Attachments 1 to 5 to ABS Comments on the

Draft System of Environmental-Economic Accounting:

Experimental Ecosystem Accounting

(November 2012 version)

These five documents are supplied in support of the ABS response to consultation on the draft SEEA Experimental Ecosystem Accounting.

They provide additional detail and background information for consideration by the Editor and the Editorial Board in finalising the draft of the SEEA Experimental Ecosystem Accounting.

The attachments are:

1. Specific comments by chapter and paragraph
2. Some new text on units, building on the current text on units, as a track-change word document
3. Australian examples of additional physical boundaries for areas that could be used for ecosystem accounting
4. An Australian example of a scientific accreditation process for the data used to construct the accounts
5. An ABS note on valuation prepared for the Valuation sub-group of the SEEA

Attachment 1. Comments by paragraph and chapter

Note: Many of the comments below have been picked up in the overall response provided to the UNSD.

General comment

The table of contents as well as the numbering of paragraphs and section is appreciated, but has not worked in some cases – e.g. there are at two 2.2.2s, one on page 19, and one on page 21.

This will need to be corrected in the final version.

Chapter 1

Paragraph 1.1: Need to include a definition of ecosystems here.

1.42, p. 11. Suggest a rewrite last sentence to: "Resilience indicates the propensity of ecosystems to withstand pressure or to revert back to previous conditions following a disturbance".

Chapter 2

2.1, p. 15, suggest using 'for example' or 'including' to imply that the list is not exhaustive of possible processes that may affect change in an ecosystem whether natural or human-caused.

2.3, p. 15, suggest using 'influenced' or 'mediated' by human action, rather than 'dominated'.

2.4, p. 15, the reference to ecology here is not correct as ecology is the study of the relationships of living and non-living things, or, to put it another way, the study of ecosystems. Suggest rephrasing here and elsewhere in the document. For example: "Assessment of ecosystems should consider their components and location. Key characteristics of an ecosystem are . . . ".

2.5, p. 15: mix of singular and plural. Biodiversity is not commonly described as a characteristic of ecosystems. Need to clearly define biodiversity and how it relates to ecosystems and their characteristics.

2.6, p. 15, insert a comma between 'interconnected' and 'commonly'.

2.7, p. 15: introduces the idea that an ecosystem should be defined spatially and that area should be considered an ecosystem asset. The second sentence then defines the ecosystem asset as an ecosystem with a spatial area. The description is a little confusing and the use of these terms here is not always consistent with the use of 'ecosystem asset' later in the document. This needs to be made clearer.

2.9, p. 16: The term ecosystem asset (now italicised but not previously) is now being used to describe spatial areas of stocks within an ecosystem rather than the spatial extent of the ecosystem as defined in 2.7.

2.11, p. 16: it is incorrect to state that mineral and energy resources do not interact as part of ecosystem processes. Many mineral and energy resources are produced by ecosystems (e.g. fossil fuels, phosphate); most are also used by ecosystems in some way (e.g.: phosphate, potassium) and many others interact (e.g.: radioactivity and heavy metals bioaccumulate in ecosystems; using trace mineral concentrations in ecosystems is a major area of mineral exploration research). This clarification needs to be added. Also the issue of timescale is important (see comment on paragraph 2.105 below)

2.25, p. 19 resource should be plural in ‘’extraction of mineral and energy resources”

2.30, p. 21, sentence should read “The selection of characteristics and indicators should be made on a scientific basis” (insert ‘a’).

2.30, p. 21,in relation to “such that there is assessment of the resilience, vigour and organisation of the ecosystem asset”, resilience has been defined earlier but no definitions are given for vigour or organisation. Is the organisation referring to the same organisation that is a characteristic of an ecosystem as defined in 2.4? If so, this seems to contradict the first part of this sentence which is describing how to choose which characteristics to measure, as does using resilience which has also been described as one of those characteristics. The last part of this point refers to the ‘ecosystem as a whole’. Is this the same thing as the ‘ecosystem asset’ or is some broader scale meant?

2.33, p. 21, ‘Ecosystem extent reflects the area of an ecosystem asset’ – seems self-referencing as the ecosystem asset is defined as the ecosystem in a spatial area.

2.33, pp. 21-22, ‘for an ecosystem as a whole the concept of extent is generally considered in terms of area e.g. hectares for particular types of land cover’. This implies that land cover is an ‘ecosystem as a whole’, but goes on to say that changes in the mix of land covers may be important indicators of changes in ecosystem assets, which then implies land cover is a characteristic (a subset) of ecosystem assets not the ecosystem asset.

2.53, p. 25, ecosystem should be singular.

2.73, p. 28: repetition of ‘also’ in second sentence.

2.78. It is not clear what is meant by the second sentence of this paragraph: "the extension that is likely to be required for ecosystem accounting is the spatial disaggregation of information from asset accounts for these resources with specific recording of inter-ecosystem flows". Clarify or delete.

2.98, pp. 32-33: the introduction of the idea of ‘hydrological years’ is confusing, so needs to be removed or clarified.

2.105, p. 34: this repeats the view that mineral and energy resources, soil and renewable energy sources do not arise from ecosystem processes. Not considering these as part of the accounting systems may be pragmatic, but the reasoning given needs to be sounder. An argument might be that most of these ecosystem processes involve such long timescales as to be beyond the field of interest. This will not necessarily be true for soil or some renewable energy sources, but it improves the current explanation.

Chapter 3

3.6, p. 37, point (ii), the reference here to ‘other producers’ is not clear in this context, particularly to those without an understanding of the SNA. Also can public benefits accrue to private producers? If not then we need another way to say that benefits accrue to people that do not own or manage the land from which the benefits are generated.

3.6, p. 37, point (iii), ‘there are ecosystem services that are generated from areas that are not privately owned or managed and contribute. .’ This could be made clearer to those without knowledge of the SNA by stating what the areas are first, rather than what they are not. E.g. ‘some ecosystem services are generated from public areas (e.g. national parks)’.

3.7, p. 37, the idea encapsulated here that the public benefits provided by ecosystem services ‘are likely to be produced unintentionally by a private producer’ is problematic. Rather than produced, which has a specific meaning in the SNA, perhaps we could use generated? This would make more sense given that the ‘producer’ has little or no involvement in generation of the service in this scenario.

3.11, p. 38, Here the draft states that ‘biodiversity is a core characteristic of ecosystems’ but 2.4 (p. 15) does not list biodiversity as a key characteristic of an ecosystem but rather considers it under ‘composition’. Similarly, as noted above 2.5 (p. 15) describes biodiversity as ‘an important broad characteristic’ of ecosystems. It is important to develop clear and consistent definitions for terms such as biodiversity, characteristics and attributes and in particular how biodiversity and ecosystems relate (see separate discussion on biodiversity above).

3.12, p. 38, Terminology: is ‘final output’ an ecosystem service?

The role of a Panda in an ecosystem or generation of an ecosystem service is not necessarily clear to non-specialists. Iconic species are also not listed in an example of the cultural services in CICES (see table 3.1) and could be considered for inclusion.

3.15, p. 39, suggest some explanation of abiotic services be put in this document rather than referring the reader to the SEEA Central Framework. Without it, it is unclear what is meant. For example, physico-chemical processes described in the second sentence here are abiotic processes and are generated as part of ecosystem processes, so it seems like they should be included. The next point, 3.16, has a similar issue where ‘natural inputs’ are included but abiotic services are not.

