System of Environmental Economic Accounting

Session 1: Ecosystem accounting overview

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Regional Training Workshop on the SEEA Experimental Ecosystem Accounting for Countries of Latin America and the Caribbean

21-23 November 2018, Rio de Janeiro, Brazil

United Nations

Outline

- General introduction to the System of Environmental Economic Accounting (SEEA)
- Introduction to SEEA Experimental Ecosystem Accounting
- Overview of the SEEA EEA accounts

SEEA EEA Training Programme - 3 phases

1. Online phase:
   - > Self-paced modules (https://elearning-cms.unstats.un.org/)
   - > Webinars (https://seea.un.org/news/seea-webinar-experimental-ecosystem-accounting)
2. In-person phase
   - > Rio de Janeiro workshop
3. Follow-up activities

General Introduction to the System of Environmental Economic Accounting (SEEA)

SEEA

Measuring sustainability

Assets

Services

Economy and well-being

Regeneration

Waste & degradation

SEEA

Legal and political commitments

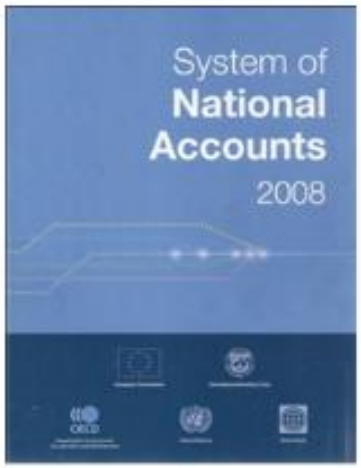
- 1992: CBD Aichi Targets (Target 2)
- 1992: Agenda 21 (Rio)
- 2012: The Future we Want (Rio+20)
- 2015: 2030 Agenda for Sustainable Development and the Sustainable Development Goals
- European Legislation
- Natural Capital Accounting

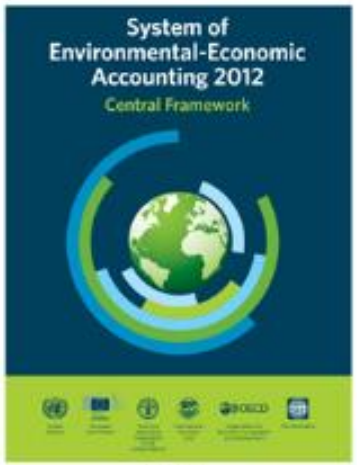
The System of Environmental-Economic Accounting (SEEA)

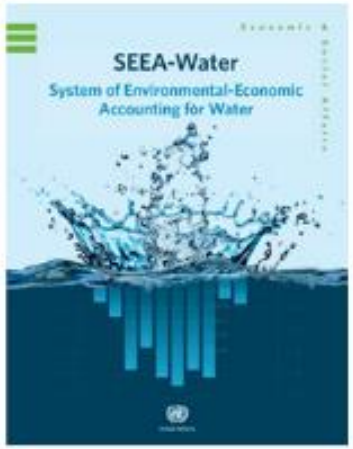
An internationally agreed statistical framework to measure the environment and its interactions with economy.

- The **SEEA Central Framework** was adopted as an international statistical standard by the UN Statistical Commission in 2012
- The **SEEA Experimental Ecosystem Accounting** complement the Central Framework and represent international efforts toward coherent ecosystem accounting
  - **Technical Recommendations** (2017) present updates and extensions of ecosystem accounting concepts, methods and structure, and providing practical guidance on its implementation
- **SEEA EEA Revision** by 2020

The SNA and SEEA: Systems of integrated information







SEEA-

Energy

(forthcoming)

SEEA-

Agriculture, Forestry and Fisheries

(forthcoming)

Others

(forthcoming)

Natural Capital Accounting

Individual environmental **assets & resources:**

Timber
Water
Soil
Fish

Ecosystems: Biotic and abiotic elements functioning together:

Forests
Lakes
Cropland
Wetlands

SEEA Central Framework (SEEA-CF) starts with economy and links to physical information on natural assets, flows and residuals

+

SEEA Experimental Ecosystem Accounting (SEEA-EEA) starts with ecosystems and links their services to economic and other human activity

