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System of Environmental-Economic Accounting— Ecosystem Accounting

Global Consultation on the complete document: Comments Form

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

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The comments form has been designed to facilitate the analysis of comments. There are six 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: seea@un.org.

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General comments

Question 1: Do you have comments on the overall draft of the SEEA Ecosystem Accounting?

South Africa would like to thank the UNSD, the author and all other contributors for the well written and improved SEEA EA manual. We are in support of dropping the word "experimental" from the previous published manual's title and adopting the manual as a standard.

We have some suggestions relating to Section D of the document, which deals with accounting for ecosystem services and assets in monetary terms. As discussed in our comments on Section D below, we recommend that a clearer distinction be made between economic valuation and accounting valuation. We support the document as a standard for accounting valuation, with clear articulation of the cautions that should be applied in the use and application of accounting values for ecosystems. We have provided broad suggestions for how this could be achieved in the text.

Another suggestion is that the title should be "SEEA Ecosystems" rather than "SEEA Ecosystem Accounting", to match with SEEA Water, SEEA Energy etc. Also, it would be great to avoid another "EA" acronym.

Comments by sets of chapters

Question 2. Do you have comments on Chapters 1-2 of the draft SEEA Ecosystem Accounting?

Comments on Chapter 1

Several of my comments on Chapter 1 speak to the relationship between SEEA EA and biodiversity. It's important to frame this issue correctly right upfront. I have picked up on some of these comments again in Chapter 2 and the section of Chapter 13 that deals with thematic accounts for biodiversity.

Paragraph 1.1
This is a heartfelt plea to delete the first sentence. It frames the entire document negatively rather than positively, and the paragraph is better off without it. A strong lesson from South Africa's mainstreaming work is that negative framing is counterproductive – it has the opposite of the intended effect. First emphasise contribution of ecosystems and biodiversity to people and the economy, then say they are under pressure. Also as a messaging principle it's important to emphasise the we have the tools and capacity to act – it's not doom and gloom. SEEA EA is exactly one of those tools.
In the next sentence (which would become the first sentence), switch the order of biodiversity and ecosystems i.e. "There is increasing recognition that ecosystems and biodiversity…" (see later comments on the primary focus of SEEA EA being ecosystems rather than biodiversity)
Later in the paragraph: Global Biodiversity Framework not Global Biodiversity Agenda, and rather say "conserve" biodiversity, which is broader than "protect".

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Last sentence: switch order of "biodiversity and ecosystems" to "ecosystems and biodiversity".

In this paragraph I think it's fine to say "ecosystems and biodiversity", but I would resist the temptation to add "and biodiversity" all over the place. Saying this mainly in case other reviewers suggest this.

Paragraph 1.2

Just to note the statement that SEEA EA is a framework for organising information about ecosystems – full agreement with this statement. Importantly, SEEA EA is <u>not</u> a framework for organising information about biodiversity – it was not designed for that. (This does not take away from the value of accounting for biodiversity as a thematic area, which draws together information from ecosystem accounts that is relevant from a biodiversity perspective and links it to other information related to biodiversity and to social and economic information.)

Paragraph 1.7

Replace "key biodiversity areas" with "biodiversity priority areas". Key biodiversity areas are one variant of biodiversity priority areas; there are many others that are also accepted and useful.

Paragraph 1.18

Second last sentence: switch order of "biodiversity and ecosystems" to "ecosystems and biodiversity". Ecosystems are the primary focus of SEEA EA.

Paragraph 1.20

This is a useful paragraph that shows how SEEA EA is grounded in long-standing work on ecosystems and ecosystem services. Note that biodiversity measurement and assessment frameworks haven't formed a substantial part of the foundation of SEEA EA, and rightly so. This goes to my comments elsewhere that SEEA EA has been designed as a measurement framework for ecosystems, and is not especially well suited to organising information about biodiversity. This is not a problem. It should be seen as a strength of SEEA EA that its focus on ecosystems is clear.

Paragraph 1.21

In the third row, replace "agricultural areas" with "cultivated areas".

"Agricultural areas" are not a good example of an ecosystem type, as agricultural areas can take the form of many different ecosystem types and will usually span several different ecosystem types within a country. For example, agricultural areas can take the form of extensive rangelands that would be considered natural or semi-natural OR they can take the form of cultivated land that would be considered part of the intensive land use biome in the GET.

Please check this throughout Chapter 1 and rest of the document. (I have also commented on this in Chapter 3.)

Paragraph 1.23

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Could add after the second sentence: "These values can be considered accounting values and are a subset of broader monetary values".

See my comments on Section D – I think it may be useful to distinguish between accounting values, which are narrowly defined according to SEEA principles, and broader monetary values, which are currently more commonly used by economists to value ecosystem services. Accounting takes a narrower perspective on monetary values than economics does.

Paragraph 1.26, sub-point v.
Watch out for "forest bias", where examples focus mainly on forests to the exclusion of other ecosystem types. This is especially important in Chapter 1, which sets the tone for the document. Also the term "variables" is used here in a different sense to Chapter 5.
Suggested changes to the text:
- "trends ~~in terms of key variables~~ in condition indicators e.g. for forests, wetlands, coastal dunes"
- "composition of ecosystem types e.g. rates of conversion from ~~forest to agricultural land~~ natural to intensively managed ecosystem types.

Paragraph 1.30
Sentence in the middle: "The measurement of ecosystem services through ecosystem accounting can thus be seen to extend the SNA production boundary and consequently expand the measurement of output, income and GDP and associated monetary values of ecosystem assets."
This doesn't seem right given the emphasis throughout the document that ecosystem services are by definition considered to be outside of the SNA production boundary (e.g. in para 2.31 "In effect, ecosystem accounting recognizes a set of flows that are not recorded within the current production boundary of the SNA"). Should this rather say that the measurement of ecosystem services complements the measurement of production within the SNA production boundary?
Is there a conceptual challenge here that as the SNA production boundary expands over time, the quantum and value of ecosystem service production could shrink? An example I can think of is subsistence production. Before subsistence production was included in the SNA production boundary, the whole volume of subsistence production as a non-SNA benefit would legitimately have been considered an ecosystem service. With the inclusion of subsistence production in the SNA production boundary, one should now isolate the contribution of the ecosystem to the SNA-benefit and limit the definition of the ecosystem service to that portion, at least in principle. I may be confused here.

Paragraph 1.35
The second last bullet is incorrect – it gives the wrong title of the document and the description is inaccurate. It should be changed to:
• Exploring approaches for constructing species accounts in the context of SEEA EEA (UNEP-WCMC, 2016) – which provides guidance on how an accounting approach can be applied to compiling information about species of special concern, such as species of social, economic or conservation importance

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Paragraph 1.36 on other global environmental measurement initiatives

It's important that there's often a two-way relationship between these initiatives and SEEA EA. SEEA EA not only draws info from some of them but info from ecosystem accounts can also contribute to some of them.

Suggested change to last sentence to reflect this:

In some ~~many~~ cases, the data currently collected through these initiatives may provide source data for the compilation of ecosystem accounts, <u>and in other cases information from ecosystem accounts may support these initiatives</u>.

Paragraph 1.37

The second last bullet deals with the IUCN's Red List of Ecosystems, Red List of Species, World Database on Protected Areas and Key Biodiversity Areas. It refers to all of them as "knowledge products", but the Red List of Ecosystems and Red List of Species are in the first instance assessment frameworks. The guidelines for Key Biodiversity Areas provide a framework for assessment and spatial prioritisation. This is an important distinction as it goes to the issue of the relationship between SEEA EA and biodiversity.

Suggested rewording of this bullet:

- International Union for the Conservation of Nature (IUCN) <u>assessment frameworks</u> ~~knowledge products~~ including the Red List of Species, Red List of Ecosystems, and Key Biodiversity Area <u>guidelines</u>; <u>and knowledge products such as the</u> World Database on Protected Areas (UNEP-WCMC and IUCN) ~~and Key Biodiversity Areas~~;

Paragraph 1.40

In the last sentence, suggest replacing "local communities" with "managers". It's unlikely that local communities will be direct users of SEEA EA. Managers of ecosystems and natural resources could be a large user group.

Paragraph 1.47

In the first sentence, suggest deleting "(a) the type of research question being investigated". Accounts would not usually be developed in response to a specific research question (although the development of accounts might suggest research questions). The sentence is better without this bit.

Suggest deleting the last sentence: "In practice, it is likely that a mix of spatial detail will be applied depending on the specific account, the variable being considered and the environmental context of a country." Using a <u>mix</u> of spatial scales in an ecosystem account would create big headaches – you want to settle on one spatial scale across a set of accounts for a particular realm.

Replace last sentence with: "<u>The spatial scale of accounts might differ for different realms, and the spatial resolution may increase over time as more and better data become available</u>."

Paragraph 1.50 dealing with potential applications of ecosystem accounts.

Suggest the following changes and re-ordering:

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"These applications include highlighting the ecosystems and ecosystem services of particular concern to policymakers; ~~supporting assessments of biodiversity and indicating specific areas or facets of biodiversity under particular threat;~~ <u>providing information to inform the management of ecosystems;</u> monitoring the effectiveness of various policies; providing detailed spatial information on ecosystem services supply; <u>supporting assessments of biodiversity;</u> and supporting economic and financial decision-making.

It is especially important to delete the phrase "indicating specific areas or facets of biodiversity under particular threat". SEEA EA was not designed to do this and is not well suited to this. The IUCN's Red List of Ecosystems and Red List of Species are assessment framework specifically designed to assess threat status of ecosystems and species, and more recently the framework and guidelines for identifying Key Biodiversity Areas has been developed to support identification of spatial priorities for conservation action. It is very important that SEEA EA is not shoe-horned into being applied to these purposes, which would not do any favours to either the IUCN's frameworks or the SEEA. The principles, approach, methods and guidelines for the Red List of Species and Red List of Ecosystems were developed over long periods of time with extensive involvement and consultation of scientists and practitioners. It is neither necessary nor appropriate for SEEA EA to venture into this territory.

Some of the spatial information on ecosystems that underpins ecosystem extent and condition accounts also underpins the Red List of Ecosystems, and thus a country that has developed a Red List of Ecosystems might be in a good position to develop ecosystem extent and condition accounts, or vice versa. But the principles, approach, methods and purpose of ecosystem accounts and the Red List of Ecosystems are different. *Ecosystem extent and condition accounts* can provide some information about biodiversity (for example natural ecosystems with declining extent and declining condition are likely to have experienced biodiversity loss) and in the absence of a Red of Ecosystems these accounts could be used as a rough-cut first take on which ecosystems are at risk from a biodiversity perspective. But preferably the spatial information that underpins the ecosystem extent and condition accounts should be analysed within the Red List of Ecosystems framework in order to draw conclusions about the state of biodiversity. It would be extremely unreliable to draw any consistent link between *ecosystem service accounts* and biodiversity.

As far as species are concerned, there are two main links with ecosystem accounts:
- Information about indicator species can be relevant for assessing ecosystem condition, in the form of species-based indicators of condition. Using species data in indicators of condition does <u>not</u> require that accounts have been produced for those species or that Red List assessments have been done for those species.
- Information about socially and economically important species may be relevant for measuring some ecosystem services. Using species data in measuring

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ecosystem services does <u>not</u> require that accounts have been produced for those species or that Red List assessments have been done for those species.

- In addition to the use of species data in ecosystem condition and ecosystem service accounts, it may be useful to develop species accounts for selected species of special concern, but this is never essential and is not a pre-requisite for using species data in ecosystem accounts.

Only a tiny subset of species are directly relevant for ecosystem accounts and species accounts, whereas biodiversity information management systems and assessment frameworks (such as the Red List of Species) are designed to deal with data on as many species as possible. Systematically organised spatial data on species that has been developed for Red List assessments may prove to be useful for ecosystem condition accounts, ecosystem services accounts and species accounts, so in that sense they can complement each other.

South Africa's experience is that the Red List of Ecosystems, Red List of Species, ecosystem accounts and species accounts can complement each other well, providing different tools, indicators and perspectives for different audiences. They draw on much of the same underlying information, and investing in those foundational datasets strengthens both ecosystem accounting and biodiversity assessment.

Landscape-level analyses can inform assessments of biodiversity *and* can inform assessments of ecosystem condition, but these are two different applications of the same underlying data.