3.23, p. 40: the acronyms ‘MA’ and ‘TEEB’ should be spelled in full.

3.62, p. 48, last sentence – believe the authors’ intend ‘than’ rather than ‘that’.

Chapter 4

4.8 & 4.9, p 54: There is an apparent inconsistency in definitions: ‘key characteristics’ for ecosystem condition are listed but are different to those previously. ‘Qualities’ of ecosystems are now listed as ‘resilience, vigour and configuration,’ previously this was ‘organisation’ not ‘configuration’, etc.

4.12, top of p.55 believe the authors’ intend ‘relatively’.

4.14, p.55 the discussion about relative conditions and a benchmarking point suggests a point in time ‘before significant patterns of recent landscape change were in evidence’. This would benefit from more explanation and/or a definition. For example, what is considered ‘significant’ in patterns of landscape change and what is considered ‘recent’? Will this change across continents? Also it should be made clear if landscape change affected, for example, by beaver dam building in North America should be included. Our understanding is that it should not be included, but this should be made clearer.

4.33, p. 58 missing word between enhancements and the – perhaps it is ‘are’. This sentence is also confusing in its intent – in what aspect is the ‘increase’ in an ecosystem asset to be considered an enhancement: an increase in condition or extent or both? Please refer to the note on terminology where we suggest replacing the words degradation and enhancement with other terms.

4.35, p. 58 in the sentence ‘a particular feature of ecosystem assets is that they naturally regenerate’ the word ‘naturally’ is potentially misleading. Ecosystems do not have to be natural – an agricultural landscape is an ecosystem and regeneration may be the result of a mixture of ‘natural’ and human inputs. The problem would be addressed by deleting the word ‘naturally’ (i.e. the important thing is the regeneration). Here again the distinction between ecosystems and ecosystem assets remains unclear and confusing.

4.58, p. 62: It appears that biodiversity is sometimes used to refer solely to animals (rather than all life). If this is the case it would be better to say animals. For example, the confusion is apparent in the sentence that explains there may be overlaps between vegetation and biodiversity where vegetation should be a subset of biodiversity.

4.63, p. 63 the first sentence, particularly ‘it may be instructive to accounts may be compiled’ needs correction.

4.64, p. 63 While mapping is an important tool for presenting accounting and other information, this appears to be the first mention of mapping in the document. Perhaps something about the communication information from accounts, via means other than tables, including maps, can be added earlier in the document (possibly as a new section in chapter 1 on communication)

4.71, p. 65: the concept of ‘naturalness’ of vegetation is problematic. Suggest using the world ‘condition’.

4.71, p. 65: This is an interesting case where it could be explained why an air filtration service would not exist if people were not in the area – the physical processes which produce the service exist but are not used (nor valued). This is similar for flood protection. Impacts on the environment from soil erosion, silt in the water column and other impacts would occur without flood protection in an area whether or not people were living in the area. However, there could also be ‘downstream’ effects of such flooding that affect people or the drinking water quality. Here the relationship to inter and intra ecosystem need to be made clearer, particularly the point at which they become services to people that are outside of the area (EAU).

4.71, p. 65 end of paragraph – the question mark seems out of place.

4.73, p. 65 the statement that the required resolution depends on data availability is incorrect – data availability will impact the achievable resolution but not the required or desirable resolution.

4.75, p. 66 the separation of biodiversity from ecosystem quality is problematic here, particularly given the numerous preceding definitions of biodiversity which place it as a descriptor of ecosystem quality.

It’s not clear what point is being made in the last sentence here, which appears to separate a beach vista from an ecosystem characteristic. A beach may be considered an ecosystem of its own or an ecotone (the gradational point between two ecosystems). Previous discussions have said that the enjoyment of scenery would come under a cultural value attached to the ecosystem, which could also be an ecosystem characteristic.

Table 4.5.1 (p. 70) replace "Rocks" with "Limestone".

4.89, p. 69 CO_2 needs a subscript 2.

4.99, p. 72 Biodiversity is defined again, this time as a 'fundamental component' of ecosystems. Later, it is something that can have a relationship with ecosystems rather than being part of them.

4.98, p. 71: There is a double nested parenthetical clause here that is missing an end parenthesis. Suggest rewriting to remove the double-nesting for clarity.

4.101 p. 72 the sentence 'by making biodiversity accounts for particular spatially defined areas..' is very dense and could be made clearer.

4.102 p. 72 seems to be another case where biodiversity is used where 'animals' are meant – many land cover measures are, after all, a relatively direct measure of vascular plant diversity.

4.104, p. 73 is another definition of biodiversity. This time, biodiversity contains ecosystems rather than ecosystems containing biodiversity.

4.105, p. 73 the taxonomic system most commonly used (and not the only one, see also the phylocode) is properly referred to as Linnean taxonomy rather than 'binomial nomenclature'. The explanation (i.e.: genus and species) could be deleted.

4.108, p. 73 is an example of the definition problems. This argument is circular given the difficulty of placing biodiversity either within or containing ecosystems. E.g. biodiversity loss is discovered through degradation of ecosystems which you measure using biodiversity loss.

4.109, p. 73 the clarification (e.g. plague proportions) is not useful as 'plagues' can be naturally mediated events.

The discussion of homogenisation could be read as an oversimplification. Adding an 'in general' to this statement will address this.

4.110, p. 74 the last sentence needs some clarification of expression ('than accounting of all aspects..')

4.115, p. 74 the second sentence needs to be corrected – suggest 'to' is inserted before 'combine'.

4.119, p. 75 last sentence should be 'threatened species'. Second last sentence is confusing and needs to be rephrased.

4.120, p. 75 second last sentence, delete 'then', last sentence (p. 76), insert 'and' between 'elephants' and 'other'.

4.112, p. 74 previous discussion has discounted the possibility of measuring genetic diversity but it is now listed as one of the indicators of the state of biodiversity.

4.121, p. 76 iconic values and charismatic megafauna are not the same concept. Suggest that these be separated and explained.

4.122 and Table 4.5.1, p. 76. Monera is missing from the 5 Kingdoms (only 4 are shown).

4.123: the comment that comparisons between countries should have some caveats. Comparing entire countries of different sizes or climatic zones (e.g. Brazil with Luxembourg) may not be particularly informative.

4.124, p. 77 discusses the importance of including all kingdoms while leaving one out (Monera).

4.125, p. 77 last sentence, delete second 'into account'

Chapter 5

Para 5.1., p. 79: "Valuation ~~is~~ therefore involves the estimation of missing prices". Here it is explicit that the current scope of valuation in the SEEA Part is about pricing. However, this scope could be broadened to include other techniques, such as choice modelling, which do not convert individual preferences to prices. If it remains excluded from the scope, then at least a mention of these approaches would be appropriate.

Also to make the scope of valuation clearer in the text, most of the time it would be better to say "monetary valuation" rather than just "valuation". This is done in some cases (e.g. in last sentence of paragraph 5.3) but should be done consistently (e.g.: in para 5.11, 2nd sentence; 5.9 1st sentence "value *in monetary terms*").

Para 5.4, p. 79: This is a good paragraph but a third point could be that different benefits occur depending on whether you are a final user or producer of ecosystem services. Also in first sentence refer to both ecosystem assets and ecosystem services (currently just the latter).

