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**Ecosystem accounts within SEEA revision
An EEA proposal**

Paper prepared by the European Environment Agency

(for discussion)



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EEA/BSS/JLW

Note to UNCEEA meeting of 26-27 June 2008

Ecosystem accounts within SEEA revision An EEA proposal

Following discussions in the Johannesburg LG meeting (March 2007) of the EEA presentation of “The Recording of Ecosystem Services in the SEEA” and of the options of a specific chapter on land and ecosystem accounting in SEEA part 2 and of a supporting manual, a clarification paper was asked from the EEA¹. The discussion of the paper in the Rome LG meeting concluded in the request for a position paper to be submitted to the Brussels LG meeting convened for September 2008.

The UNCEEA Bureau has recently decided that the publication of the SEEA2012 would be made as three volumes, respectively Volume 1 “The Statistical Standard”, Volume 2 “Non-Standard Accounts” (where most ecosystem accounts are most likely to be covered) and Volume 3 “Applications”. Plan and provisions have been made for edition of Volume 1 and its presentation to the March 2012 meeting of the UN Statistical Commission. Volumes 2 and 3 will be published “shortly after”.

Because of the importance of ecosystem and ecosystem services accounting per se as well as considering the overall balance of the SEEA and its capacity of responding to the policy demand, the EEA proposes to follow the move fostered by UNCEEA Bureau and meet the 2012 deadline for its own commitments regarding land and ecosystem accounts. Would this proposal be agreeable to UNCEEA, the EEA will examine the editorial requirements, look for the partnership of organization most interested in part or the whole project and adjust accordingly its position paper which will be submitted to the next LG.

1. Background

¹ An Ecosystem Approach to SEEA, Clarification paper for the London Group (Rome, December 2007)

In response to an ever-increasing policy demand, the EEA has continued playing an active role in the implementation of land accounts and the experimentation and development of ecosystem accounts in various contexts.

Beyond GDP

The first initiative is that of the “Beyond GDP” conference organised in Brussels (November 2007) by the European Parliament where the EEA presented a contribution on “*Accounting fully for ecosystem services and human well-being*²”. The paper develops the view that on the basis of accounts in physical units for the ecosystem capital stocks, flows, resilience and services, two adjunctions to GDP can be envisaged. From the demand side, non-market end use individual and collective ecosystem services should be added to the final consumption derived from GDP in order to obtain a more inclusive aggregate reflecting better human well-being. From the supply side, the additional costs necessary for maintaining ecosystems in a position of delivering their services over time should be added up to the market value of goods and services for computing their full cost. The calculation should be done for domestic products/ecosystems as well as for the imported ones.

TEEB

The third initiative is the demand of a ‘Stern-like’ report for biodiversity expressed by the G8+5 meeting in Potsdam (March 2007), supported by the German government and the European Commission, which have installed a study team in which the EEA is participating. The initial purpose of measuring the costs of inaction regarding biodiversity (as Stern has measured the cost of inaction re climate change) has been somehow rephrased and the interim report presented in the recent Biodiversity COP9 in Bonn (May 2008) is named TEEB for ‘The Economics of Ecosystems and Biodiversity’. Inter alia, it contains a recommendation for the development of ecosystem accounts in the context of the SEEA revision. One particular contribution of the EEA to the TEEB endeavour is a study on ecosystem accounting for the Mediterranean coastal wetlands. The study is continuing and will result in a publication by the end of this year, but from the first phase important conclusions can be drawn for implementing ecosystem accounts. They are presented below.

IPES

Ecosystem accounts have been presented in February 2008 to the UNEP working group on international payments for ecosystem services (IPES). Discussion is ongoing on the possible use of accounts for framing international markets based on “cap and trade” principles

Eureka!

² <http://www.beyond-gdp.eu/presentations.html>

Following the conclusions of an international workshop on ecosystem and natural capital accounting organised jointly by EEA and UNSD in Copenhagen (November 2006), ecosystem accounts have been given a central position in framing the forthcoming European ecosystem assessment (Eureca2012!), the European branch of the future second Millennium Ecosystem Assessment launch by UNEP.

ISEE

In the New-Delhi Conference of ISEE, the International Society for Ecological Economics (December 2006), the presentation of land accounts in Europe gave the opportunity of liaising with similar initiatives, in particular with the authors of the first “green accounts” for India³.

Land cover accounts update 2006

The 2006 update of the land cover accounts of Europe has started, with results for a first group of a dozen of countries at fall 2008 and, in 2009 the remaining of the 32 EEA member countries plus 6 associated Balkan countries. In parallel EEA cooperates with the European Space Agency in order to adapt their GlobCover programme to the requirements of land cover accounts with two objectives: 1/ “nowcasting” land accounts every year in the interval of two Corine Land Cover inventories (5 to 10 years) and 2/ implementing simplified land cover accounts at the global level.

