

## Technical Expert Meeting on Ecosystem Accounts

London, 5-7 December 2011

### Meeting Minutes

#### Session 1

##### Introductory Statements

1. Opening statements were made by Jil Matheson, UK National Statistician, and Peter Unwin, Head of the Environment Group, UK Department for Food and Rural Affairs. It was suggested that the expert group establish the frame within which the ideas for ecosystem accounting may be organized and help clarify the links between ecosystem accounts and other national accounts and statistics. The expert group was encouraged to:
  - be bold and ambitious with the project, despite the technical difficulties and fact that the topic is still evolving, considering the strong demand for evidence resulting from ecosystem accounts for public policy;
  - adopt a systems approach coherent as much as possible with the existing national accounting standards;
  - engage with the various stakeholder communities to deal directly with the challenge of coordinating with groups and on issues that are different from the regular work of statistical offices.
2. Introductory statements were made by the World Bank, EEA and UNSD to provide the group with the background on the project and the objectives of the agencies.
3. The Wealth Accounting and Valuation of Ecosystem Services (WAVES) project will be central to the World Bank's contributions to Rio +20. The strategy of WAVES is to build a critical mass of developed and developing countries producing the accounts. The objective of WAVES is to link the production of accounts with policies.
4. The Simplified Ecosystem Capital Accounts (SECA) project initiated by EEA is based on the recognition of a need to bring together official statistics, geographical information, and *in situ* monitoring data on the environment. One of the objectives of SECA is to help discussions on ecosystem services move from research towards greater influence on decision-making. EEA emphasized that it is important to be practical and be aware of the needs in regards to precision, relevance, and timeliness of the statistics.
5. UNSD clarified to the group that the purpose of SEEA Experimental Ecosystem Accounts is to provide the conceptual framework and principles within which it was hoped that official statisticians and accountants would advance and test the methodologies and systems-approach

to the environment. It was clarified that the term “Experimental” is not to imply that different methodologies and approaches will be presented in the SEEA but rather that consensus on methodologies, terminology, accounts and tables would be sought and this would be used as the basis for experimentation in countries to gain experience in the implementation.

6. As mandated by the Statistical Commission, it is planned that the SEEA Experimental Ecosystem Accounts be submitted to the UN Statistical Commission by early 2013. A roadmap outlining the activities and timeline of the project, envisages that a first complete draft of the document be available by June, 2012 for discussion by the UN Committee of Experts on Environmental-Economic Accounting (UNCEE). The expert group was encouraged to focus explicitly on what could be accomplished in this time frame, while also identifying ideas for the middle and longer terms, including possibly the development of a separate manual on “SEEA Land and Ecosystems”.
7. Noting that the expert group represents a small subset of a much larger and diverse community, it was requested that the members play a role of “ambassadors” within their respective institutions and countries to assist with abroad and inclusive review of SEEA Experimental Ecosystem Accounts throughout the process of its development.

### **Policy applications**

*Discussant: Patrick ten Brink*

#### Outcomes and actions

- *The SEEA Experimental Ecosystem Accounts should identify, broadly, the main policy applications and describe how the accounts can inform policy, for example in terms of aggregates and indicators.*
- *An outcome paper will be prepared on this topic by Statistics Canada and Statistics Québec.*

#### Summary of the introduction by the discussant, papers/presentations and discussion

8. Mr. Patrick ten Brink of the Institute for European Environmental Policy (IEEP) provided the expert group with some examples of the policy demand for ecosystem accounts. Mr. ten Brink argued that a critical issue underlying the demand for ecosystem accounts is providing the right values for biodiversity and ecosystem services, values that if not made explicit are otherwise often taken for granted. It was also mentioned that ecosystem accounts should provide evidence for better assessments of the benefits from ecosystem services and of recurrent and capital expenditures in natural capital. Mr. ten Brink emphasized the need to ensure that the accounts and measures are fit for purpose, which requires constant recognition of the policy applications for the statistics.
9. Several experts emphasized the importance of explicitly identifying the expected uses of the accounts and expected key aggregates or indicator outputs. A fundamental theme proposed for

policy applications of the ecosystem accounts was land and natural resources management for the conservation and maintenance of natural capital.

There was general agreement about the importance of evaluating the details of the accounts in terms of what is 'fit for purpose', but it was emphasized that a number of criteria are necessary for such evaluation, including relevance, validity and level of precision. It was also agreed that while it is useful to analyze the criteria of precision and technical challenges for compiling different parts of the accounts, it was also important to present the system as an integrated whole.