Para 5.8: A third point could be that this is to guide public and private investment decisions. To some extent this may be covered for government in point 1

Government units is used in para 5.6 but this may confuse some people. Suggest using government sector, or just government. Similarly economic units as used in para 5.21 could be confusing and perhaps using establishments would be better. Need a discussion of these types of statistical units in chapter 2 to help those unfamiliar with SNA.

Para 5.14. A extra point is that valuations made using different approaches cannot be aggregated. An extra paragraph could be added, saying that while no recommendations are made, starting with SNA is likely to more acceptable than other approaches.

Paras 5.17 and 5.18, p 82: A related issue is the unused capacity of ecosystem assets. Since ecosystem services only exist if they are used by people, the physical production which would be ecosystem services if they were used by people are not counted. These unused potential services remain outside the system of accounting (as inter and intra ecosystem flows).

Figure 5.1 p. 83. This should be redrawn with different line types (i.e. use solid lines, dotted lines and dashed lines). This will make it easier it to understand in black and white reproductions

Para 5.48, p. 88: replace 'fully natural' with ecosystem assets largely unaffected by humans (or similar).

P.5.47, p. 88: It may be worth adding a sentence: "If these ecosystem services were not available for use in production, either they would have to be replaced with other factors of production or production would be diminished or cease".

Para 5.49, p. 88: replace "ecosystem" on 5.49 with "ecosystem asset".

Para 5.51, p. 89: Re use of he and his. An editorial choice but should the document be gender neutral?

Para 5.57, p. 90: Use of the ampersand?

Chapter 6

Section 6.2. Perhaps some examples of combined presentations could be added to this section

Paragraph 6.10: this is part of the justification and perhaps should be part of the introduction (i.e. after paragraph 6.5). It would then make a nice lead in for Section 6.2.

Paragraph 6.29 and Table 6.1: The table and explanation are good. The presentation in the table does not, however, show degradation. "Extraction and harvest" should be shown as reductions caused by human activity (as per suggestion for table 4.3) to avoid the use of the term "degradation". Whichever terms are used, the terminology should be consistent.

Paragraph 6.44 repeats a substantial part of paragraph 6.4. Reduce duplication in the later paragraph and refer back if necessary.

Attachment 2. Suggested update to text on Units

Units for ecosystem accounting

2.3.1 Introduction

2.40 In order to undertake measurement of ecosystems in a co-ordinated way and to subsequently compare and analyse information across time and between ecosystems, there must be a clear focus for measurement. Boundaries for specific ecosystems are generally drawn on the basis of relative homogeneity of ecosystem characteristics, and in terms of having stronger internal functional relations than external ones. However, these boundaries are often gradual and diffuse and a definitive boundary between two ecosystems may be difficult to establish. Further, ecosystems may be very small or very large and operate at different spatial scales.

2.41 Statistical units are the entities about which information is sought and about which statistics are ultimately compiled. It is the unit that provides the basis for statistical aggregates and to which tabulated data refer.

[Insert paragraphs on economic units from SEEA CF about here]

2.42 The statistical units of ecosystem accounting are spatial areas about which information is collected and statistics are compiled. Such information is collected at a variety scales using a number of different methods. For example, remote sensing, on ground assessments, surveys of land owners or administrative data (e.g. zoning laws or for the purpose of levying land taxes). The variety of methods and the different scales at which data sources are collected mean that unlike other areas of statistics, a single all-encompassing statistical unit cannot be identified for ecosystem accounting at this stage.

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~~2.42~~2.43 To account for the different scales and methods used to collect, integrate and analyse data ~~he units model consists of~~ three different types of units are identified: basic spatial units (BSU), land cover/ecosystem functional units (LCEU) and ecosystem accounting units (EAU). The following sub-sections describe each type of unit. The BSU, LCEU and EAU do not delineate an ecosystem per se although the LCEU may fit most closely with common conceptions of an ecosystem. ~~However, ecosystems are multi-faceted and depending on the purpose of analysis may be delineated spatially in different ways.~~

2.44 In this the accounting units model can be viewed as either bottom-up (i.e. starting with BSU) or a top-down (i.e. starting with LCEU or EAU). That is, the BSU may be aggregated to form LCEU or EAU, while LCEU or EAU can be disaggregated to form BSU. Direct measurements may be made of each of these types of units and the use of one type of unit for measurement of a particular aspect of an ecosystem does not preclude the use of other spatial units for measurement of other aspects.

~~2.43~~2.45 The statistics for each spatial unit pertain to the characteristics and location of an ecosystem (see para 2.4) and its services. In compiling accounts, it may be necessary to also collect information about ~~biological~~ the biotic components (e.g. trees, animals, etc.), but statistical units for the measurement of these characteristics are not articulated here. For a country or region the total area is generally subject to little change and the main interest of ecosystem accounting lies in assessing changes within a total area.

2.44 The units model consists of three different types of units: basic spatial units (BSU), land cover/ecosystem functional units (LCEU) and ecosystem accounting units (EAU). The following sub-sections describe each type of unit. The BSU, LCEU and EAU do not delineate an ecosystem per se although the LCEU may fit most closely with common conceptions of an ecosystem. However, ecosystems are multi-faceted and depending on the purpose of analysis may be delineated spatially in different ways.

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2.3.2 Basic spatial units

2.452.46 A basic spatial unit (BSU) is a small spatial area. Ideally, BSU should be formed by delineating tessellations (small areas e.g. 1 km^2), typically by overlaying a grid on a map of the relevant territory, but they may also be land parcels delineated by the cadastre. Grid squares, ideally each one being a BSU, are delineated to be as small as possible given available information and landscape diversity. The model can also accommodate different scale grids through spatial nesting (e.g. a 1 m^2 grid aligned within 10 m^2 and 100 m^2 grids)

2.462.47 The delineation of BSU is made purely on a spatial basis and before any other information on these areas is available. After delineation Eeach BSU should can be attributed with a basic set of available -information that is available. The most common starting point for this attribution process will be information on the location of the unit and land cover. This basic information is then extended with information relevant to the purpose of the account being compiled. For example, relevant information may include ecosystem characteristics such as soil type, groundwater resources, elevation and topography, climate and rainfall, biodiversityspecies present and their abundance, the degree of connection to related areas, current or past land uses, land ownership, location relative to human settlement, and the degree of accessibility to the area by people.

2.472.48 This set of information may be extended toalso include information on the generation of different ecosystem services from the BSU such that the BSU can represent the level at which all relevant information for ecosystem accounting is assimilated and organised. Since ecosystem services are often generated over areas larger than a single BSU a method is required to attribute information to the BSU level. This issue is discussed in Chapter 3.

2.49 If possible, information on any associated economic units, e.g.for example land owners, should be attributed to each BSU. (which may be straightforward when using land parcels and the cadastre). This range of information recognises that while each BSU is a mutually exclusive area, it can be placed into a number of spatial defined areas (e.g. EAUs) and that exists within a number of systems ecosystem assets and ecosystem services may that operate at varying spatial scales and relate to more than one economic unit. The link to economic units is discussed further in sub-section 2.3.6.

