useful for aggregate from site-level measurement of a variable to an average value for a whole ET, as is required by the structure of Table 5.3. Values for variables should ideally be recorded for every BSU of every EA, but even if they are it may not be meaningful to aggregate these values to a single value per ET. Also, the set of variables for which data are available might vary between BSUs or EAs, even within the same ET.

Data on variables has to be interpreted to be meaningful:
The interpretation of raw data on variables is not just about applying a reference level to convert a variable into an indicator. In practice there is almost always a sense-making step that requires expert knowledge and judgement, no matter how complete and high quality the data on variables is. (We will expand on this in our notes on the condition account testing process.)

A technical manual for organising and interpreting data on variables would be more appropriate than a variable account:
We suggest that instead of a variable account, it would be more useful to have a technical manual for developing datasheets for variables on ecosystem condition. Such a manual could provide guidance on how to collate and record data on variables and how to interpret them.
Different countries are likely to have at least partial systems in place to do this already, and we don't see that there is a need to standardise the way this is done across countries.
A technical manual could illustrate different examples and decision points that might be considered by countries for different ecosystems and types of information, including decisions related to aggregation. Such decisions might be influenced by the policy application of interest, the relevance/ application of information for ES accounts, etc.
We wonder if there are equivalents with collecting and recording the raw data for national accounts or demographic statistics – there must be scope for a range of ways of organising this, not necessarily in the form of accounting tables?

Additional points:
Paragraph 5.45 states that ecosystem condition accounts should clearly document the flow of information from raw data to high-level indices. We feel this is unnecessarily onerous. Is this same requirement to document the flow all the way back to raw data made of ecosystem extent and ecosystem service accounts? The raw data should be clearly organised and available, but not necessarily presented in the accounts.

We note that certain individual variables relevant to ecosystem condition might link directly to particular ecosystem services and thus also be relevant to ecosystem service accounts. That would provide further impetus to gather data for those variables systematically and as comprehensively as possible, but it is not a reason in itself to present them as a component of an ecosystem condition account.

Comment on aggregation of condition variables and indicators

In the process of retrospectively fitting our national river ecosystem accounts to the tables in Chapter 5, we have realised that in practice we aggregate directly from variables to sub-indices rather than via the route of indicators. Also, we often use proxies for variables where data for a particular variable is not available. Data for many variables is partial (even using proxies) and different for different BSUs, so in practice it's not possible to be fully systematic about moving from variables to indicators to sub-indices. This requires gathering whatever data is available on a range of variables, and then put this though a sense-making process involving experts. More on this in our notes on the condition testing exercise.

If one is able to present a combination of individual indictors as well as sub-indices in an account, we suggest that it would make sense to show the indicators and their related sub-index in the same table, in other words to combine indicators and sub-indices in one table.

We suggest that the final table should deal with just the Ecological Condition Indicator, as the apex indicator of the condition account. It may be useful to introduce the term ecosystem condition category (ECC), as a possible complement to Ecosystem Condition Index. The final stage of the condition account could be to present either an ECI or ECC, or both.

We suggest that in Tables 5.4 and 5.5 it would be useful to include a column for recording the change between the opening and closing values of indicators, sub-indices and ECI.

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?

We support the approach to reference condition in the chapter. We agree that in general the reference condition should be "natural", but that anthropogenic ETs are likely to require different treatment with respect to reference condition.

It may be important for the chapter to be more explicit about the fact that using a reference condition of natural does not imply that that natural is necessarily the ideal or desired condition for all ecosystems. For example, this could be added in paragraph 5.32, which explains that using a reference condition of natural allows for recording the change from natural and reflecting this in the accounts. In many cases the policy or management objective for an ecosystem may be to maintain it in a semi-natural or moderately modified state, not to insist on keeping or returning it to a natural state. A semi-natural state is often wholly adequate to support provision of a range of ecosystem services.

Paragraph 5.32 says that the change from the natural state "is likely to be of direct interest in assessing many environmental policies and associated objectives concerning conservation". This seems too narrow. Change from the natural state might also be of direct interest in assessment policies that have to do with management of ecosystems for a range of purposes beyond conservation, e.g. through integrated land management or integrated water resource management in multi-functional, multi-use landscapes.

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

Again through working further with our existing river ecosystem accounts, we have realised the value of having a conceptual framework to guide selection of indicators or sub-indices. We didn't make this conceptual framework explicit in the original discussion document on the river accounts (Nel & Driver 2015), but it has been developed by river ecologists in South Africa and globally over decades. So in practice we would continue to use this conceptual framework rather than the ECT to guide selection of indicators, and will be sure in future documentation of accounts to make this explicit! We will say more on this in our notes on the condition account testing process.

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

Comments on spatial units for marine ecosystem accounts

Paragraph 3.18 (page 4) says that the scope of national ecosystem accounts should aim to extend out to the boundary of the Exclusive Economic Zone (EEZ) – we agree with this.