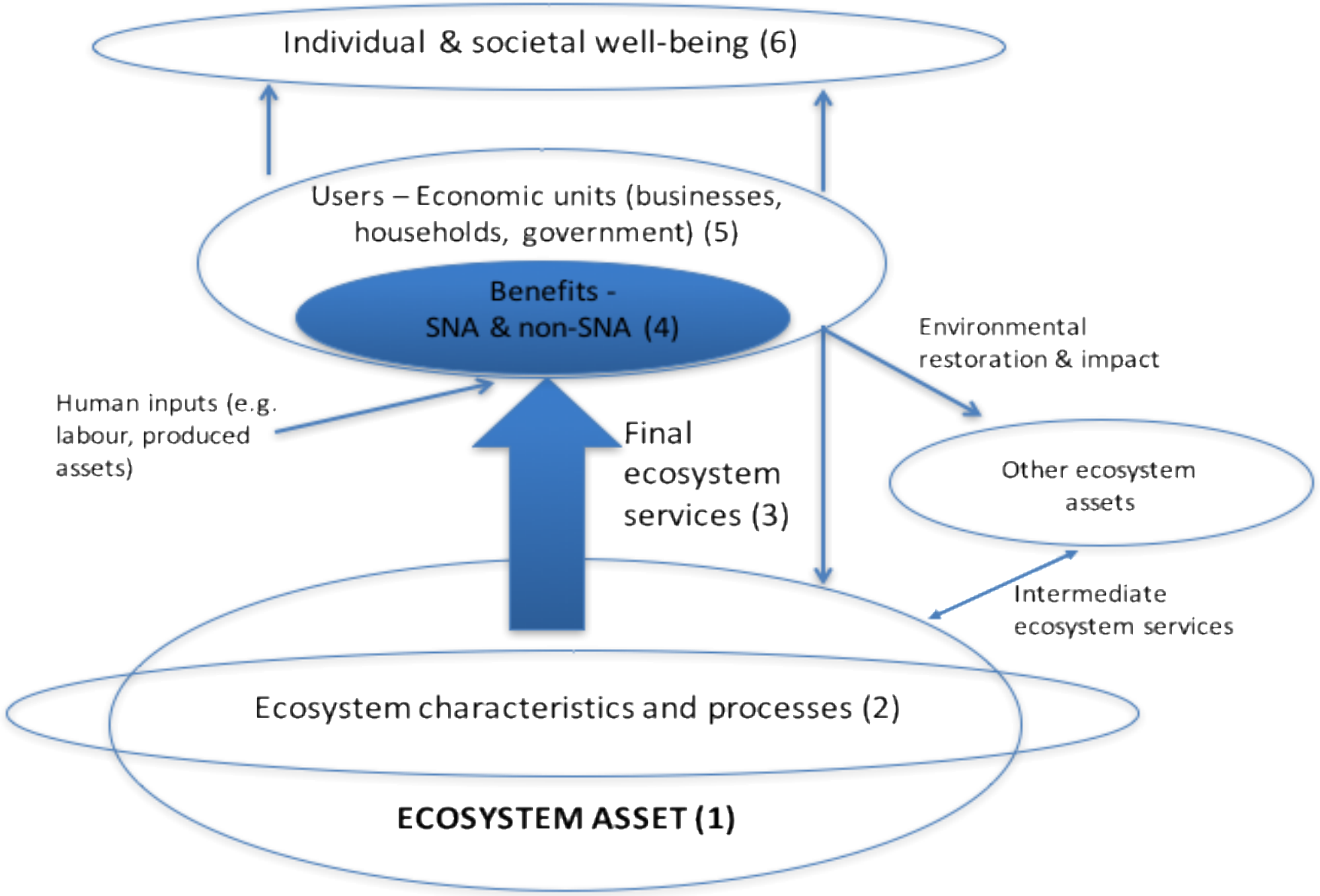
=

Together, they provide the foundation for measuring the relationship between the environment, and economic and other human activity

Introduction to SEEA Experimental Ecosystem Accounting (SEEA EEA)