2.3.3 Land cover/ecosystem functional units

2.482.50 The second type of unit is the land cover/ecosystem functional unit (LCEU). For most terrestrial areas an LCEU is defined as the set of contiguous BSUby satisfying a pre-determined set of factors relating to the characteristics and ~~operation~~ function of an ecosystem, generally represented by ~~. Examples of these~~ factors ~~include~~ including land cover type, water resources and soil type. A particular feature is that the ~~set of BSU that comprise an~~ LCEU should be seen as operating ~~in a~~ relatively ~~joint manner and~~ independently from neighbouring LCEU.

2.51 The resulting LCEU would commonly be considered an ecosystem or biome noting that these concepts are not strictly able to be defined purely in spatial terms. LCEU can be disaggregated into BSU (e.g. by overlaying a grid) or conversely BSU may be aggregated to form a LCEU. Following standard approaches to statistical classification, BSU would be classified to particular LCEU on the basis of a pre-dominance of characteristics within the BSU. This is akin to classifying an enterprise to a particular industry based on the pre-dominance of a particular economic activity in that enterprise.

~~2.49~~2.52 A provisional land cover/ecosystem functional unit classification showing 15 classes is shown in table 2.5. The classification is based on the FAO Land Cover Classification System, version 3 (LCCS 3) (FAO, 2009). This approach uses as its starting point the Land Cover Classification presented in the SEEA Central Framework Chapter 5 (which is also based on LCCS 3) and combines these into classes that are optimised for the analysis of changes in land cover and land use. The cover classes can be augmented by other characteristics, for example, relating to broad climatic zone (e.g. tropical, sub-tropical and temperate), elevation (e.g. lowlands, highlands) and topography (e.g. plains and mountains).

~~2.50~~ LCEU will vary in size depending on the situation in a given country. Also, not all countries will have all types of LCEU described in table 2.5. ~~For the purposes of national level ecosystem accounting it is appropriate to consider only a limited set of LCEU classes.~~ Various studies and reports (e.g. CBD, MA, UK NEA) have used different classifications but all using terms that may be considered commonly understood (e.g. forests, wetlands, grasslands, coastal areas).

Comment [RM1]: Should be spelled out, footnoted or listed in the glossary or Abbreviations listing

~~2.51 A more rigorous approach that may better suit the purposes of international comparison for ecosystem accounting has been developed based on the FAO Land Cover Classification System, version 3 (LCCS 3) (FAO, 2009). This approach uses as its starting point the Land Cover Classification presented in the SEEA Central Framework Chapter 5 (which is also based on LCCS 3) and combines these into classes that are optimised for the analysis of changes in land cover and land use. A provisional set of 15 classes is shown in Table 2.5.~~

~~2.52~~2.53 At any point in time, all LCEU should be mutually exclusive. ~~, i.e. all BSU should be within only one LCEU.~~ However, over time as changes in land cover and land use occur, some BSU will need to be re-classified to different LCEU – for example from Agriculture associations and mosaics to Urban and associated developed areas.

~~2.53~~2.54 For smaller scale analysis, it may be relevant to undertake accounting for a single LCEU. There may also be interest in aggregation of information about specific types of LCEU, where ever they are located e.g. concerning all open woodlands or wetlands in a country or region.

Table 2.5 Provisional Land Cover/Ecosystem Functional Unit Classes

Description of classes
Urban and associated developed areas
Medium to large fields rainfed herbaceous cropland
Medium to large fields irrigated herbaceous cropland
Permanent crops, agriculture plantations
Agriculture associations and mosaics
Pastures and natural grassland
Forest tree cover
Shrubland, bushland, heathland
Sparsely vegetated areas
Natural vegetation associations and mosaics
Barren land
Permanent snow and glaciers
Open wetlands
Inland water bodies
Coastal water bodies
Sea

2.542.55 It is likely that LCEU represent the closest approximation to ecosystems in spatial terms in the way that large scale ecosystems are commonly envisaged. However, in order to more fully adapt LCEU to ecosystems types it is likely to be necessary to allow for variations in climatic conditions, geophysical conditions, and land use. In relation to land use, for some purposes it may be relevant to cross-classify LCEU by the extent to which the area is considered influenced by human activity. Thus types of LCEU (e.g. forest tree cover) may be considered as reflecting natural, semi-natural, agricultural or other types of ecosystems.

2.552.56 While table 2.5 presents a provisional list of land cover/ecosystem functional unit classes, Nno definitive classification of ecosystems is provided in the SEEA Experimental Ecosystem Accounting. Progressive experimentation in the development of ecosystem accounts in various countries may reveal a consistent core set of classes that can be developed into an ecosystem classification in the future.

2.3.4 Ecosystem accounting units

2.562.57 The delineation of an EAU is based on the purpose of analysis and should therefore take into consideration administrative boundaries, environmental management areas, large scale natural features (e.g. river basins) and other factors relevant to defining areas relevant for reporting purposes. This is different from the LCEU which are based on physical land cover. Overall, EAU should be relatively large areas about which there is interest in understanding and managing change over time. Consequently, EAU should be fixed or largely stable spatial areas over time.

2.572.58 Depending on the size of the country there may be a hierarchy of EAU building from smaller reporting units to the national level. For example, starting from a local administrative unit a hierarchy of EAU may build to provincial and then national level. In all cases, a country's total area will represent a single level in a hierarchical EAU structure.

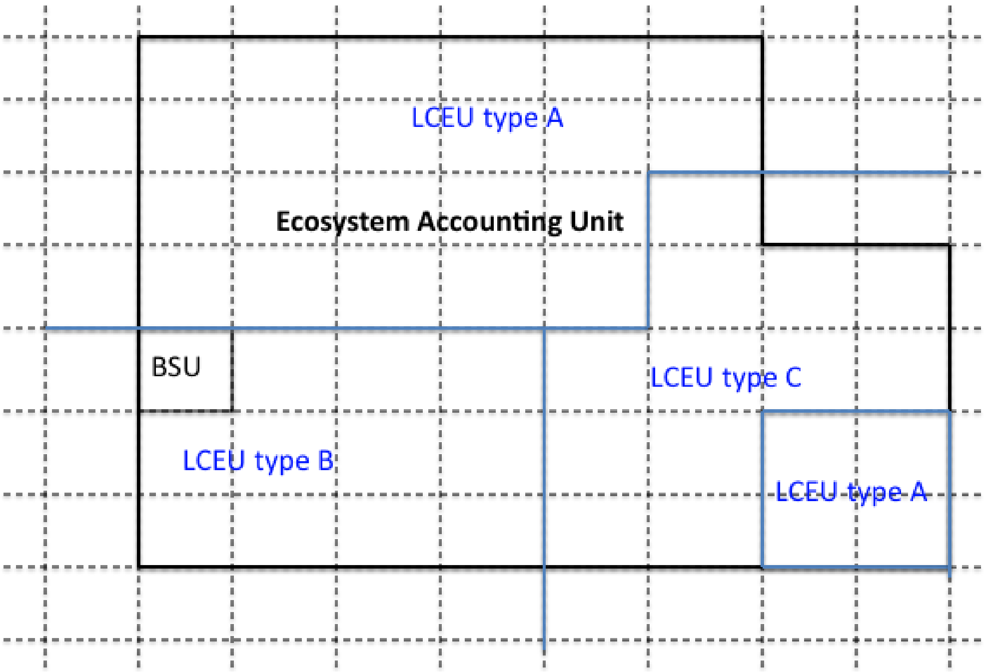
~~2.58~~2.59 A specific concept that has been developed that may be useful in the delineation of EAU is socio-ecological systems. Areas defined as socio-ecological systems integrate ecosystem functions and dynamics as well as human activities and the range of interactions of these components.

