Introduction to Core Accounting Principles on SEEA and SNA

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Objectives of the Session

• Define the scope of measurement in the SEEA
  > Defining the economy and the environment
  > The production boundary
  > Economic units – sectors and industries

• The accounting structure of the SEEA

• SEEA Central Framework

• SEEA Experimental Ecosystem Accounting
**SEEA Conceptual Framework**

- **Economic Units**
  - Enterprises
  - Households
  - Government
  - Non-profit institutions

- **Activities**
  - Production
  - Consumption
  - Accumulation

- **Instruments**
  - Financial/Monetary
  - Taxes/subsidies
  - Financing
  - Resource rent
  - Permits

- **Economic Units**

- **Environment**

- **Environment**
  - Natural inputs
  - Ecosystem services

- **Economy**
  - Outside territory of reference

- **Individual Environmental Assets (e.g., land, water, mineral and energy, soil, aquatic)**

- **Ecosystem Assets**

- **Residuals (e.g., emissions, waste)**

- **Exports/Imports**

- **Transboundary Environmental Flows**

- **Outside territory of reference**
Defining the Economy
Defining the “Economy”

- Economic activities
  - Production, Consumption, Accumulation
- Economic products
  - Goods and services
- Economic assets
  - Produced, Non-produced, Financial assets
- Economic units
  - Establishments, enterprises, households, governments
- Economic territory
  - Residence, geographic coverage
Constituents of an Economy?

**Institutional unit**: an entity capable of owning assets, incurring liabilities, carrying out economic activities taking decisions on all aspects of economic life and engaging in transactions with other entities.

**Economic Territory**: The geographic territory administered by the government of the country within which persons, goods, and capital can circulate freely.

The economic territory in which an institutional unit has its centre of predominant economic interest [2008 SNA] is the residence of the unit.
State whether TRUE or FALSE.

1. Foreign students staying for three years are considered residents.

2. A branch of Citi Bank (an American bank) in Tokyo is a resident of Japan.

3. Australian crew of a ship of a Japanese company are residents of Japan.

4. Non-residents are not considered to be owners of immovable assets.

5. All unincorporated businesses without separate accounts belong to the household sector.

6. Branch of a foreign NPI serving residents households is treated as a resident NPISH.

7. Central Bank is part of the general government sector.

8. A branch of a Japanese company in Thailand is resident of Japan.

Q 2. TRUE
Q 4. TRUE
Q 5. TRUE
Q 6. TRUE
Q 7. FALSE
Q 8. TRUE
The Production Boundary

• “Production is an activity carried out ... by an institutional unit that uses inputs of labour, capital and goods and services to produce outputs of goods and services” (2008 SNA, 6.24)

• In practice:
  > Exclude things you do only for yourself
  > Exclude household production of services for itself
    • Except rent of owner-occupiers & wages of domestic staff
  > Include household production of goods for itself
    • Agricultural products, fishing, fuelwood, clothes, furniture, water, energy
  > Include concealed and illegal activity
Physical Flows in the SEEA

**Economy**
- Enterprises
- Households
- Government

- **Natural inputs** (e.g. minerals, energy, timber, fish and water)

- **Products**

- **Residuals** (e.g. air emissions, solid waste, return flows of water)

**Environment**
- Mineral and energy resources
- Timber resources
- Fish resources
- Water resources
- Soil resources
- Land
Types of Output and Production

• Market output
  > Transactions between economic units at market prices

• Non-market output
  > Not transacted at market prices (government education, health)
  > Valued at cost of production

• Own-account production (within establishments)
  > For own final consumption (e.g. subsistence agriculture) : INCLUDED
  > For own final capital formation (e.g. building own house) : INCLUDED
  > For own intermediate consumption : EXCLUDED (except ancillary activity)
Domestic Economy

Institutional Sectors

These are legal entities recognized by law. Includes quasi-corporate, which are not a legal entity.

- Corporate
  - Financial corporate sector
  - Non-financial corporate sector
- General government
- Household sector
- NPISHs

This sector includes all resident household units (which are not legal entities) and all the unincorporated enterprises (not classified as corporation or quasi corporation) owned by them.
Enterprises, Establishments and Industries

- Enterprises
  - Institutional units from the perspective of being producers of goods and services

- Establishments
  - Enterprises in a single location performing a single or predominant type of productive activity

- Industries
  - Groupings of establishments undertaking similar types of productive activity
Key Messages

• Many aspects to defining the economy
• Measurement boundaries are important to understand
  > Production boundary key determinant of the size of GDP
• Own-account activity needs special consideration
• Economic (institutional) units can be seen from two key perspectives
  > Institutional sector: Similar economic behaviours / legal basis
  > Industry: Similar productive activities
Defining Environmental Assets
The SEEA Central Framework Accounts

1. **Stock accounts** for environmental assets: natural resources and land
   - physical (e.g. fish stocks and changes in stocks) and/or monetary values (e.g. value of natural capital, depletion)

2. **Flow accounts**: supply and use tables for products, natural inputs and residuals (e.g. waste, wastewater) generated by economic activities.
   - physical (e.g. m$^2$ of water) and/or monetary values (e.g. permits to access water, cost of wastewater treatment, etc.)

3. **Activity / purpose accounts** that explicitly identify environmental transactions already existing in the SNA.
   - e.g. Environmental Protection Expenditure (EPE) accounts, environmental taxes and subsidies

4. **Combined physical and monetary accounts** that bring together physical and monetary information for derivation indicators, including depletion adjusted aggregates
Discussion:

What “Things” Might be Considered Environmental Assets?
Definition of Environmental Assets

“Environmental assets are the naturally occurring living and non-living components of the Earth, together constituting the bio-physical environment, which may provide benefits to humanity.”
Definition of Environmental Assets

Individual environmental assets / resources

Timber
Water
Soil
Fish

Ecosystems

Forests
Lakes
Agricultural areas
## Scope of Individual Resources

1. **Mineral and energy resources**
   - 1.1 Oil resources
   - 1.2 Natural gas resources
   - 1.3 Coal and peat resources
   - 1.4 Non-metallic mineral resources (excluding coal and peat resources)
   - 1.5 Metallic mineral resources

2. **Land**

3. **Soil resources**

4. **Timber resources**
   - 4.1 Cultivated timber resources
   - 4.2 Natural timber resources

5. **Aquatic resources**
   - 5.1 Cultivated aquatic resources
   - 5.2 Natural aquatic resources

6. **Other biological resources** (excluding timber resources and aquatic resources)

7. **Water resources**
   - 7.1 Surface water
   - 7.2 Groundwater
   - 7.3 Soil water
Physical and Monetary Scope

