SEEA EXPERIMENTAL ECOSYSTEM ACCOUNTING REVISION 2020

REVISION ISSUES NOTE

Background

In March 2013, the United Nations Statistical Commission endorsed the System of Environmental-Economic Accounting – Experimental Ecosystem Accounting (SEEA EEA) as the basis for commencing testing and further development of this new field of national accounting. The SEEA EEA was formally published in 2014 as a joint publication of the United Nations, European Commission, Food and Agriculture Organization of the United Nations, Organisation for Economic Co-operation and Development and the World Bank.[1]

While the ecosystem accounting system described in SEEA EEA was novel, it reflected the integration of many existing strands of expertise including statistics and national accounting, ecology and natural science, geography and geo-spatial measurement. By providing a platform by which these disciplines could exchange and share ideas, there has been rapid growth in the development and and testing of ecosystem accounting. From a zero base in 2012, there are currently over 40 countries with ecosystem accounting programs of some type underway and there are applications in, and participation from, all sectors – public, private, academia and civil society.

Given this level of interest, testing and experimentation, the body responsible for the development and advancement of the SEEA, the UN Committee of Experts on Environmental-Economic Accounting (UNCEEA), following the decision of the United Nations Statistical Commission from March 2017, determined in June 2017 that a revision of the SEEA EEA drafted in 2012 was appropriate with the intention to reach agreement on as many aspects of Ecosystem accounting as possible by 2020. This revision process has now commenced. The revision process will be based on the SEEA EEA endorsed in 2013, the experiences of the many initiatives on ecosystem accounting in practice, and on the recently released Technical Recommendations in support of the SEEA EEA 2012.[2]

As customary when launching a revision process, issues that remain unsolved and need to be addressed have been identified. A list of issues has been developed through discussions at the June 2016 and June 2017 meetings of the UNCEEA and the October 2017 meeting of the London Group on Environmental Accounting. The current list has been endorsed by the SEEA EEA Technical Committee, the working group under the auspices of the UNCEEA that will substantially oversee the revision process.

In order to ensure a wide and inclusive revision process, the UNCEEA is now seeking input from experts working in organisations, initiatives or disciplines with a connection to ecosystem accounting. Your feedback would be most welcome on:

- The coverage and description of the revision issues described below

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[1] https://seea.un.org/sites/seea.un.org/files/seea_eea_final_en_1.pdf
[2] https://seea.un.org/sites/seea.un.org/files/technical_recommendations_in_support_of_the_seea_eea_final_white_cover.pdf

- The priority areas for research and discussion
- Your interest in participating in the revision process, noting the particular area/s to which you, your organisation or any groups that you participate in may wish to contribute
- Your suggestions as to other relevant organisations, groups or networks and associated events who should be connected to the revision process.

Please submit your responses to the Secretariat for the revision process, the UN Statistics Division, at seea@un.org by Friday, 23 March 2018.

Summary of issues

The list of issues considered here builds on the list of research topics identified and prioritised at the UNCEEA meeting in June 2016. That list reflected a blend of conceptual work and specific areas for testing and experimentation. The further discussion of the research agenda with respect to the SEEA EEA Revision at the UNCEEA meeting in June 2017 highlighted a dual focus for the revision in resolving conceptual issues, while elaborating a targeted approach in the testing and experimentation of these issues. At the same time, there are a few general connections that must be considered in working towards standardized concepts for ecosystem accounting:

- First, progress on conceptual aspects must take into account the findings and experience that continues to emerge from ongoing testing of the SEEA EEA framework and also from the wide range of related projects on ecosystem measurement and valuation, including the EU funded project "Natural Capital Accounting and Valuation of Ecosystem Services." Additional testing may be undertaken to test specific aspects of the research issues in an integrated approach possibly in collaboration with private cloud and data providers. This will be done through direct engagement with the various projects and also through involvement of the national experts in the discussions of revision issues.

- Second, close connections must be maintained to progress on the implementation of the SEEA Central Framework and associated technical discussions. There should be a clear articulation of the links between the two components of the SEEA.