Comments on Chapter 2

Paragraphs 2.3 and 2.8
First sentence "Ecosystems are the focus of ecosystem accounting."
Echoed in para 2.8 "…the same underlying focus for measurement, i.e. the ecosystem".
Yes! The focus of ecosystem accounting is not biodiversity. Please avoid the temptation to add "and biodiversity" in case that's suggested by other reviewers. I may be needlessly worried here.

Paragraph 2.6
Second sentence – suggest adding an example related to conversion, which is the biggest pressure on natural ecosystems in the terrestrial realm:
"…human actions, involving deliberate management or disturbance, such as <u>conversion to other uses,</u> the extraction of natural resources, pollution or restoration and conservation activity.

Paragraph 2.7
Suggest "Five distinct <u>measurement</u> perspectives are relevant", for clarity.
Could "spatial frame perspective" just be "spatial perspective"? Should it include an element related to nesting of spatial units at successive hierarchical levels?

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Paragraph 2.13
Support for this definition of ecosystem condition.

Paragraph 2.16
Should "interactions" rather be "transactions"?

Figure 2.1
Hope this won't be taken the wrong way… It would be great to have a graphic designer do further work on this diagram and others in the document, including more intentional and sparing use of colour. For example, in this diagram the colour for ecosystem assets is the same as for benefits – this seems a bit odd.
Should "GDP boundary" be "SNA production boundary"?

Paragraph 2.19
A couple more examples would be useful in this paragraph. Suggestions:
"For instance, in a natural forest or wetland ecosystem, processes exert the dominant effect on the dynamics of the ecosystem and there are likely to be fewer impacts from human management of the ecosystem or from human disturbances. At the other end of the spectrum, for example, in intensively cultivated fields or in ponds where there is intensive aquaculture, ecosystem processes are heavily influenced by human management."

Paragraph 2.20
I'm not sure if all of this is right. "Key characteristics of the operation of an ecosystem" – operation seems like an odd word here. Not sure that "composition" is generally understood to include non-living components. Is this paragraph essential?

Paragraphs 2.21 to 2.23 dealing with biodiversity
Suggest moving these paragraphs to the end of this section, after para 2.24 and 2.25. They are currently in the middle of the section and seem to break up the rest of the section.

Paragraph 2.21
This paragraph introduces the first discussion of biodiversity in the document, so I think it needs to clearly place biodiversity in the context of SEEA EA. Suggest changing the first sentence to something along the lines of:
"Biodiversity and ecosystems are interrelated, especially in the case of natural ecosystems. Although biodiversity is not the primary focus of the SEEA EA, ecosystem diversity is considered to be a component or aspect of biodiversity, along with species diversity and genetic diversity. This means that there are various links between ecosystem accounting and biodiversity."
The sentence "The SEEA EA tends to focus on data concerning ecosystem diversity and between species diversity" is confusing – it's not clear what "tends to focus on" means. Perhaps "SEEA EA includes some information on ecosystem diversity and species diversity"? Not sure the last sentence is necessary.

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Paragraph 2.22

In the second sentence change "is characterised by" to "is caused by".
The second part of the paragraph (from "Generally, …) is too sweeping and paints too much of a uni-directional picture of the relationship between biodiversity and ecosystem services. It's important to be more circumspect and nuanced here, and to convey that the relationship between biodiversity and ecosystem services is complex and not linear. It's partly because of this complex relationship that it's not appropriate or useful for SEEA EA to be used as a measurement framework for biodiversity.

I have also commented on this issue in Chapter 6 – pasted here as the same applies:
Comment on Section 6.3.3 The link between biodiversity and ecosystem services
I'm concerned that this section gives the impression that loss of biodiversity is always a problem from an ecosystem services perspective. Often it's not. The supply of many ecosystem services doesn't require pristine biodiversity at the ecosystem, species or genetic level. At the extreme, intensively managed ecosystem types generally have very little biodiversity intact, and yet are some of the most productive ecosystem types in terms of producing ecosystem services. For many ecosystems, there can be substantial losses of biodiversity in terms of composition with little impact on their capacity to supply services. Often it is only when ecosystem structure, processes and functions are destroyed or critically altered that the supply of ecosystem services is disrupted. I'm not sure how to address this neatly in this section, but there's too much of an easy impression given here that loss of biodiversity generally impacts negatively on production of all ecosystem services.

Paragraph 2.25

In row 6, change "management of wetlands" to "restoration of wetlands". Restoration is a better example of enhancement.

Paragraph 2.26

Suggested change for added clarity in row 5: "…where the supply of services involves more than one ecosystem asset of different ecosystem types"

Paragraph 2.28

To check my understanding: Could the last sentence be:
"Thus, for example, where fish are sourced from aquaculture facilities the ecosystem input contribution will be significantly lower, as it will have been substituted by human inputs"?

Paragraph 2.34

Could add "the scope of value or values" in the first sentence.

Paragraph 2.37

In line 5, suggest replacing "information content" with "information and indicators"

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Paragraph 2.38
In line 6, suggest deleting "its capacity to", so the sentence reads "will influence the supply of ecosystem services"

Paragraph 2.40 describing ecosystem extent accounts
The examples here are terrestrially biased and much more specific than the examples given in the subsequent paragraphs describing the other accounts.
Suggest the following changes:
"Data from extent accounts can support the derivation of indicators of composition and change in ecosystem types deforestation, desertification, urbanization and other forms of land use driven change, and thus provide a common basis for discussion among stakeholders, including related to conversions between different of the changing composition of ecosystem types within a country."

Paragraph 2.44
"Ecosystem monetary asset accounts" are sometimes referred to as "Monetary ecosystem asset accounts". I prefer "monetary ecosystem asset accounts".

Paragraph 2.45
Change "agricultural land" to "cultivated land". See my comments in Chapters 1 and 3 on this issue.

Figure 2.3: Stylised integration of ecosystem accounts for selected ecosystem types
I found this diagram useful.
Same comment re changing "agricultural land" to "cultivated land" in the heading row.
In the second row, change "area" to "extent" i.e. opening and closing extent?

Paragraph 2.49
Suggested addition after second sentence ending "management expenditure":
"Data from other information systems or measurement frameworks can also sometimes be drawn on or linked to thematic accounts."
I'm thinking of, for example, demographic data and biodiversity data, but I'm sure there are other examples. I think it's important that thematic accounts have SEEA at their core but can link different types of info from various other frameworks to the core accounts.

Paragraph 2.51
Again a note to stick here to "ecosystems" and not be tempted to expand to "ecosystems and biodiversity".

Paragraph 2.52
In the last sentence, add "environmental management" after "spatial planning" – another big area of potential application.
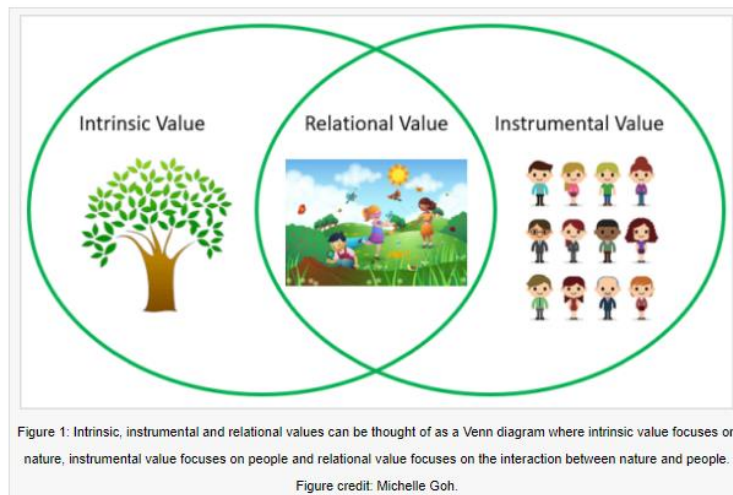
Paragraph 2.53

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In the second sentence, suggest "the value perspectives [plural] of ecosystem accounting" – to emphasise that accounting can support several perspectives.

Paragraph 2.55
The second continuum should be from intrinsic to relational to instrumental values – "relational" sits in the middle between intrinsic and instrumental. See cute graphic below.
I'm not sure one can really have a continuum of three things, but OK.

Figure 1: Intrinsic, instrumental and relational values can be thought of as a Venn diagram where intrinsic value focuses on nature, instrumental value focuses on people and relational value focuses on the interaction between nature and people.
Figure credit: Michelle Goh.

https://biol420eres525.wordpress.com/tag/intrinsic-value/

Paragraph 2.56
There's no definition provided for "non-anthropocentric value", which feels like a gap. Having said that, it's not clear to me what the difference is between "intrinsic value" and "non-anthropocentric value" – the definition would be exactly the same?

Figure 2.4
It doesn't make sense to lump intrinsic and relational together at one end of the horizontal axis – relational values are by definition not the same as intrinsic values. Relational values could possibly sit in the middle of the horizontal axis?
Looking at this again after a break, I'm still not sure that the anthropocentric – non-anthropocentric axis adds anything. Intrinsic and non-anthropocentric seem to mean the same thing, and the quadrant "Non-anthropocentric + Instrumental" seems to be inherently contradictory.

Section 2.4.2 overall
Could SEEA EA not just adopt the IPBES values framework, which includes intrinsic, relational and instrumental values and went through indepth consultation over several years with hundreds of values experts from around the world? We would have to have a VERY good reason for the SEEA community to develop its own framework that is only marginally different from the IPBES framework.

Paragraph 2.59

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This paragraph feels apologetic, and I'm not sure it adds anything that's not covered in Section 2.4.3. The second sentence seems like a generic statement rather than something that's relevant to the values discussion specifically. Rather leave this paragraph out?

Paragraphs 2.61 and 2.62
It may be useful to make it explicit in one or both of these paragraphs that accounting values represent a subset of instrumental values, to link the discussion back to the values framework. I think it would be useful to use the term "accounting values" in these paragraphs.

Paragraph 2.63
Delete "it is evident from consideration of the wider literature" – this is evident from SEEA EA itself.

Section 2.5.2 Length of the accounting period
Suggest adding a paragraph to this section along the lines that initially the length of the accounting period for ecosystem accounts may well be substantially more than a year, and that shouldn't deter one from producing the accounts. In South Africa our first set of river accounts was for a 12 year accounting period, and our first set of land and terrestrial ecosystem accounts have a 24 year accounting period. We aspire to a five year accounting period for ecosystem accounts – that will be a big achievement that is still in the distant future.

Paragraph 2.78
Might be important to mention conversion of variables to normalised indicators in this paragraph.

Section 2.5.5 Gross and net recording
My sense is that this section is fundamental, but there are parts that I think I'm not quite getting, especially in para 2.83 and 2.84. Is there a way to break this down even further / explain even more slowly?

Paragraph 2.83
"In ecosystem accounting, the recording of ecosystem services is undertaken such that all flows between ecosystem assets and economic units are explicitly identified, i.e., the recording is in gross terms."
- Does this apply to physical and monetary accounts?
- Does the recording in gross terms mean that there's double counting? (if net means there isn't double counting – para 2.82)
The second part of this paragraph I find difficult to follow.

Paragraph 2.84
"…it is common to express the relevant values being in "net" terms when the costs of supplying the ecosystem service are deducted"

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- I'm struggling to follow this. What costs are associated with supplying ecosystem services? Aren't they supplied free by the ecosystem asset?

"Deducting these costs, as appropriate for the valuation technique being applied, is required to ensure that the monetary valuation is focused on the contribution of the ecosystem."

- Does this assume that it's possible to isolate the contribution of the ecosystem asset from the total value of the SNA benefit, which is often not possible in practice?

Paragraph 2.90

I think it's more likely that ecosystem accounts will draw on information developed for scientific, research or management purposes than for administrative purposes?

In addition to piecemeal local bits of data from various studies, it is quite possible that info for ecosystem accounts will be drawn from national information management systems related to ecosystems developed by e.g. environment ministries (I'm thinking of e.g. South Africa's national ecosystem classification system) – in this case the requirement will be to draw these systems into national statistical quality frameworks where possible.

Question 3. Do you have comments on Chapters 3-5 of the draft SEEA Ecosystem Accounting?

Comments on Chapter 3

Paragraph 3.6

Definition of ecosystem type

Paragraph includes the sentence: "Each ecosystem asset is classified to an ecosystem type which reflects a distinct set of abiotic and biotic components and their interactions"

This wording matches the definition of ecosystem type in the Glossary. It might be useful to make it explicit here that this is the definition of an ecosystem type.

Suggest the following slightly rounded out version of the definition, which could also be used in the Glossary:

"An ecosystem type is a spatial unit or set of spatial units that reflect a distinct set of abiotic and biotic components and their interactions. Ecosystem assets of the same type are expected to share similar ecological characteristics."

