DEPARTMENT OF ECONOMIC AND SOCIAL AFFAIRS
STATISTICS DIVISION
UNITED NATIONS

System of Environmental Economic Accounting

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

First Global Consultation on:

Chapter 6: Ecosystem services concepts for accounting

Chapter 7: Accounting for ecosystem services in physical terms

Comments Form

Deadline for responses: 20 August 2020
Send responses to: seea@un.org

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

Jointly written with Ken Bagstad (kjbagstad@usgs.gov), Julie Hass (jlhass@gmail.com), Charles Rhodes (charlesrrhodes@gmail.com), Marc Russell (Russell.Marc@epa.gov), and Scott Wentland (scott.wentland@bea.gov)

The comment 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 the following e-mail address: seea@un.org.

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

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Questions related to Chapter 6

Question 1: Do you have comments on the concepts and definitions for ecosystem services, benefits and associated components of the ecosystem accounting framework?

1. Section 6.2.3 Well-being – this section should be deleted. The valuation chapters discuss how concepts of welfare, utility, consumer surplus, and well-being are not being directly measured in ecosystem services and asset accounts, so it is not clear why this section exists here, given the emphasis on SNA-based valuation and economic measurement in the valuation chapters.
    - Para 6.19 references Annex 8.1 by saying, "under various assumptions, to make inferences about changes in well-being using information about changes in flows of ecosystem services" which seems to imply that well-being or some closely related welfare-based concept is going to be measured as part of the accounts. It seemed like that that this was not the purpose of Annex 8.1.
2. Where the SNA boundary stops and the ecosystem services boundary begins may not be as well defined as the chapter seems to imply. Or, at least there are still blurred lines that the chapter could better delineate. For example, the statement in 6.10 mentions that, "The measurement scope of products is defined by the SNA production boundary which explicitly excludes ecosystem services by considering that '*a purely natural process without any human involvement or direction is not production in an economic sense*' (2008 SNA, 6.24)." Recording ecosystem services as transactions supplied by ecosystems as additional producing units thus supports an extension of the SNA production boundary is interesting in that, "the total output of the extended system is increased." Since we are defining ES as the contributions of ecosystems to benefits (rather than the benefits themselves) and that there is a human component to most ES, is the implication that SNA's exclusion of ecosystem services is an improper one (since there are very few "natural processes without any human involvement or direction")? Some of the regulating ES traditionally treated as outside the SNA production boundary do have human involvement/direction, at least in a highly complementary fashion. For example, flood regulation is typically provided by both green and gray infrastructure (yet SNA would only treat gray); should a full accounting for flood regulation implicitly include green and gray in the SNA estimates (connected substitutes as recognized by engineers, and with blurry areas like vegetated constructed features that have green and gray attributes), rather than gray in SNA and green in SEEA-EEA? By convention the latter is the standard, but for definitional consistency, the chapter seems to imply the line is blurrier, rather than clarifying this sufficiently.
    - Relatedly, Para 6.23 is very important! And exactly how to separate what is in and out of the SNA vs. ecosystem accounting is not described in sufficient detail.
3. Para 6.7, on the definition of ecosystem services:
    - Why is the definition stating that "ecosystem services are the contributions of ecosystems" and not 'the contributions of ecosystem **assets**'? In the next sentence it states that, "Ecosystem services are recorded as flows between ecosystem assets and economic units…" Shouldn't the initial definition include the word "assets"? From an accounting standpoint, the terms services and assets connote flows and stocks, so while this is a semantical point, it is somewhat jarring from the eye of a national accountant when the terminology is not consistent with the standard accounting concepts.
    - Why is "other human activity" included in the definition? In para 6.9 it clearly states that "the amount supplied by the ecosystem must equal the amount used by the economic unit." Isn't economic activity enough in the definition? Or is this also meaning to include things like crime and war as "other human activity" that

may not be in the SNA production boundary? If so, this may need some clarification.

