System of Environmental Economic Accounting
Introduction to Ecosystem Accounting

United Nations Statistics Division
Content

• Overview and background
• Basic concepts and definitions
• Accounts
The System of Environmental Economic Accounting (SEEA)

- The SEEA Central Framework was adopted as an international statistical standard by the UN Statistical Commission in 2012 to measure the environment and its relation with the economy.

- The SEEA Experimental Ecosystem Accounting complements the Central Framework and represents international efforts toward coherent ecosystem accounting.
Two Different Perspectives

SEEA Central Framework:
Individual environmental assets/resources
- Timber
- Water
- Soil
- Fish

SEEA Experimental Ecosystem Accounts:
Ecosystem assets (spatially based)
- Forests
- Lakes
- Agricultural areas

Ecosystem Assets are environmental assets viewed from a systems perspective
SEEA EEA: Background

- Complements SEEA Central Framework with focus on ecosystems perspective
- Developed as part of broader process of revising SEEA 2003
- Integrated statistical framework for accounting for ecosystem assets and associated ecosystem services
- Not a statistical standard – “Experimental” for now
- EEA Revision by 2020 launched
Relationship to SEEA Central Framework

- Extends range of flows (production boundary) for accounting compared to SNA and SEEA in physical and monetary terms.
- Many flows from Central Framework also included in Experimental Ecosystem Accounting (e.g. flows of timber), but extension of EEA is to attribute flows to spatial areas.
- Some Central Framework natural input flows are excluded from Experimental Ecosystem Accounting (e.g. mineral and energy resources).
Key concepts: definitions
Ecosystem assets are spatial areas containing a combination of biotic and abiotic components and other characteristics that function together:

- Ecosystems are considered assets because they support not only economic production, but also our well-being, health and security.
- Potential ecosystem assets include forests, wetlands, agricultural areas, rivers and coral reefs.

Example: A forest is an area that:

- Can be located on a map (spatial)
- Contains trees, shrubs, grasses, soil biota, birds, mammals, insects… functioning together with
- The soil, water, geology (rocks), sunlight, wind…
Ecosystem accounting framework

1. Ecosystem asset (1)
   - Ecosystem characteristics and processes (2)
     - Final ecosystem services (3)
       - Benefits - SNA & non-SNA (4)
         - Users – Economic units (businesses, households, government) (5)
           - Individual & societal well-being (6)

2. Human inputs (e.g. labour, produced assets)

3. Environmental restoration & impact
   - Other ecosystem assets
     - Intermediate ecosystem services
**The Ecosystem Services Cascade**

**Ecosystem services** are the contribution of ecosystems to benefits for people...

1. **Biophysical structures** (e.g., forests and wetlands), composition and processes (e.g., photosynthesis and competition) **support ecosystem function** (growth of biomass) which **generate ecosystem services**.

2. **Services**, when used (capital as well as labor is applied) **generate benefits**, which can be valued.

3. The use of ecosystem services for generating benefits, in turn, **puts pressure on the biophysical structures and processes** (e.g., by degradation or conversion).

Source: Nottingham School of Geography
Ecosystem accounting is spatial

• Ecosystems are different and function differently depending on where they are
• Their capacity to supply services depends on their location
• The benefits of many services depends on whether or not the ecosystems are accessible
• Therefore…Ecosystem accounting needs to integrate spatial and non-spatial data
• For example, wetlands in northern Canada may have the capacity to purify water, but there is no population there to benefit from it.
Ecosystem accounts
Connections between ecosystem and related accounts and concepts

**Accounts in Physical Terms**
1. Ecosystem extent account
2. Ecosystem condition account
3. Ecosystem services supply and use account - physical

**Tools:**
Classifications, Spatial units, scaling & aggregation, Biophysical modelling

**Accounts in Monetary Terms**
4. Ecosystem services supply and use account - monetary
5. Ecosystem monetary asset account

**Tools:** Valuation techniques

**Thematic accounts**
- Land
- Water
- Carbon
- Biodiversity

**Integrated accounts**
- Combined presentations
- Extended supply and use accounts
- Sequence of accounts
- Balance sheets

SEEAA
Broad steps in ecosystem accounting

a. Steps in physical terms

- Ecosystem extent (by ecosystem type)
- Ecosystem condition (by ecosystem type)
- Ecosystem services supply (by ecosystem type)
- Ecosystem services use and benefits (economic units – incl. h/holds)

b. Steps in monetary terms

- Ecosystem services supply and use values
- Ecosystem asset values (by ecosystem type)
- Integrated accounts
  - Combined presentations
  - Extended supply & use tables
  - Sequence of sector accounts
  - Balance sheets
# Ecosystem extent account

## Maps

## Ecosystem type

### Spatial units

### Classifications

## Proxy ecosystem type (based on land cover)

<table>
<thead>
<tr>
<th>Artificial surfaces</th>
<th>Herbaceous crops</th>
<th>Woody crops</th>
<th>Multiple or hayed crops</th>
<th>Grassland</th>
<th>Tree-covered areas</th>
<th>Shrub-covered areas</th>
<th>Regularly flooded areas</th>
<th>Sparse natural vegetated areas</th>
<th>Terrestrial barren land</th>
<th>Permanent snow and glaciers</th>
<th>Inland water bodies</th>
<th>Coastal water and inter-tidal areas</th>
<th>TOTAL</th>
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### Opening extent