- Third, final description of concepts should take into account the potential for implementation. It is acknowledged that the development of additional compilation and guidance materials for ecosystem accounting is essential and, as work proceeds through the revision to clarify conceptual aspects, it is expected that work on guidance materials will occur in parallel.

In addition, a number of the issues pertain to the development of classifications. It is therefore expected that as the measurement boundaries and concepts are further clarified it will be appropriate and necessary to enlist experts in classification to participate in the revision process.

With this background, this paper identifies four research areas and six primary issues for the SEEA EEA Revision as listed in table 1. In the remainder of the paper, for each proposed revision issue within the four main research areas, there is (i) a description of the issue and the key research questions; (ii) a discussion of connections between issues; (iii) suggestions for the proposed timing of work; and (iv) initial thoughts on the likely communities of interest in advancing the research work.

Table 1: Summary of issues for SEEA EEA Revision issues

Research area	SEEA EEA Revision Issue
1. Spatial areas	1. Classification of ecosystem types
2. Ecosystem condition	2. Characteristics and indicators of ecosystem condition
3. Ecosystem services	3. The description and classification of ecosystem services
4. Accounting treatments and valuation	4. Valuation concepts for ecosystem services and ecosystem assets
	5. Valuation methods for key ecosystem services
	6. Accounting for ecosystem capacity, degradation and enhancement

Research area 1: Spatial areas

Spatial units are at the heart of ecosystem accounting. The focus to date has been the development of a measurement approach that enables relatively broad scale terrestrial ecosystems to be accounted for. The general approach for delineating these areas has become relatively well established although there are still important matters requiring resolution.

Issue 1: Classification of ecosystem types

Description

The key focus in this research area is establishing statistically and accounting relevant classifications for land use, land cover and ecosystem types with careful review and application where possible of existing classifications of this type. The land use and land cover classifications of the SEEA Central Framework retain a status of "interim" and given the importance of ecosystem types in underpinning ecosystem accounting, it is essential that substantial, and integrated, progress is made in this area. Work for the revision must establish clear principles for defining ecosystem type classes, in particular concerning links to land use, management and ownership, as well as determining an appropriate set of classes for use at international level. Work should also ensure alignment in the advancement of the SEEA Central Framework land use and land cover classifications as well as ecosystem services and related ecosystem indicators.

Distinct focus should be placed on the description and classification of marine areas given the strong interest in applying ecosystem accounting for these areas. Also, consideration should be given to articulating the connection to atmospheric units in order to complete a spatial delineation of the environment. Defining atmospheric units is relevant, for example, in advancing of the natural cycles such as carbon accounting but also in fully integrating flows such as GHG emissions within the ecosystem accounting framework.

An emerging interest concerns ecosystem accounting for urban areas considering the large proportion of the work population living in cities. These should be distinguished from areas defined in terms of land cover or use as built-up areas and instead considered as a combinations of multiple ecosystem types. In this sense, urban areas may be considered a specific form of ecosystem accounting area but one requiring specific definition to support policy and decision making.

The research will involve significant engagement with a variety of stakeholders since the range of approaches and applications of land classifications is large and has been developed for a wide range of purposes at national, regional and global level. A key issue will be the extent to which a set of ecosystem types can be defined for SEEA EEA purposes to which other (national and international) land related classifications can be linked and which can be used to support international reporting and comparison (e.g. SDGs).

In addition to considering the classifications themselves, it will be necessary to agree on standard national boundaries for statistical purposes such that country areas underpinning the accounts are consistently defined and harmonised.

Finally, while the focus of the research work will be more conceptual, it will need to ensure good connections are made to the users of accounting information and to the sources of information on land cover and land use, especially the remote sensing communities and those looking to establish national spatial data infrastructures (NSDI). This will be co-ordinated with work already underway on user engagement under the auspices of the UNCEEA, and other relevant groups, including the United Nations Global Working Group on Big Data and in particular the Task Teams on Earth Observation.