• In principle, when accounting for environmental assets in physical terms include all environmental assets whether or not they have a monetary value
  > All land in a country is included in physical land accounts
  > Also timber resources, other biological resources, soil, inland water resources

• Mineral and energy resources scope is known deposits

• Aquatic resources scope is all resources within EEZ plus rights on high seas
  > In practice limit to commercial stocks and subsistence
Key Points and Boundary Issues

• Distinct treatment of land
  > Account for its provision of space / area not the resources that are within it

• Include natural and cultivated biological resources

• Oceans and atmosphere excluded

• Stocks of potential energy from renewable sources excluded
  > E.g. solar, wind, tidal power
  > Slight exception for hydropower
Ecosystem Assets

• Areas comprising combinations of individual resources (timber, soil, water, etc) but also having ecological processes and characteristics

• Aim to assess
  > Condition of the ecosystem within an area (i.e. how is it functioning, quality of processes)
  > Flow of ecosystem services to economic and human activity

• Ecosystem asset accounting measures environmental impact rather than environmental pressures
Economic and Environmental Assets

ECONOMIC ASSETS
- Produced assets
  - Fixed assets & inventories
- Non-produced assets
  - Contracts, marketing assets, etc.
- Financial assets

ENVIRONMENTAL ASSETS
- Produced assets
  - Cultivated biological resources
- Non-produced assets
  - Natural resources & land
- Natural resources & land with no economic benefits (e.g. barren land, known mineral deposits without current economic value)
Key Messages

• Environmental assets can be seen from two perspectives: individual resources & ecosystems

• Both natural and cultivated resources are included in scope

• Scope is generally broader in physical terms than in monetary terms

• Land is accounted for in terms of area/space
Exercise:

Defining the scope of measurement
The Structure of Accounts
Sequence of Accounts

- Describes sequence of interconnected flow accounts linked to different types of economic activity taking place within a given period of time, together with balance sheets that record the values of the stocks of assets and liabilities held by institutional units or sectors at the beginning and end of the period.
- Each flow relates to a particular kind of activity such as production, or the generation, distribution, redistribution or use of income.
Sequence of Accounts

Links between the Accounts

Production Account

Income Accounts

Capital Account (non-financial assets)

Financial Account (financial assets/ liabilities)

GDP

savings

Transaction Accounts

Opening Balance Sheet

Other Economic flows

Closing Balance Sheet
SNA framework

Industries

- Industrial output of goods and services
- Industrial intermediate demand

Final demand

- Gross fixed capital formation
- Financial and produced assets, opening balance

Assets

- Financial and produced assets, closing balance
- Other changes in volume & holding gains/losses on financial & produced assets

Sectors

Commodities

Wastes
## SEEA framework

### Sectors

- **Industries**
  - Industrial output of goods and services
  - Industrial intermediate demand
  - Resource production by industries
  - Resource use by industries
  - Waste consumption by industries
  - Waste output by industries
  - Waste output by households/gov’t

- **Final demand**
  - Environmental protection expenditures
  - Final demand
  - Resource production by households/gov’t
  - Resource use by households/gov’t
  - Waste consumption by households/gov’t

- **Assets**
  - Financial and produced assets, opening balance
  - Natural resource assets, opening balance
  - Natural resource assets, closing balance
  - Changes in natural resource assets
  - Changes in and holding gains/losses on natural resource assets
  - Financial and produced assets, closing balance
  - Natural resource assets, closing balance
  - Other changes in volume & holding gains/losses on financial & produced assets
  - Changes in and holding gains/losses on natural resource assets

### Commodity flows

- Resource production by industries
- Resource use by industries
- Resource production by households/gov’t
- Resource use by households/gov’t

### Waste flows

- Waste consumption by industries
- Waste consumption by households/gov’t
- Waste output by industries
- Waste output by households/gov’t

### Changes in volume and holding gains/losses

- Other changes in volume & holding gains/losses on financial & produced assets
- Changes in and holding gains/losses on natural resource assets
Supply and Use Tables

- Matrices that record how supplies of different kinds of goods and services originate from domestic industries and imports and how those supplies are allocated between various intermediate or final uses, including exports.
- Involve the compilation of a set of integrated production and generation of income accounts for industries by drawing upon detailed data from industrial censuses or surveys.
- Provide an accounting framework within which the product flow method of compiling national accounts, whereby the total supplies and uses of individual types of goods and services have to be balanced with each other, can be systematically exploited.
## Basic Supply and Use Table

<table>
<thead>
<tr>
<th></th>
<th>Industries</th>
<th>Households</th>
<th>Government</th>
<th>Accumulation</th>
<th>Rest of the world</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Supply table</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Products</td>
<td>Output</td>
<td></td>
<td></td>
<td></td>
<td>Imports</td>
<td>Total supply</td>
</tr>
<tr>
<td><strong>Use table</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Products</td>
<td>Intermediate consumption</td>
<td>Household final consumption</td>
<td>Government final consumption</td>
<td>Gross capital formation (incl. changes in inventories)</td>
<td>Exports</td>
<td>Total use</td>
</tr>
<tr>
<td></td>
<td>Value added</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The table represents the basic supply and use framework, detailing the flow of goods and services from industries to households, government, accumulation, and the rest of the world, with imports and total supply. Similarly, it tracks the use of these goods and services through intermediate consumption, household final consumption, government final consumption, gross capital formation, and exports, leading to total use and value added.
Supply table – show the flows relating to the production, generation, and supply of natural inputs, products and residuals by different economic units by different economic units or the environment

<table>
<thead>
<tr>
<th>Natural inputs</th>
<th>Products</th>
<th>Residuals</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Production; Generation of residuals</td>
<td>Accumulation</td>
<td>Flows from the environment</td>
<td>Total Supply of Natural Inputs (TSNI)</td>
</tr>
<tr>
<td>Production; Generation of residuals by industries (incl. household production on own account) - classified by ISIC</td>
<td>Generation of residuals by households - classified by ISIC</td>
<td>A. Flows from the environment (incl. natural resource residuals)</td>
<td>Total Supply of Natural Inputs (TSNI)</td>
</tr>
<tr>
<td>Flows from the rest of the world</td>
<td>Flows from the environment</td>
<td>B. Imports of products</td>
<td>Total Supply of Products (TSP)</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Use table – show the flows relating to the consumption and use of nature inputs, products and residual by different economic units or the environment