## Session 2

### Structure of Accounts

*Discussant: Carl Obst*

Papers:

- *Towards an Integrated Structure for SEEA Ecosystem Stock and Flow Accounts* (M. Vardon, M. Eigenraam, J. McDonald, R. Mount, A. Cadogan-Cowper)
- *An Experimental Framework for Simplified Ecosystem Capital Accounts* (J.L. Weber)
- *Linking the Ecosystem Accounting Framework with Country-specific Indicators* (A. Hauser, B. Schweppe-Kraft, E. Schwaiger, M. Nagy, C. Schlatter)

### Outcomes and actions

- *There was general agreement that the structure of accounts should, while maintaining consistency with the SEEA Central Framework, be flexible enough to allow for different approaches to be presented. It should be clarified that depending on the measurement objective, either the model in which ecosystems are considered assets or the model in which ecosystems are considered statistical units, may be appropriate. The outcome paper on this issue should attempt to elaborate how the two models should be integrated.*
- *The Editor, Carl Obst will prepare an outcome paper presenting the conceptual framework for ecosystem accounts on the basis of the discussions.*

### Summary of the introduction by the discussant, papers/presentations and discussion

10. A variety of approaches to structure were presented in the papers. These approaches were summarized according to 2 models (including combinations of the 2):
  - a. In the first model ("model A") ecosystems are assets. The implication of this model is that ecosystem services are included as part of the production functions of existing institutional units of the national accounts.
  - b. In the second model ("model B") ecosystems are production units. The implication is that ecosystem services are provided by environmental assets held as natural capital by nature and should be considered as produced by ecosystem units rather than the units and production functions of the economy.

11. Following the presentation of the structure, Jean-Louis Weber of EEA presented the conceptual framework that provides the structure for the current work on Simplified Ecosystem Capital Accounts.
12. There was general agreement that the structure of the accounts should attempt to be accommodating to both models. Depending on the measurement objective either model described above (or a combination of the two) may be appropriate. The purpose of the structure of the accounts is to provide the umbrella framework to facilitate convergence towards a common use of terms and concepts.

### **Principles of monetary valuation**

*Discussant: Glenn-Marie Lange*

Papers:

- *Monetary Valuation for Ecosystem Accounting* (M. Pittini)
- *Valuation of ecosystem goods and services in Victoria, Australia* (M. Eigenraam, M. Vardon, J. Hasker, G. Stoneham, J. Chua)
- *Some Notes on Prospects for Including Natural Lands as Sources of Ecosystem Services in National Accounts* (R.D. Simpson)
- *Point of View on Policy Applications, Accounting Units and Principles of Monetary Valuation, and Québec's Experience* (S. Uhde)

### Outcome & actions

- *While it is broadly agreed that cost-based approaches to valuation are not appropriate for valuing ecosystem services in the accounting context, there should be further investigation of such approaches for other purposes, in particular for the purpose of valuing physical deteriorations and assessing trade-offs (cost-benefit analyses).*
- *It was recommended that the outcome paper should describe various methods for valuing ecosystem services that are market based thus in line with the SNA principles. The paper should also look at possible methods for valuing marginal changes to assets or to ecosystems (e.g. degradation). A key role of SEEA Experimental Ecosystem Accounts will be to harmonize the use of terminology and definitions to facilitate further experimentation with valuation methods.*
- *The World Bank WAVES project will continue to expand on its survey of experts to evaluate valuation techniques according to services and according to the policy relevance within the national accounting context, with an aim to produce conclusions in time for inclusion in the drafting of SEEA Experimental Ecosystem Accounts.*

### Summary of the introduction by the discussant, papers/presentations and discussion

13. A variety of approaches to monetary valuation were discussed and each was critiqued on the challenges of feasibility and applicability or coherence to the System of National Accounts.

Questions were raised about priorities for valuation and whether the approaches should emphasize measurement of flows, marginal changes, or assets. In particular there were questions on the applicability of measures from new “quasi-markets” and on whether or not measures of recovery or avoidance costs should be included in the accounts.

14. Techniques to monetary valuation of ecosystem goods and services are now available along with a vast number of case studies. By monetising changes in the flows of benefit from an underlying stock of natural capital, valuation could also support a fuller inclusion of the value of ecosystem services and natural resources. The available studies have shown that valuations are directly useful for policy making at smaller scales but questions remain about the quality of aggregated information higher levels (e.g. national scale). Thus, the group encouraged a pragmatic approach to monetary valuation in ecosystem accounts, for example by focussing on harmonizing use of terminology and classifications, etc., used in experimental studies.
15. Economic valuation will disentangle the contribution of ecosystem services whose value is included at least implicitly in the System of National Accounts (SNA), for example the contribution of pollinators to agricultural production. It can also genuinely extend the accounting framework to encompass ecosystem services that lie outside of the SNA production boundary (e.g. carbon storage or flood protection by wetlands).
16. The various techniques were discussed in the papers on the basis of the challenges of feasibility and coherence to the System of National Accounts. Realizing proxy prices for ecosystem services through the creation of “smart markets” was considered promising. Shortcomings of auctions were acknowledged in revealing the supply side (landowners) of the environmental market while the willingness to pay – demand side (in this case the government) – is not known fully. Meanwhile, the auction aimed to provide an incentive to landholders to truthfully reveal their true costs for changing or modifying the use of their land for increased provision of a desired suite of ecosystem goods and services.
17. Significant progress is being made in the design and creation of institutions that mimic the way markets reveal prices. The common feature of these techniques (sometimes referred to as market-based instruments) is that they aim to overcome complexities that inhibit transactions (leading to price revelation) in domains of the economy where markets have not evolved. Tradable permits for pollution is a simple example of where a market can be created by capping emissions and allowing these rights to be traded.
18. A field trial of a smart market for native vegetation offsets (The Native Vegetation Exchange) is currently under way in Victoria. In this case the environmental asset is the land containing specific types of native vegetation that need to be packaged and traded to offset the clearing of native vegetation for development. If successful, this intervention will discover prices based on the private information of market participants and will expand the boundary of the market economy. The Victorian government has made a significant investment in conservation auctions