SEEA

Ecosystem Accounting model



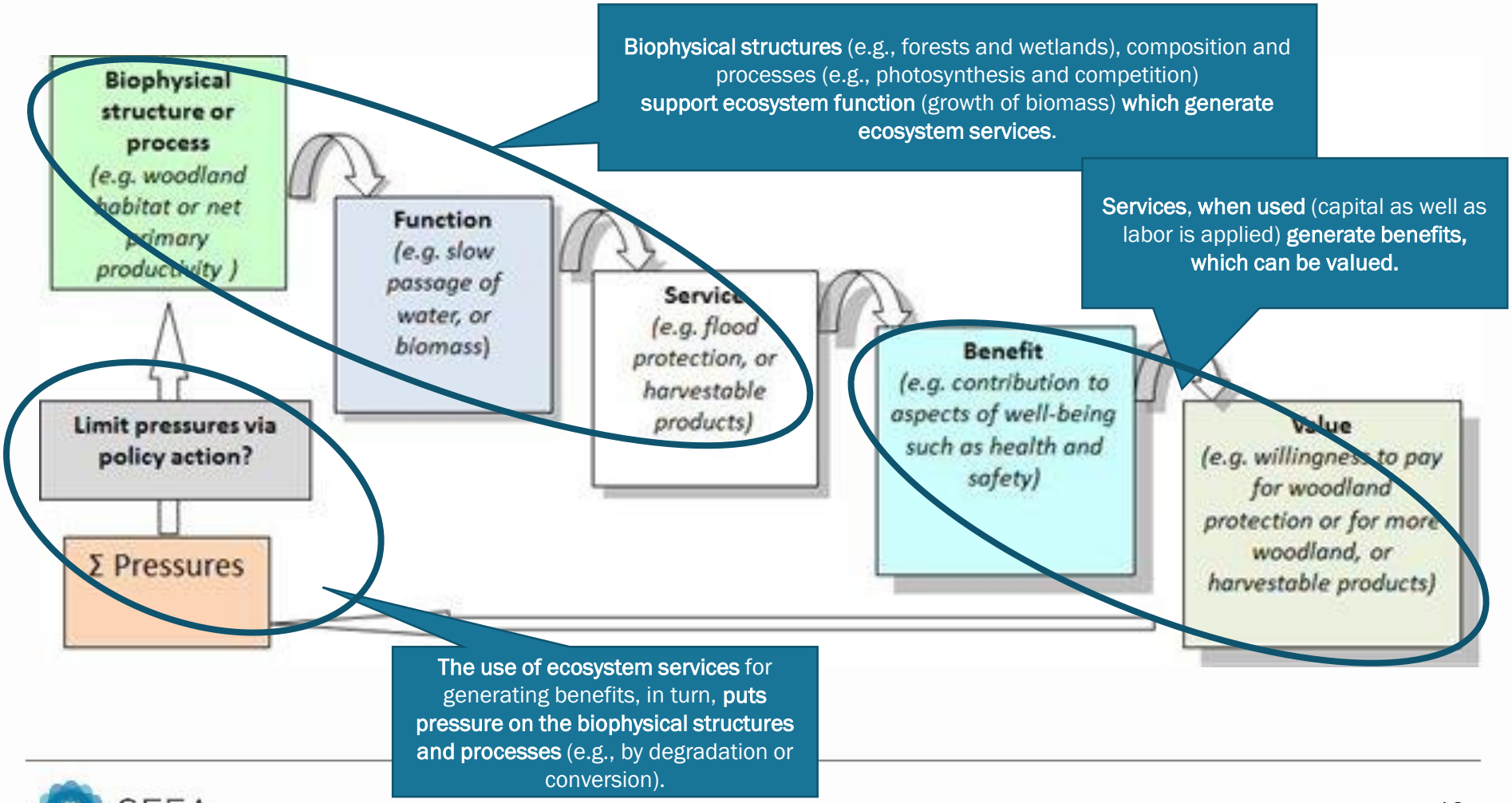
Ecosystem assets: a definition

- 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**.

- 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…

The Ecosystem Services Cascade

Ecosystem services are the contribution of ecosystems to benefits for people…



SEEA

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, tropical forest in the Amazon region vs. Tijuca national park.
- Use of Geographic information systems (GIS)
  - > Manage spatial information as layers
  - > Tools to integrate spatial information
  - > Generate tables based on common properties (e.g., land cover and land cover change)

Pop quiz!

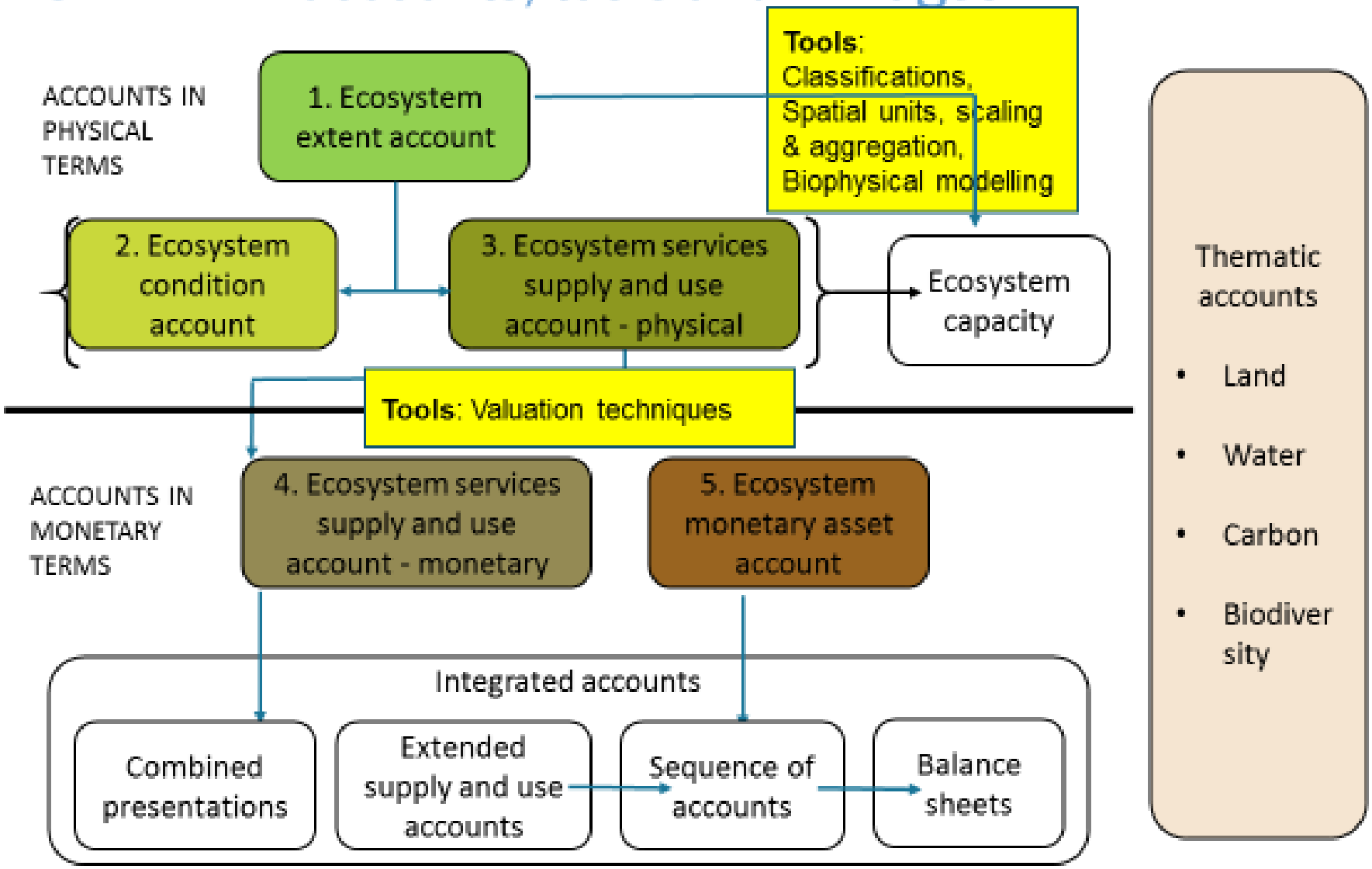
- What is an important ecosystem type in your country and what services does it provide?