~~2.59~~2.60 For the purposes of national scale ecosystem accounting it is recognised that EAU are likely to contain a range of ecosystem types (reflected in different types of LCEU) and generate a range of ecosystem services.

~~2.60~~2.61 For a single country it may be relevant to recognise different hierarchies of EAU. For example, a set of EAU may be delineated based on administrative regions, a second set may be based on catchment management areas, and a third set may be based on soil types. All EAU within each set may be aggregated to form national totals but there should not be aggregation of EAU across different sets (e.g. adding some administrative regions with some catchment areas) since this would imply the aggregation of “non-matching units”.

~~2.61~~2.62 Figure 2.4 provides a stylised depiction of the relationships between EAU, BSU and LCEU where, in this case the BSU are defined by grid squares. Attribution of BSU to EAU and to LCEU should be based on predominance. Note that it is possible for a number of LCEU types to be present within a single EAU and for a single LCEU type to appear in various locations within an EAU.

Figure 2.4 Stylised depiction of relationships between EAU, BSU and LCEU



2.3.5 Units in relation to ecosystem services

~~2.62~~2.63 It should be recognised that since any given spatial area may generate a number of types of ecosystem services it is likely that a single BSU will be involved in the generation of a range of ecosystem services. In this sense there is no direct analogy between the BSU and an establishment in economic statistics that undertakes a single kind of activity.

~~2.63~~2.64 In addition, it is likely that many ecosystem services are generated over a larger spatial area than a single BSU or, at least, are measured over areas larger than a single BSU. Given this, it may be useful to map sets of BSU that are relevant to the generation of particular ecosystem services. Often these maps will reflect a contiguous set of BSU (for example, in the case of provisioning services from a forest), but this need not be the case. It is possible that some ecosystem services are generated in a single BSU (e.g. cultural services from a local fishing spot).

~~2.64~~2.65 Although the generation of ecosystem services may take place over varying spatial areas depending on the ecosystem service, a useful measurement starting point may be to consider the ecosystem services generated within an LCEU. Particularly for provisioning and cultural services, an LCEU is likely to provide a useful spatial boundary for the measurement of ecosystem services. Maps of ecosystem service generation may be useful tools in delineating LCEU by providing an understanding of concentrations of related ecosystem services.

2.3.6 Relationship to economic classifications

~~2.65~~2.66 The cross-classification of BSU information with economic units is central to assessment of the relationship between ecosystem services, ecosystem assets and economic activity. The application of ecosystem related information to questions of land management and ecosystem degradation requires such connections to be made.

~~2.66~~2.67 Ideally, the linking of BSU to economic units would be undertaken in the process of attributing BSU with basic information on, for example, land use or ownership (via cadastres). If this detailed linking is not possible then broader assumptions may be used for example by linking information on land cover and land use to BSU.

~~2.67~~2.68 For certain ecosystem services it may be relevant to use economic units as a basis for collecting relevant data. This may most relevant in respect of provisioning services.

~~2.68~~2.69 It is noted that the beneficiaries of the ecosystem services may be the land user or owner, or, it may be people living nearby (as in the case of air filtration) or populations at large (as in the case of carbon sequestration). Further, in specific cases the beneficiaries may be spatially delineated, such as in the case of people living downstream in the flood zone of an upper catchment that is managed with the aim of protecting its hydrological services.

2.3.7 Issues in the delineation of units

~~2.69~~2.70 The delineation of units should be undertaken in concert with the development of spatial databases in Geographic Information Systems (GIS). These databases should contain information such as soil type and status, water tables, rainfall amount and pattern, temperatures, vegetation, biodiversity, slopes, altitude, etc., as well as, potentially, information on land management and use, population, and social and economic variables. This information may also be used to assess flows of ecosystem services from given spatial areas.

2.702.71 In presenting accounts for ecosystems at a national level, the geographic scope of the accounts should be clearly stated. Often, the scope may be limited to terrestrial areas but there may be good reasons to extend coverage to incorporate marine areas under the control of a national administration. In the context of the SEEA this is deemed to extend to the country's Exclusive Economic Zone (EEZ). Particular care should be taken in defining the treatment of coastal ecosystems that straddle terrestrial and marine areas. Additional considerations in the delineation of statistical units for coastal areas, marine environments and rivers are discussed in an annex.

2.712.72 The delineation of units for the atmosphere should be considered in the context of delineating BSU. It is suggested that each space above a BSU be considered a unit of atmosphere with this space constituting an "air volume". Depending on the purpose of the account any information about the quality of the air or its form (e.g. presence of greenhouse gases) may then be attributed to the terrestrial BSU below. Recognising atmospheric characteristics of BSU may be useful in, for example, the organisation of information on topics such as air pollution.

2.722.73 The boundaries of a country's atmosphere should align with the terrestrial and marine boundaries used in the ecosystem accounts. Thus, it would consist of all air volumes directly above that stated scope of the accounts, potentially out to the limit of the EEZ.

1. **Attachment 3. Different boundaries for ecosystem accounting (i.e. EAU). To show land cover, and in particular LCEU, are not the only boundary needed for ecosystems accounting.**

Land cover is not the only way to describe the physical environment and is not the only set of units needed for describing ecosystems.

There are dozens upon dozens of other ways to segment the physical world, and the choice of method should be determined entirely by the purpose. We suggest that the focus on the LCEU could be misleading and that by giving other examples of units for accounting will avoid confusion.

Australia for example, can be described by bioregion, catchment, vegetation or soil types (Fig 1).

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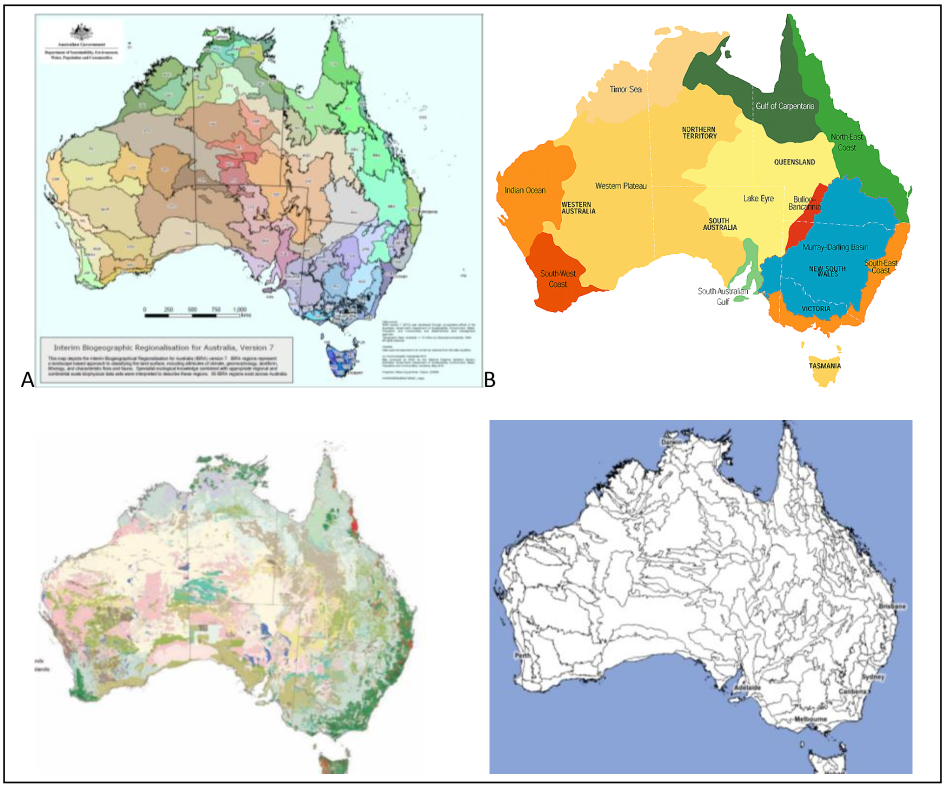

Figure 1: Examples of potential units to divide Australia into for accounting purposes: A. IBRA Bioregions, B. Catchments, C. Major Vegetation Groups, and D. Soil Classes.