Could also note that ecosystem types can be defined at a range of spatial scales? Although that potentially best left to later in the chapter.

Paragraph 3.9

Seems contradictory to say that subterranean ecosystems are close to the Earth's surface.

Footnote 20

Could add: "but ecosystem accounts can be compiled in the absence of this information", just to make this explicit.

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Paragraphs 3.11 and 3.12

Paragraph 3.11 deals with "conceptual approach for marine ecosystems".

However, the paragraph actually sets out an operational approach not a conceptual approach, and this is not the only operational approach that is consistent with SEEA EA.

All that's needed conceptually is a boundary for the marine realm in relation to SEEA EA, which is provided by the sea floor. There's not a conceptual boundary needed as there is for the atmosphere, as there's no need to decide for the marine realm what falls within the scope of SEEA EA and what is an environmental asset that is dealt with in the SEEA Central Framework. Additionally, the approach proposed to delineating marine ecosystems in the second bullet of paragraph 3.11 and paragraph 3.12 is not the only one that is possible or sensible (for example, it is quite different to the approach used in the South African National Ecosystem Classification System). The issue of how to delineate marine ecosystems beyond the continental shelf (e.g. by stratifying according to depth) is best dealt with in Section 3.3 on delineating ecosystem assets – there's no need to include it here as a conceptual issue.

Recommendation: All that is needed in paragraph 3.11 is a clear statement that the conceptual boundary for the marine realm is provided by the seabed. Paragraph 3.12 can be deleted.

Paragraph 3.20

Could add to this paragraph that the same applies to pelagic ecosystems if these are identified. Their "footprint" can be defined in 2D terms. They coexist with benthic ecosystems and can be accounted for separately and alongside benthic ecosystems.

Paragraph 3.28

"Agricultural land" is given as an example of an ecosystem type.

Recommendation: rather say "cultivated land".

"Agricultural land" is not a good example of an ecosystem type, as agricultural land can take the form of many different ecosystem types and will usually span several different ecosystem types in a country. For example, agricultural land can take the form of extensive rangelands that would be considered natural or semi-natural OR it can take the form of cultivated land that would be considered part of the "intensive land use" biome in the GET.

Suggest checking for this throughout the document – there are several places where agricultural land is given as an example of an ecosystem type.

Paragraph 3.32

Last sentence of the paragraph: "It is also expected that in the delineation of an ecosystem asset the condition of that asset will be relatively homogenous following the approach to the measurement of ecosystem condition described in Chapter 5."

This is not consistent with the approach to the measurement of condition in Chapter 5. It may be in some cases, but not always, and I think there may be confusion between extent and condition here. For example, a portion of an ecosystem asset could undergo a change in condition over an accounting period without a change to the delineation of the ecosystem asset. Such a change in condition might be attributed to the whole ecosystem asset based on a majority rule approach.

Recommendation: This sentence could be replaced with:

"It is not expected that ecosystem condition will necessarily be homogenous across an ecosystem asset, as assessing condition is a separate step to delineation of ecosystem assets.

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Only when a change in condition is sufficient to be considered a conversion would this impact on delineation of the ecosystem assets concerned."

Paragraph 3.33, point iii
Just a note: The requirement that ecosystem assets be geographically exhaustive means that mines will be considered ecosystems. They would presumably fall within the Ecosystem Functional Group T7.4 Urban and industrial ecosystems. It doesn't sit comfortably with me to consider mines an ecosystem type, but perhaps it's useful. Wondering how one would define ecosystem condition indicators for mines, but I suppose one could. Has this ever come up in discussion?

Paragraph 3.34
Could add another example: Conversion of a natural ecosystem to an intensively managed ecosystem, such as draining and cultivating a wetland, expanding cultivation into previously natural or semi-natural areas.

Section 3.3.2 Principles for the delineation of small ecosystems and features
This sub-heading doesn't seem right:
- The section is more about challenges rather than principles?
- The section doesn't deal specifically with small ecosystems and features. It deals with linear ecosystems and features, but these can be large (e.g. wide rivers).
- Perhaps two sub-sections are needed in the chapter: one dealing with generic issues related to spatial scale (which includes the issue of small features); and another dealing with linear features.

Paragraph 3.37
A general discussion about scale is perhaps needed in this chapter. This paragraph is not really about small features.
The last word of the paragraph "the units" is not clear – the ecosystem assets or the ecosystem types?

Paragraph 3.39
"The general principle is that for a given ecosystem account a single spatial scale of analysis should be selected…"
- Is this a principle or recommended practice? Not sure
- This is relevant not only to small ecosystems and features – should rather be mentioned in a more general discussion on spatial scale

Paragraph 3.42
Agreed it is ideal to map wide downstream rivers based on area not just length and treat them as such in the accounts. However, I suspect that in many countries this has not been done and all rivers are still mapped just as lines, so it shouldn't be stated as a requirement.
In South Africa we are dealing with this exact issue at the moment, as we are embarking on mapping rivers in 2D as part of piloting accounts for ecological infrastructure in particular

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catchments. The approach we've come to is to map two elements: the river channel, and the riparian functional zone. It's a complex task and it will take many years to do this for the whole country.

So suggestion for this paragraph:
- Large rivers should ideally be mapped as areas, which could include the river channel and the riparian functional zone
- If this is not possible, rivers should be accounted for just in terms of length

Also in this paragraph: It may be better to use the term "distinct" rather than "separate" e.g. "distinct ecosystem type with an associated area".

Paragraph 3.47
"Any ecosystem classification to be used for ecosystem accounting should ideally satisfy the definition of ecosystem assets"
This doesn't really make sense to me. Should this be "satisfy the definition of ecosystem types"? The definition of an ecosystem asset (paragraph 3.5 is "a contiguous space of a specific ecosystem type", so there's something circular/self-referential about saying the classification should satisfy the definition of ecosystem assets.

Section 3.4.2 SEEA Ecosystem type reference classification.
Full support for this section.
The section includes definitions of realm (para 3.55) and biome (para3.56). It might be useful for it to also reiterate the definition of ecosystem type.

Paragraph 3.59
In the first sentence "it is expected that delineation of ecosystem types [rather than assets] would occur at fine levels of detail…"?

Paragraph 3.60
Last sentence: "…the heterogeneity within these land use classes may be described by means of condition variables (e.g. the percentage cover of trees, grass and water within urban parks)"
Caution needed here. This potentially introduces confusion between delineating ecosystem types and assessing ecosystem condition. These are EITHER characteristics that distinguish difference ecosystem types OR condition variables. They can't be both.
Could delete this sentence – it's not essential.

Paragraphs 3.66 through 3.70
These paragraphs are getting into the realm of the accompanying technical guidance mentioned in paragraph 3.63. Also, they represent just one technical approach of many possible approaches.
Suggest replacing paragraphs 3.66 to 3.70 with the following more general points:
- If a country has an existing classification of ecosystem types, the BSU grid can simply be overlaid on the existing map of ecosystem types, and ecosystem types can be attributed to BSUs.

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- If there is no existing classification of ecosystem types, then the BSU grid can be used to combine data on various characteristics to identify and delineate different ecosystem types (this is where the tools and approaches mentioned in para 3.63 and 3.64 can be useful). Further guidance provided in accompanying technical guidance that is being developed.

Paragraph 3.71
This paragraph is confusing and difficult to follow. It seems to be talking to a highly specific instance and I think won't be applicable in many (most?) contexts. The last two sentences make sense to me but aren't essential to say here.

Paragraph 3.76
Last sentence "Of particular interest in the analysis of ecosystems may be data on the extent and changes in extent of protected areas."
This is one among a very wide range of aspects of land and water management. It's not clear why the extent of protected areas (which incidentally doesn't necessarily tell one anything about land management within those areas) is singled out here, especially as protected areas are mentioned in the previous para 3.75.
Suggest deleting this sentence.

Paragraph 3.77
First sentence: "Land ownership, encompassing ownership across all realms…" – this doesn't really make sense to me.
Middle of the paragraph – it's not only areas beyond the EEZ that are not owned. Also areas within the EEZ are not owned (certainly in South Africa, and I don't think we're an exception in this respect).

Section 3.5.3 Organising data about socio-economic and other characteristics
This subsection seems to backtrack into a discussion on ecological characteristics, which isn't necessary. It also jumps forward to measuring ecosystem services, which should rather be left to Chapter 7. Para 3.79, para 3.81 and first sentence of para 3.80 could be deleted. Rather start this sub-section with second sentence of para 3.800, then para 3.82 and 3.83.

Paragraph 3.79
First sentence: "Beyond land related data, the delineation of ecosystem assets will generally require the use of various data concerning ecological characteristics."
As noted above, not clear why we're going back to ecological characteristics.
Also, the delineation of ecosystem assets will actually seldom require the data and characteristics listed here – this is unlikely to apply in many contexts, for example if there's an existing classification of ecosystem types (also see comments on paragraphs 3.66 through 3.70). As suggested above, rather delete this paragraph.

Paragraph 3.81
Suggest leaving all of this to Chapter 7 – not necessary to include here.

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Paragraph 3.83
Suggest small addition to end of first sentence: "across many <u>ecological, social and economic</u> characteristics".
A lovely sentence I came across the other day that speaks to this paragraph: "Location is the key to combining environmental, social and economic information".

Annex 3.2
Agree useful to include this annex

Comments on chapter 4

Overall comment on Chapter 4
I would like to recommend including the concept of a reference extent in the extent account, as an optional addition to the opening extent and closing extent. An extent account can easily be compiled without a reference extent, but including a reference extent enables additional analyses, indicators and applications of the account.

The reference extent is an accounting entry that remains consistent across accounting periods. The closing extent can then be evaluated against the reference extent as well the opening extent for a particular accounting period, providing two different pieces of information.

The reference extent complements the concept of a reference condition in the condition account, and enables the calculation of an ecosystem extent index to complement the ecosystem condition index. The ecosystem extent index is defined as: closing extent / reference extent * 100.

The reference extent could be a historical (pre-industrial) extent, or it could be the extent at any other chosen date that's feasible. This is indirectly referred to in paragraph 4.28, which talks to the possibility of including an opening extent for e.g. 1750. I think it would be conceptually clearer to think of this as a reference extent than a long-ago opening extent, which also then delinks it from necessarily being prior to substantial human impacts on the landscape.

The inclusion of a reference extent in South Africa's recently completed terrestrial ecosystem extent accounts has been simple to achieve and extremely useful. The reference extent is based on the delineation of the historical extent of vegetation types in the National Vegetation Map. For future wetland ecosystem accounts it will be more challenging to identify a reference extent as the historical (pre-industrial) extent of wetlands is unknown and not possible to model reliably. So for wetland ecosystem extent accounts we will need to select a best available baseline as the reference extent. Note that this need not be pinned to a particular date, it could just be a best minimum estimate of previous extent of wetlands based on available data – which might go back to, say, c1950 for some parts of the country and earlier or later for other parts of the country. All of this could be labelled "reference extent", with footnotes about how it was derived. For river ecosystem accounts the reference extent is provided by the total length of rivers. The extent accounts for rivers are rather dull, as river length is likely to be stable for very long periods, and for rivers the condition account is of much more interest than the extent

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account. For marine ecosystems the reference extent is provided by the historical extent as mapped in the national map of marine ecosystem types. As with rivers, the current extent of marine ecosystem types is unlikely to differ substantially from the reference extent, except perhaps for coastal ecosystem types that have been converted to intensive uses. All of this is to make the point that the concept of a reference extent can be operationalised in all realms, but there's no need for it to be operationalised in exactly the same way for all realms.

The diagram below illustrates for the terrestrial realm how the inclusion of a reference extent enables an ecosystem extent index to be derived, and how that relates to the reference condition and ecosystem condition index.