Related ecosystem accounting issues

Establishing a classification of ecosystem types is fundamental to ecosystem accounting since these are the building blocks of the ecosystem accounting system. With respect to other issues there are important links to the development of indicators of ecosystem condition and the description and classification of ecosystem services. In both cases, clarity on the range of ecosystem types will support discussion.

Key communities of interest

Communities of interest include experts working across the following fields:

- environmental-economic accounting
- official statistics
- land use and land cover change
- marine and coastal ecology
- geospatial information, including remote sensing/earth observation data
- ecosystem services modelling

Possible timeframes and approach

It would be expected that the discussion of this issue will take some time given the many available alternatives. To provide some structure, the discussion should start with the SEEA Central Framework classifications for land use and land cover and document the range of leading international and national classifications of land. Then, using experience in ecosystem accounting, focus should turn to establishing the principles of the classification using the guidance in the SEEA EEA Technical Recommendations (Chapter 3) as a starting point.

It is recommended that work on this issue commence as soon as possible – likely early 2018 with the aim of producing a first draft classification of ecosystem types for discussion by end 2018. A number of rounds of consultation are likely to be required. Target for completion by June 2019.

A consideration will be the extent to which this work is combined with progressing towards the finalisation of classifications for land use and land cover for the SEEA Central Framework.

Research area 2: Ecosystem condition

The measurement of ecosystem asset condition is a fundamental aspect of ecosystem accounting since it is the regular monitoring of asset condition that is central to assessing the changing capacity of ecosystems to supply ecosystem services.

Issue 2: Characteristics and indicators of ecosystem condition

Description

The SEEA EEA outlines the conceptual basis for measuring condition. This research issue concerns developing a generalised model/structure of characteristics and indicators of condition for different ecosystem types. As reflected in the Technical Recommendations in support of the SEEA EEA, discussion on the measurement of ecosystem condition has advanced somewhat since 2012 but there remains a lack of clarity on precisely which characteristics are relevant in the monitoring of condition. A key issue is the extent to which non-ecological characteristics, including land use and management practices, are appropriate for inclusion within an overall condition assessment.

Further, it has been proposed that SEEA EEA should provide a broad structure for the key or core types of ecological and non-ecological characteristics which should be the focus of measurement in different ecosystem types, noting that ideally the same broad structure should be used in measuring condition across different ecosystem types.

Associated with the definition of characteristics, this research issue should investigate types of indicators that would be most relevant for different characteristics, in particular considering the potential to utilise summary or holistic indicators for specific ecosystem types. In this context, an area for specific consideration is the role of indicators of biodiversity.

This issue also encompasses developing more definitive advice with respect to reference conditions. While there has been general support for the concept of using reference conditions, there has been no clear agreement on how such reference conditions should be established with views ranging from the application of pristine/natural conditions to the condition of the ecosystem asset at the beginning of the accounting period.

The requirement is to determine the conceptual approach that is most appropriate for ecosystem accounting, with due consideration of whether the use of different reference conditions is problematic for ecosystem accounting and comparison within and across countries. It is noted that there should be close connections to defining the key/core characteristics for the measurement of condition since (i) a priori it would appear that the characteristics selected for monitoring condition of a given ecosystem types should also be taken into consideration in determining the reference condition; and (ii) the reference condition is likely to be relevant in determining approaches to the aggregation of condition measures.

The discussion should also consider the potential to aggregate across ecosystem assets and ecosystem types or otherwise provide summary perspectives on ecosystem condition across an ecosystem accounting area. This will likely link directly to the issue of defining reference conditions.

Finally, a link should be made to the measurement of ecosystem capacity. This concept was introduced in the SEEA EEA but not developed to the point of a definition amenable to measurement. This reflected a lack of consensus on the basket of goods and services that would underpin the measurement of capacity in practice. Since the drafting of the SEEA EEA, the concept of ecosystem capacity has been further discussed and some measurement has been

undertaken, but more work is needed. Under this research area, the focus should be on biophysical aspects of the measurement of condition. This work should complement the focus in revision issue 6 which is on conceptualising ecosystem capacity in the system of ecosystem accounts.