- What are examples of spatial data that you may wish to integrate into ecosystem accounting?

- Why is GIS a useful tool for ecosystem accounting?

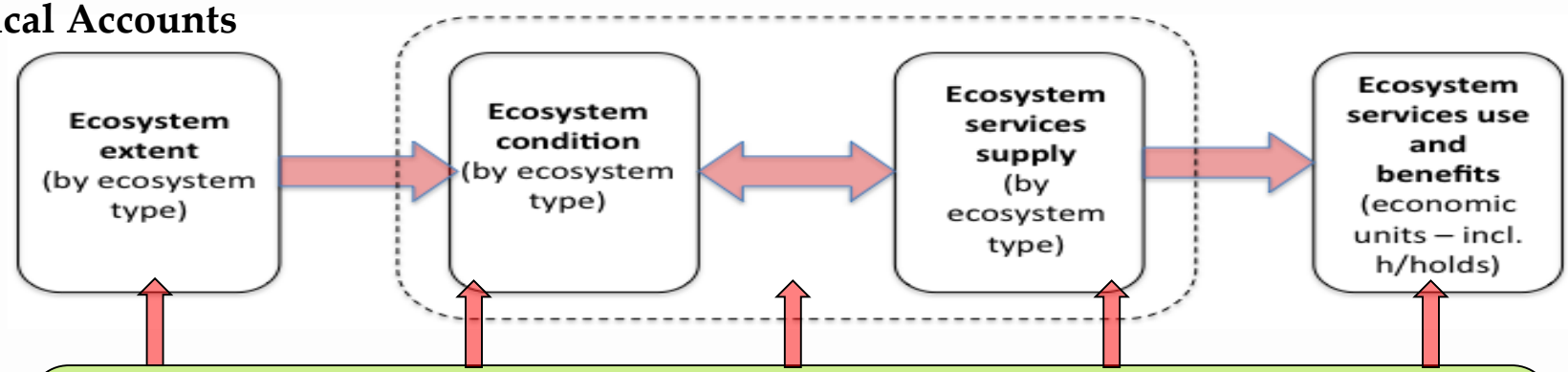
SEEA EEA – set of accounts

SEEA-EEA accounts, tools and linkages



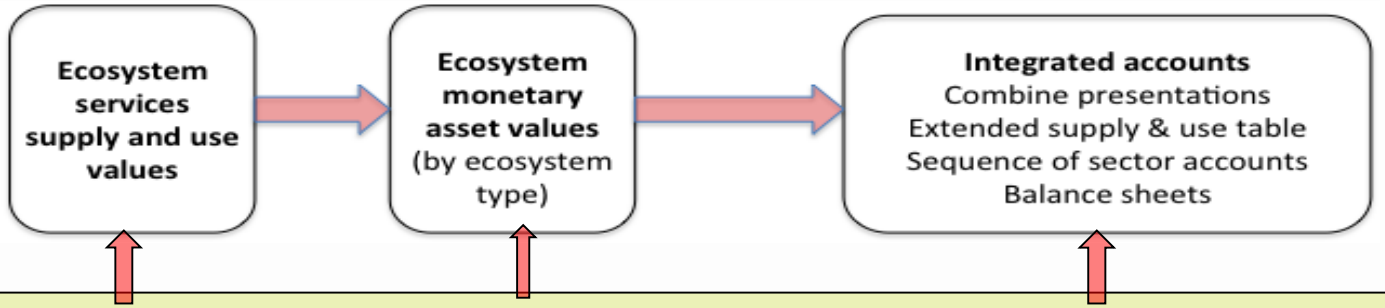
Broad steps in ecosystem accounting

a. Physical Accounts



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
Source: Official statistics, spatial data, remote sensing data

b. Monetary Accounts



Supporting information: SNA accounts, I-O tables
Tools: Valuation techniques

1. Ecosystem extent account

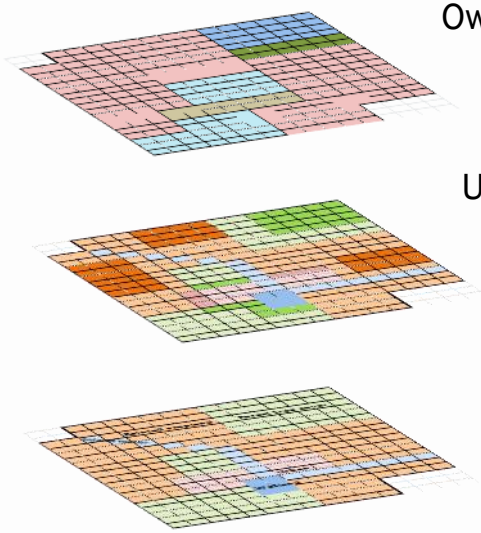
- **What?**
  - **National** coverage of terrestrial, freshwater, coastal and marine areas
  - Mutually exclusive and exhaustive coverage

- **Why?**
  - Land management, conservation policies
  - Spatial foundation for other accounts
    → basis for allocating macro data to spatial units
  - Builds on SEEA-CF (land, forest, water)

1. Ecosystem extent account

What does an Extent Account look like?