and the administrative tools needed to support them. The auctions have revealed a supply side price for private landowners for a selection of ecosystem goods and services but true demand side price (willingness to pay by government) has not yet been determined. Despite this possible limitation, the information revealed in the process is potentially very useful for government decision-making, and the conservation auction processes are continuing. Further structuring of the information from the conservation auctions into an accounting framework should further enhance the usefulness of these data. Integration of this information would not require much adjustment to the existing accounts (asset, physical and monetary flow, and land accounts) of the SEEA Central Framework.

19. Work undertaken by the US EPA on the generation of estimates for the valuation of preservation and restoration of land for the sequestration of nutrients and retaining floodwater for the improvement of water quality in Chesapeake Bay demonstrates that valuations are context dependent. Moreover, the value of land retained in a natural state may depend on the ecosystem services it provides in extreme circumstances, not necessarily evident on a regular basis. Flood protection, for example, is a typical service that may only become clear under unusual circumstances.

### **Session 3**

#### **Classification of Ecosystem Services**

*Discussant: Haripriya Gundimeda*

Papers:

- *Common International Classification of Ecosystem Services (CICES): 2011 Update* (R. Haines-Young and M. Potschin)
- *Classification and Prioritization of Ecosystem Services* (S. Maynard and S. Cork)
- *Linking the Ecosystem Accounting Framework with Country-specific Indicators* (A. Hauser, B. Schweppe-Kraft, E. Schwaiger, M. Nagy, C. Schlatter)

#### Outcome and Actions

- *CICES was considered an important step forward in the development of a common classification/list of ecosystem services for the purpose of ecosystem accounts*
- *Further review and commenting on the existing classifications was considered necessary before its finalization.*
- *Roy Haines-Young would initiate the discussion among the subgroup of the Expert Group.*

Summary of the introduction by the discussant, papers/presentations and discussion

20. A Common International Classification of Ecosystem Services (CICES) was developed through a collaborative process led by EEA in 2009 and 2010. CICES went through extensive consultation<sup>1</sup> and was presented to the United Nations Committee of Experts on Environmental-Economic Accounting (UNCEEA) in June, 2010. An updated paper considering the application of CICES was prepared for this expert group meeting and was discussed along with papers outlining related experiences in Australia and in Austria, Germany, and Switzerland.
21. The comparison of study cases from Australia, Austria, Germany, and Switzerland with the existing CICES draft raised some questions about the hierarchical structure of CICES and how it would be implemented for ecosystem accounting. The papers also raised important questions about the use of terminology in the classification, the underlying scope and definition of ecosystem services, and how measurement of ecosystem services can be related to the scale of compilation and analysis of other information in the accounts.
22. It was felt that CICES was an important step forward in the development on an agreed classification/list of ecosystem services. However, the comparison of study cases from Australia, Austria, Germany, and Switzerland with the existing CICES and the discussions during the meeting, raised the following questions on the following issues:
- Hierarchical structure of CICES and its implementation for ecosystem accounting
  - Terminology
  - Scope and definitions of ecosystem services, including the condition and capacity of ecosystems (supporting services), and abiotic services (e.g. whether solar or geothermal energy sources)
  - Relationship of CICES with the scale of compilation and analysis of the information in the accounts
  - Exclusion of supporting services.

### **Prioritization of Services**

*Discussant: Anton Steurer*

Papers:

- *Prioritization of Ecosystem Services for Ecosystem Accounting* (L. Hein)
- *Prioritization of Ecosystem Services for Ecosystem Accounting* (R. Haines-Young)

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<sup>1</sup> The CICES website (<http://cices.eu>) was established in 2010 and remains available for further refinement of the proposal.