I have provided suggestions in my paragraph-specific comments below on where the reference extent could be included in the text. I think these suggestions would be sufficient to cover the inclusion of a reference extent (i.e. I don't think it would require huge changes to the text).
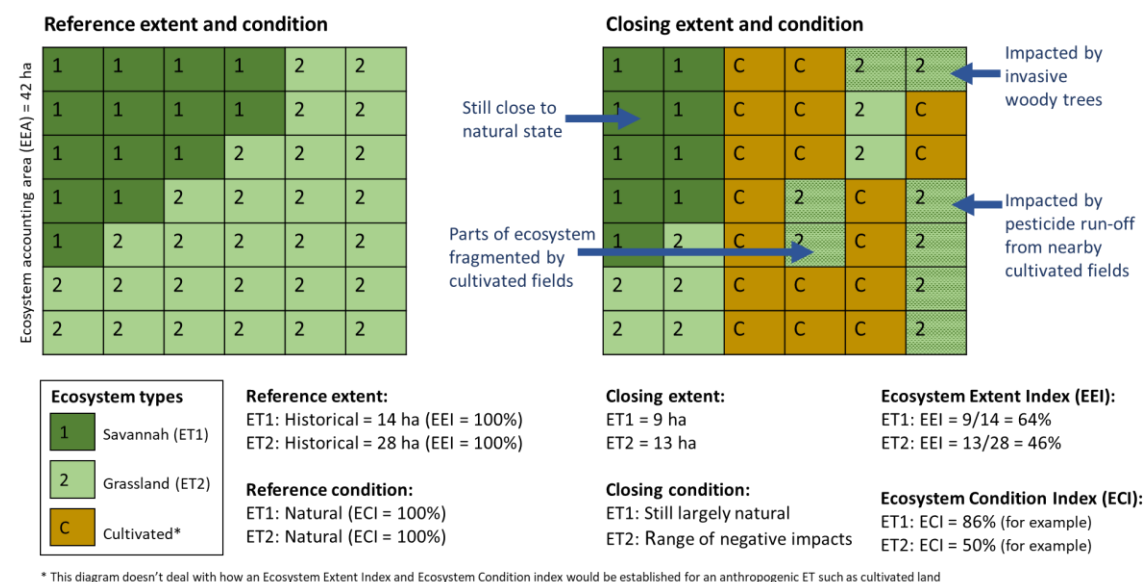

Figure 1. Illustration of the concept of reference extent. In this case the reference extent is the historical extent (prior to major human modification of the landscape), but the reference extent could equally be the extent at some agreed point in time for which data are available or can be estimated.

Paragraph 4.2

Replace "urbanisation" with "urban expansion" or "urban sprawl". Urbanisation is the process of people moving from rural to urban areas, not expansion of the urban footprint. The two are often related but not the same. For example, if urban edges are firmly defined and implemented, urbanisation will not necessarily result in expansion of the urban footprint.
Caution on "other forms of ecosystem change" in the middle sentence – this is quite sweeping, and many forms of ecosystem change won't be picked up by the extent account. Perhaps "some other forms of ecosystem change".
See chapter 3 comment on the use of "agricultural areas" – rather "cultivated areas". Suggest changing throughout the chapter.

Paragraph 4.4
Suggest adding to end of first sentence: "…and where possible/relevant changes relative to the reference extent".

Paragraph 4.5
Could add that the ecosystem extent account and ecosystem condition account provide most information when viewed and interpreted jointly.

Section 4.2.2 Structure of extent accounts and accounting entries
Paragraph 4.9
Could add a sentence here about potential inclusion of a reference extent in addition to opening extent and closing extent.

Paragraph 4.12
Could add that it may be appropriate to compile separate tables for different realms, as units of measurement may differ for different realms (e.g. ha for terrestrial and km² for marine).

Table 4.1
It might be useful to include one or two of the anthropogenic biomes in the example tables. Currently only natural or semi-natural biomes included.
Suggest including a row for "reference extent (optional)" above the row for "opening extent". This would not alter any of the other rows.

Paragraph 4.13
Suggested addition to first sentence: "The accounting entries encompass reference extent (if relevant), opening and closing extent, …"

Paragraph 4.14
Suggested addition at the beginning of the paragraph:

- "Reference extent represents the total area of ecosystem assets for a given ecosystem type at an agreed point in time, providing a baseline extent that remains stable across all accounting periods. This could be a historical (e.g. pre-industrial) baseline or a more recent baseline for which data are available or can be estimated or reconstructed."

Question related to managed/unmanaged expansion and regression:
Would abandonment of cropland and reversion to natural or semi-natural ecosystems be treated as managed or unmanaged change? This is quite a common situation in South Africa, for example as subsistence croplands are abandoned when people move to urban areas, or when commercial cultivated fields that are no longer profitable are left fallow. The timeframe over which the reversion to semi-natural occurs can be quite long, so in this sense this is an unmanaged conversion (para 4.24).
Also, in some cases restoration (such as reforestation of cultivated areas) takes place through active human intervention, and in some cases it takes place through the withdrawal of human activity – is that a managed or unmanaged change?

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There's a link here with the discussion on conversions in section 4.2.3, which should perhaps be referenced. Managed expansion/regression will generally take place within one accounting period, whereas unmanaged expansion/regression will often take place gradually over several accounting periods, and will be recorded initially as a change in condition until some threshold is judged to have been passed and the change is seen as a conversion and recorded in the extent account.

Paragraph 4.23
First sentence: Suggest deleting "ecosystem condition" which is potentially confusing, and adding something about impacts.
So the sentence would read: "Ecosystem conversions are of particular interest in understanding trends in and impacts on biodiversity and flows of ecosystem services."
Could add to this paragraph that ecosystem conversions for a given ecosystem type should ideally be interpreted together with information on ecosystem condition for that ecosystem type to provide a holistic view of changes in the ecosystem type, although this is also addressed in para 4.26.

Paragraph 4.25
Suggested addition to the last sentence for added clarity: "This change of ecosystem type for a given ecosystem should be recorded as an expansion or regression in the extent account in the accounting period in which the change took place."

Paragraph 4.26
Last sentence: "This highlights the relevance of considering measures of ecosystem condition in understanding changes in ecosystem extent."
I'm not sure this is quite right. It's not so much that ecosystem condition measures are needed to understand changes in ecosystem extent; rather than the two should be considered together. Could strengthen the point (or even add an additional para) to highlight the importance of viewing the extent account and condition account as a complementary pair of accounts that should be interpreted jointly rather than in isolation of one another. If only an extent account has been compiled and a condition account is not yet available, it should be noted that the extent account provides partial information about the state of a given ecosystem type. Having said that, large or rapid decreases in extent of a given ecosystem type will often be associated with a decline in condition (at least for natural or semi-natural ecosystem types), as decreases in extent are often accompanied by fragmentation and disrupted ecological functioning of those portions of the ecosystem type that remain. So in the absence of an ecosystem condition account, the extent account can provide a rough first-cut proxy of condition for some ecosystem types.
[This is why decreases in extent are the basis for Criterion A in Red List of Ecosystem assessments.]

Paragraph 4.28
This paragraph refers indirectly to the concept of a reference extent, but calls it an opening extent. A reference extent could be thought of as an opening extent of a special type. If the

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concept of a reference extent is included earlier in the chapter, this paragraph is probably not necessary. Without the concept of the reference extent, the idea of taking the account back to a pre-industrial time period is quite complicated to explain, as evidenced by this quite complicated paragraph!

Paragraph 4.32
The first sentence could be read to imply that one needs maps to make a change matrix. A change matrix can be churned out in Excel without ever having made a map, so could just delete "by comparing maps" from this sentence. Where the change matrix shows large switches between different ecosystem types, producing and comparing maps can then give insight into the spatial patterns of those switches.

Paragraph 4.35
This approach to complementary extent accounts for sub-surface ecosystem assets could also apply to pelagic ecosystem assets in the marine realm. Exactly the same principles apply.

I have not commented on chapter 5 – decided to place my attention elsewhere.

Question 4. Do you have comments on Chapters 6-7 of the draft SEEA Ecosystem Accounting?

Comments on Chapter 6

There are several concepts in this chapter that haven't been included in the Glossary. Suggest adding users, beneficiaries and environmental flows to the Glossary.

Paragraph 6.5
This paragraph is not easy to follow.
"…when ecosystems change (e.g. in terms of land use, management planning and protected status)" – may be this should be when ecosystem extent and condition changes?
The last sentence of the paragraph is "This focus implies a general focus on those ecosystem contributions that may be at risk of being lost or becoming scarce." I think this is a dangerous route to go down. The purpose of accounting for ecosystem services surely includes making visible those ecosystem services that are not (yet) at risk of being lost or becoming scarce. Strongly suggest deleting this sentence.

Paragraph 6.9
The last sentence includes the first mention of "passive receipt", which is mentioned again in footnote 44. Given that many regulating and maintenance services are passively received, I think a paragraph on passive receipt might be warranted somewhere in the chapter.

Paragraph 6.16
Last sentence is about the aim of isolating the ecosystem's contribution to the benefit. Could add here that, as discussed later, this is often challenging in practice.

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Paragraph 6.17
Suggest adding: For non-SNA benefits, the whole benefit is attributed to the ecosystem.

Paragraph 6.23
In the last sentence, the phrase "as additions to the SNA production boundary" is unclear. Should this be "as outside the SNA production boundary"?

Paragraph 6.28
Could state explicitly that beneficiaries include a wider set of economic users than users. It's not clear to me whether users are a subset of beneficiaries or if users and beneficiaries are separate sets of economic units.

Paragraph 6.35
Does "current economic valuations" mean the SNA?

Table 6.2
It would be useful to include a column for beneficiaries in this table, as has been done in the examples in Annex 6.1.

Paragraph 6.37
It would be useful to include an additional bullet for beneficiaries.

Paragraph 6.45
Is it true to say that the consumption of provisioning services is generally active (not sure if that's the right word), while regulating and maintenance services are generally passively received? Cultural services could be either depending on the service. If so, this might be a useful point to include here or elsewhere.

Table 6.3 Reference list of selected ecosystem services
"Water supply" is listed under provisioning services, but my understanding from the earlier discussion is that water supply is considered an environmental flow not an ecosystem service.
The description of water supply refers to water purification and water flow regulation, but these are regulating and maintenance services. Confusing.

Also in Table 6.3, the description of river flood mitigation refers to "the contributions of forests and other ecosystem in protecting the banks of rivers from floods". It would be better to refer to riparian vegetation – forests are just one form of such vegetation. Riparian vegetation could fall within many different ecosystem types. Also I think it's not so much that riparian vegetation protects the banks of rivers, rather just: "riparian vegetation, which provides structure and a physical barrier to high water levels…"

Section 6.3.3 The link between biodiversity and ecosystem services
I'm concerned that this section gives the impression that loss of biodiversity is always a problem from an ecosystem services perspective. Often it's not. The supply of many

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ecosystem services doesn't require pristine biodiversity at the ecosystem, species or genetic level. At the extreme, intensively managed ecosystem types generally have very little biodiversity intact, and yet are some of the most productive ecosystem types in terms of producing ecosystem services. For many ecosystems, there can be substantial losses of biodiversity in terms of composition with little impact on their capacity to supply services. Often it is only when ecosystem structure, processes and functions are destroyed or critically altered that the supply of ecosystem services is disrupted. I'm not sure how to address this neatly in this section, but there's too much of an easy impression given here that loss of biodiversity generally impacts negatively on production of all ecosystem services.

Paragraph 6.49
Sentence in the middle: "Further, as biodiversity is lost, these ecosystem processes are impacted."
It's important to qualify this: "Further, as biodiversity is lost, these ecosystem processes may be impacted." Some ecosystem processes and functions can withstand substantial loss of biodiversity. This is why many ecosystem services can be sustainably produced even when there's been substantial loss of biodiversity. This goes to the broader point that the relationship between biodiversity and ecosystem services is complex.

Paragraph 6.59 and 6.60
These two paragraphs seem to contradict one another. I'm not clear from this discussion whether non-use values should be included in ecosystem services accounts or not.

Paragraph 6.67
Middle sentence contrasts biomass harvested directly by a final consumer with biomass grown and supplied to other economic users. Where does subsistence production fit into this picture? It is grown but not supplied to other economic users?

Paragraph 6.68
Second sentence: "In line with treatments in the SNA, all biomass provisioning that is input to subsistence production of agriculture, forestry and fisheries should be included in the scope of ecosystem accounts".
This doesn't make sense to me. The SNA production boundary includes subsistence production, so it's not clear why subsistence production would be treated differently from commercial production. South Africa's GDP figures include estimates of subsistence agriculture and fisheries, and subsistence production takes place on a large scale, with a total area of subsistence crops of just less than 2 million hectares in 2014. Is the assumption that the inputs to subsistence production from economic units are small and therefore needn't be considered? That might be controversial.
Commercial production isn't addressed explicitly in the paragraph – perhaps it should be.

Paragraph 6.70
Could add, "In cultivated production processes, which include commercial and subsistence cultivation, joint production is considered…"

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Paragraph 6.73

Last sentence: "Compilers are thus encouraged to estimate the ecosystem contribution to cultivated biomass production processes especially where these might be changing over time."