Maps



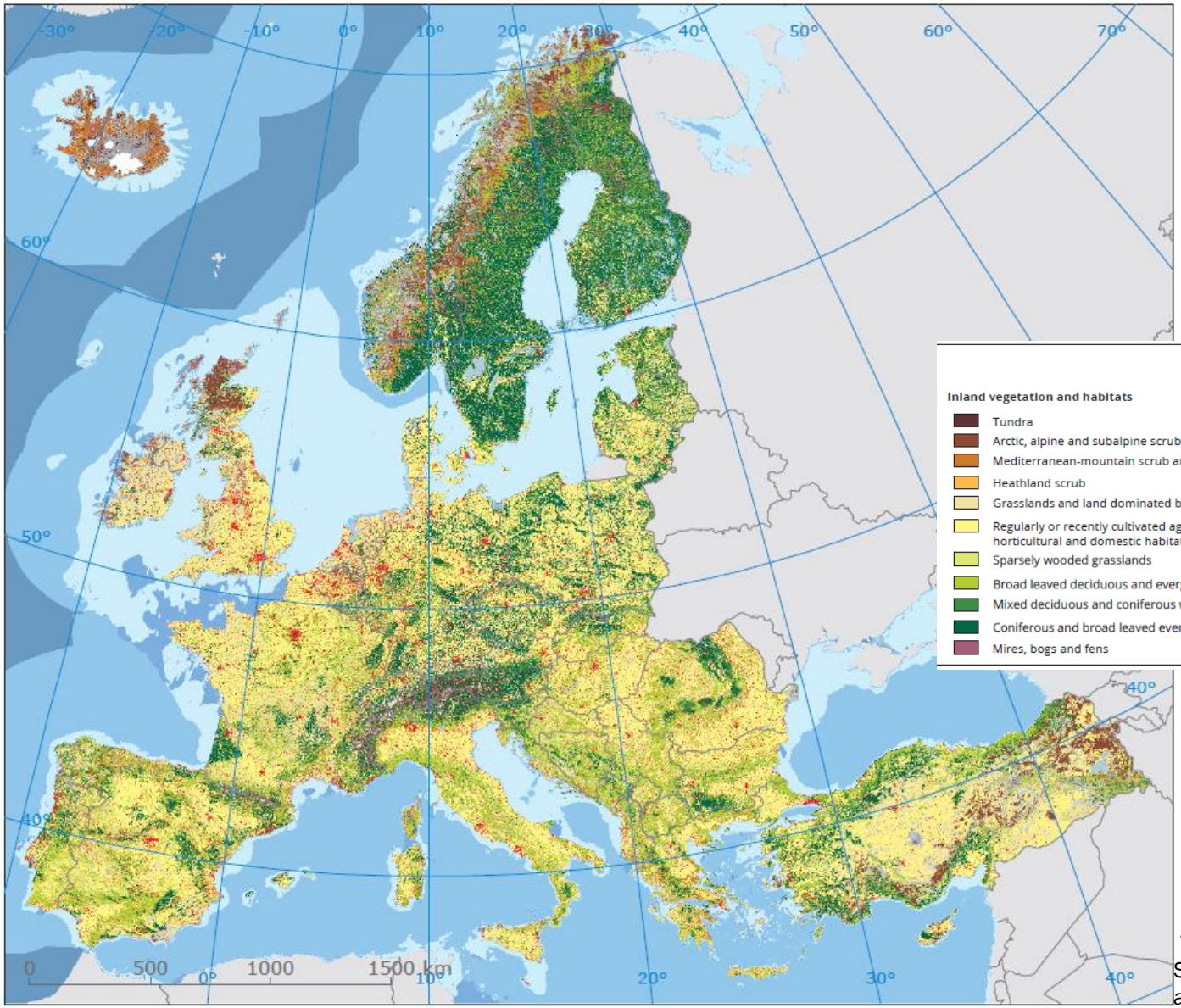
Tables

	Proxy ecosystem type (based on land cover)															
	Artificial surfaces	Herbaceous crops	Woody crops	Multiple or layered crops	Grassland	Tree-covered areas	Mangroves	Shrub-covered areas	Regularly flooded areas	Sparse natural vegetated areas	Terrestrial barren land	Permanent snow and glaciers	Inland water bodies	Coastal water and inter-tidal areas	Sea and marine areas	TOTAL
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	
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																

Spatial units
Classifications

1. Ecosystem extent account

Example: Ecosystem map of Europe



Ecosystem map (aggregated)

Marine waters
- European regional seas
- Open waters

Marine seabed and coastal habitats
- Sublittoral sediment
- Infralittoral and circalittoral rock and other hard substrata
- Marine habitats
- Coastal habitats

