A transaction based approach to defining and measuring ecosystem services

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Environmental-Economic Accounting

**CORE MODEL**

- Single *asset* framework applied to different landscapes and ecosystem types
- Assess impact of human activity on extent and *condition*
- Asset and condition combine to produce *ecosystem services*
- **Benefits** to economic and social-wellbeing
  - Evaluate benefits and tradeoffs among different ecosystem uses
Contrasting approaches ecosystem services

• **MA 2005 – Benefits approach – RHS of the core model**
  • provisioning, supporting, regulating, cultural

• **CBD – Ecological approach – LHS of the core model**
  • ecosystem approach is one based on the application of appropriate scientific methodologies focused on levels of biological organization, encompassing the essential structure, processes, functions and interactions among organisms and their environment.

• **CICES – Extended benefits approach – RHS of the core model**
  • Extension of the MA 2005 to include the cascade model
  • Incorporating ecosystems and functions
  • provisioning, supporting, regulating, cultural
Challenge

• Different starting points to define ecosystem services
  • Benefits versus ecological approach
  • Result in different descriptions and definitions of ecosystem services

• Further, the boundary between ecosystems and other elements of the environment make the challenge more complex
  • Soil and ecosystems
  • Economic unit (human activity) and ecosystems

• Both approaches leave a number of issues unresolved from an accounting perspective
  • Intermediate services?, Supporting services?, Links between units and boundaries between units?

• Accounting links between SNA, SEEA CF (AFF) and SEEA EEA?
Environmental units

- Atmosphere
- Biosphere
- Lithosphere

Hydrosphere

Land – economic construct – not an environmental unit
Environmental units – physical transfers (SEEA CF)

- **Atmosphere**
  - *Atmospheric processes*

- **Ecosystem**
  - *Ecosystem processes*

- **Soils**
  - *Soil processes*

- **Ground Water**
  - *Groundwater processes*
Building on SNA construct

- **Economic flows**
  - Creation, transformation,...... Changes in volume and composition

- **Transaction**
  - Economic flows........ between institutional units by mutual agreement
  - Or........ within an institutional unit that is analytically useful to treat like a transaction

- **Production**
  - production is for sale, for own use or is made available to others at little or no cost
Linking economic units (institutions) and environmental units

Soil Water Balance Account:

= +100 irrigation +40 rainfall –90 ecosystem –30 losses +20 storage (t-1) –25 evaporation = +15 storage (t+1)
Environmental Units – processes (production)

• Each unit undertakes processes that have the potential to be services
  • Ecosystem processes
  • Soil processes
  • Atmospheric processes
  • Groundwater processes

• Environmental unit processes
  • Similar to production processes undertaken by institutional units

• Transfers – physical movements between units (water, nitrogen, etc)

• Transaction – between units (including economic) were there has been a transformation – a process has been employed
Ecosystem production (services) model

Ecosystem Unit
- Ecosystem Processes
  - Autotrophs
  - Heterotrophs
  - Decomposers
  - N, P, K, H2O, Transfers

Soil Unit
- Soil Processes
  - Ecosystem products
  - Decomposers
  - Chemical reactions

Final

Inter

Economic Unit (Household)
- Production Processes
  - Ecosystem Products
  - Capital
  - Labor
  - Intermediate Goods
  - Products (Non-SNA Benefit)

Ecosystem Unit
- Ecosystem Processes
  - Autotrophs
  - Heterotrophs
  - Decomposers
  - N, P, K, H2O, Transfers

Final

Inter

Economic Unit (Business)
- Production Processes
  - Ecosystem Products
  - Capital
  - Labor
  - Intermediate Goods
  - Products (SNA Benefit)
## Transaction based ecosystem services

<table>
<thead>
<tr>
<th>Ecosystem Units</th>
<th>Ecosystem Process (Production)</th>
<th>Ecosystem services (Products)</th>
<th>Economic Units</th>
<th>Economic inputs</th>
<th>Economic process</th>
<th>Economic product (benefits)</th>
<th>Final or Intermediate</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Pasture</strong></td>
<td>Biomass accumulation</td>
<td>Grass</td>
<td>Farmer</td>
<td>Fertiliser, labour, machinery, etc.</td>
<td>Grazing</td>
<td>Cow</td>
<td>Final</td>
</tr>
<tr>
<td><strong>Wheat</strong></td>
<td>Biomass accumulation</td>
<td>Wheat plant</td>
<td>Farmer</td>
<td>Fertiliser, labour, machinery, etc.</td>
<td>Farming</td>
<td>Wheat</td>
<td>Final</td>
</tr>
</tbody>
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*Note: The table above illustrates the transaction-based ecosystem services approach. It shows the flow of ecosystems and economic processes, with corresponding economic units and inputs, leading to final or intermediate product benefits.*
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<td>Plantation forest</td>
<td>Biomass accumulation</td>
<td>Trees</td>
<td>Forester</td>
<td>Fertiliser, labour, machinery, etc.</td>
<td>Forestry</td>
<td>Logs</td>
<td>Final</td>
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<td>Biomass accumulation</td>
<td>Water regulation</td>
<td>Society</td>
<td>Weed and pest control</td>
<td>Government management of wetland</td>
<td>Flood protection</td>
<td>Final and Intermediate</td>
</tr>
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<td>Water holding or capture</td>
<td>Water storage</td>
<td>Farmer</td>
<td>Machinery (pump)</td>
<td>Irrigation farmer</td>
<td>Water</td>
<td>Final</td>
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<td>Nutrient capture and processing</td>
<td>Water filtration</td>
<td>Society</td>
<td>Weed and pest control</td>
<td>Government management of wetland</td>
<td>Clean water</td>
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<td>Biomass storage</td>
<td>Carbon storage</td>
<td>Society</td>
<td>Seedling trees</td>
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Accounting linkages

- **SNA**
  - Institutional units (economic units) – trade in land (SEEA CF)
  - Transactions and production – between economic and ecosystem units

- **SEEA CF**
  - Land (economic construct) – ecosystems, soils (Asset), water

- **SEEA EEA**
  - Ecosystems – soil, water
  - Economic units – ecosystems, soils, land, atmosphere, groundwater

*Clarifying accounting units that engage in transactions provides an approach to identifying and measuring ecosystem services*
Thank You
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