Interested to know whether this estimation of the ecosystem contribution has ever been achieved in practice.

It's not clear to me why this is more important if the contribution is changing over time. I would think it's especially important in cases where cultivated production is of high intensity, regardless of whether the contribution is changing over time.

Paragraph 6.74

This seems to be an extremely important paragraph.

Recognising the challenges in estimating the ecosystem contribution to cultivated biomass, the paragraph goes on to say "the gross biomass harvested is considered a suitable proxy measure for the flow of biomass provisioning services in cultivated production contexts, irrespective of human inputs and intensity of management."

This means that the measurement of the ecosystem service will include both SNA benefits and non-SNA benefits, which seems to be counter to a fundamental principle of ecosystem accounting that has been emphasised elsewhere in the document.

Also, if gross biomass is used as a proxy, the flow of ecosystem services from more intensively managed highly productive agricultural ecosystem types (such as commercial cultivation) will always be greater than the flow of ecosystems services from less intensively managed agricultural ecosystem types (such as subsistence cultivation). This doesn't seem right. I would think if anything the contribution of ecosystems to more intensively managed biomass production is probably smaller than the contribution of ecosystems to less intensive production, because human inputs can replace ecosystem inputs in intensive agriculture systems. Yet the flow of ecosystem services will end up being bigger from the intensive systems.

The use of gross harvested biomass as a proxy for may also have knock-on effects for monetary ecosystem service accounts for cultivated biomass, if the ecosystem service value is derived for the full volume of biomass. Footnote 50 may be relevant here, but it's meaning is unclear to me. I'm concerned that we are heading down a route where the accounting value of ecosystem services from intensively managed ecosystem types will almost always be higher than the accounting value of ecosystem services from natural and semi-natural ecosystem types. This would be really problematic from the point of view of policy implications, given that expansion of intensive land and resource uses is one of the biggest pressures on natural ecosystems and biodiversity. Just want to be sure we aren't digging a hole for ourselves here.

Paragraph 6.79

Suggest splitting the paragraph in two – the first sentence deals with a separate issue to the rest of the paragraph.

Cattle rearing is an important example in addition to chicken and pigs.

Comments on Chapter 7

Section 7.3.1 Spatial allocation of ecosystem services to ecosystem assets
Suggest that this sub-section should be elevated to a section in its own right, not subsumed under 7.3 Considerations in accounting for ecosystem services in physical terms.
Also, the heading could be broadened to "Allocation of ecosystem services to ecosystem types". Spatial allocation of ecosystem services to ecosystem assets is one step in allocating ecosystem services to ecosystem types, which is fundamental to constructing the ecosystem service supply and use tables.
It would be useful to put this discussion earlier in the chapter, as in other parts of the discussion there's an assumption that it's possible to allocate ecosystem services to ecosystem types without this having been explicitly discussed.

Section 7.3.2 Determining ecosystem service measurement baselines
I wonder if there is a link here to the ecosystem condition account. I didn't fully understand the discussion about measurement baselines for regulating and maintenance services, but could these be linked to the reference condition of the ecosystem types that supply the service? The baseline would be the level of supply associated with the reference condition of the underlying ecosystem type. This seems to be hinted at in para 7.70 which talks about the characteristics of the ecosystem type, but I didn't follow that sentence. Some of the ecosystem characteristics that underpin the condition account also link nicely to ecosystem services, so if there are condition indicators for these characteristics, the reference level for the condition indicator could also be the baseline level of supply for the associated ecosystem service.

Paragraph 7.71
I didn't understand the definition of the ecosystem service measurement baseline.
It may be useful to have different definitions of the measurement baseline for provisioning, cultural and regulating services. A default baseline of zero makes sense (to me) for provisioning services and cultural services, but for regulating and maintenance services the baseline could be defined as the level of supply that would be associated with the reference condition of the underlying ecosystem type (see previous comment).

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Question 5. Do you have comments on Chapters 8-11 of the draft SEEA Ecosystem Accounting?

We have several suggestions about Chapters 8-11 that make up Section D, discussed below. We have set out proposals for specific issues that could be addressed more clearly or comprehensively in the text. Our comments on this section are broad rather than relating to specific paragraphs.

1. *A clearer distinction should be made between the economic approach and the accounting approach to valuation of ecosystems, and it should be made clearer that the focus of Section D is only on accounting valuation*

The economic approach to ecosystem valuation ("economic valuation") has been developed as part of the discipline of environmental economics over the past several decades. Valuation based on this approach often uses the Total Economic Value (TEV) framework to guide which values of ecosystems are included. The TEV framework includes both use values and non-use values of ecosystems, and it encompasses both exchange value and consumer surplus (i.e. it aims to measure the welfare value of ecosystems not just the exchange value).
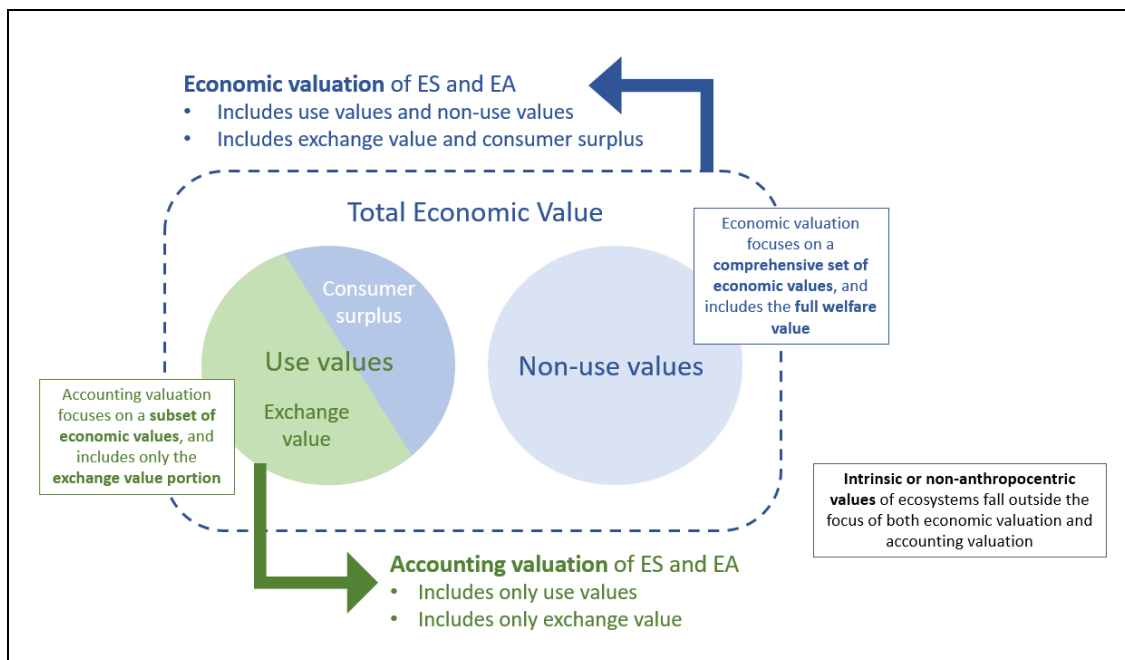
In contrast, the accounting approach to ecosystem valuation ("accounting valuation") deliberately focuses only on use values, and deliberately excludes consumer surplus. It also requires that a transaction between an ecosystem asset and a user can be identified. This means that it encompasses only a portion of the use values of ecosystems. This purposefully narrow focus is designed to be consistent with accounting principles, and means that accounting values of ecosystems can be linked directly to the System of National Accounts (SNA).

Neither economic valuation nor accounting valuation is intended to address intrinsic or non-anthropocentric values of ecosystems, and this should also be clearly spelt out in the text.

The deliberately narrow focus of accounting valuation means that accounting values have inherent limitations in what they represent and how they should be used. These limitations need to be well understood by both compilers and users of monetary ecosystem accounts to ensure that the accounts are not misrepresented or misused.

To aid this understanding we suggest that SEEA EA should set out the distinction between the economic approach and the accounting approach to valuation more comprehensively, and that the term "monetary valuation" should not be used in a generic sense without specifying whether economic valuation or accounting valuation is being referred to.

Below is a diagram (PowerPoint version attached) that is intended to illustrate the difference between economic valuation based on the TEV framework and accounting valuation based on accounting principles. It may be useful to include a diagram along these lines in the document.

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Economic valuation of ES and EA
- Includes use values and non-use values
- Includes exchange value and consumer surplus

Total Economic Value

Consumer surplus

Use values

Exchange value

Non-use values

Economic valuation focuses on a **comprehensive set of economic values**, and includes the **full welfare value**

Accounting valuation focuses on a **subset of economic values**, and includes only the **exchange value portion**

Intrinsic or non-anthropocentric values of ecosystems fall outside the focus of both economic valuation and accounting valuation

Accounting valuation of ES and EA
- Includes only use values
- Includes only exchange value

2. *The inherent limits in the concept of accounting values for ecosystems should be clearly articulated and should be distinguished from limitations related to data constraints, methodological constraints or other practical factors*

As discussed above, accounting values for ecosystem services and ecosystem assets have an intentionally narrow conceptual focus, and this needs to be well understood by compilers of the accounts and well communicated to users of the accounts. The document could make explicit recommendations to compilers of the accounts that they set out the narrow scope of accounting values clearly in presenting the accounts and discussing the results or findings. In addition, compilers of the accounts will need to set out limitations of the accounts that are the result of incomplete data and/or imperfect methods.

Accounting values can be derived only for those ecosystem services that have actually been quantified in physical supply and use tables, which might be a small number because of resource and data constraints. This is perhaps obvious, but could be emphasised more in the document.

The document should advise compilers of monetary accounts for ecosystems to distinguish clearly in presenting the results of the accounts between those limitations that could be addressed in future accounts through better data, methods and/or additional resources, and those limitations that are inherent and intentional in the concept of accounting valuation and that will thus remain into the future regardless of additional effort put into production of the accounts. Caution to users is needed on the grounds of both of these sets of limitations, but they should not be conflated. It is important not to create the impression that the limits inherent in accounting valuation will be overcome over time simply through additional effort, as this could raise false expectations as to possible future applications of the accounts.

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3. More emphasis is needed on the fact that accounting values do not necessarily reflect the importance of ecosystems for people and the economy

Because of the limited scope of accounting values for ecosystem services and ecosystem assets, these values do not necessarily reflect how *important* a particular ecosystem service, ecosystem asset or ecosystem type is to people and the economy. Also, the exchange values captured in accounting values often reflect the relative scarcity of an ecosystem service or the ecosystem type(s) from which it flows rather than its importance. Abundant ecosystem services and ecosystem types are likely in general to have lower per hectare accounting values than those that are scarce, regardless of their relative importance. (Also see point 5 below.)

This means that ecosystem services and ecosystem assets with low accounting values may nevertheless be critically important for supporting the welfare of large numbers of people and essential for the functioning of certain economic sectors. Especially in a developing country context, accounting values are unlikely to be a good reflection of the dependence of people on ecosystems, especially low income households, because the exchange values of the services concerned may be very low.

Section D should note explicitly that the accounting value of an ecosystem and its economic and social importance will often diverge considerably. This is one of the reasons it's essential to use a range of metrics to assess the importance of a particular ecosystem service, ecosystem asset or ecosystem type, as discussed in point 4 below.

4. More emphasis is needed on the fact that a range of monetary metrics and non-monetary metrics are needed to assess the importance of ecosystems, and that many of these do not require monetary accounts for ecosystems to be developed

It would be useful to note in Chapter 12 that there are monetary metrics related to ecosystems that can be derived directly from national accounts in the absence of monetary ecosystem accounts. For example, the contribution to GDP or the gross value added of sectors that on the face of it depend directly on ecosystems, such as fisheries, forestry and agriculture, can be extracted directly from national accounts without ecosystem accounts having been developed. The size of the nature-based economy can also be extracted from national accounts without the development of ecosystem accounts. These are relatively crude monetary metrics but are much lower hanging fruit than developing monetary ecosystem accounts and can send a powerful message to decision makers.

Substantial resources are required to develop monetary ecosystem accounts, even in well-resourced and data-rich environments, whereas other monetary metrics may be less resource intensive and yet effective if developed systematically and provided as a time series.

It may also be useful to note that if national accounts (or their underlying data) were made more spatially explicit it may be possible to link physical ecosystem accounts directly to

national accounts, e.g. looking in more detail at which industry sectors depend and/or impact on particular ecosystem types. Future work to explore options for spatial articulation of national accounts could be recommended.