Annex 4: Scientific Accreditation of Ecosystem Condition in Australia

Prepared by the Wentworth Group of Concerned Scientist.

Scientific Accreditation of Ecosystem Condition

1. Ecosystem Condition Indicators

Measuring the condition of ecosystem assets enables the accounting of ecosystem degradation.

Indicators of ecosystem condition should therefore provide quantifiable and transparent measures of both the state (quality) of the asset, and be able to detect change over time.

Measuring the condition of ecosystems is complex because of the many biophysical interactions within individual ecosystems, the many interactions between ecosystems, because ecosystems operate across multiple scales, and because ecosystems exhibit a high degree of natural variation over differing time scales.

Because of this, different indicators are often needed to measure the same asset in different locations, as the pressures causing degradation vary.

Indicators need to reflect an ecosystem's vigour (level of ecological productivity), its organisation (structure and interactions), and its resilience (ability to respond to a disturbance by resisting damage and recovering quickly).[1] As a consequence, a number of indicators usually need to be combined into an index to provide a valid measure of ecosystem condition.[2] A scientifically valid measure of freshwater river ecosystem condition, for example, might require the combination of up to 20 separate condition scores.[3]

An index of ecosystem condition can be generated by:

- using a single indicator; or
- combining two or more indicators; or
- combining scientifically valid weighted indicators; or
- using a scientific model that incorporates various indicators and weightings to reflect a holistic view of the ecosystem.[4,5]

2. A Common Unit of Measure of Ecosystem Condition

Central to the ability to aggregate scientific information to construct ecosystem asset accounts is the ability to construct a common, non-monetary, unit of measure of ecosystem asset condition - enabling apples to be compared with oranges.

A common unit of measure is constructed by comparing current condition with reference condition. It compares the current condition against the reference benchmark, giving a score out of 100.[6,7,8,9,10,11,12,13]

Reference benchmarking is a method used extensively in the ecological scientific literature to create a relative measure of condition. The reference benchmark is a scientific estimate of an asset in an undegraded condition.

It can be a direct measure of an indicator at a site that is in an undegraded condition,[14] it can use scientific modelling that estimates the condition of an asset in an undegraded condition,[15] or it can be an estimate at fixed point in time (for example, an estimate of an asset's condition prior to industrial development).[16]

The reference benchmark enables the description of the condition of an asset in relative terms. It acts as a common denominator, a normalising factor. It sets the upper bounds for the measurement of the asset in the ecosystem condition account.

For example, somewhere within the national boundary there is likely to be site where an asset (for example, a river or a forest) that is in an undegraded condition. The condition of the river or forest in that location may provide the reference benchmark measure for that asset.

The benefit of the reference condition benchmark concept to ecosystem accounting is that it enables complex scientific information to be placed in an accounting framework, creating a standardised *common unit of measure* that is capable of addition and comparison. This allows for the comparison of the condition of different assets, and the use of different indicators to compare the condition of the same asset in different location: the comparison of a river with a forest, or one forest with another.[17]

3. Scientific Accreditation of Ecosystem Condition Accounts

Measurement standards are fundamentally important to the integrity of any accounting system. Markets and decision-makers must have confidence that the measured indicators properly reflect the condition of the assets being measured.[18]

Measurement standards are not in the Central Framework, nor are they in the System of National Accounts, because there are already agreed standards for the measures in these accounts, whether they are national currencies or international standards for weights and measures. For example, the SNA requires that: *"All entries in the accounts have to be measured in terms of money, and therefore the elements from which the entries are built up must be measured in terms of money… Money is thus the unit of account in which all stocks and flows are recorded".*[19]

The acceptance of ecosystem condition accounting is therefore dependent on the establishment of a formal process by which scientists accredit the quality of the indicators, indices and reference benchmarks that underpin an ecosystem condition account.

The purpose of accreditation is to ensure that the information contained within an asset condition account is fit-for-purpose, scientifically robust, based on quality data, that it contains appropriate measures of ecosystem condition, and that it can be aggregated.

Scientific accreditation requires independent scientific experts formally assessing the account against a set of criteria or standards, and then making a judgment as to whether it meets those criteria to an acceptable level:

1. It contains an appropriate set of assets;
2. It is based on indicators that are suitable measures of those assets (Box 1);
3. It is based on quality data (Box 2);
4. It contains reference benchmarks that are scientifically valid;
5. It contains common units of measure that are scientifically valid; and
6. It is able to be aggregated with environmental accounts from other regions.

BOX 1: Indicator Selection Principles[20]

1. ***Relevant*** – the indicator is a measure or surrogate of the condition of an environmental asset or system
2. ***Simple*** – the indicator is easily interpreted, monitored, and appropriate for community use.
3. ***Sensitive*** – the indicator is able to detect change in the condition of the environmental asset.
4. ***Measurable*** – the indicator can be statistically verified, reproduced and compared.

5. ***Timely*** – the indicator shows trends over time, provides early warning of potential problems and highlights future needs or issues.
6. ***Aggregative*** – the indicator is amenable to combination with other indicators to produce more general information about environmental conditions.

BOX 2: Data quality standards

The standards of data quality include:

1. Field data should be collected under appropriately designed sampling programs that are: fit for the issue, question or hypothesis of interest; are of an acceptable spatial and temporal resolution; and detect change and do not pick up change that is not there.
2. Data sets should be suitably accurate and precise, statistically verifiable and reproducible.
3. Data sets should be treated and analysed to accepted standards (if available).

4. **References**

[1] Rapport, D. J.,Constanza, R. and McMichael, A. J. , 1998. *Assessing ecosystem health* in Trends in Ecology & Evolution, Volume 13: 10, 1 October 1998, pp. 397-402.

[2] Costanza, R., 1992. *Toward an operational definition of ecosystem health*. In Constanza, R Norton, B. and Haskell, B. (eds.). *Ecosystem Health: New Goals for Environmental Management*. Island Press, Washington.

[3] reference SEQ and European Water ….

[4] Smith M.J., Storey A.W. (eds), 2001. *Design and Implementation of Baseline Monitoring (DIBM3): Developing an Ecosystem Health Monitoring Program for Rivers and Streams in Southeast Queensland*. Report to the South East Queensland Regional Water Quality Management Strategy, Brisbane.

[5] Smith M.J., Storey A.W. (eds), 2001. *Design and Implementation of Baseline Monitoring (DIBM3): Developing an Ecosystem Health Monitoring Program for Rivers and Streams in Southeast Queensland*. Report to the South East Queensland Regional Water Quality Management Strategy, Brisbane.