Related ecosystem accounting issues

There will be close connections to a number of research issues, including

- Classification of ecosystem type: The types of ecological and non-ecological characteristics applied in the measurement of condition will likely also be relevant in considering the delineation of ecosystem assets.

- Description and classification of ecosystem services: The choices of characteristics for the measurement of ecosystem condition are generally accepted to be linked to the basket of ecosystem services provided by an ecosystem asset. Consequently, the discussion of ecosystem condition will be usefully informed by progress on the description of ecosystem services.

- Accounting for ecosystem capacity and ecosystem degradation: Changes in ecosystem condition underpin the measurement of ecosystem capacity and degradation and it will be necessary to ensure that the progress of research in these areas is aligned.

Key communities of interest

Communities of interest include experts working across the following fields:

- environmental-economic accounting
- official statistics
- ecology and biodiversity
- measurement of carbon, soil, water and biophysical processes
- marine and coastal ecology
- geospatial information, including remote sensing/earth observation data
- natural resource economics and management (e.g. forestry, fisheries)
- ecosystem services modelling

Possible timeframes and approach

It is expected that strong progress can be made in this area through a thorough discussion of existing approaches and clarification on the requirements for ecosystem accounting purposes. A review of current approaches to condition measurement was presented at the London Group meeting in October 2017 and this can serve as a basis for further discussion. The Technical Recommendations in support of the SEEA EEA also provide a synthesis of the current state of play. Crucial is consideration of the various international and national monitoring systems relevant for measuring ecosystem condition. Experts with experience in such monitoring systems are of particular relevance to the working group.

Discussion on this issue should commence as soon as possible – likely early 2018 – with initial proposals for consultation completed by mid 2018 and advanced conclusions by end 2018.

Research area 3: Ecosystem services

Measuring ecosystem service flows in physical terms is important to enable a broad mapping of the role of ecosystem assets and the relevant beneficiaries; and to facilitate the valuation of ecosystem services.

Issue 3: The description and classification of ecosystem services

Description

The broad conceptual place of ecosystem services in ecosystem accounting is well understood and in particular the recognition that ecosystem services are outputs generated by ecosystem assets and consequently provide the link between the measurement of ecosystem extent and condition on the one hand and the benefits people obtain from ecosystems on the other.

However, while this general framing is well accepted there are a range of measurement boundary challenges that remain the subject of ongoing discussion. These include:

- the boundary between final ecosystem services and benefits, especially with respect to provisioning services in relation to crops
- the definition and treatment of intermediate services, and hence the issue of measuring dependencies between ecosystem assets
- the distinction between SNA and non-SNA benefits
- the relationship between the definition of ecosystem services and the SNA production boundary
- the differences, if any, in the time of recording and other accounting treatments between ecosystem services and related flows of natural inputs in the SEEA Central Framework
- the treatment of users and beneficiaries with respect to the consumption of ecosystem services
- the extent to which accounting systems can record the contributions of ecosystem services to broader well-being, reflect for example in health outcomes.

A key aspect of the work required in this research area is therefore to work through these various conceptual issues and finalise treatments that are appropriate from an accounting perspective.

To make this conceptual discussion most relevant, an essential requirement of this research is that the most commonly discussed and measured ecosystem services (perhaps around 15-20 services across provisioning, regulating and cultural services) are described in a consistent way with agreed terms for each service. At present, different experts will use different descriptions and varying terms for what might be similar ecosystem services. This variation is considerably limiting the potential for the measurement community to make clear progress through exchanges of experience, and conveying knowledge to new participants. The conceptual treatments must be able to be consistently applied to all ecosystem services.

Among the key ecosystem services particular note is made of the need for agreed descriptions of:

- carbon sequestration and carbon storage
- ecosystem services in the context of cultivated assets including agriculture and forestry
- water related services such as water regulation, sediment retention, water yield, water purification

- habitat and nursery related services
- marine ecosystem services
- the potential for services to be recorded in relation to the use of space – e.g. use of land for landfill/solid waste, use of waters for navigation.