Further, it may be useful for Chapter 12 to refer specifically to social valuation of ecosystems as a complement to monetary valuation and to give some examples of possible metrics (e.g. number of households dependent on particular ecosystem services, livelihoods based on ecosystem services, or employment in industry sectors that depend on ecosystem services or assets). Linking population census data (which is often spatially explicit) to physical ecosystem accounts may be very revealing in terms of links between people and ecosystem services, and can provide spatially detailed as well as national-level metrics.

In our comments on Section 12.1, we have suggested an additional paragraph which captures some of the point we are making here, along the lines of:
"It may also be possible to make links between ecosystem accounts and a range of economic measures not linked to valuation of ecosystem services and assets, such as job numbers, unemployment and household income. The spatially explicit nature of ecosystem accounts means that it may be possible to link the accounts directly to demographic information, for example from the population census. Metrics on the numbers of people or households that depend directly or indirectly on ecosystem services can provide powerful complements or alternatives to monetary valuation of ecosystem services, especially in cases where monetary values (and especially accounting values) are relatively low but levels of dependence by people are high."

5. *It may be useful for the document to articulate that accounting values are likely in general to be higher for ecosystem services, ecosystem assets and ecosystem types that are scarce and that are currently used by many economic units*

Accounting values of ecosystem services and their related ecosystem assets could be high for two main reasons:
-      Supply of the ecosystem service is limited (i.e. it is scarce)
-      Demand for the ecosystem service is high (i.e. there are many transactions between the underlying ecosystem asset and users of the ecosystem service)

The reverse is also true: accounting values for ecosystem services and ecosystem assets that are abundant or for which demand is low are likely to be smaller.

Ecosystem accounts are generally presented by ecosystem type, so accounting values for ecosystem services and ecosystem assets are summarised or aggregated to ecosystem types. Ecosystem types are assigned a per hectare value for flows of ecosystem services and a per hectare asset value.

In general, ecosystem types that are scarce (i.e. have a small spatial extent) in a particular country context are likely to have higher per hectare values than ecosystem types that are relatively widespread (i.e. have a large spatial extent) in that context, and ecosystem types

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that are used by many economic units (whether households or firms) are likely to have higher values.

Scarcity of an ecosystem type could reflect natural scarcity (i.e. the extent of the ecosystem type has always been small relative to other ecosystem types), or it could be that the ecosystem type was historically widespread but has been converted over time to other ecosystem types.

In most cases ecosystem types that are in close proximity to people will have more users than ecosystem types that are remote from people, and will thus have higher per hectare values than remote ecosystem types. An exception could be ecosystem types that are remote but well visited e.g. by ecotourists, or ecosystem types that are remote but are the location for intensive economic activity by a few economic units (struggling to think of an example that isn't mining).

This likely pattern of higher accounting values for small, heavily used ecosystem types should not be taken to mean that those ecosystem types are of greater value or greater importance in general terms. This is particularly important in a developing country context such as South Africa, where many natural ecosystem types are still relatively widespread and sparsely used and are thus likely to have low per hectare accounting values, while intensively modified ecosystem types (such as cultivated areas and urban areas) are limited in extent and heavily used relative to natural ecosystems, and are thus likely to have higher per hectare accounting values. Expansion of intensively used ecosystem types is one of the greatest pressures on natural ecosystem types and biodiversity, and there is a potential risk that in such a context the argument could be made that converting natural areas to intensively modified areas is desirable because it increases the value of ecosystem services and ecosystem assets. In a developed country context, such as in Europe, this issue may not arise because natural ecosystem types are often scarce and often have many users, so their accounting value is likely to be high.

For extensive arid or semi-arid ecosystem types, accounting values will likely always be low. An example is the Succulent Karoo biome in South Africa and Namibia, which one of 34 global biodiversity hotspots and is a semi-arid shrubland. It has extremely high species richness and endemism for succulents, and parts of the biome are under pressure from conversion to cultivation and mining. Accounting values for Succulent Karoo ecosystem types are likely to be extremely low, as ecological productivity is low, population density is sparse and economic activity is limited overall, so there few potential uses and users of ecosystem services. It would be problematic to use accounting values as the basis for development planning and decision-making about economic impacts in the Succulent Karoo.

It would be useful for Section D to note explicitly that a pattern of higher per hectare values for ecosystem types that are smaller in extent and/or have more users may emerge both at the country level and the global level, and that it does not necessarily reflect relative importance of the ecosystem types concerned from a social or economic perspective and

definitely not from a biodiversity perspective. This means that low accounting values should be treated with particular caution for extensive, relatively remote ecosystem types, and should not be used as justification to intensify use of these ecosystem types without a range of other factors being considered, including non-monetary metrics.

6. *It would be useful for the document to state clearly that monetary accounts for ecosystem services and ecosystem assets should not be used on their own as the basis for policy or decision-making, and that they will not necessarily lead to better decisions that favour sustainability*

The document in its current form doesn't actively state that using accounting values will necessarily lead to better social and economic decisions, but we suggest that it is important to actively state the opposite. Accounting values *may* provide evidence that supports better decision making related to ecosystems in some circumstances, but this will only be the case if the limitations of the accounts are fully appreciated. Also, accounting values are unlikely to be sufficient on their own to support better decisions, regardless of the context or how accurate they are. We suggest that it is important to state explicitly that in all cases in which accounting values are used to support decision making, they should preferably be considered in conjunction with physical ecosystem accounts as well as other metrics that quantify the importance of ecosystems for people and the economy, including broader monetary metrics and social metrics.

Question 6. Do you have comments on Chapters 12-14 of the draft SEEA Ecosystem Accounting?

Comments on Chapter 12

Title of Section E: Complementary valuations, thematic accounting and indicators.
See comment on Chapter 12 title, which I think is too narrow.
Suggested title for Section E: Complementary economic measures, thematic accounting and indicators

Chapter 12 scope and title
This chapter title is narrower than the scope of the chapter. The chapter deals not only with complementary approaches to valuation but also with other economic measures that can be derived from or linked to ecosystem accounts. The chapter includes several examples of physical ecosystem accounts providing important information for deriving economic measures other than valuation (e.g. para 12.17 on externality assessments, para 12.25 on COED and para 12.33 on restoration costs).
Suggested chapter title to reflect this scope: Complementary economic measures, including alternative approaches to valuation.

Section 12.1 Introduction
Suggest an additional paragraph at the end of this section, along the lines of:

"It may also be possible to make links between ecosystem accounts and a range of economic measures not linked to valuation of ecosystem services and assets, such as job numbers, unemployment and household income. The spatially explicit nature of ecosystem accounts means that it may be possible to link the accounts directly to demographic information, for example from the population census. Metrics on the numbers of people or households that depend directly or indirectly on ecosystem services can provide powerful complements or alternatives to monetary valuation of ecosystem services, especially in cases where monetary values (and especially accounting values) are relatively low but levels of dependence by people are high."
[An aside: These non-monetary metrics can be much quicker and easier to derive than monetary valuations, and they can be very powerful for making the case for ecosystems to policymakers. We have developed some of these metrics in South Africa to great effect.]

Comments on Chapter 13

Section 13.2 General principles of thematic accounting

This is an extremely useful section.
Some of the principles seem to be principles for ecosystem accounting in general, not just for thematic accounting, particularly para 13.3 and 13.5, and parts of para 13.6 and 13.7.
For me the three-step approach of 1) select entities, 2) classify them, 3) organise and present info about these entities in structured accounting tables, was useful to read in those terms. Then step 4) derive indicators.
It might be useful to set this out in Chapter 2?

Paragraph 13.10
First bullet. The example given for forests of "adapted extent and condition accounts at the level of particular species" is unclear and confusing. Not at all sure what this means. Perhaps instead say "accounts for forest-based species that are of particular conservation, social or economic importance"?

Section 13.3 Accounting for biodiversity

Section 13.3.1 Introduction
I think it's important to start this section with a paragraph that states the relationship between ecosystem accounting and biodiversity, along the lines of:
"The primary purpose of ecosystem accounting is to provide a framework for organising information about ecosystems. However, biodiversity and ecosystems are interrelated, especially in the case of natural ecosystems. Although biodiversity is not the primary focus of the SEEA EA, ecosystem diversity is considered to be a component or aspect of biodiversity, along with species diversity and genetic diversity. This means that there are various links between ecosystem accounting and biodiversity."

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Paragraphs 13.12 and 13.13
I don't think it's necessary to capitalise "Accounting for Biodiversity" and put it in inverted commas.

Paragraph 13.13
Last sentence on species accounts: "… demonstrating the potential of an accounting approach to support co-ordination of data on biodiversity".
I think caution is needed here. An accounting approach will not always be useful or appropriate for co-ordinating data on species, especially spatial data on species.
Suggest changing this to: "…demonstrating the potential of an accounting approach to support organisation and presentation of information on some species"

Suggested additional paragraph for the end of Section 13.3.1, to pull together the introduction:
"Accounting for biodiversity as a thematic area entails extracting or drawing together information from ecosystem asset and ecosystem services accounts that is relevant from a biodiversity perspective. It can also include building on this with additional accounts, for example accounts for species of special concern or for protected areas. Thirdly it can include linking these accounts to other information related to biodiversity and to social and economic information."
(As an aside/note of caution: I'm a big fan or accounting frameworks and a big fan of biodiversity, but we need to be purposeful about which elements of biodiversity data and information it makes sense to pull into an accounting framework. Particularly for species, and maybe particularly in a mega-diverse country context, trying to gather and organise large amounts of data into an accounting framework would be enormously time and energy consuming with little clear benefit in terms of policy relevance or application.)

It may also be useful to add a paragraph here on the IUCN's Red List of Species and Red List of Ecosystems, for example:
The IUCN's Red List of Species and Red List of Ecosystems provide systematic, detailed, comprehensive and consistent frameworks for assessing threat status of species and ecosystems respectively – for species, the risk of extinction and for ecosystems, the risk of collapse. Ecosystem accounting and accounting for biodiversity is likely to draw on some of the information that underpins Red List assessments, and information gathered and organised to produce ecosystem accounts may also provide useful inputs for Red List assessments. In this way, SEEA EA and Red List assessments can be complementary and mutually reinforcing.

Paragraph 13.15
Last sentence: "Ecosystem condition accounts track changes in several biodiversity indicators which can also be used to understand trends in biodiversity."
This is not quite right – "biodiversity indicators" is too broad.
Suggest changing this sentence to: "Ecosystem condition accounts may use species-based indicators to contribute to measurement of ecosystem condition, and other

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indicators in ecosystem condition accounts may provide useful information from a biodiversity perspective." (This also links better with Table 13.1)

Table 13.1 Linking SEEA accounts to biodiversity
A few changes to this table:
Suggest combining row 2 and row 3 related to condition accounts and indicators, and calling is "Indicators of ecosystem condition"
Row 2 on biotic characteristic indicators:
- The paragraph on "relevance" includes some wild overstatements. Biotic indicators in condition accounts don't distinguish assets of higher value or importance, and don't provide indicators of where biodiversity is threatened.
Row 3 on abiotic characteristic indicators
- The "relevance paragraph" is loose.
New suggested "Relevance" text for combined row on indicators of ecosystem condition:
- "The condition account includes an account of indicators of condition for biotic, abiotic and landscape or seascape characteristics of ecosystems. Biotic indicators can include species-based indicators that draw of biodiversity data. Abiotic indicators can provide information about pressures on biodiversity (e.g. pollutant concentrations) and landscape or seascape level indicators can provide information on fragmentation of ecosystems, which is often associated with biodiversity loss."

The first SEEA Central Framework row should be "Land account" not "Land use". The indicator given is not sensible – suggest changing it to "Change in area of land cover classes that impact on biodiversity".
The "Relevance" paragraph is confusing. Rather say "The land account can show increases or decreases in land cover classes that impact on biodiversity, for example increases in intensively managed land cover classes may be associated with loss of biodiversity."

The second SEEA Central Framework row is for emissions accounts, with the indicator given as "Spatially disaggregated emission flows" – but is this possible? SEEA CF is not spatially explicit (except for land accounts) so this seems implausible. Rather delete this row?

Paragraph 13.20
It's not clear what "high biodiversity value" means in this paragraph. Does it mean "high biodiversity importance" or "high ecosystem service value"? I don't think "high biodiversity value" is a sensible concept in SEEA EA, because biodiversity is not considered an ecosystem service.
Need to be careful here. The monetary value of non-conservation land uses will often be higher than conservation land uses, so these sorts of presentations can easily backfire. I think they only give the "right" answer in unusual circumstances.