4. Para 6.11, on the definition of Benefits:
    - "Benefits are the goods and services that are ultimately used and enjoyed by people…" How is 'enjoyed' going to be measured? Delete the words 'and enjoyed' from definition. Stating that these are used is enough.
    - Why is a benefit only a gain or positive contribution to well-being? – it could be positive for part of the picture but negative for another. Harvesting timber (provisioning service) is a positive contribution to human well-being, but a negative for the birds that just lost their habitat. It is not clear why there is a one-sided description of a 'benefit,' unless it is understood to be "net benefit" which is benefits net of costs. To consider another example, a flood is negative for some, and it can be good for others – example of the Nile flooding is a classic example now that Ethiopia has built a dam on the Nile and controls the flows.
        - Further, why is the concept of 'well-being' introduced into this definition? Why is this necessary? Perhaps deleting this non-ecological concept from the definition to leave the definition as, "Benefits are the goods and services that are ultimately used by humans" or something to this effect would be more precise and measurable.
5. Para 6.14:Clear air? Is this a typo and it should be 'clean air'?
    - Why is it necessary to have a link to 'human well-being'? and how is 'well-being' going to be measured? Perhaps change to, '…with an identifiable link to human use,' which is more objectively measurable.
6. Para 6.20: "the economic unit that has the direct connection to the ecosystem, i.e., the unit that is the counterparty in the transaction with the ecosystem, is labelled the user of the ecosystem service." This implies that households, not businesses catering to recreationists, are the users of ES (since this question is on the agenda for discussion in the August 2020 Expert Forum; it looks like this is discussed further in paragraphs 7.43-7.47).
7. Paragraph 6.30, "factors determining supply": "For example, the service of air filtration requires that there is some release of air pollutants and some level of atmospheric pollutant concentrations." – these are termed "enabling actors" by some (La Notte and Marques 2017, One Ecosystem, and relate to residuals (ref paragraph 6.87) in the case of industries that release air or water pollutants; by others these are the "disservices" (e.g., floodwater, disease) that are controlled by regulating ecosystem services (flood regulation, disease regulation; a point made here: https://www.sciencedirect.com/science/article/abs/pii/S2212041614001016?via%3Dihub). These linkages may be helpful to clarify.
8. Paragraph 6.34: "Biodiversity also plays a fundamental role in maintaining the capacity of ecosystem assets to continue to generate ecosystem services into the future." – the chapter should be very careful about using terms like "capacity" as there are plans to introduce a precise definition for this in section 6.2.8.
9. Para 6.30. At the end of paragraph starting: *Factors determining supply*: consider adding "alongside ecosystem inputs such as soil nutrients, organic matter, water, pollination etc."
    - All ecosystem services are treated as being supplied by ecosystems,…" Why only by ecosystems? Wouldn't it be more precise to that ES are being supplied by "ecosystem assets"?
    - Why are purchased seeds or seeds saved from previous harvests not included here?

10. 6.2.2 Benefits – needs further clarification (or appendix/URL reference) regarding what the SNA benefits entail. To the non-SNA versed reader, it is not clear what the difference is in "water" produced by economic unit (SNA benefits – 6.1.2) and "flood protection" which is not(?) produced by an economic unit (non-SNA benefits – 6.1.4). In 6.2.2, example economic units are identified as "business, government or household", all of which are direct beneficiaries of flood protection, and government or businesses could be producers of a flood protection benefit. In addition to clarifying, the authors should consider adding "economic units" to the glossary to clarify this important term.
11. 6.2.3 Well-being. If this section is kept, it could be clarified that measuring well-being is not an objective of the vast majority of national statistical agencies (and by extension, this manual), but it is common in the academic literature and something users of the accounts might construct outside the parameters of the national accounts. Smith et al. 2013 presents a compilation of information on a broad assortment of approaches to measuring well-being, including the referenced OECD work:
    - Smith, L. M., Case, J. L., Smith, H. M., Harwell, L. C., & Summers, J. K. (2013). Relating ecosystem services to domains of human well-being: Foundation for a US index. *Ecological Indicators*, *28*, 79-90.
12. Section 6.2.6 and para 6.28 Abiotic flows:
    - This needs to be expanded – since this is the first time we encounter this term. More examples are needed – ideally a list of abiotic flows or greater description in the glossary.
13. Table 6.1 and para 6.30 – the descriptions shown in the table do NOT correspond to the descriptive text in para 6.30. Especially the box with "users" is not the same and should be expanded to include government since government agencies benefit from air filtration services – governments are also owners of major structures such as bridges and buildings.
14. Where is Annex 6.1? – It would be helpful to have this to better understand these 'logic chains'
15. Para 6.31: The SEEA does NOT adopt CBD's definition – SEEA's ecosystem accounting approach is now adopting the CBD's definition. The SEEA-CF says NOTHING about CBD.