Complementing the development of conceptual treatments and agreed descriptions of key ecosystem services is the development of an agreed ecosystem services classification for ecosystem accounting purposes. There are two classification systems that are being used: CICES (Common International Classification of Ecosystem Services), primarily used by the Europeans (version 4.3 was recently released) and the FEGS (Final Ecosystem Goods and Services) and NESCS (National Ecosystem Services Classification System), primarily used in the United States. The SEEA EEA presents a version of CICES as at the time of release of the SEEA EEA, FEGS was not known to the statistical community. Finally, alternative typologies for grouping different ecosystem services might also be considered. For example, by degree of connection to human well-being or linkage to ecosystem processes.

These various approaches to ecosystem services description and classification are distinct but through the revision process the aim is to find a suitable pathway to support implementation and comparison between ecosystem accounting projects.

Related ecosystem accounting issues

Clarifying the descriptions of key ecosystem services will be important in advancing the valuation of ecosystem services since valuation requires a clear and common understanding of the nature of the service being valued. It will also be important to link these ecosystem services to the ecosystem types and the indicators of ecosystem conditions.

Key communities of interest

Communities of interest include experts working across the following fields:

- environmental-economic accounting

- ecology and biodiversity

- measurement of carbon, water and biophysical processes

- marine and coastal ecology

- environmental economics and ecosystem services valuation

- ecosystem services measurement and modelling

Possible timeframes and approach

There has been ongoing discussion on the linkages between the CICES, FEGS and NESCS classification systems over the past two years. The results of these discussions should inform progress towards finalising appropriate conceptual treatments as well as supporting the improved description of key ecosystem services. Given the importance of this issue, it is proposed that work continue on this issue with the intent to propose outcomes for consultation within the context of the SEEA EEA revision by late 2018, noting that consultation process may well be quite extended beyond this point.

Research area 4: Accounting treatments and valuation

Determining appropriate application of national accounting principles to the measurement of ecosystems and undertaking valuation are challenging areas. There have been some important advances in both areas, including improved understanding of the use of non-market valuation techniques from environmental economics for ecosystem accounting purposes, but a range of issues remain. It is noted that monetary valuation is not mandatory within the SEEA EEA, but where such values are required, including for example for full integration with the SNA, the aim of research must be to ensure that the SEEA EEA treatment of monetary valuation is as clear as possible and that proposals for the integration of ecosystem services and assets with standard economic accounts are fully articulated.

Issue 4: Valuation concepts for ecosystem services and ecosystem assets

Description

The development of valuation concepts for ecosystem services and ecosystem assets is an ongoing field of research and investigation. While it will be important to test methods in practice and gain experience from their application, it is also important to continue the dialogue between economists and accountants on the appropriate and relevant methods, assumptions and applications of valuation for accounting purposes.

The recently release Technical Recommendations provide a substantive update to the thinking on valuation for ecosystem accounting taking advantage of a range of discussions and incorporating research work through the World Bank WAVES program. There is now an improved foundation for discussion and a number of issues have been clarified relating to the estimation of non-market values for ecosystem accounting purposes. Of importance is establishing a clear understanding of the appropriate assumptions concerning institutional arrangements that should underpin the estimation of the exchange values needed for national accounting (i.e. should exchange values be estimated with an assumption of perfect markets, monopoly markets, or some other institutional arrangement). While the technical material has advanced, much wider discussion is needed of the current line of thinking.

Beyond the valuation of ecosystem services, the SEEA EEA provides a conceptual model for the valuation of ecosystem assets through estimating the net present value (NPV) of ecosystem services. Assuming that methods are in place for the valuation of ecosystem services themselves, applying NPV approaches requires the selection of discount rates and the estimation of the pattern of future flows of ecosystem services relative to the capacity of an ecosystem asset. These are not trivial choices and further advice is required on how such choices should be made in an ecosystem accounting context taking into consideration the potentially infinite asset lives of ecosystem assets, the reality that most ecosystem assets will generate a basket of ecosystem services, and how SEEA EEA based valuation relates to the valuation of ecosystem assets as public goods.