[6] Stoddard, J.L, Larsen, D.P, Hawkins, C.P., Johnson, R.K. and Norris, R.H. 2006. *Setting expectation for the ecological condition of streams: A concept of reference condition*. Ecological Applications. 16(4): 1267-1276.

[7] Gibbons, P., Briggs, S.V., Ayers, D.A., Doyle, S, Seddon, J., McElhinny, C., Jones, N., Sims, R., and Doody, J.S., 2008. Rapidly quantifying reference conditions in modified landscapes. *Biological Conservation* 141: 2483 – 2493.

[8] Landres, P.B., Morgan, P., Swanson, F.J., 1999. Overview of the use of natural variability concepts in managing ecological systems. *Ecological Applications,* 9: 1179–1188.

[9] Fule, P.Z., Covington, W.W., Moore, M.M., 1997. Determining reference conditions for ecosystem management of southwestern ponderosa pine forests. *Ecological Applications,* 7: 895–908.

[10] Holling, C.S., Meffe, G.K., 1996. Command and control and the pathology of natural resource management. *Conservation Biology,* 10: 327–328.

[11] Gibbons, P., Briggs, S.V., Ayers, D.A., Seddon, J.A., Doyle, S.J., Cosier, P., McElhinny, C., Pelly, V., Roberts, K., 2009. An operational method to assess impacts of land clearing on terrestrial biodiversity. *Ecological Indicators*, 9: 26–40.

[12] Laughlin, D.C., Bakker, J.D., Stoddard, M.T., Daniels, M.L., Springer, J.D., Gildar, C.N., Green, A.M., Covington, W.W., 2004. Toward reference conditions: wildfire effects on flora in an old-growth ponderosa pine forest. *Forest Ecology and Management,* 199: 137–152.

[13] Whiteley, J., Bendell-Young, L., 2007. Ecological implications of intertidal mariculture: observed differences in bivalve community structure between farm and reference sites. *Journal of Applied Ecology,* 44: 495–505.

[14] Reynoldson, T.B., Norris, R.H., Resh, V.H., Day,K.E., & Rosenberg, D. (1997) The reference condition: a comparison of multimetric and multivariate approaches to assess water-quality impairment using benthic macro-invertebrates. *Journal of North American Benthological Society*, 16: 833-852.

[15] Stoddard, J.L, Larsen, D.P, Hawkins, C.P., Johnson, R.K. and Norris, R.H. (2006) Setting expectation for the ecological condition of streams: A concept of reference condition. *Ecological Applications*. 16(4): 1267-1276.

[16] North America uses a 'pre-Columbian' benchmark (Hughes, R. M., P. R. Kaufmann, A. T. Herlihy, T. M. Kincaid, L. Reynolds, and D. P. Larsen (1998) A process for developing and evaluating indices of fish assemblage integrity. *Canadian Journal of Fisheries and Aquatic Sciences,* 55: 1618–1631) and Europe uses a 'pre-intensive agriculture' date. For Great Britain this has been defined as approx. 1850 (Wallin, M., T.Wiederholm, and R.K.Johnson, 2003. Final guidance on establishing reference conditions and ecological status class boundaries for inland surface waters. EU Common Implementation Strategy (CIS) for the Water Framework Directive.

Australia uses a pre-European settlement date as the benchmark for an undegraded reference condition (for example native vegetation and rivers) Norris, R.H. and M. Thomas (1999) What is river health? *Freshwater Biology*. 41:197-210).

The Norway Nature Index and the Netherlands … use … (reference)…

[17] Wentworth Group of Concerned Scientists, 2008. *Accounting for Nature: A Model for Building the National Environmental Accounts of Australia.* Available at http://www.wentworthgroup.org

[18] Cosier P and J McDonald, 2010. *A Common Currency for Building Environmental (Ecosystem) Accounts,* 2010. Paper prepared for the 16th Meeting of the London Group on Environmental Accounting, Santiago, Chile, 25-28 October, 2010.

[19] System of National Accounts, 2008 para 3.14

[20] Australian Natural Resource Management Groups, 2011. *Australian Regional Environmental Accounts Trials 2011: Draft Guidelines.* http://nrmregionsaustralia.com.au/nrm

Attachment 5: ABS Paper contributed to the SEEA Valuation Discussion Group
Michael Davies
September 2012

I have been asked to be part of the SEEA Valuation Discussion Group as a national accounts expert to bring an SNA perspective to the group.

The core issue under discussion is the valuation, using monetary units, of environmental stocks and flows which are not subject to market transactions and therefore do not have observable values. My understanding of the objectives of the exercise is to come up with methods of valuation which result in credible valuations which can be used to combine and compare with valuations based on SNA principles.

In this contribution, I will attempt to describe the basis of valuation in the SNA and the status of non-market transactions in the SNA. From these, it is possible to derive a range of characteristics necessary for valuations to be credible and robust for analysis. The SEEA EEA proposals for valuation can be tested against these characteristics.

I realise that this overlaps with some of the material in the draft SEEA EEA chapter and it will all be self-evident to those familiar with the SNA. Nevertheless, I think it is worth spelling out the SNA position in simple terms.

The views expressed are those of the author and not of the Australian Bureau of Statistics.

SNA Valuation

The SNA is a conceptual framework for the organisation of observed data. The framework is consistent with economic theory, but the valuation of stocks and flows does not depend on economic theory. The values are observed.

The SNA framework defines a transaction as an exchange of value. It requires that stocks and flows be valued at market prices. When goods and services are bought and sold on markets, monetary transactions take place and the values of the purchases and sales can be observed and recorded in accounts. A description of the characteristics of SNA valuations is included in Appendix 1.

There are ongoing debates about the finer points of the SNA, including valuation methods, but generally SNA based data are widely used and accepted as credible estimates. Users focus on the numbers and not the methods used to estimate them.

The inclusion of both real and financial stocks and flows in the SNA and the articulation of the relationships between these makes SNA based statistics extremely useful, for example in analysing the recent financial crisis which has had significant impacts on real activity. The inclusion of non-monetary stocks and flows in the SNA has always been a contentious issue as it decreases the usefulness of the statistics for these purposes. Non-monetary activities have been included somewhat arbitrarily as an uncomfortable compromise. The discussion of the identification of non-market activities to be included in the SNA accounts and their valuation parallels the issues discussed in the SEEA context.

The decrease in usefulness of SNA statistics as non-monetary activities are added is because non-market activities are intrinsically different from market activities and their movements may be different. They have no direct financial implications and are not subject to the same fluctuations as market activities. This complicates analysis.

For those non-monetary activities which are included, no value can be observed. The SNA recommends several methods to value these transactions. The methods are all aimed at approximating the value which the stock or flow would have if it was transacted. They are not theoretical models of the determination of value.

Exceptions in the SNA

At times, an economic unit in its capacity as producer provides a good or services to itself in its capacity as a consumer. These are similar to barter transactions, where goods and services are exchanged without money changing hands.

In this case, both the transaction and the quantities transacted are observed. Only the price is estimated. There are no financial entries for these transactions. However, they usually have close counterparts transacted on markets (that is the same goods and services have observable prices) and they usually interact with market activities, for example they are internal transactions in an economic unit which buys inputs in the market and sells outputs in the market.