- Linking the Ecosystem Accounting Framework with Country-specific Indicators (A. Hauser, B. Schweppe-Kraft, E. Schwaiger, M. Nagy, C. Schlatter)

#### Outcome and actions

- *The outcome paper for this issue should investigate how different measures and valuations of ecosystem services apply to the different policy questions, taking care to note existing work in this area and noting that the situation may vary with different types of landscapes or environments. Further work would also be needed to take into account both the flow and stock attributes of the services (fish stock versus fish catch); the spatial context of production of the service and the benefit accrued; mapping of ecosystem units and supply for aggregation purposes; and the suitability of methods of measuring ecosystem services (spatial modelling, spatial regression, geo-statistical interpolation) given data availability and the characteristic of the landscape.*
- *The World Bank will extend its survey of international experts and will report back to the expert group on the conclusions of this exercise. This extended survey should obtain (i) a more comprehensive understanding of criteria for ranking the feasibility of and/or policy interest in including ecosystem services in SEEA; (ii) the scores of ecosystem services versus these criteria; and (iii) availability of data at country and at an international level that can be used for ecosystem accounting*
- *The issue should be renamed “evaluating measurement options across ecosystem services” to avoid misinterpretation. The intention of this issue should be to assess the technical feasibility of various options for ecosystem services measurement and valuation rather than to prioritize against other criteria that may vary across different policy circumstances.*

#### Summary of the introduction by the discussant, papers/presentations and discussion

23. The issue of prioritisation was addressed in the papers from two angles: technical feasibility and the policy needs. A paper prepared by Lars Hein for the World Bank was based on a preliminary survey of 9 international experts to elicit information on issues, mainly from the perspective of data availability and technical feasibility, for valuations across different services and methodologies.

24. The paper elaborates the concept of ecosystem services in relation to economic production and land use. Based on the survey of experts, the paper identified the issue of scaling up local, point-based estimates of ecosystem services supply to national level aggregates. This process requires both a high availability of point-based data on ecosystem services supply, credible methodologies for spatial modeling and/or interpolation at higher scales, and spatial data to allow spatial modeling or interpolation at aggregated scales. Because data availability and methods for analyzing specific services differs strongly between ecosystem types, the feasibility of analyzing ecosystem services was analyzed for specific ecosystem types. In line with the scope of the study, only regulating and cultural services were included. Both the perceived feasibility with regards to biophysical quantification of ecosystem services supply at national scales, and the quantification in economic terms were ranked in support of the physical and monetary valuation of the ecosystem services in the accounts. In general, there is consistency between the two in part, because economic quantification is only possible if biophysical quantification is feasible as well. The survey informed that that carbon sequestration ranked highest for feasibility in measurability, followed by services related to tourism and recreation, coastal protection, air filtration, and amenity services. However, there are likely to be significant differences between individual countries in terms of data availability and policy priority, in addition to differences in ecology.

25. A paper prepared by Roy Haines-Young focused on the relevance of ecosystem services measures for better understanding the key policy concerns, including the services contributing the most to well-being and the identification of adverse changes to ecosystem integrity. The paper argued that criteria for prioritization of ecosystem service measurement should include: (i) more fully capturing the integrity of ecosystems via changes in the 'supporting' or 'intermediate' services; (ii) identifying essential 'final' services; (iii) identifying the greatest risks to ecosystem service output, particularly from large or irreversible impacts or from impacts requiring significant restoration costs and thus posing significant burdens on the future. The paper argued that while data availability is an important practical constraint, prioritization should be mainly based on policy needs rather than strictly data driven. Through this approach to prioritization, the paper noted that the role and advantages of ecosystem accounts would be made more explicit as a tool for overcoming these information gaps.

26. In the discussion, experts agreed broadly on an inclusive set of criteria for prioritisation of the measurability of services in the development of SEEA experimental ecosystem accounts (that is broadly agreed methods of measuring ecosystem supply at high aggregation level, data availability, relevance in public utility in terms of economic importance and policy impact, sensitivity of the services, etc.). It is not expected that the SEEA experimental ecosystem accounts will need to provide a specific ranking of ecosystem services for prioritisation, but rather could discuss the criteria.

#### **Session 4**

##### **Land cover mapping, land cover classifications, and accounting units**

*Discussant: Leo Koltola*

Papers:

- *Land Cover Mapping in Canada with Respect to Ecosystem Accounting* (P. Adams, M. Bordt, G. Filoso, and G. Gagnon)
- *Ecosystem Statistical and Accounting Units, Land Cover, Remote Sensing and Adjustments* (R. Mount, B. Allison, P. Tickle, V. Bordas)
- *Definition and Classification of the Socio-Ecological Landscape Unit* (J.L. Weber)
- *Accounting Units for Ecosystem Accounts* (A. Alfieri, D. Clarke, I. Havinga)
- *Land Cover Classification for Ecosystem Accounting* (A. di Gregorio, G. Jaffrain, J.L. Weber)
- *Point of View on Policy Applications, Accounting Units and Principles of Monetary Valuation, and Québec's Experience* (S. Uhde)

##### Outcome and actions

- *An outcome paper should be prepared that builds on the agreed principles of the description of accounting units. The description of the accounting units should take the smallest relevant land unit representing structures, functions and processes capable of delivering ecosystem services as starting point. Moreover, most services are scale-dependent and thus often it may only make sense to associate flows of services with higher levels of spatial aggregation of these units. In the description of the accounting unit, the outcome paper should also take into account the mapping techniques and land cover classifications for ecosystem accounting.*

##### Summary of the introduction by the discussant, papers/presentations and discussion

27. Six papers were prepared for this issue and the majority of discussions focused on statistical/accounting units and classifications. A paper prepared by experts by Statistics Canada

provided a useful overview of the critical concepts underlying land cover units and classifications as they have been applied in Canada. The paper also reviewed the current issues with data sources. The paper presented some of the current activities and outputs of Statistics Canada pertaining to compiling and analysing land cover information.