Question 2. Do you have comments on the content and descriptions in the reference list of selected ecosystem services?

1. It is unfortunate that there is no total reference list of ecosystem services in this chapter. What if ISIC did not cover all economic activities, or if HS did not cover all products? While they are under revision all the time, these classification systems are enough at the time of their approval to construct a cohesive and comprehensive set of standardized accounts. It is therefore difficult to evaluate if this proposed set of chapters describes a complete set of ecosystem services accounts in the same way as the SNA and related documentation are able to, which seems to be a prerequisite for no longer being experimental.
2. Biomass provisioning services: "…These services may be provided in cultivated and natural production contexts…" Shouldn't these be separated so there is no double counting with the SNA and SEEA-CF accounts? Are seeds included here?
3. Water supply: Is only fresh water included? A great deal of brackish water is used as cooling water and salt water is used for desalination. In the description, cooling water for nuclear and other thermoelectric power generating facilities

should be included in the list. This type of water flow is critical to the operation of nuclear facilities (France is particularly concerned about this topic!)

4. In Table 6.2, greater definitional clarity is needed for "Peak flow mitigation" which could be assumed to be related to river flood mitigation but is a separate item, so that the concepts can be consistently used by account developers without confusion.
5. The fact that "gamete dispersal in marine contexts" is included in pollination services is potentially confusing. Gamete dispersal is mainly by ocean currents (or are there examples of other biota transporting the gametes of different species?). By analogy, we don't consider wind pollination to be an ecosystem service, so should we consider marine gamete dispersal to be one if it's similarly done by abiotic currents?
6. Descriptions were extremely helpful in preventing misunderstanding that could result from simplification in the names of the services on the left side of the table. Very helpful that likelihood of the named service being final or intermediate is included, again to help a common understanding.
7. Pg 12: Remove the line under Flood mitigation services
8. For pollination services: Intermediate? Maybe for natural biomass but not for row crop agriculture.
9. Pg13: For amenity Services: There is some overlap between cultural services that needs to be worked out.

Question 3. Do you agree with the proposed treatments for selected ecosystem services described in Section 6.4 for biomass provisioning services, global climate regulation services, cultural services, water supply and abiotic flows?

1. Consistent, clear, and well-defined terminology is critical for this manual.
    - Para 6.50: The variety of terminology used is very confusing – why isn't 'ecosystem services' or simply 'ecosystem' used in this sentence? Why are biomass provisioning services 'ecological contributions'? What is the difference between ecological contributions and ecosystem contributions?
    - Para 6.52 What is meant by, 'The contribution of the ecosystem is evident up to the point of harvest'? What exactly is the 'evident contribution'? This is very unclear and makes a fairly clear and simple example totally incomprehensible. But the growth of cultivated forests is recorded as 'inventory' in the SNA – so it would appear that double counting is going to take place.
    - Para 6.55 What is meant by 'gross biomass harvested'? Not clear what is meant – the term is just used several times without definition.
2. Paragraph 6.60: "At the same time, there will be a clear connection to the measurement of recreation-related ecosystem services, including hunting, trapping and fishing. In these instances, cultural services may be recorded in addition to biomass provisioning services.": Would this, for example, also hold for the harvest of biomass used for ceremonial/spiritual purposes, that this could be recorded in both biomass provisioning and spiritual, symbolic, and artistic services? Some additional examples would be instructive here.