The SNA recommends that internal non-monetary transactions be valued at the sum of costs of production. This is aimed at approximating the market value. It is not put forward as a theory of the determination of value.

The SNA recognises that not all transactions represent an obvious exchange of value. The payment of tax to the government is an example. It could be argued that this is payment for a range of services, but as there is no directly identifiable value provided by the government in exchange for the tax payment, it is treated as a one-sided transaction called a transfer.

The SNA recommends the imputation of some transactions. An example is the imputation of rent of owner occupied dwellings. The dwelling owner is recorded as running a business which produces housing services. The owner both produces and consumes the services. The treatment is similar to that for an economic unit consuming its own production described above. In this case, producing a credible valuation is easy. If a house is rented and an identical house is owner occupied, the value of the service equals the observed rent.

SEEA EEA

The draft SEEA Experimental Ecosystem Accounts (SEEA EEA) proposes methods for placing a monetary valuation on ecosystems and ecosystem services.

The challenges of doing this are the same as those faced by all attempts to place monetary values on non-monetary transactions. For example, these problems arose recently in the ABS in attempts to value to work of volunteers.

The draft chapter contains what is effectively a survey of possible methods. Some of the methods are based on the methods recommended in the SNA to approximate valuations in the exceptional cases where there are no observed values. Others are based on economic and welfare theory.

To achieve the level of credibility and robustness of SNA valuations, the identification of which services and assets to value should be based on clearly articulated principles. The principles need to be agreed, then services and assets tested against these case by case.

Secondly, to gain acceptance as credible, coherent valuations which can be combined and compared with SNA based valuations, SEEA valuations need to be firmly and clearly based on the simple basic principles of SNA valuation rather than based on exceptions. Such a principle based approach will provide values for both stocks and flows.

With reference to the above and Appendix 1, some of the problems from an SNA point of view with the suggestions in the draft chapter are, to varying degrees:

- the nature of the services is vague and their identification is not principles based

- the production of the services is not visible - are other goods and services used in the production of the services? if so, where are these recorded?

- the delivery of the services are not exchanges of value - while it is postulated that one party benefits from the delivery of the service, the party who benefits does not surrender anything of value in exchange - the core issue here is that there are no ownership rights over the assets or the services

- because of the above, there are no observable values

-in most cases, there are not readily understandable parallels to services or assets with observable prices

- the values derived do not seem to have price and volume dimensions

Conclusion and Way Forward

The estimation of monetary values for non-monetary activities is a vexed issue in the SNA context. It has been discussed for many years with no resolution. The challenges faced in putting monetary values on ecosystem services and assets are the same as those faced by other attempts to put monetary values on non-monetary activities.

The principles based approach of the SNA requires that the identification of activities to which values can be applied and their valuation need to be firmly and clearly based on the simple basic principles of the SNA. Using tenuous analogies to SNA exceptions and contentious theoretical constructs as the basis of valuation is unlikely to produce credible valuations. The likely outcome of this approach is that potential users will focus on the contentious aspects of the valuation methods and debate them endlessly rather than accept the valuations as meaningful statistics for analytical purposes.

An SNA style approach would involve:

- deriving principles for the identification of services and assets to be recorded and valued

- identifying the transactions - this needs to be an exchange of value between two parties

- valuing the transactions using methods that are based on observed values

The biggest impediment to this approach is the lack of property rights over the services and assets. This makes the identification of an exchange of value difficult.

The key to credible valuation appears to be to address this stumbling block. This may mean imputing ownership. Once this is done, transactions which represent an exchange of value can be imputed.

As mentioned above, the challenges of doing this are the same as those faced by all attempts to place monetary values on non-monetary transactions. This means that there is a variety of people coming at what is essentially the same problem from different angles. For example, these problems arose recently in the ABS in attempts to value the work of volunteers. Similar issues are addressed in World Bank work on calculating an Adjusted Net Saving measure.

It would make sense for the interested parties to work together on a common approach to valuing non-monetary activities.

Appendix 1:

Valuation in the System of National Accounts

In the SNA, flows are valued at the volumes multiplied by the price per unit of volume agreed upon by the transactors. This is the market value. Stocks are valued at the volume multiplied by the price per unit of volume realisable in the market. In the simplest case, this is the volume multiplied by a price observed in a transaction at the time of valuation. There are methods of approximating this value, for example in the case of a lack of observable transactions, but they are all attempts to estimate the fundamental concept described here.

SNA example

The simplest case to illustrate basic SNA valuation principles is the sale and purchase of goods.

An example is the purchase of three bottles of wine for $99.

The characteristics of this transaction are:

- There is a flow of three bottles of wine from the seller to the buyer.
- There is a flow of $99 from the buyer to the seller.
- The buyer has three more bottles of wine after the transaction.
- The seller has three less bottles of wine after the transaction.
- The buyer has $99 less cash after the transaction.
- The seller has $99 more cash after the transaction.

All of these are inextricably related. There is a set of identities. For example:

- The $99 flow is a volume of three bottles of wine multiplied by a price of $33 per bottle.
- The changes in the values of stocks equal the values of the flows.
- The value received by the buyer is equal to the value surrendered by the seller.
- The value received by the seller is equal to the value surrendered by the buyer.

These identities form the basis of the construction of a set of accounts.

There are some other characteristics which form the basis of a set of coherent, credible accounts.

- The stocks and flows to be included are clearly defined using a set of principles.
-
- The identification and valuation of the stocks and flows is based on ownership. In the example above, the seller owns the three bottles of wine before the transaction and owns the cash after the transaction. The basis of the flows is changes of ownership of wine and cash. The basis of the stock changes is the ownership of the stocks at a point in time.

The characteristics described above result in the recording of credible, coherent values for stocks and flows for the sale and purchase of a good. These allow the comparison of diverse stocks and flows at a point in time and across time.

The recording of the sale and purchase of a service is somewhat more complex, but can be described by building on the goods example. In the case of goods, the good is produced and goes into inventories (an asset). A service is consumed as it is produced, so there are no inventories of services. However, the producer of a service transforms goods and services (including capital services) into a service. They use up the goods and services in the production of services just as producers of goods do. If we look at it as if the services are produced, go into inventories and are instantly sold from inventories, the goods model above can be applied. There is not as clear a connection between flows and stocks.

A special type of service is a capital service. In the production of goods and services described above, capital assets provide a flow of services into the production activity. The full details of the production and consumption of these services are not recorded in the accounts as they are within the producing unit. Nevertheless, they are similar to the production of other services.

Michael Davies
September 2012

References

European Commission, Food and Agriculture Organization, International Monetary Fund Organisation for Economic Cooperation and Development, United Nations & World Bank. 2012, *System of Environmental-Economic Accounting Central Framework*

European Commission, International Monetary Fund, Organisation for Economic Co-operation and Development, United Nations and World Bank. 2009, *System of National Accounts 2008*, New York

Hill, Peter (2008), *The SNA : some outstanding issues*, <http://unstats.un.org/unsd/nationalaccount/workshops/2008/hlf/sna-outstanding-issues.pdf>

World Bank: Adjusted net saving – a proxy for sustainability

<http://web.worldbank.org/WBSITE/EXTERNAL/TOPICS/ENVIRONMENT/EXTEEI/0,,contentMDK:20502388~menuPK:1187778~pagePK:148956~piPK:216618~theSitePK:408050,00.html>