<table>
<thead>
<tr>
<th>Natural inputs</th>
<th>Products</th>
<th>Residuals</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intermediate consumption of products; Use of natural inputs; Collection of residuals</td>
<td>Final consumption*</td>
<td>Accumulation</td>
<td>Flows to the rest of the world</td>
</tr>
<tr>
<td>Industries - classified by ISIC</td>
<td>Industries - classified by ISIC</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Natural inputs</td>
<td>Products</td>
<td>Residuals</td>
<td>Total</td>
</tr>
<tr>
<td>Extraction of natural inputs</td>
<td>Intermediate consumption (incl. purchase of recycled and reused products)</td>
<td>Household final consumption (incl. purchase of recycled and reused products)</td>
<td>Accumulation</td>
</tr>
<tr>
<td>B. Extraction used in production</td>
<td>F. Household final consumption (incl. purchase of recycled and reused products)</td>
<td>G. Gross Capital Formation (incl. fixed assets and inventories)</td>
<td>H. Exports of products</td>
</tr>
<tr>
<td>B2. Natural resource residuals</td>
<td>O. Accumulation of waste in controlled landfill sites</td>
<td>P. Residuals sent to the rest of the word</td>
<td>Q. Residual flows to the environment</td>
</tr>
<tr>
<td></td>
<td>Q1. Direct from industry and households (incl. natural resource residuals &amp; landfill emissions)</td>
<td>Q2. Following treatment</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Total Use of Natural Inputs (TUNI)</td>
<td>Total Use of Products (TUP)</td>
<td>Total Use of Residuals (TUR)</td>
</tr>
</tbody>
</table>

Total use
**Integration of Asset Accounts and Supply and Use Tables (1/2)**

**Supply table in monetary terms**

<table>
<thead>
<tr>
<th>Products</th>
<th>Output</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Industries – classified by ISIC</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Government final consumption expenditure</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gross capital formation</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Flows from the Rest of the World</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Use in monetary terms**

<table>
<thead>
<tr>
<th>Products</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Industries – classified by ISIC</td>
<td></td>
</tr>
<tr>
<td>Household final consumption expenditure</td>
<td></td>
</tr>
<tr>
<td>Government final consumption expenditure</td>
<td></td>
</tr>
<tr>
<td>Gross capital formation</td>
<td></td>
</tr>
<tr>
<td>Flows to the Rest of the World</td>
<td></td>
</tr>
</tbody>
</table>

**Supply table in physical terms**

<table>
<thead>
<tr>
<th>Natural inputs</th>
<th>Output</th>
<th>Residuals</th>
</tr>
</thead>
<tbody>
<tr>
<td>Products</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Industries (including household production on own account) – classified by ISIC</td>
<td>Generation of residuals by households</td>
<td></td>
</tr>
<tr>
<td>Residuals generated by industry</td>
<td>Residuals generated by household final consumption</td>
<td></td>
</tr>
<tr>
<td>Residuals from scrapping &amp; demolition of produced assets</td>
<td>Emissions from controlled landfill sites</td>
<td></td>
</tr>
<tr>
<td>Imports</td>
<td>Residuals received from rest of the world</td>
<td>Residuals recovered from the environment</td>
</tr>
</tbody>
</table>

**Use in physical terms**

<table>
<thead>
<tr>
<th>Natural inputs</th>
<th>Intermediate consumption; Use of natural inputs; Collection of residuals</th>
<th>Final consumption</th>
<th>Accumulation</th>
<th>Flows to the Rest of the World</th>
<th>Flows to the Environment</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Industries – classified by ISIC</td>
<td></td>
<td></td>
<td></td>
<td>Flows from the Rest of the World</td>
<td>Flows from the Environment</td>
<td></td>
</tr>
<tr>
<td>Extraction of natural inputs</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Household final consumption</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gross capital formation</td>
<td></td>
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<tr>
<td>Exports</td>
<td></td>
<td></td>
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<td></td>
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</tr>
<tr>
<td>Residuals sent to the rest of the world</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Residual flows to the environment</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### Integration of Asset Accounts and Supply and Use Tables (2/2)

<table>
<thead>
<tr>
<th>Asset accounts (Physical and monetary terms)</th>
<th>Produced assets</th>
<th>Environmental assets</th>
</tr>
</thead>
<tbody>
<tr>
<td>Industries &amp; Households &amp; Government &amp; Rest of the world</td>
<td>Imports</td>
<td>Exports</td>
</tr>
<tr>
<td>Monetary supply and use table</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Product-supply</td>
<td>Output</td>
<td></td>
</tr>
<tr>
<td>Product-use</td>
<td>Intermediate consumption</td>
<td>Household final consumption expenditures</td>
</tr>
<tr>
<td>Imports</td>
<td>Exports</td>
<td>Gross capital</td>
</tr>
<tr>
<td>Physical supply and use table</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Natural inputs-supply</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Natural inputs-use</td>
<td>Inputs of natural resources</td>
<td></td>
</tr>
<tr>
<td>Imports</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Product-supply</td>
<td>Output</td>
<td></td>
</tr>
<tr>
<td>Product-use</td>
<td>Intermediate consumption</td>
<td>Household final consumption</td>
</tr>
<tr>
<td>Imports</td>
<td>Exports</td>
<td>Gross capital formation</td>
</tr>
<tr>
<td>Residuals-supply</td>
<td>Residuals generated by industry</td>
<td>Residuals generated by household final consumption</td>
</tr>
<tr>
<td>Residuals-use</td>
<td>Collection and treatment of waste and other residuals</td>
<td></td>
</tr>
<tr>
<td>Imports</td>
<td>Residuals sent to the rest of the world</td>
<td></td>
</tr>
<tr>
<td>Revaluations</td>
<td>Closing stock</td>
<td></td>
</tr>
</tbody>
</table>

Source: SEEA
**Table 378-0005**

Natural resource assets and produced assets
annual (dollars x 1,000,000)