Currently the discussion on marine ecosystems is located mainly in Section 3.3.2 on treatment of specific ecosystems and features.
We suggest that it is important to deal with marine ecosystems as part of Section 3.2.1, rather than dealing with them primarily as "specific ecosystems and features", which can easily feed into a perception that marine ecosystem accounts are somehow not part of the core ecosystem accounts for a country that has a marine territory.
Linear features and complex mosaics cut across realms, so it is appropriate to deal with them in Section 3.3.2 as specific types of features that require different treatment. However, we don't think it's appropriate to lump the whole marine realm into the basket of "specific ecosystems and features".

Ecosystems beyond the continental shelf need special treatment only if they haven't been represented as 2D. Benthic ETs can always be mapped as 2D, and it may be possible to integrate benthic and pelagic ETs into a single 2D representation. In South Africa, after much to and fro over several years, the decision was made to combine the benthic and pelagic into a single set of offshore marine ETs that are represented as 2D. It is only if pelagic ETs have been delineated separately from the underlying benthic environment that they present a challenge for ecosystem accounting. So we suggest that it is only pelagic ETs that need special treatment and should be included in Section 3.3.2.

Paragraph 3.36: "From the two-dimensional perspective of an EAA, the area of all marine ecosystems beyond the continental shelf cannot easily be incorporated. Therefore, for the purposes of accounting for ecosystem extent and aligning the area of the EAA and EAs, *only the area of ocean beyond the continental shelf should be included in the extent account [we take this to mean that it should not be divided into different ETs?]*. However, complementary accounts for marine ecosystems beyond the continental shelf that encompass the full range of relevant ecosystem assets, including those associated with pelagic ocean waters and deep sea floors can be

compiled. These accounts will be able to adopt all of the core ecosystem accounting principles, such as concerning measurement of condition and ecosystem services, but variation is required concerning accounting for ecosystem extent given the three-dimensional nature of the ecosystem structure. These accounts are described in Chapter 12 on thematic accounting."

Several comments on paragraph 3.36:

- We feel that the recommendation to treat the area beyond the continental shelf as effectively a single ET is too drastic a measure. This is one option, but should not be the primary recommendation. If a country has defined and mapped ETs from its coastline all the way to the end of the EEZ, these ETs should be the basis for marine ecosystem accounts. If a country has not done this, then the area beyond the continental shelf could be treated as a single ET.
- There may well be countries where 2D marine ETs have been mapped for the whole EEZ including the area beyond the continental shelf - South Africa is an example. Our intention is to compile ecosystem extent accounts for the full set of marine ETs from inshore to the outer edge of the EEZ.
- Even in cases where the area beyond the continental shelf has not been subdivided into different ETs, it could still be included in the core set of accounting tables for completeness rather than relegated to "complementary accounts". This would be consistent with paragraph 3.18 which says that the scope of the accounts should include the whole EEZ.
- If pelagic ecosystems have been delineated separately from benthic ecosystems they probably need special treatment and should be dealt with in section 3.3.2.
- We are also concerned about the reference to thematic accounts at the end of paragraph 3.36. Presumably the thematic accounts referred to here are ocean accounts, but we think it's important to keep marine ecosystem accounts within the core chapters on ecosystem accounts, even if pelagic ecosystems need special treatment in cases where they have been delineated separately from benthic ecosystems. Thematic ocean accounts can then add various other information over and above the marine ecosystem accounts.

Comment on Section 3.4.2 Relationship with data on land

It may be useful to include a qualifier that this applies primarily to the terrestrial realm. The freshwater realm is also arguably "on land" (or land-based as opposed to marine), but data on land cover and land use has many limitations when it comes to mapping freshwater ETs and EAs.

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

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

Comments on terminology

In the context of ecosystem condition accounts, the plural of indicator should be indices not indexes.
From a quick google search:

- Both "indexes" and "indices" are acceptable plural forms of the word "index" or to refer to more than one index. Index is one of those rare words that have two different plurals in English. "Indices" is originally a Latin plural, while "Indexes" has taken the English way of making plurals, using –s or –es. Though both are still widely used, they take on different usage in their senses.
- "Indices" is used when referring to mathematical, scientific and statistical contexts. It is used to refer to a numbers, symbols, and figures comparing a value to a standard. "Indexes" is usually used in reference to written documents, such as bibliographical or citation listings.

Chapter 5 uses a range of terms in relation to ecosystems, including components, characteristics, attributes and indicators. It may be worth checking that these are all used consistently.

Comment on degradable stocks

Section 5.4.3 on use of data on environmental pressures includes a discussion on degradable stocks (paragraph 5.76 – 7.78). I found these paragraphs difficult to follow, I think partly because the term "degradable stock" seems to be being applied to a range of quite different things, including:

- ETs (eg forests)
- Provisioning ecosystem services (eg timber, fish)
- Pressures (eg pollutants, invasives)