Paragraph 13.22

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In row 3 change "status/extinction risk" to "threat status (extinction risk)".

Paragraph 13.25
I think we need to be careful about linking species accounts to ecosystem condition indicators. Species-based indicators in condition accounts draw on species information, but species accounts are unlikely to be a useful way to organise species data for species-based condition indicators. Species accounting tables are unlikely to provide spatial information or to add any particular value to species data for the purpose of condition accounting.
Delete "synthesis into Red Lists documenting extinction risk" from the list of examples – Red Lists are not indicators of condition.
Also, I don't think it would be feasible to use species accounts to track the status of invasive species – this seems far fetched. Suggest deleting this bit.
Not sure what to suggest for this paragraph – I think it needs to be reworked, maybe to say simply that species data can be used in biotic ecosystem condition indicators, but that does not imply that species accounts should be developed for the species concerned. Organising spatial data on species distribution, occurrence and abundance systematically to support biotic indicators for condition accounts doesn't in itself constitute species accounting.

Section 13.3.4 Potential biodiversity indicators
Paragraph 13.36
This paragraph is very confusing and I'm not sure it adds anything. The list of indicators provided seems quite random and many of them are not related to either ecosystem accounts or species accounts. It is not the role of SEEA EA to provide biodiversity indicators. SEEA EA provides ecosystem indicators, some of which can provide some information about biodiversity. Biodiversity indicators are provided by biodiversity measurement and assessment frameworks such as the Red List of Species (headline indicators: species threat status and Red List Index) and Red List of Ecosystems (headline indicator: ecosystem threat status). Suggest deleting this paragraph.

Below I've **repeated some comments from Chapter 1** (related to paragraph 1.50) that provide background and expand on my comments above on accounting for biodiversity:

The IUCN's Red List of Ecosystems and Red List of Species are assessment framework specifically designed to assess threat status of ecosystems and species, and more recently the framework and guidelines for identifying Key Biodiversity Areas has been developed to support identification of spatial priorities for conservation action. It is very important that SEEA EA is not shoe-horned into being applied to these purposes, which would not do any favours to either the IUCN's frameworks or the SEEA. The principles, approach, methods and guidelines for the Red List of Species and Red List of Ecosystems were developed over long periods of time with extensive involvement and consultation of scientists and practitioners. It is neither necessary nor appropriate for SEEA EA to venture into this territory.

Some of the spatial information on ecosystems that underpins ecosystem extent and condition accounts also underpins the Red List of Ecosystems, and thus a country that has developed a Red List of Ecosystems might be in a good position to develop ecosystem extent and condition accounts, or vice versa. But the principles, approach, methods and purpose of ecosystem accounts and the Red List of Ecosystems are different. *Ecosystem extent and condition accounts* can provide some information about biodiversity (for example natural ecosystems with declining extent and declining condition are likely to have experienced biodiversity loss) and in the absence of a Red of Ecosystems these accounts could be used as a rough-cut first take on which ecosystems are at risk from a biodiversity perspective. But preferably the spatial information that underpins the ecosystem extent and condition accounts should be analysed within the Red List of Ecosystems framework in order to draw conclusions about the state of biodiversity. It would be extremely unreliable to draw any consistent link between *ecosystem service accounts* and biodiversity.

As far as species are concerned, there are two main links with ecosystem accounts:
- Information about indicator species can be relevant for assessing ecosystem condition, in the form of species-based indicators of condition. Using species data in indicators of condition does <u>not</u> require that accounts have been produced for those species or that Red List assessments have been done for those species.
- Information about socially and economically important species may be relevant for measuring some ecosystem services. Using species data in measuring ecosystem services does <u>not</u> require that accounts have been produced for those species or that Red List assessments have been done for those species.
- In addition to the use of species data in ecosystem condition and ecosystem service accounts, it may be useful to develop species accounts for selected species of special concern, but this is never essential and is not a pre-requisite for using species data in ecosystem accounts.

Only a tiny subset of species are directly relevant for ecosystem accounts and species accounts, whereas biodiversity information management systems and assessment frameworks (such as the Red List of Species) are designed to deal with data on as many species as possible. Systematically organised spatial data on species that has been developed for Red List assessments may prove to be useful for ecosystem condition accounts, ecosystem services accounts and species accounts, so in that sense they can complement each other.

South Africa's experience is that the Red List of Ecosystems, Red List of Species, ecosystem accounts and species accounts can complement each other well, providing different tools, indicators and perspectives for different audiences. They draw on much of the same underlying information, and investing in those foundational datasets strengthens both ecosystem accounting and biodiversity assessment.

Section 13.5 Accounting for the ocean

There are a few references in this section and in Annex 13.2 to "ocean ecosystems". All of these should be changed to "marine ecosystems", to be consistent with the GET reference classification. An easy search and replace.

Section 13.5.1 gives a very useful intro and context.

Paragraph 13.67
Mention high seas? Not included?

Paragraph 13.68
In the first sentence, instead of just saying "non-produced assets" and giving examples of ecosystem assets, it may be useful to say "ecosystem assets and other non-produced assets" and give examples of both. Helps to lay the basis for later discussion that distinguishes marine ecosystem assets from individual environmental assets in the ocean.
Suggest adding at the end of the paragraph: "(5) Changes in protection of oceans". Accounts for marine protected areas could be a very useful element of thematic accounts for oceans.

Paragraph 13.69
Suggest adding at the end of the paragraph: "protection and zoning of the ocean". Protection is an important governance process in the ocean, often more complex than in the terrestrial realm.

Figure 13.2
Please split "Ocean assets" into two separate sets of boxes. One set for "Marine ecosystem assets", with extent and condition boxes, and then a separate box or boxes for "Individual environmental assets", to reflect para 13.72 and 13.73. I think in general individual environmental assets are not measured through extent and condition accounts, so different "sub-boxes" would be needed for individual environmental assets. It would be useful to add a box for the ocean economy satellite account to the diagram, so that the diagram reflects all the elements that are mentioned in the text.

Paragraph 13.80
I think "By focusing on one biome…" should be changed to "By focusing on one realm…". There are four biomes in the marine realm, all of which fall within the scope of ocean accounts.

Paragraph 13.84
It may be useful to make a link to Chapter 5 and the ecosystem condition typology here. Not sure there's consistency between the characteristics mentioned here and the ecosystem condition typology.
The first part of the opening sentence ("What may be of most interest to ecosystem accounting…") seems like a potential over-statement. Perhaps just "Of relevance to ecosystem condition accounting…"?

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Table 13.4

Might need to check alignment between this table and the section of Annex 13.2 that deals with condition of marine ecosystems (incorrectly called "ocean ecosystems" in Annex 13.2).

Section 13.6 Accounting for urban areas

Paragraph 13.86

Line 6: "water" should be "freshwater ecosystems" (the examples given are wetlands and streams, which fall firmly within "freshwater ecosystems" rather than "water").

Paragraph 13.88

Could add urban open space systems to the list of possible applications in the last sentence.

Paragraph 13.92 (dealing with continuum from urban core to periphery)

Suggest adding after the first sentence:

"Less developed areas can include large natural or semi-natural areas in some cities." (An example: the City of Cape Town includes large almost-wilderness areas in Table Mountain National Park, which falls within the metro boundary. There might be similar situations in other cities especially in developing countries.)

Paragraph 13.95

Second sentence: "Condition indicators that are predictors of urban ecosystems services should be selected." This is a very strong statement. Suggest changing "should" to "could".

The next sentence is: "This does not prevent users from compiling thematic environmental quality and biodiversity indicators for other purposes". The meaning of this is unclear – rather leave the sentence out? I'm not sure it adds anything essential.

It may be useful to make a link here to Chapter 5, including the recognition in Chapter 5 that reference levels and reference condition is likely to require a different approach for intensively managed ecosystem types such as urban areas to the approach used for natural or semi-natural ecosystem types.

Table 13.6 show and example of a conditional variable account. Could also mention condition indicator account.

Table 13.5 Example – extent account using landscape approach

Essential change: The sub-class "Cropland" has been placed under the broader class "Natural and semi-natural types". This is not correct and not consistent with the GET reference classification. Even in an urban context, croplands can't be considered natural or semi-natural ecosystem types.

Suggest there should be three broad classes in this table instead of two:

- Urban/built-up type and example sub-classes

- Other intensively managed types and example sub-classes [new]
  - Croplands
  - Recreational green space (this would include a range of individual assets such as sports fields, public parks, golf courses etc) [I think this would be useful to add. This sort of non-natural ("manicured") urban green space is linked to important ecosystem services and isn't covered under built-up types or natural and semi-natural types.]
- Natural and semi-natural types

Table 13.6 Example of condition variable account
Could give an example of condition indicator account as well?
Change "opening stock" and "closing stock" to "opening value" and "closing value" throughout the table, to be consistent with Chapter 5.

Table 13.7 Example – extent accounting using individual asset approach
Essential change: The ecosystem type/asset "Cropland" has been placed under the broader class "Natural and semi-natural types". This is not correct and not consistent with the GET reference classification. Even in an urban context, croplands can't be considered natural or semi-natural ecosystem types.
As with table 13.5, suggest there should be three broad classes:
- Built urban ecosystem types/assets
- Non-natural vegetated ecosystem types/assets (there are several of these in the column headings)
- Natural and semi-natural ecosystem types/assets

Table 13.8 Example – ecosystem service account table using landscape approach
Essential change, as for Table 13.5: The sub-class "Cropland" has been placed under the broader class "Natural and semi-natural types". This is not correct and not consistent with the GET reference classification. Even in an urban context, croplands can't be considered natural or semi-natural ecosystem types.
Suggest there should be three broad classes in this table instead of two:
- Urban/built-up type and example sub-classes
- Other intensively managed types and example sub-classes [new]
  - Croplands
  - Recreational green space (this would include a range of individual assets such as sports fields, public parks, golf courses etc) [I think this would be useful to add. This sort of non-natural ("manicured") urban green space is linked to important ecosystem services and isn't covered under built-up types or natural and semi-natural types.]
- Natural and semi-natural types

Annex 13.2
As noted earlier, replace "ocean ecosystems" with "marine ecosystems" to be consistent with GET reference classification.

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Might be important to check for consistency of the marine ecosystem condition indicators included in this table with Chapter 5.

Comments on Chapter 14

Paragraph 14.13
This paragraph frames the discussion of indicators very much in terms of the economy. It doesn't mention that ecosystem accounting also provides indicators that are useful for environmental policy, land use planning, marine spatial planning, conservation and so on.
I would rather frame the discussion on indicators in terms of the need, both globally and nationally, for a coherent set of environmental (including ecosystem) indicators that have the same standing as the economic and demographic indicators commonly produced by NSOs. Such indicators can then be applied in a wide range of policy and decision-making contexts by a wide range of users, as economic and demographic indicators are.

Paragraph 14.14
Could add to the end of the first sentence: "for a wide range of sectors" (see comment for para 14.13).

Figure 14.1 Information pyramid
The bottom level of the pyramid says "Basic data: environment, economic, social statistics". Should this "statistics" be "data"?

Paragraph 14.21
Suggest changing last bit "ensures robustness of the indicators sourced from accounts" to "adds to the usefulness of indicators derived from the accounts".

Paragraph 14.22
This setting out of these different types of indicators is very useful.
The description of ratio indicators is "indicators derived by combining data from different accounts, for example the flows of ecosystem services per hectare from different ecosystem types".
Must ratio indicators always use information from two different accounts? Could they sometimes use two bits of info from one account?
For the example given:
  - Does the flow of ecosystem services per hectare use info from two different accounts? Isn't all this info included in the ecosystem services supply and use account?
Another example:
  - The Ecosystem Extent Index we've derived from our terrestrial ecosystem extent account is a ratio based on the reference (historical) extent and the closing extent, both of which come from one account.

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Table 14.1 Potential indicators on ecosystem extent

This is a useful table. It would be useful to number the rows 1 – 4.

For the first two rows, not sure it's necessary to give all of these examples – could just say for any biome, ecosystem functional group or nationally defined ecosystem type.

The fourth indicator is Percentage of area changed. We have called this Percentage turnover.

Main comment here is to add a fifth indicator to the table, the ecosystem extent index:

5. Ecosystem extent index (closing extent / reference extent)	Ecosystem accounting area	Ecosystem type	%

The ecosystem extent index is possible to derive only if a reference condition is included in the ecosystem extent account (see my comments on Chapter 4).