<table>
<thead>
<tr>
<th>Categories</th>
<th>2008</th>
<th>2009</th>
<th>2010</th>
<th>2011</th>
<th>2012</th>
</tr>
</thead>
<tbody>
<tr>
<td>Non-financial assets</td>
<td>7,412,200</td>
<td>6,629,425</td>
<td>7,313,829</td>
<td>7,960,934</td>
<td>8,041,096</td>
</tr>
<tr>
<td>Produced non-financial assets</td>
<td>4,187,815</td>
<td>4,246,166</td>
<td>4,408,493</td>
<td>4,635,292</td>
<td>4,895,157</td>
</tr>
<tr>
<td>Residential structures</td>
<td>1,654,058</td>
<td>1,687,356</td>
<td>1,778,316</td>
<td>1,871,006</td>
<td>1,980,938</td>
</tr>
<tr>
<td>Non-residential structures</td>
<td>1,319,709</td>
<td>1,328,319</td>
<td>1,393,163</td>
<td>1,489,886</td>
<td>1,588,777</td>
</tr>
<tr>
<td>Machinery and equipment</td>
<td>311,551</td>
<td>324,913</td>
<td>304,853</td>
<td>307,726</td>
<td>325,358</td>
</tr>
<tr>
<td>Intellectual property products</td>
<td>186,567</td>
<td>189,216</td>
<td>193,329</td>
<td>199,999</td>
<td>207,612</td>
</tr>
<tr>
<td>Consumer durable goods</td>
<td>465,860</td>
<td>476,435</td>
<td>495,912</td>
<td>513,720</td>
<td>525,196</td>
</tr>
<tr>
<td>Inventories</td>
<td>244,505</td>
<td>233,382</td>
<td>236,050</td>
<td>249,915</td>
<td>259,899</td>
</tr>
<tr>
<td>Weapons Systems</td>
<td>5,565</td>
<td>6,545</td>
<td>6,870</td>
<td>7,040</td>
<td>7,377</td>
</tr>
<tr>
<td>Non-produced non-financial assets</td>
<td>3,202,382</td>
<td>2,383,259</td>
<td>2,903,336</td>
<td>3,321,642</td>
<td>3,149,329</td>
</tr>
<tr>
<td>Land</td>
<td>1,805,153</td>
<td>1,931,790</td>
<td>2,037,456</td>
<td>2,202,114</td>
<td>2,360,816</td>
</tr>
<tr>
<td>Timber</td>
<td>131,789</td>
<td>71,567</td>
<td>122,276</td>
<td>120,499</td>
<td>113,133</td>
</tr>
<tr>
<td>Subsoil resource stocks</td>
<td>1,291,443</td>
<td>379,902</td>
<td>745,604</td>
<td>999,029</td>
<td>671,990</td>
</tr>
<tr>
<td>Selected energy resources¹</td>
<td>987,017</td>
<td>256,900</td>
<td>516,642</td>
<td>679,642</td>
<td>441,628</td>
</tr>
<tr>
<td>Selected mineral resources²</td>
<td>304,426</td>
<td>123,002</td>
<td>228,962</td>
<td>319,387</td>
<td>230,862</td>
</tr>
</tbody>
</table>

Footnotes:

1. Includes crude oil, natural gas, crude bitumen and coal.
2. Includes gold, iron, copper, nickel, lead, zinc, molybdenum, uranium, diamonds and potash.
3. Corrections have been made to the following variables for 1990 to 2012: Selected energy resources; Subsoil resource stocks; Non-produced non-financial assets; Non-financial assets.

Source: Statistics Canada, Table 378-0005 - Natural resource assets and produced assets, annual (dollars), CANSIM (database), (accessed: 2014-06-06)
Key messages

• All economic stocks and flows can be organized and placed in context

• National accounting is not only output and intermediate consumption

• One account is not sufficient – different questions require a focus on different accounts and balancing items

• The accounting system is complete and internally consistent
The SEEA Central Framework
The SEEA Central Framework Accounts

1. **Stock accounts** for environmental assets: natural resources and land
   - physical (e.g. fish stocks and changes in stocks) and/or monetary values (e.g. value of natural capital, depletion)

2. **Flow accounts**: supply and use tables for products, natural inputs and residuals (e.g. waste, wastewater) generated by economic activities.
   - physical (e.g. m² of water) and/or monetary values (e.g. permits to access water, cost of wastewater treatment, etc.)

3. **Activity / purpose accounts** that explicitly identify environmental transactions already existing in the SNA.
   - e.g. Environmental Protection Expenditure (EPE) accounts, environmental taxes and subsidies

4. **Combined physical and monetary accounts** that bring together physical and monetary information for derivation indicators, including depletion adjusted aggregates
## Asset accounts

<table>
<thead>
<tr>
<th>Asset accounts</th>
<th>Topics covered (detailed definition)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mineral and energy resources</td>
<td>Physical and monetary accounts for minerals and energy stocks (oil, natural gas, coal and peat, non-metallic minerals and metallic minerals) (CF 5.172)</td>
</tr>
<tr>
<td>Land</td>
<td>Physical and monetary accounts for land, land cover, land use and forest (CF 5.235)</td>
</tr>
<tr>
<td>Soil resources</td>
<td>Area and volume of soil resources (CF 5.318)</td>
</tr>
<tr>
<td>Timber resources</td>
<td>Physical and monetary accounts for timber resources (CF 5.343)</td>
</tr>
<tr>
<td>Aquatic resources</td>
<td>Physical and monetary accounts for fish, crustaceans, molluscs, shellfish and other aquatic organisms such as sponges and seaweed as well as aquatic mammals such as whales. (CF 5.393) (CO2, pollutants) (CF 3.233)</td>
</tr>
<tr>
<td>Other biological resources</td>
<td>Cultivated animals and plants including livestock, annual crops such as wheat and rice, and perennial crops such as rubber plantations, orchards and vineyards. (CF 5.462)</td>
</tr>
<tr>
<td>Water resources</td>
<td>Stock of water resources (CF 5.471)</td>
</tr>
</tbody>
</table>
# General structure of the physical account for environmental assets (physical units)

<table>
<thead>
<tr>
<th></th>
<th>Mineral &amp; energy resources</th>
<th>Land (incl. forest land)</th>
<th>Soil resources</th>
<th>Timber resources</th>
<th>Aquatic resources</th>
<th>Water resources</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Opening stock of resources</strong></td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td><strong>Additions to stock of resources</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Growth in stock</td>
<td>na</td>
<td>Yes*</td>
<td>Soil formation</td>
<td>Growth</td>
<td>Natural growth</td>
<td>Growth</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Soil deposition</td>
<td>Natural growth</td>
<td>Natural growth</td>
<td>Precipitation</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Return flows</td>
</tr>
<tr>
<td>Discoveries of new stock</td>
<td>Yes</td>
<td>na</td>
<td>na</td>
<td>na</td>
<td>na</td>
<td>Yes*</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Yes*</td>
</tr>
<tr>
<td>Upwards reappraisals</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes*</td>
<td>Yes*</td>
<td>Yes*</td>
<td>Yes*</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Yes*</td>
<td>Yes*</td>
<td>Yes*</td>
<td>Yes*</td>
</tr>
<tr>
<td>Reclassifications</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td><strong>Total additions to stock</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