3. Para 6.62 – include other types of fires, not just bushfires. The term forest fires is more commonly used in much of the world.
4. Paragraph 6.70: what about e.g., wildlife webcams, which are not set up for commercial purposes like nature documentaries are? Are these still considered SNA benefits if, e.g., set up by a Park Service to allow people to look at charismatic wildlife (and the only costs are the camera and the web feed), yet the benefits are substantial (https://www.tandfonline.com/doi/abs/10.1080/21606544.2018.1483842, albeit in this study, it was measured using consumer surplus)?
5. Section 6.4.3 Cultural services: Is the discussion in para 6.69 of bequest, insurance and options values needed here? It broadens the discussion in a non-useful and confusing manner. The economic transactions of donations to non-profit groups are already in the SNA – what is the purpose of this paragraph and how does it fit within the delineated boundaries of the SNA and ES? This is another example of where, if anything, the lines are blurred more than clarified, making the practical compilation of these accounts by national statistical agencies more difficult.
6. 6.5.5: If biomass harvested is already a SNA benefit then how do we separate the non-SNA benefits derived from the ecosystem? Shouldn't the ecosystem's contribution be measured as removed water, nutrients from the soil, which could be quantified as the amount of fertilizer/water/organic matter that needs to be added to soil each harvest to replace what was there originally? It could be measured as the assimilated nutrients, water, etc from the growth cycle of the crop minus nutrient/water added by humans during growth.
7. 6.5.7: Same issue here with livestock biomass being a SNA benefit and the need to separate out ecosystem contributions from human. Could be measured as the assimilated organic matter/nutrients/water minus that supplied by humans
8. Para 6.74: Benefits from being outdoors – These can be negative or costs for workers having to endure extreme heat during the summer and cold in the winter – for example, construction work, farm work, gardening, snow shovelling. One person's hot day sunbathing at beach could be another person's miserable day in the heat. Much of human history has been spent conquering the negative aspects of the outdoor elements. Further, jobs with more exposure to extreme elements, all else equal, should compensate workers more for this exposure than similar jobs not exposed to the negative outdoor elements, so to some extent these benefits/costs are internalized in existing SNA accounts, but for ES they may not be internalized. To be sure, these are complications, but the asymmetry in the accounting should at least merit further discussion of these conceptual issues.
9. Para 6.76: last sentence is unclear. …it is this ecological contribution… In this sentence, what does 'this' refer to? Why is the term 'ecological contribution' used when it has not been well-defined? Do you mean ecosystem service, or is ecological contribution something else (undefined so far)?
10. Para 6.78: describes two different approaches. Which approach is recommended? And why? This type of unclear description in a proposed statistical manual lacks sufficient guidance.
11. Para 6.80 states that water abstracted from marine ecosystems should be treated as an abiotic flow – but no explanation of why this is the treatment. Because there is no scarcity?

12. Para 6.81 also describes water abstracted for generating electricity in hydroelectric power plants – there is no such thing as 'hydropower production' – please consult energy statistics for the correct terminology here. This treatment deserves another look since the level of the water in rivers and behind dams in reservoirs is not constant and are starting to dry up in many parts of the world. This topic needs more careful consideration before such a blanket statement can be made.
13. Para 6.84 Flows related to the generation of energy: There is nothing called 'hydropower' – there is electricity from hydroelectric power plants and thermoelectric power generation. There is potential energy and kinetic energy and the rotation of turbines that generate electricity. The terminology used in this paragraph is not correct and needs to be revised to reflect the reality of electricity production.

Question 4. Do you have any other comments on Chapter 6?