Inland surface waters
- Inland waters and shores

Inland vegetation and habitats
- Tundra
- Arctic, alpine and subalpine scrub and grassland
- Mediterranean-mountain scrub and brushes
- Heathland scrub
- Grasslands and land dominated by forbs
- Regularly or recently cultivated agricultural, horticultural and domestic habitats
- Sparsely wooded grasslands
- Broad leaved deciduous and evergreen woodland
- Mixed deciduous and coniferous woodland
- Coniferous and broad leaved evergreen woodland
- Mires, bogs and fens

Inland unvegetated or sparsely vegetated habitats
- Screes, inland cliffs
- Snow or ice-dominated habitats
- Miscellaneous inland habitats with very sparse or no vegetation

Human made constructions and habitats
- Constructed, industrial and other artificial habitats

Non classified areas
- Unclassified areas
- Outside area of interest

Source: EEA, 2015a, *European ecosystem assessment: Concept, data, and implementation,* EEA Technical Report No 6/2015, European Environment Agency

Ecosystem extent account, Netherlands, 2006 - 2013

Ecosystem Unit	Area (km2)			Area (percentage)		
	2006	2013	Δ	2006	2013	Δ
Agriculture	19174	18811	−363	46,16	45,29	−0,87
Forest	3207	3216	8	7,72	7,74	0,02
Heath	394	427	33	0,95	1,03	0,08
Sand	356	358	2	0,86	0,86	0,00
Wetlands	461	580	119	1,11	1,40	0,29
Other nature	4061	4007	−54	9,78	9,65	−0,13
Public green areas	710	708	−1	1,71	1,70	0,00
Built-up and paved	5236	5410	175	12,60	13,03	0,42
Inland water	4088	4199	111	9,84	10,11	0,27
Sea	3846	3815	−31	9,26	9,18	−0,08
Unknown/null	6	8	2	0,01	0,02	0,00
The Netherlands	41539	41539	0			0,00

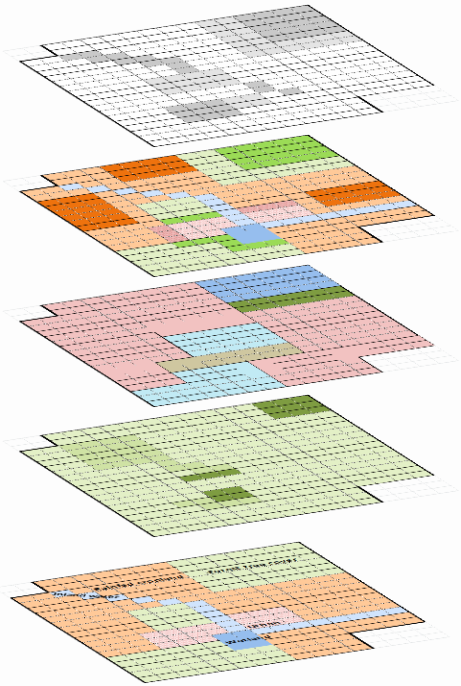
2. Ecosystem condition account

- **What?**
  - **Ecosystem condition** reflects the overall quality of an ecosystem asset, in terms of its characteristics.