Basket of 4 indicators

In parallel to “Beyond GDP”, and in relation to the EU Resource strategy, the European Commission has launched a short term initiative for supplementing GDP with one or a small number of physical indicators. A “basket of 4” indicators has been selected and will be tested now: Ecological Footprint (EF), Environmentally-weighted Material Consumption (EMC), Human Appropriation of Net Primary Production (HANPP) and Land and Ecosystem Accounts (LEAC). The candidate LEAC indicator is the Net Landscape Ecological Potential. During the discussion of the evaluation report, it was broadly agreed that a distinction should take place between the indicators and the data from which they should be computed. Economic-environmental accounts were mentioned as the appropriate common data infrastructure, EMC being related to NAMEA and EF and HANPP to LEAC, in particular for improved calculation of biocapacities.

ESEA

Last but not least, ecosystem accounting has been acknowledged as an important module to be included in the revised European Strategy for Environmental Accounting (ESEA) and developed under coordination of EEA.

³ <http://www.gistindia.org/publications.asp>

2. Importance of ecosystem accounting within the SEEA

2.1. Issues and options

Land and ecosystem accounts are not just another chapter of the SEEA but an essential feature of its closure, a macro-ecological closure in the sense of national accounts models include a macro-economic closure which accounts for the feedbacks of the primary effects of scenarios. Without ecosystem accounts, accounts would deliver just an incomplete vision of the relation between the economy and the environment, based on assumptions on potential pressure or damage but not on measurements of the actual impacts. Without this direct measurement of environmental impacts, the feedbacks from environmental degradation on the economy and human well-being cannot be correctly described, the more as we are in that case in areas where uneven spatial distributions, multi-functionality and non-linear relations are the rule.

The present limitations of national accounts regarding the environment have been summarised in that way in the EEA contribution to Beyond GDP:

- Risks of unsustainable use of the living natural capital are ignored: the negative impacts of over-harvesting, force-feeding with fertilisers, intoxication, introduction of species, fragmentation by roads, or sealing of soil by urban development have no direct monetary counterpart in GDP or in corporate accounts.
- The natural capital is not even amortised in companies' accounting books and in the national accounts – no allowance is made for maintaining ecosystems' critical functions and services. The full cost of domestic products is not covered in many cases by their price.
- This is as well the case of the price of imported products made from degraded ecosystems: their full cost is not covered by their price.
- Actual value for people of free end-use ecosystem services is not accounted in their final consumption (the market tells: price is zero).

The purpose of ecosystem accounts is to propose an answer to these questions now, by connecting the SEEA tables to the ecosystem in the same way as they are connected to the economic system. It is not an attempt of building a different accounting system, with different rules and not even an attempt to solve all pending questions. In a short to medium term horizon, ecosystem accounts stick to a partial integration of SEEA components and leave more complete integration to the care economic and ecological research.

The proposed solution is to:

- Account for the natural capital in physical units⁴: stocks of systems (functional landscapes, water systems⁵, soil, sea, and atmosphere), stocks of components (land cover, habitats, species, biomass, water, C, N, P...), ecosystem health (vigor, organization, resilience, independence, support to healthy populations); material and energy flows; ecosystem services (provisioning, cultural and regulation).
- Measure the monetary amount of depletion as the cost of repositioning ecosystems on a sustainable path (capacity of continuing supplying their services over time) up to a level decided by the society – and expressed by stated targets (International conventions, regulations, laws...). This approach is non-normative, doesn't seek identifying the society objective to an economic optimum. Instead, the society objective reflects multiple criteria of appreciation which are costs and economic benefits as well as other values (option, bequest, existence...) which are generally considered as very difficult to assess in monetary terms.
- Set aside the monetary valuation of the living/cycling natural capital – the ecosystem – which is not intrinsic to ecosystem accounts but belongs to economics assets balance sheets, in short to the SNA itself. Accepting that position, at least for the short to medium term relieves from difficult and uncertain questions related to relations between natural capital and services (selection of the services, valuation of the services, discounting rate, and extrapolation) which can be addressed at the scale of a project but are much more hazardous at the level of national accounts.
- Consider ecosystem maintenance in terms of a potential of delivering their services (maintenance of the present and future services in a given region or at the global level) and not as the strict conservation of existing ecosystems as they are. The rationale is that of the mitigation (see the European Environmental Liability Directive of 2004 or the mitigation constraints of the Habitats Directive or the Wetland Mitigation Banking system in the USA...). It limits debates on opportunity costs.
- Measure the ecosystem services first in physical terms according to the population which benefits of them. A strict definition of ecosystem services is used here: only the ecosystem functions which are used by people.
- Value only the final use individual or collective ecosystem services.
- Don't calculate another value for the ecosystem services incorporated into products, and stick to the market value (that of GDP) even though actual prices seem undervalued in many cases. They are the objective prices. The amount of externalities is calculated differently before, as repositioning cost (maintenance or restoration cost additional to what is currently paid by public and economic actors).
- Provide the best integration with material flows accounts, NAMEA and expenditure accounts.