1. 6.14 & 6.74: Some people, park service employees, some farmers, low-wage recreation industry employees, may be expressing high values for the amenity benefits of being in beautiful outdoor settings, sacrificing more lucrative or socially connected opportunities in a way that is not reflected in the SNA or the SEEA CF. This work-hour and work-setting amenity benefit ES may be substantial at a national scale. The issue should not simply be skipped "by convention" as proposed here. "By convention" there are no ES at all in the SNA, or only deeply embedded ES unattributed to ecosystem assets, so there should be greater discussion of what delineates the boundary between the SNA and ES here and more rationale on why some benefits are included and others are excluded.
2. It would be useful, somewhere in Ch. 6 or 7, to note that in cases where final ecosystem services cannot be measured but proxy measures can, that these can be recorded as functional state characteristics in ecosystem condition accounts (referencing the chapters/paragraphs on ecosystem condition appropriately). A good example of this is here: https://www.sciencedirect.com/science/article/abs/pii/S2212041620300413
3. Factors determining supply – what is an "ecological iconic landmark"?
4. 6.50: consider changing "SNA benefits in the form of" to "SNA benefits that take the form of" to avoid any confusion that food or fibre is the provisioning service rather than the SNA benefit; i.e., that the relation is "SNA benefit in the form of", and not "provisioning service in the form of"
5. 6.89: It is not convincing that this is an adequate treatment. If a polluting industry is avoiding a storage or processing cost by dumping waste into the environment, whether as physical storage, or for slow or fast environmental mediation, this is a value to the polluter. The polluter could be assessed the cost of degrading the environment (waste burden beyond remediation capacity), then also the cost imposed on the environment that is ecologically remediated in the year. Together the value of these two assessments (one in the condition account, one in the ES SUA) might be estimated in monetary valuation as (at least) equivalent to the storage or liability costs avoided by not handling the industry waste in an economic market. Then there is a separate ES for pollution

remediation by the user of the ecologically purified ecosystem products from economically contaminated sites, which is in the current text, the only ES involved. These are not uncommon circumstances that any country could face when compiling these accounts and the chapter should consider these conceptual issues more carefully.

6. Annex 6.1 table, related to proxy measure discussed in 6.51. While assessing proportions is controversial, should the prospect of portioning be discussed more thoroughly? As the text currently stands, in theory, cultivated crops are joint products, and economic inputs account for some portion of the biomass volume (quantity and quality). Consider a simple hypothetical example, where the economic contribution to crop volume is A and the ecosystem contribution is B, then A + B = crop volume (e.g., = 100). Value is assessed here as B = 100. To claim the value of A (labor, purchased inputs like artificial fertilizers and irrigation water) = 0 does not seem prima facie defensible without some explanation. If there is a need to acknowledge the difficulty of parsing the value without actually doing the parsing or offering an example, this is similar to extant language for other challenging issues in the draft text, and that may be proffered. Simplification to a "B=100" default for examples in Chapter 7 is fine, but it may be useful to acknowledge in Chapter 6 the implications of the A = 0 assertion. By Liebig's law, min(A, B) = 100, at the limit for this measure both A and B could be 100 or one could be higher, and the equation = 100. A strict application of this could have B =100 and A = 0, but that is a single exceptional case, not an expected or default understanding. One might simply mention the assumptions that make the A=0 interpretation of the text possible, and that the assignment of fractional productivity is an outstanding issue for further discussion and development.

Questions related to Chapter 7

Question 5. Do you have comments on the proposed recording approaches for ecosystem services supply and use tables described in section 7.2?

1. Tables 7.1 supply and use –
    - 1) There is no description about what is additive – i.e. across rows but not down columns. This is different from the manner that all other SUTs in the statistical system are set up. To see that they are balanced, the sum of the totals of the rows = the sum of the totals of the columns. Apparently with ecosystem accounts this main concept of SUTs is being broken without any explanation or justification. This is not a good idea to start breaking the fundamental principles of SUTs.
    - 2) There is no good description regarding the units to be used in the tables – and the examples later in the chapter use many different units – again without explaining that this is OK in a SUT system (which in any other setting it is NOT OK – for example, an Energy SUT the units need to be converted to the same energy unit). It is only stated that the units used in the supply table need to be the same as in the use table (para. 7.8).
    - 3) There is no description of the different types of entries shown in tables 7.4 and 7.5 regarding intermediate services and abiotic flows – these just

suddenly appear in the later tables as part of examples. If Tables 7.1 Supply and Use are the official set up of the Ecosystem Services SUTs then these aspects of recording need to be shown in the main tables. ES, IS, AB need to be included in tables 7.1 not just in the examples later in the chapter.