- **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

2. Ecosystem condition account

Maps



Carbon

Water

Soil

Biodiversity

Vegetation

Tables

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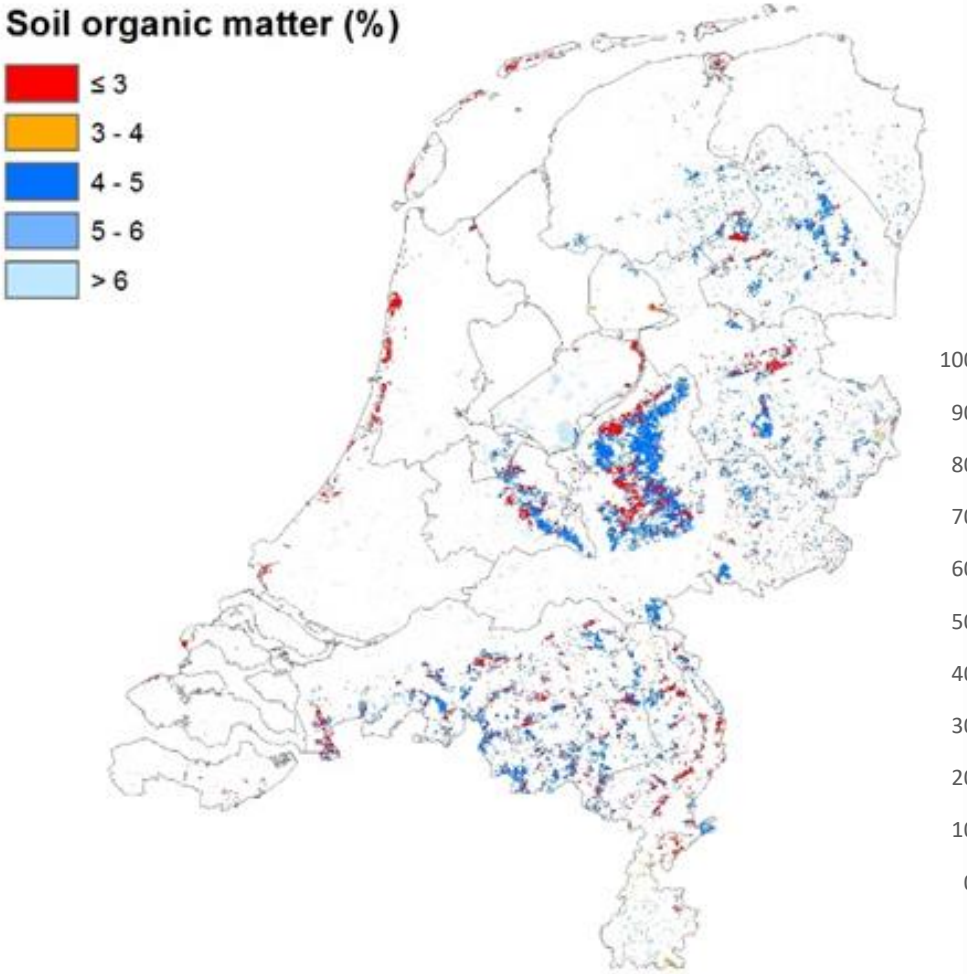
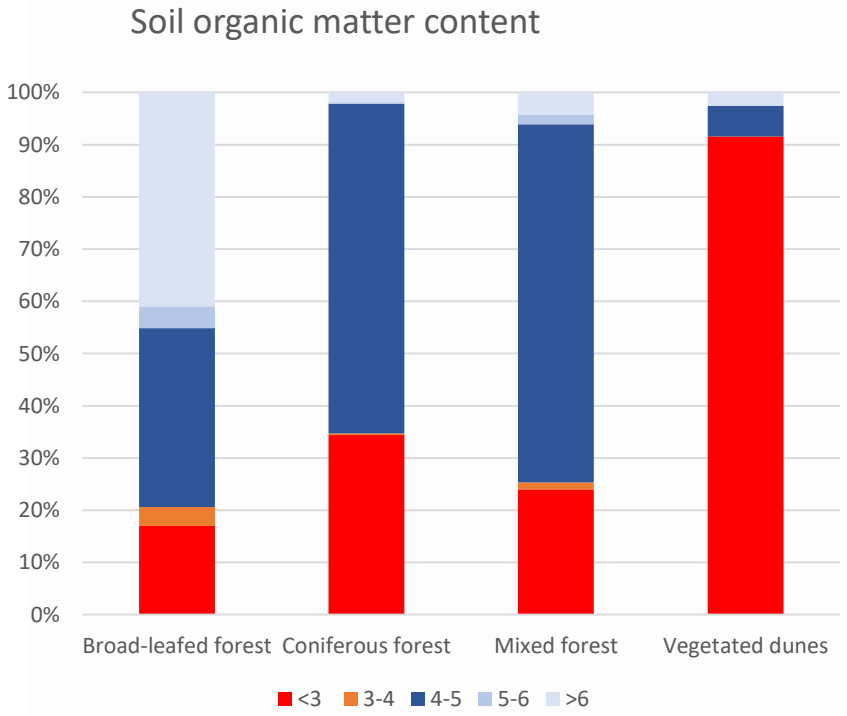
Example indicators of condition		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Vegetation (e.g. native cover)	Opening condition															
	Closing condition															
Water quality (e.g. turbidity, pH)	Opening condition															
	Closing condition															
Soil (e.g. erosion, pH, nutrients)	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

Example: soil organic matter in forests





SEEA

Example: Condition account for Dutch forests, 2013

	Indicator	Unit	Deciduous forest	Coniferous forest	Mixed forest	Mixed forest (Dunes)
EXTENT						
	Extent	ha	109,142	81,923	118,571	15,943
STATE INDICATORS	Tree cover	%	54	64	64	32
	Shrub cover	%	10	6	7	9
	Low vegetation cover	%	28	24	23	43
	Carbon stock in biomass	Mton C	6.8	5.1	7.4	1.0
	Protected areas (Natura2000, EHS)	% of area	16	44	38	
	Living Planet Index	Index 2000=100	102			54
	Characteristic species	Index intact=100	33.1			46.0
	Ecosystem quality	% of area with ≥50% of qualifying species	33.9			63.5
	Habitat structure and function		Unfavourable/inadequate			Unfavourable /bad
	Soil organic matter	% of area with <3% SOM	17	34	24	92
	Air pollution – PM10	μg PM_{10} /m^3	19.9	20.2	20.1	17.2
	Air pollution – PM2.5	μg $PM_{2.5}$ /m^3	12.8	13.0	12.9	10.8
	Air pollution – NO2	μg NO_2 /m^3	16.0	15.7	15.5	12.3
	Air Pollution – SO2	μg SO_2 /m^3	0.9	0.8	0.8	1.2
PRESSURE INDICATORS	Urbanisation	% paved surface	13	6	8	9
	Temperature change	°C increase	0.10	0.02	0.05	0.04
	Acidification	mol H^+/ha/ yr	2368	2724	2663	1887
	Eutrophication	mol N/ha/ yr	1713	2025	1982	1220
	Drainage organic soils	cm	67	97	85	29