In addition, an important issue that arises is the comparison of these NPV based ecosystem asset values with existing values for areas of land that might be present in standard national accounts and balance sheets. Two related research issues emerge. The first is to understand further the extent to which there is an overlap in the valuations of these assets from different perspectives. The second is to consider how market values of land assets might be used to estimate the prices of ecosystem services.

Finally, in advancing and establishing the relevant valuation concepts for accounting purposes, it will be necessary to place these values within a broader framing of potential environmental

values. This should include connecting with the work of sociologists and others involved in well-being research. In setting this broader context for valuation, it will be necessary to recognise the alternative policy and analytical uses of values and to clarify the role of exchange values.

Related ecosystem accounting issues

There will be close connections to the other research issues on valuation, in particular issue #5 which aims to examine the issue of valuation by considering individual key ecosystem services. This is because the way in which ecosystem services are characterised can vary significantly and the approach to valuation will depend to a large extent on the characterisation that is set or assumed. Connection to work on issue #3 on the description of ecosystem services will also be of high relevance since reaching common ground on these descriptions will be of tremendous help in applying appropriate valuation techniques for ecosystem accounting.

Key communities of interest

Communities of interest include experts working across the following fields:

- environmental-economic accounting
- national accounting
- official statistics
- natural resource economics and management (e.g. forestry, fisheries)
- environmental economics and ecosystem services valuation
- ecosystem services measurement and modelling

Possible timeframes and approach

There has been important progress in recent years and it would be expected that much clear advice on valuation of ecosystem services could emerge through the course of the SEEA EEA Revision process. At the same time, it should be expected that this area of measurement remains challenging and particular care is needed on ensuring a common understanding of the purpose of valuation and the links to the choice of valuation methods. While engagement with various experts from the environmental economics community has been successful in recent years, a stroner connection is needed to tbe broader national accounts community, including those working on the valuation of land.

Issue 5: Valuation methods for key ecosystem services

Description

Notwithstanding the need for further conceptual advances on valuation for accounting purposes, it is recommended that in parallel research investigate the estimation of exchange values for specific ecosystem services selected for their relevance from the categories of provisioning, regulating and cultural services. From this basis, more generic findings will be able to be conveyed and should be adapted within the concept focused research. Specific issues to be considered for the relevant ecosystem services include (i) appropriate valuation approaches in the situation of low or negative resource rents, (ii) the use of cost based approaches, especially the use of restoration cost approaches, (iii) approaches to the valuation of water, and (iv) the use of data from PES schemes.

In addition, it should be recognised that the conceptual discussion of accounting for ecosystem services has focused on provisioning and regulating services. While there remain important issues for resolution for these types of services, the conceptual basis for the inclusion of cultural services in an accounting system has not been articulated in the same detail. As well, in the testing of ecosystem accounting there has been less focus on cultural services.

Thus, while there is no doubt that cultural services should be within scope of the discussion in ecosystem accounting, there is less clarity on (i) exactly what the ecosystem contribution is to benefits in the case of cultural services (i.e. distinguishing services and benefits in the case of cultural services is much harder than for other services); (ii) the link to concepts of non-use of ecosystems; (iii) the implications for valuation in exchange value terms. Further work is required to develop the relevant concepts and connect cultural services more definitively to ecosystem accounting.

Related ecosystem accounting issues

There will be connections to research issue #4 on the valuation concepts for ecosystem services and ecosystem assets and to research issue #3 on the description of key ecosystem services. Indeed, there should be a close alignment between the ecosystem services that are the focus of research within issues #3 and #5.

Key communities of interest

Communities of interest include experts working across the following fields:

- environmental-economic accounting
- national accounting
- official statistics
- ecology and biodiversity
- marine and coastal ecology
- natural resource economics and management (e.g. forestry, fisheries)
- environmental economics and ecosystem services valuation
- ecosystem services measurement and modelling

Possible timeframes and approach

Work on this issue is likely to be best taken forward in parallel with research on the valuation concepts (issue #4), although it may prove useful at this point in time to progress work in relation to individual ecosystem services first before returning to conceptual issues and thus utilising the findings in relation to the individual ecosystem services. Rounds of consultation on selected groups of services through 2018 would be a good way to proceed.