- 4) The ecosystem types in the columns (Level 3 of IUCN typology) and the reference list of the ecosystem services used in the rows – do not provide much overlap. For example, where you would find the providing services are not in any of the ecosystem types shown in the columns. This becomes very confusing – you think about certain types of biomass that is harvested, but cannot find the column where it should go. Consider the row 'Grazed biomass provisioning' – under which terrestrial ecosystem type listed in the columns would it be entered?
- 5) In Table 7.1 Use Table – Why is tourism, recreation related services the only cultural service where intermediate services can be recorded?
- 6) In both the supply and use Tables 7.1, why is the sub-group "biomass provisioning" not having its own row but is together with the 3rd level category 'crop provisioning'? This is confusing – especially with the example used of 'wheat' later in the chapter.
- 7) attenuation is spelled wrong in the category 'Noise attenuation services'

2. The choice of IUCN GET and the EFG Level 3 sampling in the tables (e.g., Table 7.1) that presents ecosystems at their T(X).1 levels for the columns presents a potential bias. While it is a fair representation to sample at the T(X).1, the effect across the whole table suggests a purist ecological position that may conflict with the "coming together of ecology and economics" nature of the SEEA EEA attempt. For example, there is a column for glaciers (many countries don't have them at all) and a column for "submerged artificial structures" (many countries don't have them at all), but no column for any level of developed area or urban environment where humans have buildings (every country in the world has them, and since ES value is based in human use or appreciation and urban areas have the highest concentration of humans, trees in urban environments can be worth many times what trees are worth in remote forests).
3. This seemingly simple structural sampling choice (each (T)(X).1 is an exemplar column) perhaps accidentally represents a supply table oriented to miss critical ecosystem services – without "developed areas" columns, and with some of the other columns almost surely blank for many countries...always. While to an extent standardized tables will always have some blank lines for some countries, that tack just here may belie an ecological puritanism in the GET design. The problem may be deeper than the example tables in Chapter 7, and go to a bias in the version 1 IUCN Global Ecosystem Typology, and indicate a need for something more compatible with accounting needs, including a deeper gradation of developed areas, and a conscious representation of them in SUA.
    - A lack of distinction between urban ecosystem types will likely hinder nascent progress on urban ecosystem accounting. La Notte (2018) provides one proposal for classifying ecosystem types in cities, splitting

them into Urban artificial surfaces, Green spaces (urban forests, gardens, and parks), Urban drainage systems (urban wetlands, artificial water bodies, ponds/drains/lakes/floodplains), and other Urban green elements (street trees, green corridors, green walls & roofs). It would be very constructive for the ecosystem extent team to seriously consider proposals like this.

    - La Notte A., 2018. Accounting for the ecosystem services generated by Nature-based Solutions to measure urban resilience. A methodological proposal, ECONOMICS AND POLICY OF ENERGY AND THE ENVIRONMENT" 2/2018, pp. 43-61, DOI:10.3280/EFE2018-002003

4. Paragraph 7.12: Transitional realms as defined by Keith et al. are heterogeneous enough that the value of reporting them as a lumped realm is questionable. These transitional systems include shorelines, inland wetlands, and estuarine waters – it is difficult to see the value in lumping these into a single category.
5. Table 7.1: Why not just use the names of the major categories instead of just choosing the first sub-category under each?
6. Table 7.2: The fact that we propose to record the same thing in both the Ecosystem accounts and the economic supply and use tables is evidence that we are recording the wrong thing in the Ecosystem accounts. The yield of crops is the combination of human and ecosystem input so we need to separate those out as best we can. Account for the joint product in the economic tables. While it is understandable that there are difficulties in measuring the ecosystem contribution to the joint production of crop biomass, caveats and assumptions should be very clear so as to avoid confusion and future complacency in not trying to move from the proxy measure, which is already in the economic accounts, to a more true representation of ecosystem contributions to crops.
7. Table 7.4: In the schema where total crop yield is not a measure of a final ecosystem service, pollination service will become a final ecosystem service. Since Table 7.4 proposes to measure pollination as the number of visits we should not force it to be an intermediate service just because we can't measure the ecosystem contributions to crop yield. It can and should be treated as a final ecosystem service. The chapter should use a different example for intermediate services than this confusing one.
8. Para 7.11 – The example of different types of households by income quintile – seems to be irrelevant in this context. A split of urban/suburban/rural households would have been a more relevant break down with respect to ecosystem services. Especially since most farmers around the world are classified as 'households' except for the large agribusinesses but that is not who is involved in most agricultural activities in the world.
9. Para 7.23 refers to section 7.5 which does not exist – it should be 7.4
10. The example in para 7.25 and Table 7.2
    - 1) Here there is the use of the terminology "Biomass provisioning services (wheat)" – It would appear that based on table 6.2 and the list of Provisioning services in Table 7.1, the category should be called "crop provisioning" – there is NO category called 'wheat'. Mixing the terminology is confusing and inconsistent. Change the discussion and