## Reductions in stock of resources

<table>
<thead>
<tr>
<th></th>
<th>Extractions</th>
<th>na</th>
<th>Soil extraction</th>
<th>Removals</th>
<th>Removals</th>
<th>Harvest</th>
<th>Gross catch</th>
<th>Abstraction</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal reductions in stock</td>
<td>na</td>
<td>na</td>
<td>Erosion</td>
<td>Natural losses</td>
<td>Natural losses</td>
<td>Natural losses</td>
<td>Normal losses</td>
<td>Normal losses</td>
</tr>
<tr>
<td>Catastrophic losses</td>
<td>Yes*</td>
<td>Yes*</td>
<td>Yes*</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Downwards reappraisals</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes*</td>
<td>Yes*</td>
<td>Yes*</td>
<td>Yes*</td>
<td>Yes</td>
<td>Yes*</td>
</tr>
<tr>
<td>Reclassifications</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>na</td>
</tr>
</tbody>
</table>

## Closing stock of resources

|                               | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |

---

**Note:**
- * indicates new data elements introduced in the physical account framework.
- **Cultivated** and **Natural** columns indicate the classification of resources.
### Example:
Monetary stock accounts for crude bitumen in Canada

**Table 153-0005**

**Value of established crude bitumen reserves**
annual (dollars x 1,000,000)

<table>
<thead>
<tr>
<th></th>
<th>2005</th>
<th>2006</th>
<th>2007</th>
<th>2008</th>
<th>2009</th>
<th>2010</th>
<th>2011</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reconciliation account, established crude bitumen reserves, opening stock</td>
<td>107,560.2</td>
<td>111,305.7</td>
<td>197,972.4</td>
<td>167,541.6</td>
<td>437,070.6</td>
<td>143,720.4</td>
<td>301,647.0</td>
</tr>
<tr>
<td>Reconciliation account, established crude bitumen reserves, additions</td>
<td>1,185.8</td>
<td>105,844.5</td>
<td>11,345.0</td>
<td>89,040.4</td>
<td>68.2</td>
<td>97.3</td>
<td>2,872.7</td>
</tr>
<tr>
<td>Reconciliation account, established crude bitumen reserves, depletion</td>
<td>3,934.1</td>
<td>3,894.6</td>
<td>3,685.9</td>
<td>7,725.0</td>
<td>2,931.7</td>
<td>6,378.5</td>
<td>9,359.3</td>
</tr>
<tr>
<td>Reconciliation account, established crude bitumen reserves, revaluation</td>
<td>6,493.8</td>
<td>-15,283.1</td>
<td>-36,089.8</td>
<td>168,213.5</td>
<td>-290,486.7</td>
<td>164,207.9</td>
<td>81,064.9</td>
</tr>
<tr>
<td>Reconciliation account, established crude bitumen reserves, closing stock</td>
<td>111,305.7</td>
<td>197,972.4</td>
<td>167,541.6</td>
<td>437,070.6</td>
<td>143,720.4</td>
<td>301,647.0</td>
<td>376,225.2</td>
</tr>
</tbody>
</table>

**Footnotes:**

2. For concepts, sources and methods, see "Concepts, Sources and Methods of the Canadian System of Environmental and Resource Accounts", catalogue number 16-505-GPE.
3. The reconciliation account entries are calculated using the present value methodology.
4. Negative values for net price I, net price II and present value are set to zero.

**Source:** Statistics Canada. Table 153-0005 - Value of established crude bitumen reserves, annual (dollars), CANSIM (database). (accessed: 2014-06-06)
## Flows accounts

<table>
<thead>
<tr>
<th>Physical flow accounts</th>
<th>Topics covered (detailed definition)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Full set of supply and use tables for materials</td>
<td>All resources and materials (energy, water, air emissions, water emissions, solid waste) (CF 3.45)</td>
</tr>
<tr>
<td>Economy-wide material flow accounts (MFA)</td>
<td>Supply and consumption of energy; air emissions, water emissions, and solid waste (CF 3.279)</td>
</tr>
<tr>
<td>Physical supply and use tables for water (PSUT water)</td>
<td>Supply (precipitation) and consumption of water (CF 3.186)</td>
</tr>
<tr>
<td>Physical supply and use tables for energy (PSUT energy)</td>
<td>Supply and consumption of energy (CF 3.140)</td>
</tr>
<tr>
<td>Air emissions accounts</td>
<td>Air emissions (CO2, pollutants) (CF 3.233)</td>
</tr>
<tr>
<td>Water emissions accounts</td>
<td>Water emissions (CF 3.257)</td>
</tr>
<tr>
<td>Waste accounts</td>
<td>Solid wastes (CF 3.268)</td>
</tr>
</tbody>
</table>

- CF = Central Framework, white cover edition, refers to paragraph number
## Example: Supply and Use table for Air Emissions

<table>
<thead>
<tr>
<th>Type of substance</th>
<th>Supply table for air emissions</th>
<th>Generation of emissions</th>
<th>Accumulation of emissions</th>
<th>Total supply of emissions</th>
<th>Use table for air emissions</th>
<th>Total use of emissions</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Industries</td>
<td>Households</td>
<td></td>
<td>Flows in the Environment</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Agriculture</td>
<td>Mining</td>
<td>Manufacturing</td>
<td>Transport</td>
<td>Other</td>
</tr>
<tr>
<td>Carbon dioxide</td>
<td></td>
<td>10610.3</td>
<td>2002.2</td>
<td>41424.4</td>
<td>27957.0</td>
<td>82402.4</td>
</tr>
<tr>
<td>Methane</td>
<td></td>
<td>492.0</td>
<td>34.1</td>
<td>15.8</td>
<td>0.8</td>
<td>21.9</td>
</tr>
<tr>
<td>Dinitrogen oxide</td>
<td></td>
<td>23.7</td>
<td>3.5</td>
<td>0.8</td>
<td>0.8</td>
<td>2.6</td>
</tr>
<tr>
<td>Nitrous oxides</td>
<td></td>
<td>69.4</td>
<td>6.0</td>
<td>37.9</td>
<td>259.5</td>
<td>89.0</td>
</tr>
<tr>
<td>Hydrogenocarbons</td>
<td></td>
<td>0.3</td>
<td>0.4</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Perfluorocarbons</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sulphur hexafluoride</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Carbon monoxide</td>
<td></td>
<td>41.0</td>
<td>2.5</td>
<td>123.8</td>
<td>46.2</td>
<td>66.2</td>
</tr>
<tr>
<td>Non-methane volatile organic compounds</td>
<td></td>
<td>5.2</td>
<td>6.5</td>
<td>40.0</td>
<td>16.4</td>
<td>27.2</td>
</tr>
<tr>
<td>Sulphur dioxide</td>
<td></td>
<td>2.7</td>
<td>0.4</td>
<td>28.0</td>
<td>62.4</td>
<td>8.1</td>
</tr>
<tr>
<td>Ammonia</td>
<td></td>
<td>107.9</td>
<td>1.7</td>
<td>0.2</td>
<td>0.9</td>
<td>2.3</td>
</tr>
<tr>
<td>Heavy metals</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Persistent organic pollutants</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Particulates (incl PM10, dust)</td>
<td></td>
<td>7.0</td>
<td>0.1</td>
<td>8.3</td>
<td>9.3</td>
<td>4.4</td>
</tr>
</tbody>
</table>
## Example: Air emission accounts in Denmark