Definition: the proportion an ecosystem type that remains intact relative to its reference extent, i.e. closing extent as a proportion of reference extent.

Shows which ecosystem types have most declined in extent.

Tracked over time, shows which ecosystem types are declining in extent most rapidly.

Paragraph 14.27

Is it important to say something about the condition indicators being normalised?

Table 14.2 Potential indicators on ecosystem condition

Bit confusing that the Unit of measurement (last column) is "Index" for all the indicators. Rather say % or scale of 0 to 1?

Section 14.4.1 SEEA EA and global indicator monitoring frameworks

I would switch the order of the discussion – SDGs first (para 14.36 – 14.38), then Post 2020 GBF (para 14.33 – 14.35). The focus of the SDGs is much broader. Post 2020 GBF has a relatively narrow focus.

Paragraph 14.34

Suggested addition to first sentence: "The SEEA can support monitoring and reporting on the post 2020…". Otherwise this feels like too much of a broad sweeping statement.

In the middle of the paragraph there's a reference to "the biodiversity target". Not clear what this is.

Table 14.5 Potential indicators for the 2050 Goals

Table caption should say "Post 2020 GBF Goals" and should indicate that these are draft Goals.

The first two indicators both say "selected natural ecosystems" followed by a list of a few ecosystem types that can be read to mean that these are the only ones to focus on. Suggest changing this to just "natural ecosystems" and making clear that the list gives

some examples. The Goal refers to all natural ecosystems, and an advantage of SEEA EA is that is covers all natural ecosystems, not just some.

The second indicator is "biomass of selected natural ecosystems", but the Goal talks to integrity of natural ecosystems. Biomass is just one of many potential indicators of integrity, and needs to be interpreted carefully in relation to integrity (e.g. increases in biomass can indicate declines in integrity for some ecosystem types). Suggest replacing this with "Condition of natural ecosystems" (from the condition account). This would also complement the previous indicator "Extent of natural ecosystems".

Essential change: The third SEEA indicator listed for Goal A is the Red List Index. Perhaps this was included by accident. The Red List Index is NOT a SEEA indicator and should be deleted from this table. The Red List Index is derived from the Red List of Species. It cannot be derived from SEEA accounts, and sits outside the scope of SEEA EA. The Red List Index is a great example of a biodiversity indicator that complements SEEA indicators – there is no need to bring it into the SEEA measurement framework.

So to summarise my recommendation is that there should be two indicators for Goal A:
- Extent of natural ecosystems (e.g. forest, savannas, grasslands, wetland, mangroves, saltmarshes, coral reefs, seagrass)
- Condition of natural ecosystems (e.g. forest, savannas, grasslands, wetland, mangroves, saltmarshes, coral reefs, seagrass)

Table 14.6 Potential indicators for the 2030 Targets
Table caption should say "Post 2020 GBF Targets" and should indicate that these are draft targets.

The items in the column "Potential SEEA indicators" are a confusing mix. They seem to include some SDG indicators, and many of them have only an indirect link to ecosystem accounts – at best ecosystem accounts might be able to make a contribution to measuring the indicator.
I think it's important not to take a broad-brush approach here and not to include SDG indicators, which have their own table (Table 14.7).

Below I've given a suggested reworking of this table to focus specifically on SEEA EA accounts rather than a mix of other things. I think it's important to stick to SEEA EA accounts specifically rather than SEEA accounts in general (including Central Framework accounts).

Suggested changes to Table14.6

Target	~~Potential SEEA indicators~~ Relevant SEEA EA accounts

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1. By 2030, [50%] of land and sea areas globally are under spatial planning addressing land/sea use change, retaining most of the existing intact and wilderness areas, and allow to restore [X%] of degraded freshwater, marine and terrestrial natural ecosystems and connectivity among them	~~Proportion of land that is degraded over total land area (SDG 15.3.1)~~ ADD: Ecosystem extent accounts for natural ecosystem types ADD: Ecosystem condition accounts for natural ecosystem types
2. By 2030, protect and conserve through well connected and effective system of protected areas and other effective area-based conservation measures at least 30% of the planet with the focus on areas particularly important for biodiversity	~~Coverage of key biodiversity areas by terrestrial protected areas~~ ~~(Link to SDG 14.5.1, 15.1.2 and 15.4.1)~~ ADD: Accounts for land-based protected areas
	~~Coverage of key biodiversity aeras by protected areas in relation to marine areas (SDG 14.5.1)~~ ADD: Accounts for marine protected areas
3. By 2030, ensure active management actions to enable wild species of fauna and flora recovery and conservation, and reduce human-wildlife conflict by [X%].	~~Red List Index (Link to SDG 15.5.1)~~ ADD: Accounts for selected species
4. By 2030, ensure that the harvesting, trade and use of wild species of fauna and flora, is legal, at sustainable levels and safe.	~~Proportion of fish caught within biologically sustainable levels (Link to SDG 14.4.1)~~ ADD: Accounts for selected species
5. By 2030, manage, and where possible control, pathways for the introduction of invasive alien species, achieving [50%] reduction in the rate of new introductions, and control or eradicate invasive alien species to eliminate or reduce their impacts, including in at least [50%] of priority sites.	~~Adoption of relevant national legislation and adequately resourcing the prevention or control of invasive alien species (Link to 15.8.1)~~ ADD: Ecosystem condition accounts may be relevant, particularly if presence of invasive alien species is included as an indicator of condition
6. By 2030, reduce pollution from all sources, including reducing excess nutrients [by x%], biocides [by x%], plastic waste [by x%] to levels that are not harmful to biodiversity and ecosystem functions and human health	~~Proportion of bodies of water with good ambient water quality (SDG 6.3.2)~~ ADD: Ecosystem condition accounts may be relevant, particularly if excess nutrients, biocides and plastic waste are included as indicators of condition
	~~Hazardous waste generated per capita (SDG 12.4.2a)~~ [I can't think of a SEEA EA account that would provide information for this indicator]
7. By 2030, increase contributions to climate change mitigation adaption and disaster risk reduction from nature-based solutions and ecosystems based approached, ensuring resilience and minimising any negative impacts on biodiversity	ADD: Carbon accounts, e.g. Tonnes of carbon retained (captured and stored/trend in the carbon sequestrated) in natural ecosystems
	ADD: Accounts for protected areas may be relevant. ~~Number of properties/area of coast protected (coastal protection services) by nature ecosystem.~~
9. By 2030, support the productivity, sustainability and resilience of biodiversity in agricultural and other managed ecosystems through conservation and sustainable use of such ecosystems, reducing productivity gaps by at least [50%].	~~Increase yield of crops from pollination~~ [unless this info can be derived from ecosystem services accounts for pollination?] ADD: Extent and condition accounts for intensively managed ecosystem types ADD: Ecosystem service accounts for services from intensively managed ecosystem types
10. By 2030, ensure that, nature based solutions and ecosystem approach contribute to regulation of air quality, hazards and extreme events and quality and quantity of water for at least [XXX million] people.	~~Tonnes of nitrogen and phosphorus removed from wastewater~~ [I don't think in this info can be derived from SEEA EA accounts?] ADD: Ecosystem condition accounts for freshwater ecosystems may be relevant here
	~~Tonnes of airborne pollutants captured by natural ecosystem~~ [Perhaps this info can be derived from ecosystem services accounts? Rather generalise this to:] ADD: Some ecosystem services accounts may be relevant

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11. By 2030, increase benefits from biodiversity and green/blue spaces for human health and well-being, including the proportion of people with access to such spaces by at least [100%], especially for urban dwellers	~~Share of green spaces over of the built-up area of cities~~ ~~(Link to SDG 11.7.1)~~ ADD: Accounts for urban areas, especially if they include a focus on natural ecosystem types within urban areas
13. By 2030, integrate biodiversity values into policies, regulations, planning, development processes, poverty reduction strategies and accounts at all levels, ensuring that biodiversity values are mainstreamed across all sectors and integrated into assessments of environmental impacts	~~Integration of biodiversity into national accounting and reporting systems, defined as implementation of the System of Environmental Economic Accounting~~ ~~(SDG 15.9.1b)~~ ADD: Existence of SEEA EA accounts
15. By 2030, eliminate unsustainable consumption patterns, ensuring people everywhere understand and appreciate the value of biodiversity, make responsible choices commensurate with 2050 biodiversity vision, taking into account individual and national cultural and socioeconomic condition	~~Material footprint per capita~~ ~~(SDG 8.4.1, 12.2.1)~~ [I can't think of indicators from ecosystem accounts that would provide this information – this is SEEA CF territory?]
	~~Domestic material consumption per capita (SDG 8.4.1, 12.2.1)~~ [I can't think of indicators from ecosystem accounts that would provide this information – this is SEEA CF territory?]

Paragraph 14.37
Suggest deleting the last sentence – it seems like an extremely specific detail to include.

Paragraph 14.38
Meaning of last part of last sentence is unclear ("or when the indicator clearly represents an input data for an accounting item of interest").

Paragraph 14.38 and Table 14.7
Suggest limiting the scope to SDG indicators that link specifically to SEEA EA rather than to SEEA in general. Links between SDG indicators and the full SEEA family should be addressed elsewhere, not in the SEEA EA document. One problem with taking such a wide broad-brush approach is that it dilutes the importance of those cases where there really is a strong link between the SDG indicator and SEEA EA.

Several of the SDG indicators in Table 14.7 have no direct link to SEEA EA, and I suggest should be deleted:
6.3.1 Proportion of wastewater safely treated
6.4.1 Change in water use efficiency over time
8.9.1 Tourism direct GDP as a proportion of total GDP and in growth rate [this comes from the Tourism Satellite Account, it is not linked to SEEA at all]
14.7.1 Sustainable fisheries as a proportion of GDP in small island developing states [it would a huge stretch to get this from SEEA EA]
15.5.1 Red List Index [see comment for Table 14.5 – the Red List Index is not related to SEEA EA]
15.8.1 Adoption of relevant national legislation and adequately resourcing the prevention or control of invasive alien species [there might be a link here to SEEA CF EPE accounts]

SEEA

15.9.1 Progress towards national targets established in Aichi Biodiversity Target 2 [about to be outdated]

Paragraph 14.1 National indicators that benefit most from having their foundation in SEEA EA
Again a broad brush approach is taken here, which I don't think it helpful and dilutes the focus on those areas where SEEA EA really can contribute.
Suggest deleting the last three items:
- Expenditure and the development of economic instruments on natural conservation
- Estimation of a nation's wealth and economic potential once the state of nature is considered
- Assessment of government performance on sustainable development

Paragraph 14.42
Suggest deleting this paragraph. It's not necessary or appropriate for SEEA EA to advise in this kind of detail on national institutional arrangements.

Paragraph 14.48, dealing with Ramsar indicators that can be supported by SEEA accounts
Again, stick to SEEA EA accounts not SEEA accounts in general.
It is highly unlikely that SEEA EA will support indicators on:
- Number of households linked to sewage systems
- Percentage of sewage coverage in the country
- Number of wastewater treatment plants
Trend in wetland condition is the only indicator that should remain in this list, to prevent this from being far-fetched.

Paragraph 14.50
This paragraph seems quite loose and overly complicated. Can it be streamlined to a few essentials?
It's not clear what the "SEEA EA indicators initiative" is. I'm not following the sentence that starts "Through the SEEA EA frameworks…".
The last sentence doesn't seem to add value – delete?

Figure 14.2 Workflow of EBVs from primary data to decision support
Not sure this diagram adds value. Rather delete?

Paragraph 14.51 and 14.52 on BIOFIN
As noted in para 14.52, BIOFIN is relevant to SEEA CF Environmental Protection Expenditure accounts. It has no direct link to SEEA EA. Suggest deleting these two paragraphs. I don't think it makes sense to go down the route of using Chapter 14 to gather together information about a whole range of projects or initiatives that are tangentially linked to SEEA EA and the scope of the chapter. BIOFIN is perhaps more relevant to thematic accounts on biodiversity.

Paragraph 14.54 on biophysical modelling

It's not clear to me why this paragraph has been included in this chapter.

If it is included, the last sentence should be deleted – this is generic info not specific to biophysical modelling.

Paragraphs 14.56 to 14.58 on scenario analysis

It's not clear to me why this discussion on scenario analysis has been included in this chapter. Scenario analysis is one potential application of SEEA EA accounts, among many others. It's not specifically linked to indicators or combined presentations.