tables under section 7.2.3 to match with the reference list and Table 7.1. Or at least use both the 2nd level and 3rd level names together, "Biomass provisioning services – Crop provisioning services" so it is clear where in the classification system you are making an example.

- 2) Earlier it was explained that the economic units to be used were according to ISIC. Why is ISIC group 011 called 'farmers' and not 'Growing of non-perennial crops'? The use of 'farmers' is very sloppy – and where most countries the farming is performed by households, the informal classification being used can be very confusing since the use would be recorded under households and not 'farmers'.
- 3) Why is the unit 'tonnes' in the supply row shaded in grey? Typo or real?
- 4) Why aren't the totals shown so that it becomes clear how the tables are balanced by rows only? For those people that only have worked with national accounts SUTs, they would immediately check the table entries by checking that the totals are the same – by rows, columns and the total of the rows equals the total of the columns. That this does NOT hold in Ecosystem Accounting is not explained or illustrated very well and should be emphasized in the table entries.

11. In para 7.26, a discussion that was in physical units (tonnes of wheat) suddenly transitions to the MONETARY SUTs of the national accounts system. This is very confusing. Technically, it would be the PSUT of the SEEA-CF material flow accounts (NOT the EW-MFA accounts of Eurostat) which would be the analogous system to which the ecosystem services SUTs would relate to directly and NOT the monetary SUTs of the national accounts. The quantum leap made from the ecosystem SUT to the monetary national accounts SUT is not obvious to those whose background is from a purely economic SUT or a purely physical flows SUT background.
12. Para 7.27 and Table 7.3
    - 1) It is unclear why the air filtration services are ONLY a benefit to households. Yes, PM2.5 particles are the ones most easily breathed by humans and which cause the most respiratory responses, but these particles are also damaging to equipment that take in air – which most machinery does through the air cooling systems and filters do not capture these particles. Why then are the benefits only attributed to 'households' and not 'government'?
    - The explanation for distinguishing between benefits to households vs. government for most of the regulating and maintenance services is very weak. At a country level, almost all of these would be benefits to more than one economic unit. It is only at much finer levels of analysis where these ecosystem services can be identified as benefiting only one economic unit. A hedge planted along a highway might provide noise attenuation services to the buildings it is nearby – so specific households and businesses. A hedge planted in another location would provide soil erosion control services. When aggregating up to a larger special area – such as national borders – then the fine-grained SUTs cannot simply be added up since the benefits would also aggregate mostly to 'government' and not to households, and all of the other economic units. Or do all of

the fine grain SUTs for the same types of ecosystem services simply add up? If they do, and the use by economic units is also kept, then the explanation regarding when to allocate benefits to households and when to allocate them to government is very unclear. If you can assign benefits to economic units at a fine grain level but not at the aggregate level, then the SUTs are dependent on the level of analysis – and this is problematic.