### Air Emission Accounts by industry and type of emission Denmark 2012

<table>
<thead>
<tr>
<th></th>
<th>Carbon dioxide incl. biomass (CO₂), 1000 tonnes</th>
<th>Carbon dioxide excl. biomass (CO₂), 1000 tonnes</th>
<th>Carbon dioxide from biomass (CO₂), 1000 tonnes</th>
<th>Sulfur dioxide (SO₂), tonnes</th>
<th>Nitrogen oxides (NOₓ), tonnes</th>
<th>Ammonia (NH₃), tonnes</th>
<th>Nitrous oxide (N₂O), tonnes</th>
<th>Methane (CH₄), tonnes</th>
<th>Non-methane volatile organic compounds (NMVOC), tonnes</th>
<th>Particulate matter &lt; 10µm (PM₁₀), tonnes</th>
<th>Sulphur hexafluoride (SF₆), tons CO₂-equivalents</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Total</strong></td>
<td>93 274</td>
<td>78 117</td>
<td>15 156</td>
<td>233 261</td>
<td>1089 108</td>
<td>76 222</td>
<td>21 557</td>
<td>262 535</td>
<td>108 838</td>
<td>48 188</td>
<td>117 852</td>
</tr>
<tr>
<td><strong>Households</strong></td>
<td>12 083</td>
<td>7 903</td>
<td>4 180</td>
<td>1 608</td>
<td>20 164</td>
<td>1 501</td>
<td>319</td>
<td>6 438</td>
<td>29 527</td>
<td>17 391</td>
<td>0</td>
</tr>
<tr>
<td><strong>Total industries</strong></td>
<td>81 190</td>
<td>70 214</td>
<td>10 976</td>
<td>231 652</td>
<td>1068 945</td>
<td>74 721</td>
<td>21 238</td>
<td>256 097</td>
<td>79 311</td>
<td>30 796</td>
<td>117 852</td>
</tr>
<tr>
<td>A Agriculture, forestry and fishing</td>
<td>2 528</td>
<td>2 264</td>
<td>264</td>
<td>1 336</td>
<td>19 908</td>
<td>73 447</td>
<td>17 515</td>
<td>200 933</td>
<td>4 258</td>
<td>7 176</td>
<td>0</td>
</tr>
<tr>
<td>B Mining and quarrying</td>
<td>1 932</td>
<td>1 777</td>
<td>155</td>
<td>180</td>
<td>7 380</td>
<td>0</td>
<td>37</td>
<td>2 663</td>
<td>3 982</td>
<td>116</td>
<td>0</td>
</tr>
<tr>
<td>C Manufacturing</td>
<td>6 537</td>
<td>5 801</td>
<td>736</td>
<td>4 999</td>
<td>12 331</td>
<td>379</td>
<td>101</td>
<td>2 606</td>
<td>31 492</td>
<td>811</td>
<td>66 369</td>
</tr>
<tr>
<td>D_E Utility services</td>
<td>24 017</td>
<td>14 599</td>
<td>9 419</td>
<td>2 833</td>
<td>15 111</td>
<td>703</td>
<td>917</td>
<td>48 443</td>
<td>1 681</td>
<td>797</td>
<td>11 036</td>
</tr>
<tr>
<td>F Construction</td>
<td>1 509</td>
<td>1 444</td>
<td>65</td>
<td>9</td>
<td>7 451</td>
<td>64</td>
<td>52</td>
<td>52</td>
<td>2 711</td>
<td>869</td>
<td>40 447</td>
</tr>
<tr>
<td>G_J Trade and transport etc.</td>
<td>42 969</td>
<td>42 793</td>
<td>176</td>
<td>222 148</td>
<td>1001 308</td>
<td>74</td>
<td>2 532</td>
<td>1 220</td>
<td>33 525</td>
<td>20 602</td>
<td>0</td>
</tr>
<tr>
<td>J Information and communication</td>
<td>101</td>
<td>96</td>
<td>5</td>
<td>5</td>
<td>304</td>
<td>4</td>
<td>3</td>
<td>11</td>
<td>92</td>
<td>21</td>
<td>0</td>
</tr>
<tr>
<td>K Financial and insurance</td>
<td>65</td>
<td>62</td>
<td>3</td>
<td>8</td>
<td>180</td>
<td>3</td>
<td>2</td>
<td>7</td>
<td>29</td>
<td>11</td>
<td>0</td>
</tr>
<tr>
<td>LA Real estate activities and renting of non-residential buildings</td>
<td>97</td>
<td>91</td>
<td>6</td>
<td>1</td>
<td>403</td>
<td>3</td>
<td>3</td>
<td>4</td>
<td>47</td>
<td>23</td>
<td>0</td>
</tr>
<tr>
<td>LB Dwellings</td>
<td>39</td>
<td>37</td>
<td>2</td>
<td>0</td>
<td>145</td>
<td>1</td>
<td>1</td>
<td>3</td>
<td>18</td>
<td>11</td>
<td>0</td>
</tr>
<tr>
<td>M_N Other business services</td>
<td>403</td>
<td>381</td>
<td>22</td>
<td>11</td>
<td>1 430</td>
<td>17</td>
<td>13</td>
<td>29</td>
<td>393</td>
<td>105</td>
<td>0</td>
</tr>
<tr>
<td>O_Q Public administration, education and health</td>
<td>846</td>
<td>727</td>
<td>119</td>
<td>98</td>
<td>2 489</td>
<td>19</td>
<td>57</td>
<td>109</td>
<td>863</td>
<td>230</td>
<td>0</td>
</tr>
<tr>
<td>R_S Arts, entertainment and other services</td>
<td>148</td>
<td>142</td>
<td>6</td>
<td>23</td>
<td>505</td>
<td>6</td>
<td>5</td>
<td>17</td>
<td>220</td>
<td>25</td>
<td>0</td>
</tr>
</tbody>
</table>

Source: Statistics Denmark
Indices (1990 = 100) for greenhouse effect and GDP (2000 prices)

Source: Statistics Denmark
Environmental activity accounts

- **Sectors**
  - Industries
  - Final demand
  - Assets

- **Commodities**
  - Industrial output of goods and services
  - Industrial intermediate demand
  - Environmental protection expenditures
  - Final demand
  - Gross fixed capital formation
  - Capital expenditures for environmental protection