⁴ Weber, Jean-Louis, *Implementation of land and ecosystem accounts at the European Environment Agency*, [Ecological Economics, Volume 61, Issue 4](#), 15 March 2007, Pages 695-707

⁵ in SEEA Water, water systems are named “assets”, water flows are accounted in asset and “supply and use” tables, water “quality” is an attribute of water ecosystem resilience...

As such the framework is fairly open to a range of uses and users. The GDP is not changed, only additions are proposed. The accounting framework doesn't preclude achieving the valuations which are not considered at this stage; instead, ecosystem accounts provide useful quantitative elements for further research on natural capital and inclusive wealth.

2.2. Implementation strategy

Many difficulties in implementing ecosystem assessment and valuation come from some confusion between scales. Complex ecological models established for case studies are with pain translated into relations between aggregated statistics or maps. And complex modelling of ecosystems for a country is generally out of reach. Environmental cost and benefit of given projects are well assessed with shadow prices resulting from direct or indirect surveys of the willingness to pay of the social groups participating in the project – as long as these groups adopt these shadow prices and make them real. Aggregating or extrapolating these measurements is far more uncertain.

In a first step, the problem could be simplified by acknowledging the existence of three different scales, each of them relating to specific information detail (more than geometry, contents) and governance. They can be summarised as:

- **action**: communities, agencies, business, citizens. The general objectives are to introduce ecosystem and biodiversity values (services, benefits and costs of projects, opportunities, environmental liability, mitigation of impacts of development, production and consumption) into economic calculation for public and private actors, facilitate access to databases (clearing mechanisms, sampling) and standardise a limited number of datasets for comparisons. Typical information relates to corporate and local government accounts, habitats scientific monitoring, case studies. *The operational objective is to support introduction of guidelines into existing accounting charts, collection of tariffs (services and costs), implementation of ecological rating, double price-tags on products...*
- **government**: countries, regions, UE... General objectives are definition and implementation of policies, tradeoffs, mitigation banking, control, enforcement. Typical information at this scale is made of administrative data, statistics, monitoring networks, cartographic databases. *Operational objectives are supporting the establishment and or development of tutelary prices, clearing house mechanisms for environmental values, normalised rating systems, monitoring networks, statistics, BGD national accounts, SEEA2012.*
- **global objectives**: Rio++ international and regional objectives, global market, global ecosystem (atmosphere, oceans, biodiversity, international catchments...). The general purpose of global accounts is framing and monitoring global conventions and international markets (of rights of using the ecosystem as public good, overall context and North-South relations). Typical information are international statistics and global/regional monitoring (GlobCover/GlobCorine and other monitoring from space, GEO-GEOSS, WMO, IPCC, IGBP, GCOS, GTOS, HDP ...) and outcomes of global models. *The operational objective is there establishing simplified SEEA accounts,*

implemented mostly top-down on a grid basis (short term): stocks and resource use, health/resilience, ecosystem reposition additional costs (distance to stated targets); it includes “virtual flows” of land, water, ecological potential... and concealed ecosystem costs (€, \$) within imports-exports.

3. An EEA proposal for SEEA revision 2012

The UNCEEA Bureau has recently decided that the publication of the SEEA2012 would be made as three volumes, respectively Volume 1 “The Statistical Standard”, Volume 2 “Non-Standard Accounts” (were most ecosystem accounts are most likely to be covered) and Volume 3 “Applications”. Plan and provisions have been made for edition of Volume 1 and its presentation to the March 2012 meeting of the UN Statistical Commission. Volumes 2 and 3 will be published “shortly” after.

We highly appreciate the commitment of UNSD and the statistical system for the success of SEEA and the decision of speeding up the edition of Volume 1 in order to keep the momentum with the SNA 2010 revision.