Issue 6: Accounting for ecosystem capacity, degradation and enhancement

Description

When considering the integration of ecosystem accounting estimates with standard national accounting data the definition and treatment of ecosystem capacity, degradation and enhancement needs to be progressed to ensure a common basis for integrated accounting.

The challenges in the measurement of degradation are many as it touches on all of the aspects of ecosystem measurement. The SEEA EEA Technical Recommendations make a good initial

step in taking the discussion further but a range of aspects require further discussion. The first concerns the concept of ecosystem capacity. This was introduced in the SEEA EEA but not developed to the point of a definition amenable to measurement. This reflected a lack of consensus on the basket of goods and services that would underpin the measurement of capacity in practice. Since the drafting of the SEEA EEA, the concept of ecosystem capacity has been further discussed and some measurement has been undertaken, but more work is needed. Under research area 2, the biophysical aspects of the measurement of condition are considered. In this research area, the focus is on conceptualising ecosystem capacity in the system of ecosystem accounts.

A second aspect is the means by which measures of ecosystem degradation can be attributed to economic units. This is not straightforward since unlike produced assets, ecosystem assets may have multiple users thus implying that the degradation will affect a range of income flows. There are a number of considerations, including ownership and regulatory requirements, that should feature in a discussion. The accounting entries related to allocating degradation estimates to multiple economic units need to be considered as well as the connection to the treatment of restoration costs.

Third, while there has been some progress on describing the issues on degradation, there is far less clarity on the treatment of activity that maintains, restores or enhances ecosystem condition. In particular, the accounting question is whether the expenditure on that activity represents a good measure of the level of investment in the ecosystem asset, or whether the more appropriate measure would be the increase in the NPV of the ecosystem service flows that arises as a result of the expenditure. A related challenge occurs in the standard SNA in the treatment of land improvement and the reconciliation of entries for capital formation and associated balance sheet entries. Given the extent of focus on developing policies to restore ecosystem condition, determining the appropriate accounting treatments for any expenditure would be a very useful development.

Finally, underpinning measurement of capacity is the connection between ecosystem condition and expected flows of ecosystem services. This is an ecological measurement challenge as much as an accounting one. While this topic will not be able to resolve this discussion, it should be possible to articulate in the SEEA EEA the type of ecological considerations that need to be considered in developing estimates of capacity and, also, it should be possible to describe how accounting approach can support the development of data sets to inform understanding of the connection between condition and service flows.

Related ecosystem accounting issues

There will be connections to many research issues. Most important will be connection to the discussion on ecosystem condition in issue #2 as this will frame the discussion of ecosystem characteristics to be considered in the assessment of capacity and hence the measurement of degradation and enhancement. However, also relevant will be discussion of ecosystem service flows and the links between final and intermediate services, these will be relevant in discussion of future ecosystem flows.

In terms of valuation, there will be direct links to the discussion of the valuation of ecosystem assets and NPV in issue #4 and also to the treatment of restoration costs in issue #5.

Key communities of interest

Communities of interest include experts working across the following fields:

- environmental-economic accounting

- national accounting

- official statistics

- natural resource economics and management (e.g. forestry, fisheries)

- environmental economics and ecosystem services valuation

- ecosystem services measurement and modelling

Possible timeframes and approach

At one level this topic could be considered a very accounting exercise but it could equally be considered an ecological exercise. It likely falls quite closely to ecological economics. The key challenge here is being able to integrate the systems thinking on connections between stocks and flows inherent in these disciplines. From this starting point ongoing rounds of consultation, progressively picking up on direct feedback and also developments in other research issues should be envisaged.

Once a group is established, work should commence immediately building on the limited literature from an ecosystem accounting perspective with the aim of producing a discussion paper by mid 2018 to commence the consultation processes. Final proposals should emerge through late 2019.