- **Wastes**
  - Resource production by industries
  - Resource use by industries
  - Resource production by households/gov’t
  - Resource use by households/gov’t
  - Waste consumption by industries
  - Waste output by industries
  - Waste consumption by households/gov’t
  - Waste output by households/gov’t

- **Changes**
  - Other changes in volume & holding gains/losses on financial & produced assets
  - Changes in and holding gains/losses on natural resource assets
  - Financial and produced assets, closing balance
  - Natural resource assets, closing balance
  - Changes in natural resource assets
  - Natural resource assets, opening balance
  - Natural resource assets, opening balance
### Activity/purpose accounts

<table>
<thead>
<tr>
<th>Monetary flow accounts</th>
<th>Topics covered (detailed definition)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Environmental protection expenditure accounts (EPEA)</td>
<td>Output of EP services in economy and expenditures on EP goods and services by resident units (CF 4.45)</td>
</tr>
<tr>
<td>Resource use and management accounts (RUMEA)</td>
<td>Production, supply and use, expenditures on and financing of resource management (CF 4.121)</td>
</tr>
<tr>
<td>Environmental goods and services sector (EGSS)</td>
<td>Characteristics of all producers of products intended for environmental protection and resource management (CF 4.95)</td>
</tr>
<tr>
<td>Environmentally related payments by government</td>
<td>Environmental subsidies, social benefits to households, investment grants and other current and capital expenditures (CF 4.138)</td>
</tr>
<tr>
<td>Environmentally related payments to government</td>
<td>Environmental taxes (taxes on products, production and income; other current taxes and capital taxes) and other payments to government (rent, sales of some goods and services, some fines and penalties) (CF 4.149, CF 4.159)</td>
</tr>
<tr>
<td>Permits and licenses to use environmental assets</td>
<td>Permits to extract and harvest natural resources (CF 4.174)</td>
</tr>
<tr>
<td>Emissions permits</td>
<td>Permits for the use of the environment as a pollution sink (emissions permits) (CF 4.182)</td>
</tr>
<tr>
<td>Costs related to termination of fixed assets</td>
<td>Environmental consequences of disposing of fixed assets (nuclear power plants, oil rigs and other equipment, landfills, mines, etc.) (CF 4.194)</td>
</tr>
</tbody>
</table>
### Example: Environmental Goods and Services Sector (EGSS) in Netherlands

<table>
<thead>
<tr>
<th>Activity</th>
<th>Main source</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sewage and refuse disposal services</td>
<td>National accounts, supply and use tables</td>
</tr>
<tr>
<td>Wholesale in waste and scrap</td>
<td>National accounts, supply and use tables</td>
</tr>
<tr>
<td>Environmental related inspection and control</td>
<td>Employment registers</td>
</tr>
<tr>
<td>Government governance related to the environment</td>
<td>Environmental Statistics, EPE statistics</td>
</tr>
<tr>
<td>Organisations and associations on the environment</td>
<td>Employment registers and business register</td>
</tr>
<tr>
<td>Internal environmental activities at companies</td>
<td>Environmental Statistics, EPE statistics</td>
</tr>
<tr>
<td>Renewable energy production</td>
<td>Energy Statistics, Renewable energy statistics</td>
</tr>
<tr>
<td>Energy saving and sustainable energy systems</td>
<td>Own constructed database and Production Statistics</td>
</tr>
<tr>
<td>Insulation activities</td>
<td>National accounts</td>
</tr>
<tr>
<td>Organic agriculture</td>
<td>Agriculture statistics, area of organic agriculture</td>
</tr>
<tr>
<td>Recycling</td>
<td>National accounts, supply and use tables</td>
</tr>
<tr>
<td>Second hand shops</td>
<td>Production Statistics</td>
</tr>
<tr>
<td>Water quantity control by waterboards</td>
<td>National accounts, Government accounts</td>
</tr>
<tr>
<td>Environmental advice, engineering and other services</td>
<td>Own constructed database and Production Statistics</td>
</tr>
<tr>
<td>Industrial environmental equipment&lt;sup&gt;1&lt;/sup&gt;</td>
<td>Own constructed database and Production Statistics</td>
</tr>
<tr>
<td>Environmental technical construction&lt;sup&gt;1&lt;/sup&gt;</td>
<td>Own constructed database and Production Statistics</td>
</tr>
<tr>
<td>Environmental related education</td>
<td>Education statistics</td>
</tr>
</tbody>
</table>

Source: Statistics Netherlands
Employment, production and value added in the EGSS in Netherlands

Index (1995=100)

Source: Statistics Netherlands
Distribution of value added EGSS over different activities in Netherlands, 2011

Source: Statistics Netherlands
SEEA Experimental Ecosystem Accounting
One Environment: Two 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 Conceptual Framework

- SNA
- SEEA Central Framework
  - Mineral and Energy Resources
  - SEEA EEA
    - Spatial Units (Ecosystem Assets)
  - Ecosystem Asset
    - Water Resources
    - Land
    - Timber Resources
    - Other ecosystem characteristics
SEEA Experimental Ecosystem Accounting

- An integrated measurement framework for ecosystem **stocks** (assets) and **flows** (services)
  - It covers “natural” as well as human-dominated systems such as croplands and intensive pastures
  - It takes a detailed spatial approach (maps and statistics)

- A synthesis of current knowledge on ecosystem services, ecosystem condition and related concepts
  - “Experimental” because significant measurement challenges remain and further testing of concepts is needed
Measures the contributions of ecosystems to economic and other human activity in an accounting framework:

- Ecosystem Assets and Condition
- "Final" Ecosystem Services (Production):
  - **Provisioning services**: represent the material and energy contributions generated by or in an ecosystem
  - **Regulating services**: regulation of biological, hydrological and climate processes
  - **Cultural services**: generated from the physical settings, locations or situation that give rise to intellectual and symbolic benefits obtained by people from ecosystem through recreation
- With thematic accounts for Carbon, Biodiversity and Water
Linking ecosystem assets and well-being through ecosystem services

Individual & societal well-being

Benefits
SNA & non-SNA

Ecosystem services

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

Ecosystem processes

Ecosystem characteristics
Intra-ecosystem flows
Inter-ecosystem flows

ECOSYSTEM ASSET

SEEA
SEEA-EEA accounts and linkages

Physical Accounts (by spatial unit)

- Ecosystem Extent Account
- Ecosystem Condition Account
- Ecosystem Services Generation Account
- Ecosystem Services Use Account
- Ecosystem Capacity Account