**Additions to extent**
- Managed expansion
- Natural expansion
- Upward reappraisals

**Reductions in extent**
- Managed regression
- Natural regression
- Downward reappraisals

**Net change in extent**

### Closing extent
Types of spatial units

BSU

Ecosystem Accounting Area (EAA)

ET1 (EA1)

ET2 (EA2)

ET4 (EA4)

ET3 (EA3)

ET2 (EA5)

ET3 (EA6)
Ecosystem condition account

• What?
  > Ecosystem condition reflects the overall quality of an ecosystem asset, in terms of its characteristics. (SEEA EEA paragraph 2.34)

• Why?
  > Policies to limit degradation of natural heritage, rehabilitation of degraded ecosystems
  > Links to capacity to produce services (Services Supply)
  > Indicators:
    - Indices of condition ➔ change over time ➔ where changes
    - Good/bad condition (exceeding “safe” levels) ➔ where
Ecosystem condition account

- What does a Condition Account look like

Maps

- Carbon
- Water
- Soil
- Biodiversity
- Vegetation

Tables

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<th>Proxy ecosystem type (based on land cover)</th>
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Example indicators of condition

- Vegetation (e.g., native cover): Opening condition, Closing condition
- Water quality (e.g., turbidity, pH): Opening condition, Closing condition
- Soil (e.g., erosion, pH, nutrients): Opening condition, Closing condition
- Carbon (e.g., net primary productivity): Opening condition, Closing condition
- Biodiversity (e.g., species richness): Opening condition, Closing condition
- Habitats (e.g., fragmentation): Opening condition, Closing condition
- Overall index of condition: Opening condition, Closing condition

Scaling & aggregation
Ecosystem services supply

• **What?**
  - Physical flows of “final” ecosystem **services** from ecosystems to beneficiaries
  - Directly used by (or affect) people

• **Why?**
  - Inform policies of contribution of ecosystems to human well-being
  - Assess trade-offs between development and conservation
  - Link to standard economic production measures in SNA
  - Link to other SEEA-EEA accounts (**Condition, Services Use, Monetary Ecosystem Services; Ecosystem Monetary Asset** valuation)
  - Indicators:
    - Flows of individual services (physical and monetary) ➔ change
    - Indices of aggregated services by ecosystem type ➔ change
Types of ecosystem services

**Provisioning Services**
- Goods that can be harvested from, or extracted from ecosystems
- Example: providing fish for fisheries, or providing wood for timber harvest

**Regulating Services**
- The regulation of climate, hydrological, ecological and soil processes
- Example: pollination, carbon sequestration, flood control

**Cultural Services**
- The non-material benefits provided by ecosystems
- Example: recreation, tourism, providing a setting for cultural or religious practices
Ecosystem services supply account

Maps

- Ecosystem extent
- Provisioning
- Regulating
- Cultural

Tables

<table>
<thead>
<tr>
<th>Ecosystem type</th>
<th>Type of service</th>
<th>Urban and associated</th>
<th>Forest tree cover</th>
<th>Agricultural land</th>
<th>Open wetlands</th>
</tr>
</thead>
<tbody>
<tr>
<td>Provisioning</td>
<td>e.g., tonnes of timber</td>
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<td></td>
<td>e.g., tonnes of wheat</td>
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<tr>
<td>Regulating</td>
<td>e.g., tonnes of CO₂ stored / released</td>
<td>e.g., tonnes of CO₂ stored / released</td>
<td>e.g., tonnes of CO₂ stored / released</td>
<td>e.g., tonnes of P absorbed</td>
<td></td>
</tr>
<tr>
<td>Cultural</td>
<td>e.g., hectares of parkland</td>
<td>e.g., number of visitors / hikers</td>
<td></td>
<td></td>
<td>e.g., hectares of duck habitat</td>
</tr>
</tbody>
</table>

Look up tables
Biophysical modelling

Valuation

Monetary Services Supply
Example: Netherlands

7.3.1 Land by use category Roerdalen

Air quality regulation (t PM_{10}/km²/yr)
- High: 5.7
- Low: 0

Carbon sequestration (tC/ha/yr)
- High: 1.45
- Low: 0

Cycling recreation (trips/ha/yr)
- High: 891
- Low: 0

SEEA
Example: Central Kalimantan

Carbon storage

Model used

Look Up Tables (every land cover class is attributed a specific carbon storage value)

Timber production

Kriging
(values are interpolated from samples)

High : 1.67 m³/ha/year
Low : 0.42 m³/ha/year

Source: Sumarga and Hein, 2014
Other issues

• Valuation in monetary terms
• Thematic accounts
  > Biodiversity
  > Carbon
  > Water
THANK YOU
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