Because of the importance of ecosystem and ecosystem services accounting per se as well as considering the overall balance of the SEEA and its capacity of responding the policy demand, the EEA proposes to follow the move fostered by UNCEEA Bureau and meet the 2012 deadline for land and ecosystem accounts as well. This will be fairly in time with the development of ecosystem accounts in the context of TEEB and Eureka! and would guarantee the full consistency of the SEEA process.

Currently, the EEA is committed to prepare a draft position paper for the September 2008 LG meeting in Brussels. The objective is to present the contents of a chapter within former Part 2 and of a supporting manual on land and ecosystem accounts. We propose presenting instead of an input to SEEA rev Part 2, an input to Volume 2 version 1.

Whereas Volume 1 contents are relatively clear, Volume 2 is fuzzier at this stage and probably of an evolutionary nature. Our understanding is that Volume 2 could cover:

- the qualitative aspects of the assets possibly treated in Volume 1 from a quantitative perspective;
- ecosystem accounts (see details in annex);
- valuation issues related to “degradation”, “depletion” being part of Volume 1.

The EEA commitment could a priori cover this bundle of issues. It would explicitly exclude issues related to subsoil assets (measurement, valuation, depletion) which relate to Volume 1 and its close linkage to SNA. If any other issues need to be included into Volume 2, it could be achieved by an external input and/or postponed up to a version 2 of Volume 2.

Would this proposal agreeable to UNCEEA, the EEA will examine and assess the editorial requirements, look for the partnership of organization most interested in part or the whole project and adjust accordingly its position paper submitted to next LG.

Annex

1st Draft outline for ecosystem accounts in SEEA revision

Tentative contents – 16 June 2008

Part A - Overview and accounting framework

Chapter 1 Objectives, system analysis, main features

1.1 Policy issues: past trends and future opportunities, options and trends

- 1.1.1 Policy demand
- 1.1.2 Ecosystem goods and services – food, energy, fiber, clean water, climate regulation, amenities
- 1.1.3 State of the natural capital – abundance, natural potential, resilience
- 1.1.4 Pressure and threats – over-harvesting, land restructuring, disposal of chemicals and residuals, introduction of species, climate change

1.2 System analysis

- 1.2.1 Functional units
 - a. Habitats, ecosystems, land cover units, socio-ecological systems
 - b. Socio-ecological systems (SES)
 - Landscape functional units: urban, cropland, pasture & natural grassland, forest, wetlands, hydrological systems
 - Soil
 - Marine systems
 - Atmosphere
 - c. Other landscape systems: bio-geographical sub-units, rivers basins, coastal systems, ecological networks
- 1.2.2 Accounting units
 - a. Functional units
 - a.1 Basic balances of stocks and flows*
 - System units: units by size, surface, length, srkm (standard river km), m³, mass
 - Components: C, N, P, biomass, water, species, populations, habitats, land cover
 - a.2 State accounts (Ecosystem Distress Syndrome method)*
 - Health / distress diagnosis: vigor, organization, resilience, independence, support to healthy populations
 - Stress / pressure
 - Ecological rating

- b. Ecosystem services
 - ecosystem functions and ecosystem services – matrix
 - ecosystem services and commodities – matrix
 - ecosystem services and land use functions - matrix
- c. Reporting units
 - Individual socio-ecological systems
 - Geographical units: natural and administrative regions
 - Institutional and other statistical units: sectors, branches, products

1.3 Valuation of services and maintenance/restoration costs

- 1.3.1 Market commodities, primary goods and services – market prices, statistics, production accounts
- 1.3.2 Final use of free ecosystem services
 - Individual and collective use
 - Scale issue
- 1.3.3 Maintenance costs – full cost of products
 - a. Actual environmental protection expenditure – ecosystem protection, management, restoration
 - b. Additional allowances for non-covered depreciation (repositioning costs)
 - Principle
 - Case of ecosystem cost contents in imports
 - Computation

1.4 Integration and Aggregates

- 1.4.1 Integration of Ecosystem accounts with NAMEA/ hybrid accounts
 - Sector analysis, values and costs
 - NAMEA's environmental themes and impacts on ecosystems
 - NAMEA for ecosystem services
- 1.4.2 Integration of Ecosystem accounts with Material and Energy Flows Accounts
- 1.4.3 Integration with environmental protection expenditure accounts
- 1.4.4 Ecosystem accounts and aggregated physical (composite) indicators: LEAC/Land Ecological Potential, HANPP, Ecological Footprint...
- 1.4.5 Ecosystem accounts and monetary aggregates:
 - Value of end use free ecosystem services and Inclusive Final Consumption (IFC),
 - Additional repositioning (maintenance and restoration) cost of domestic and external ecosystems and Full Cost of Goods and Services (FCGS – including ecosystem cost of imports) and Full Cost of Final Demand (FCFD – imports minus exports)
 - Ecosystem sustainability gap
- 1.4.6 Aggregation of socio-ecosystems and double counting issues