Ecosystem thematic accounts: Land, Carbon, Water, Biodiversity
Supporting information: Socio-economic conditions and activities, ecological production functions
Tools: classifications, spatial units, scaling, aggregation, biophysical modelling

Monetary Accounts (by spatial unit)

- Ecosystem Services Supply Account
- Ecosystem Asset Account
- Augmented I-O Table
- Integrated Sector Accounts and Balance Sheets

Supporting information: SNA accounts, I-O tables
Tools: Valuation techniques
Spatial data perspective: harmonizing reporting units

- Measurement units for social, economic and environmental parameters remain untouched
- New accounting and reporting units created for ecosystem accounting purposes

Overlay of units (UK)
Statistical units

Ecosystem Accounting Unit (EAU)

Land Cover/Ecosystem Functional Unit (LCEU)

Basic Spatial Unit (BSU)

Country
State
Region
Statistical Areas
Parcel
Grid cell (e.g. 20m x 20m or 100m x 100m)

SEEA
Example: Carbon account

Maps
- Removals
- Hydrology
- Soil
- Vegetation

Tables

<table>
<thead>
<tr>
<th></th>
<th>Geocarbon</th>
<th>Biocarbon</th>
<th>Oceans</th>
<th>Atmosphere</th>
</tr>
</thead>
<tbody>
<tr>
<td>Opening stock</td>
<td>10,000</td>
<td>400</td>
<td>20,000</td>
<td>100</td>
</tr>
<tr>
<td>Additions</td>
<td>-</td>
<td>4</td>
<td>10</td>
<td>24</td>
</tr>
<tr>
<td>Reductions</td>
<td>10</td>
<td>5</td>
<td>9</td>
<td>14</td>
</tr>
<tr>
<td>Closing stock</td>
<td>9,990</td>
<td>399</td>
<td>20,001</td>
<td>110</td>
</tr>
</tbody>
</table>

Scaling Biophysical modelling

Geocarbon Biocarbon Oceans Atmosphere

Geosphere 10,000 Biosphere 400 Oceans 20,000

Atmosphere 100

10 5 4 9 10

Opening stock: 10,000 billion tonnes C
Additions: 0 billion tonnes C
Reductions: 0 billion tonnes C
Closing stock: 9,990 billion tonnes C

Geocarbon and Biocarbon: 10,000 + 400 = 10,400 billion tonnes C
Oceans and Atmosphere: 20,000 + 100 = 20,100 billion tonnes C

Geosphere 10,000 
Biosphere 400 
Oceans 20,000

Atmosphere 100

10 5 4 9 10
European Union – Map of carbon sequestration
Example: Carbon Accounting in Australia

<table>
<thead>
<tr>
<th>Primary reservoir</th>
<th>Geocarbon (Mt C)</th>
<th>Hectares (million)</th>
<th>Biomass carbon (Mt C)</th>
<th>Soil organic carbon (Mt C)</th>
<th>Total biocarbon (Mt C)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Biocarbon</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Natural ecosystems</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rangelands</td>
<td>596.3</td>
<td>6,374</td>
<td>6,603</td>
<td></td>
<td>12,977</td>
</tr>
<tr>
<td>Non rangelands:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Eucalypt native forests</td>
<td>16.7</td>
<td>4,671</td>
<td>3,753</td>
<td></td>
<td>8,424</td>
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<tr>
<td>Shrub lands &amp; woodlands</td>
<td>14.7</td>
<td>500</td>
<td>636</td>
<td></td>
<td>1,137</td>
</tr>
<tr>
<td>Grass, shrub &amp; heath lands</td>
<td>1.6</td>
<td>37</td>
<td>51</td>
<td></td>
<td>87</td>
</tr>
<tr>
<td>Rainforests</td>
<td>2.3</td>
<td>1,225</td>
<td>252</td>
<td></td>
<td>1,477</td>
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<tr>
<td>Other</td>
<td>0.7</td>
<td>15</td>
<td>16</td>
<td></td>
<td>32</td>
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<tr>
<td>Marine ecosystems</td>
<td>1.8</td>
<td>114</td>
<td>1,084</td>
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<td>1,198</td>
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<tr>
<td>Fresh water ecosystems</td>
<td>9.9</td>
<td>4</td>
<td>7</td>
<td></td>
<td>11</td>
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<tr>
<td><strong>Total Natural ecosystems</strong></td>
<td>644.0</td>
<td>12,941</td>
<td>12,402</td>
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<td>25,343</td>
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<tr>
<td>Semi-natural ecosystems</td>
<td></td>
<td></td>
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<td></td>
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<tr>
<td>Highly modified rangelands</td>
<td>50.0</td>
<td>750</td>
<td>1,500</td>
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<td>2,250</td>
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<tr>
<td>Grazing in modified pastures</td>
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<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>outside rangelands</td>
<td></td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td><strong>Total Semi-natural ecosystems</strong></td>
<td>82.9</td>
<td>882</td>
<td>2,815</td>
<td></td>
<td>3,697</td>
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<tr>
<td>Agricultural ecosystems</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Cropping</td>
<td>25.5</td>
<td>102</td>
<td>1,022</td>
<td></td>
<td>1,124</td>
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<tr>
<td>Irrigated agriculture</td>
<td>2.6</td>
<td>12</td>
<td>105</td>
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<td>117</td>
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<tr>
<td>Plantation wood</td>
<td>2.4</td>
<td>177</td>
<td>120</td>
<td></td>
<td>296</td>
</tr>
<tr>
<td>Reservoir/dam</td>
<td>0.6</td>
<td>1</td>
<td>6</td>
<td></td>
<td>7</td>
</tr>
<tr>
<td>Other</td>
<td>6.3</td>
<td>120</td>
<td>244</td>
<td></td>
<td>363</td>
</tr>
<tr>
<td><strong>Total Agriculture ecosystems</strong></td>
<td>37.4</td>
<td>412</td>
<td>1,497</td>
<td></td>
<td>1,907</td>
</tr>
<tr>
<td>Settlements</td>
<td>2.6</td>
<td>30</td>
<td>79</td>
<td></td>
<td>108</td>
</tr>
<tr>
<td>Other</td>
<td>0.5</td>
<td>7</td>
<td>19</td>
<td></td>
<td>26</td>
</tr>
<tr>
<td><strong>Total Settlements and Other</strong></td>
<td>3.1</td>
<td>37</td>
<td>98</td>
<td></td>
<td>134</td>
</tr>
<tr>
<td><strong>Total biocarbon(^4)</strong></td>
<td>767.4</td>
<td>14,270</td>
<td>16,811</td>
<td></td>
<td>31,081</td>
</tr>
</tbody>
</table>

THANK YOU
seea@un.org