13. Table 7.4 – pollination services: All of a sudden, an area of the table that was 'grey' – meaning that entries in these areas are not allowed – is now open to be filled. In Table 7.1 Use – the squares for pollination services for forest and grassland are not grey. Why are they grey here? Only because the example is for wheat?
14. Para 7.32 Water supply: Most rivers are now regulated in some way – with barriers, dams, channels, canals, etc. and do not have 'natural flows.' Water regulation of base flows is therefore often at least partially controlled – how is this considered an ecosystem service if the base flow is controlled by humans? This issue of when is a river 'natural' has not been addressed and therefore it is difficult to identify when the water supply is 'abiotic'.
    - There are two different ways described for how to handle flows – which is the recommended approach? What are the implications of these different methods? Why choose one over the other? No concrete guidance is given – only to avoid double counting.
15. Section 7.2.5 Imports and exports: Where to record these in the main SUT system (shown in Table 7.1) was not easy to find. Perhaps there should be some type of numbering system in these tables that could be used in the description in the text.
16. Para 7.41 Imports – treatment of fish: Here it states, "…these services should be treated as an import of an ecosystem service in the accounts of the country undertaking the fishing." How do you determine this? The flag of the fishing vessel? The owner of the fishing vessel? The owner of the fishing quotas? Please realize that only the fish landed in a country and the flag of the landing vessel are typically known. When a fishing vessel transfers its catch to a transport vessel in the middle of the ocean, where the fish came from and which vessel caught the fish often gets lost – and are not recorded as exports from the fishing area where the fishing occurs. Your instructions for recording are naïve.
17. Para 7.42 – your example, "(e.g., on opposite sides of a river)" assumes that the river is the administrative boundary – but this is not stated clearly so can be confusing in countries that do not have rivers that form administrative boundaries. Countries do not like rivers as boundaries since rivers are not located in constant places.
18. Section 7.2.7 Recording abiotic flows: Para 7.49 describes an odd relationship between wind, generators, electricity, turbines, farmers, farmland, ++. The description has no relationship to reality and someone who understands energy production from wind and the correct terminology should help revise this.
19. Table 7.5 Terminology and recording: The economic units used in this table are very confusing and are not well explained. What is meant by 'electricity generator'? Is this a piece of equipment – a generator? Or an economic unit in ISIC 351 'Electric power generation'? Does the farmer own the wind masts and is responsible for the electric power generation or is it a utility company who has

placed the masts on the farmland? This example needs to be re-written and the correct statistical and energy terminology used.

Question 6. Do you have any other comments on Chapter 7?

1. Glad to see a discussion of how to handle ES imports and exports, which has been previously lacking from SEEA EEA. One could argue that in paragraph 7.42, we need not just an understanding of the location of supply and use but also of how these regions are connected (particularly for air/water currents, or in the case of migratory species which one could see are valued in-country at the point of use but have critical intermediate services, i.e., habitat support, coming from outside the country!). A potentially useful framework that could be adapted to SEEA is here https://www.sciencedirect.com/science/article/pii/S221204161730606X and a quantification example here https://www.sciencedirect.com/science/article/pii/S0959378018314705 (see in particular the coarse import/export accounts for flood regulation). Hopefully this is an area the SEEA community can work on more in the future.
2. Section 7.3.2 Baselines
    - This is an interesting application of "baseline" concepts. Since it is not consistent with other uses of the term "baseline" in environmental decision making contexts (or in environmental condition or ES assessment literature), at a minimum it should be better defined (in glossary), with brief discussion over why this is presented in a different manner.
    - Glossary
    - Suggest adding "produced by economic units" to the glossary
    - Suggest adding "baseline" to the glossary
    - Why is it necessary to introduce the new terminology, "counterfactuals"? Reconsider this terminology as it is confusing and does not help the text, or at least it could be moved to a footnote.
    - Some reference needs to be provided for RUSLE (para 7.66)
    - What is the definition of 'bare land' used in Table 7.6 – rock? Sand?
    - Overall, while an interesting application, this section needs an introduction that clearly states that this is a modelling exercise and not something that can be measured.
    - Where is this put in the ESS-SUT system? Why is this included in the manual – where is it used?
3. 7.4 Connections to SEEA-CF: Para 7.70 The second sentence is a long, run-on sentence that is confusing in terms of which of the ecosystem services are excluded from the SEEA-CF, which needs to be re-written. And it would be helpful to use commas to separate the different services since there are so many conjunctions ("and") that the groupings are not easily decipherable.