Chapter 2 Implementation of ecosystem accounts

2.1 One framework, three scales

- Action, government and global scales
- Action scale (local government, companies): coordinated guidelines, accounting charts
- Government scale: integrated accounts, economic national accounts and ecosystems – central level of SEEA
- Global scale: simplified accounts based on global monitoring and international statistics
- Vertical integration between scales

2.2 Data and partners

2.2.1 Spatial data

- a. Land cover change:
 - Corine Land Cover, GlobCorine and other satellite programmes (GEO/GEOSS)
 - Cadastre data
 - Statistical surveys
- b. Thematic classification of satellite images:
 - Global monitoring: e.g. NPP, leaf index, soil humidity, forest fires, forest structure, atmosphere and ocean global monitoring...
 - High resolution data: site data (e.g. A/DUE topical data), soil sealing, forest mapping
- c. Spatial data infrastructure: rivers, DEM, coastline, administrative limits, roads

2.2.2 In situ monitoring data (Nature, water,

2.2.3 Administrative data (Nature conservation, legal reporting...)

2.2.4 Statistical data

- a. In accounting format
- b. From surveys
- c. Local statistics
- d. Reallocations (modelling) of statistics to grids and/or to geographical breakdowns (population, nutrient surplus from agriculture)
- e. Import and export statistics

2.2.5 Cooperative networks

- a. Scientific networks
- b. International organisations – UNSD/UNCEEA, UNEP, FAO, OECD
- c. other networks

2.3 Spatial analysis

2.3.1 Mapping functional units at typical scales

- a. global/continental scales
- b. regional scales
- c. local socio-ecosystems

- c.1 individual assessment
- c.2 statistical assessment
- 2.3.2 LEAC/ land cover
 - a. Change in land cover
 - b. Measurement of ecosystem potentials and land use “temperatures”
- 2.3.3 Rivers and river basins/ catchments
- 2.3.4 Soil “digital functional mapping”
- 2.3.5 Spatially distributed (grid) stock and flow data
- 2.3.6 Coastal and marine water

2.4 Statistical analysis

- 2.4.1 Assimilation of monitoring data
- 2.4.2 Assimilation of socio-economic statistics
- 2.4.3 Case of import statistics: virtual contents analysis
 - Ecosystem repositioning costs in exporting countries
 - Virtual land use, ecological footprint
 - Virtual water

2.5 Capacity building

- Spatial analysis
- Statistical analysis
- IT support
- Institutional collaboration

Chapter 3 Synthesis and Reporting

3.1 Synthesis of physical accounts

- 3.1.1 Stocks, flows and integrity of the natural capital/ecosystem assets
- 3.1.2 Ecosystem Services
- 3.1.3 Stress/pressure indicators, impacts

3.2 Monetary values and costs

- 3.2.1 Market values of primary products
- 3.2.2 Value of (main) non-market end use ES
 - a. Site surveys, “one by one” approach and ecosystem multi-functionality
 - b. Extrapolation of site data, “benefit transfers” (possibility and boundary condition), limits to aggregation
 - c. Inclusive Final Consumption
- 3.2.3 Costs of maintenance/restoration of the natural capital
 - a. Protection and management expenditure
 - b. Measurement of gaps between policy objectives and actual ecosystem state (distance to target) – physical assessment
 - c. Valuation of additional costs for bridging gaps – computation of ecosystem repositioning costs (maintenance and restoration)
 - d. Aggregates of costs (additional cost):
 - Additional cost of maintenance/restoration of domestic ecosystems (amortisation, environmental liability, debt...)

- Additional cost of maintenance/restoration of external ecosystems non covered by import values (environmental liability to the rest of the world)
- Full Cost of Goods and Services and Full Cost of Final Demand

Part B - Accounts by dominant ecosystem types

Chapter 4 Land cover accounts

(accounting infrastructure for functional landscapes; LEAC methodology)

Chapter 5 Urban ecosystems

Chapter 6 Cropland systems

Chapter 7 Pasture, mosaics and natural grassland systems

Chapter 8 Forest ecosystems

Chapter 9 Non cultivated dryland, sparse vegetation and bare soils

Chapter 10 Wetlands

Chapter 11 Lakes and rivers

Chapter 12 Soil

Chapter 13 Sea

Chapter 14 Atmosphere

Chapter 15 Regional approaches (mountains, coastal zones, islands, catchments, biogeographic zones)