28. In a report by Stéphanie Uhde, Institut de la statistique du Québec, reference was made to Québec's ecological reference framework (ERF), which is a land classification system with units delineated based on geological factors. The report recommended that additional factors be considered in identifying units for ecosystem accounting since geological factors alone may not give a precise representation of ecosystems as functional units. Further, the report pointed out that the scope of individual accounting units may vary over time to reflect actual ecological changes and thus they should not be restricted as static spatial areas across time periods.
29. In a contribution from experts from the Bureau of Meteorology (BoM) of Australia, it was suggested that capacity for producing economic goods and services be the central conceptual criteria for defining the units and that a simple set of principles be established to support this definition and for identification of the units. The BoM paper also proposed several sets of criteria for the units, such as spatial and temporal mutual exclusivity and possibility for credible transformation into relevant reporting units.
30. In a paper prepared by Jean Louis Weber, the current approach to accounting units used for the European Environment Agency's Simplified Ecosystem Capital Accounts (SECA) project was described in detail. The approach is based on a hierarchy of spatial units, including land cover basic objects (grass, trees, etc.) and land cover types (herbaceous crops, tree covered areas, etc.), land cover functional units (which capture and characterise distributions of land cover types) and socio-ecological landscape units (SELU). The paper describes the process for deriving a map of SELUs from land cover types and other information characterising the landscapes. A classification of SELUs is proposed, which is based on dominant land cover characteristics combined with classes of altitude (mountain, highland, (inland) lowland, and coastal).
31. In a paper prepared by experts from the United Nations Statistics Division, it was proposed that the accounting unit be defined using a similar logic to the approach of the System of National

Accounts (SNA). In the SNA, the accounting units must be capable, in their own right, of performing the basic functions of production, consumption, and accumulation. Thus, in ecosystem accounts, the basic units should be defined similarly as having capacity for the production of ecosystem services, consumption of energy and other inputs necessary for the supporting functions that allow ecosystems to sustain themselves and deliver services, and accumulation of structures or material (biotic and abiotic) components. In practice, and in line with the other contributions for this session, it was proposed that these units be identified through a simple set of rules, incorporating information on land cover and other relevant proxy information.

32. In a paper prepared jointly by experts from the European Environment Agency and the United Nations Food and Agriculture Organisation (FAO), a proposed land cover classification for ecosystem accounts was presented. The proposal was developed as an application of the FAO Land Cover Classification System (LCCS). The proposed classification is a subdivision from the list of land cover types presented in Chapter 5 of the SEEA Central Framework, adapted for the specific purpose of ecosystem accounting.
33. Significant common ground among approaches was identified, particularly in regards to using a simple rule set for identifying the units and land cover classes. Overall, a consensus emerged on the need to be clear on the relations between statistical and accounting units and classifications and to keep the number of variables manageable so that stability and homogeneity over time and space can be assured when computing the accounts. For many participants, the terms statistical and accounting units meant the same thing – in other words some differences could be attributed to semantics.
34. Land cover functional units (LCFUs) and Social-ecological landscape units (SELUs) both have a role to play in SEEA Experimental Ecosystem Accounts and further clarity is needed on how they link to classifications, datasets and land/ecosystem management. Grid format seemed preferred over vector format when considering spatial analysis, though an accommodative approach embracing both options is probably desirable. The links between LCFUs, SELUs and ecosystem services is a vital issue to be clarified in the SEEA Experimental Ecosystem Accounts.

There were different opinions on whether the starting point should be, for example, land cover or ecosystem services. Both angles should be discussed in the document.

35. On classifications, the importance of defining and linking clearly between land cover, land use, landscapes, ecosystem capital and ecosystem services was emphasised. The differences between private and public use of land will also need to be addressed. All classifications are an artificial construct that provide a basis for consistency and stability and should not be interpreted or considered as fully representing reality or the truth. Furthermore, an accommodative approach to consistent “nesting” of classifications across scales – local, regional, national, global - will be an important element to focus in SEEA Experimental Ecosystem Accounts.

### **Carbon accounts and nitrogen, phosphorus, and accounting for soil**

*Discussant: Roy Haines-Young*

Papers:

- *Carbon Stock Accounts* (J. Ajani)
- *Accounting for Carbon in the National Accounting Framework: A Note on Methodology* (H. Gundimeda)
- *Constructing the NPP and Biomass Accounts and Ecosystem Carbon Balance Index: A Methodological Note* (E. Ivanov, R. Haines-Young, J.L. Weber)
- *Accounting Units for Ecosystem Accounts* (A. Alfieri, D. Clarke, I. Havinga)
- *Greenhouse Gas Reporting in Carbon Accounting of SEEA Ecosystem Accounts* (J. Muukkonen)
- *Provision of Ecosystem Services by Soil Resources* (R. Vargas Rojas)

### Outcome and actions

- *Carbon accounts should, in principle, incorporate stocks and flows of the carbon cycle comprehensively, building on the methods used by UNFCCC and IPCC for compiling statistics on emissions. The expert group considered the net carbon balance as a proxy that should be explored for the measurement of the condition of ecosystems and it recommended that the outcome paper on carbon should describe the basic model for the calculation of the net carbon balance. The paper should also describe the links with UNFCCC and IPCC methodologies and issues of scaling.*

- *The expert group agreed that accounts for nutrients and soil are important components of ecosystem accounts. It recommended that engagement with experts on soil and nutrient balances is sought in order to ensure that these topics are properly addressed in the SEEA Experimental Ecosystem Accounts.*

Summary of the introduction by the discussant, papers/presentations and discussion

36. The papers submitted for this session focused on carbon accounting. Overall a strong commonality and feasibility emerges around the concept of a net carbon balance (NCB) equal to net primary productivity (NPP) minus carbon removals.
37. A paper prepared by Judith Ajani of Australian National University argued for expanding the scope of current carbon accounting, which focuses on flows (emissions), to include carbon stock accounts, noting that in taking the perspective of the complete carbon cycle, the total amount of carbon stored in the land is highly relevant to determining the amount of CO<sub>2</sub> in the atmosphere. Ajani proposes a framework for a carbon balance sheet, measured in physical quantities of carbon, with changes estimated by reservoirs.
38. As similar scheme to Ajani was presented in a paper by Haripriya Gundimeda of the Indian Institute of Technology. Gundimeda's paper also explores possibilities for carbon accounts in monetary terms and presents current empirical experience with carbon accounting in India. A nationally aggregated table was constructed as an example of an output from this work, which presented stocks and flows of carbon in physical quantities (tonnes) and monetary terms.
39. In a paper prepared by Ivanov, et al., carbon accounts was presented as a tool for better understanding relationships between ecosystem functions and key human uses and benefits, particularly production of food, fibre, and timber. The paper proposes a "fast track" approach to implementation of carbon accounts utilizing remote sensing information and a simplified equation for calculating NCB. The paper illustrates a complete carbon stock account, presents some preliminary results produced for Europe, and discusses some of the finer technical issues in producing the accounts.

40. Jukka Muukkonen of Statistics Finland submitted a paper describing current carbon accounting activities for Finland, particularly in relation to reporting requirements to the Intergovernmental Panel on Climate Change (IPCC). The paper analysed the correspondences between the IPCC categories of land use with the current land use classification of SEEA and proposed some conclusions on how existing IPCC reporting guidance would complement the development of carbon accounting in SEEA.
41. Ronald Vargas Rojas submitted a presentation on behalf of FAO on the topic of ecosystem accounting and soil resources. The presentation described some of the fundamental relationships between soil and its functions with the objectives of ecosystem accounting. The presentation also explored some of the historical challenges in measuring the problems associated with soil, in particular with how to monitor soil health.
42. There was broad agreement that this basic model for calculation of the net carbon balance (NCB) should be incorporated into SEEA Experimental Ecosystem Accounts. NCB can be a powerful proxy for the state of ecosystems (and ecosystem services), with NPP cast as a supporting service strongly related to ecosystem function. It was agreed that there would be a clear value added in providing more detailed guidance on the NCB calculation in SEEA and a lot of research and analytical material exists for this purpose, including on how to link carbon to markets and economic values.
43. A comprehensive approach around carbon is crucial including links to other systems and the work of IPCC and UNFCCC. The issues of upscaling and downscaling of carbon accounts in support of different governance discussions will need specific attention, especially regarding scaling factors, the volatility of carbon pools, and the issue of timescale when it comes to logging and lying time, for example. Open source modeling, stratification approaches and testing NCB vis-à-vis Human Appropriated Net Primary Productivity (HANPP) are also avenues for further exploration.
44. There was limited material available for the expert group meeting in regards to accounting for soil and nutrients cycles. The OECD described ongoing work on development of international methods for nutrient balances, but further investigation is needed to understand how to

integrate these methods into the context of ecosystem accounting. Accounting for soil and nutrients cannot be ignored and requires attention in future expert meetings. As a way forward, the expert group agreed that efforts should be made to reach out to the relevant national and international experts in these areas to solicit further material on the concepts and measurement approaches for incorporation into experimental ecosystem accounts. The expert group was optimistic that enough material already exists on these topics that could be compiled for meaningful description of the issues in the context of SEEA experimental ecosystem accounts.

## **Session 5**

### **Ecosystem Health/Total ecological potential**

*Discussant: Per Arild Garnåsjordet*

Papers:

- *Accounting for the Condition of Environmental Assets (P. Cosier)*

#### Outcome and actions

- *The outcome paper for this issue should address the questions about how far SEEA should go towards calculation of indices. While the experts agreed that there is significant demand for summary indicators, the group was cautioned about challenges inherent in deriving such measures in a way that is sensible across perspectives and varying circumstances in particular in the context of official statistics.*

#### Summary of the introduction by the discussant, papers/presentations and discussion

45. The starting point for discussion on this issue was a paper prepared on accounting for the condition of environmental assets by Peter Cosier of Australia's Wentworth Group of Concerned Scientists. The paper introduces the concept of using a reference condition to calculate an index, called an "Econd", for comparing across ecosystems and assessing changes. This methodology was developed to meet specific policy demands in Australia and inform investment decisions using a scientifically rigorous process. The model was presented as a way of integrating measures of the condition of ecosystems within an accounting framework. It was agreed that the approach and concepts presented in the paper were closely aligned with those incorporated in the papers describing the EEA SECA project, a notable convergence of outcomes from two independent initiatives.

46. A number of detailed concerns were raised around the issues of how an index may be calculated and on utilizing reference conditions. It was noted that different perspectives imply different values and more investigation is needed into how weights should be applied in compiling the index. Questions were raised about how far the work on SEEA Experimental Ecosystem Accounts should go in developing composite indices as opposed to developing accounts that could support such indices. However, there was broad agreement that delivering policy-relevant indicators rather than just the tools to derive indicators should remain a goal of the system and there are certain advantages to responding to the “one number” demand as embodied in the example of GDP. It was noted that there are multiple possibilities for identifying reference conditions that could be applicable in the context of ecosystem accounts and the approach could vary across different contexts or for different uses of the information. Reference conditions could also be related to existing political commitments, for example as has been done for the Kyoto Protocol (using 1990).

47. Ultimately, the group concurred that there was a need to address both flows of ecosystem services and the condition of ecosystems in SEEA Experimental Ecosystem Accounts. The approach to accounting for ecosystem condition will rely on a clear narrative that takes a multi-functional perspective to ecosystems. A critical principle for this issue is transparency as the measures must be subject to the rigor of scientific review.

### **Landscape accounts and landscape ecological potential**

*Discussant: Lars Hein*

Papers:

- *Issue paper on Landscape accounts and landscape ecological potential (J.L. Weber)*
- *Net landscape ecological potential of Europe and change: 1990-2000 (EEA)*

### Outcome and actions

- *Further investigation should be pursued with regard to the methodology underlying the calculation of the landscape ecological potential including the weighting of its component and the adequacy as a proxy of ecosystem integrity.*

### Summary of the introduction by the discussant, papers/presentations and discussion

48. A paper on this issue was prepared by Jean Louis Weber, European Environmental Agency, which presented the landscape ecological potential measures as but one of several proposed

dimensions to the assessment of ecological potential or ecosystem condition. The paper proposed that landscape ecological potential be incorporated as part of a simplified approach to the physical accounting. The landscape ecological potential is an index incorporating information on vegetation cover, protected status, and the fragmentation of landscapes (e.g. from roadways). A key purpose and advantage of this indicator is to measure the period to period changes to better understand cases where potentials are increasing or decreasing and to make general conclusions about the effectiveness of land management policies and conservation.

49. Discussions on this issue related closely with the previous topic on total ecological potential. It was noted that ecosystem accounting requires use of physical information as a basis for measuring the benefits of ecosystems. Landscape ecological potential is an index combining three components, namely vegetation cover, protected status, and the fragmentation of landscapes. The weighting of these components, with fragmentation being heavily weighted as opposed to vegetation cover and protected status was questioned in consideration that some species are not affected by fragmentation. Additional questions raised during the discussion included the adequacy of the landscape ecological potential for ecosystem integrity and its link with the supply of ecosystem services. Further evidence on these relationships is needed to support the use of landscape ecological potential.

50. In addition, a number of clarifications were made on the technical measurement issues as well as on issues of terminology.

## **Session 6**

### **Biodiversity accounts and indexes**

*Discussant: Rocky Harris*

Papers:

- *Key Concepts for Accounting for Biodiversity* (J. McDonald)
- *Issue Paper on Biodiversity Accounts and Indexes* (P.A. Garnåsjordet)
- *Developing a Diagnostic Species and Biotope Index for Europe* (E. Ivanov, R. Haines-Young, J.L. Weber)

### Outcome and actions

- *Further research and engagement with biodiversity experts is needed to reach more concrete conclusions on the inclusion of biodiversity in ecosystem accounts. The outcome paper should try to clarify and, if possible, conclude on the various views on the ways in which biodiversity is relevant to the accounts, e.g. as an asset, as an indicator of ecosystem condition, and/or as a service. While further work would be required to clearly describe the integration of biodiversity measures within ecosystem accounts, the expert group agreed that there was already considerable expertise engaged in this process to bring together a set of core principles for incorporating biodiversity as a critical part of the ecosystem accounting system. The relevant experts participating in the discussion expressed a strong willingness to assist with this endeavour.*

#### Summary of the introduction by the discussant, papers/presentations and discussion

51. Papers were prepared for this issue by experts from the Wentworth Group of Concerned Scientists (Australia), the University of Nottingham and the European Environment Agency, and Statistics Norway. The papers presented current approaches to incorporating biodiversity information into accounting systems and index measures.
52. The paper by Jane McDonald of the University of Queensland presented clear and logical arguments for inclusion of biodiversity in ecosystem accounts, noting that, to a certain extent, the concept is already incorporated in logic of the SEEA Central Framework. The paper included a comprehensive analysis of the approaches to incorporating biodiversity measures in accounting and the relevant policy applications. The paper concludes that the practical approach from a technical perspective would be to describe biodiversity in the accounts as an asset.
53. In a joint paper from experts from the University of Nottingham and the European Environment Agency, on-going work was described to integrate biodiversity information in the context of simplified and “fast-track” ecosystem capital accounts for Europe. Some preliminary results were presented in the paper, along with a brief description of next steps, which include proposals for improving the consistency in precision of biodiversity assessments from different regions and greater harmonization of the level of spatial detail of the available data.

54. In a paper by Per Arild Garnåsjordet from Statistics Norway, a comprehensive comparison was made between the approaches to biodiversity accounts in Australia and Norway. In Norway, a major project was conducted and published in 2010 to develop a “nature index”, which incorporates expert information from across all regions of Norway.

### Conclusion and way forward

55. In the concluding session, a detailed road map was presented outlining the expected time line for activities and outputs in 2012 building towards a final draft of SEEA Experimental Ecosystem Accounts by February, 2013. Experts were requested to confirm availabilities for contributing to “outcome papers” on the 10 issues discussed during the meeting. In addition, assistance was requested for follow-up on the topics of nutrient balances and soil, for which there were not any specific proposals presented at the meeting. The suggested deadline for outcome paper is 15 February. The purpose of the outcome papers will be to synthesize and provide conclusions on the discussions during the meeting. Below is a summary of the teams that is proposed for preparing the outcome papers:

Issue 1 – Policy Applications	Statistics Canada, Statistics Quebec
Issue 2 – Structure of accounts	Carl Obst, UNSD, EEA, Australia
Issue 3 - Land cover mapping, land cover classifications, and accounting units	Statistics Finland, UNSD, Statistics Canada, Australia, FAO, India CSO, Statistics Québec
Issue 4 –Carbon accounts	Roy Haines-Young, Australia, Haripriya Gundimeda, Gerbert Roerink
Nutrient balances	<i>TBD</i>
Soil	Lars Hein, Australia, FAO
Issue 5 – Landscape accounts and landscape ecological potential	Lars Hein, EEA
Issue 6 – Biodiversity accounts and indexes	Per Arild Garnåsjordet, Jane McDonald, Ben ten Brink, Markus Lehman, Rocky Harris
Issue 7 - Ecosystem Health/Total ecological potential	EEA, Peter Cosier
Issue 8 - Classification of ecosystem services	Roy Haines-Young, Australia, Swiss Federal Office for the Environment, UNSD, FAO, OECD
Issue 9 –Prioritization of ecosystem services	Lars Hein, Glenn-Marie Lange, David Simpson, Anton Steurer
Issue 10 – Principles of monetary valuation	Glenn-Marie Lange, Paulo Nunes, Michele Pittini, David Simpson

56. During discussions, it was suggested that policy applications (issue 1) should be the first item addressed in each of the outcome papers in order to ensure that the recommendations are aligned with the expected uses of the accounts.

Detailed road map for 2012:

End of Dec. (2011)	Minutes of Expert Meeting
31 Jan. or 15 Feb.	Outcome papers
29 Feb.	1 <sup>st</sup> Draft of SEEA Experimental Ecosystem Accounts for Editorial Board
15 Mar.	1 <sup>st</sup> Meeting of Editorial Board
15 Apr.	2 <sup>nd</sup> Draft for distribution to Expert Group
16-18 May	Possible meeting of expert group in Melbourne, Australia, in connection with national seminar
Mid-May	3 <sup>rd</sup> Draft for distribution to UNCEEA
June	UNCEEA meeting
Sept.-Oct.	Global consultation
Oct.	Consultation with the London Group on Environmental Accounting at its meeting
End of Dec.	Completion of SEEA Experimental Ecosystem Accounts