3. Ecosystem Services Supply & Use

- **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

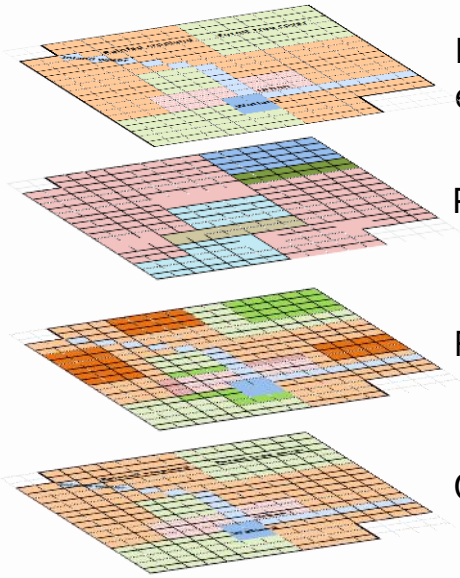
Types of ecosystem services

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

3. Ecosystem Services Supply & Use

What does an Ecosystem Service Supply Account look like?

Maps



Ecosystem extent

Provisioning

Regulating

Cultural

Tables

Type of service	Ecosystem type			
	Urban and associated	Forest tree cover	Agricultural land	Open wetlands
Provisioning		e.g., tonnes of timber	e.g., tonnes of wheat	
Regulating	e.g., tonnes of CO_2 stored / released	e.g., tonnes of CO_2 stored / released	e.g., tonnes of CO_2 stored / released	e.g., tonnes of P absorbed
Cultural	e.g., hectares of parkland	e.g., number of visitors / hikers		e.g., hectares of duck habitat

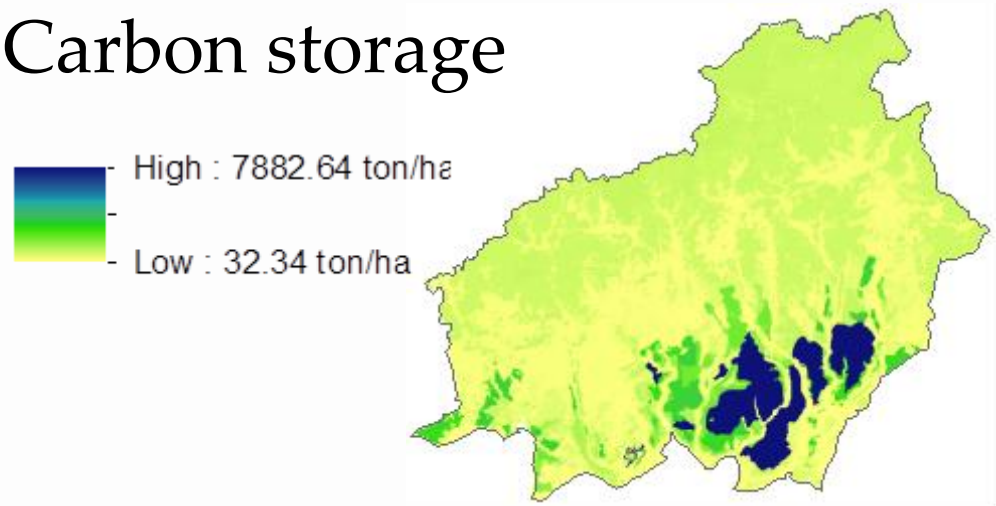
Look up tables
Biophysical modelling

Valuation

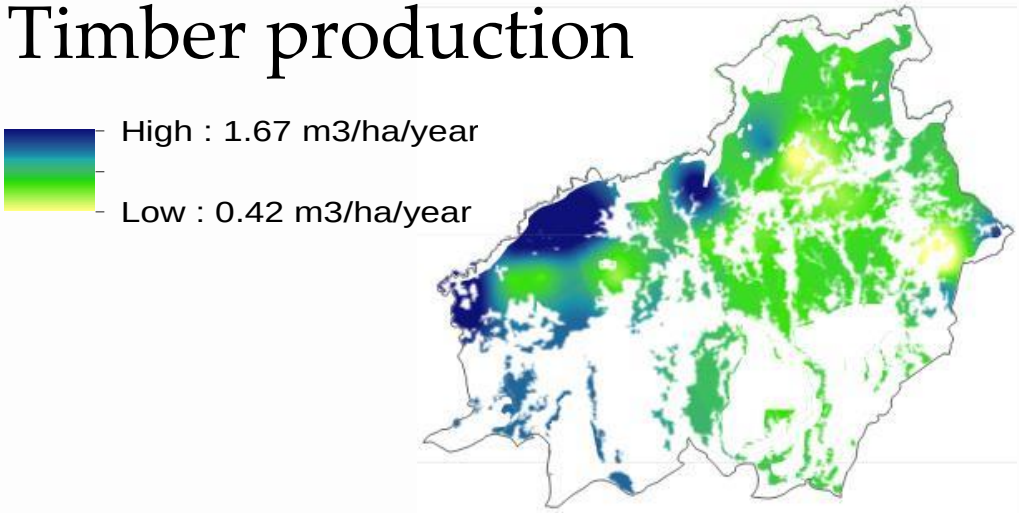
Monetary Services Supply

Example: Central Kalimantan

Carbon storage



Timber production



Model used

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

Kriging
(values are interpolated from samples)

SEEA

Source: Sumarga and Hein, 2014

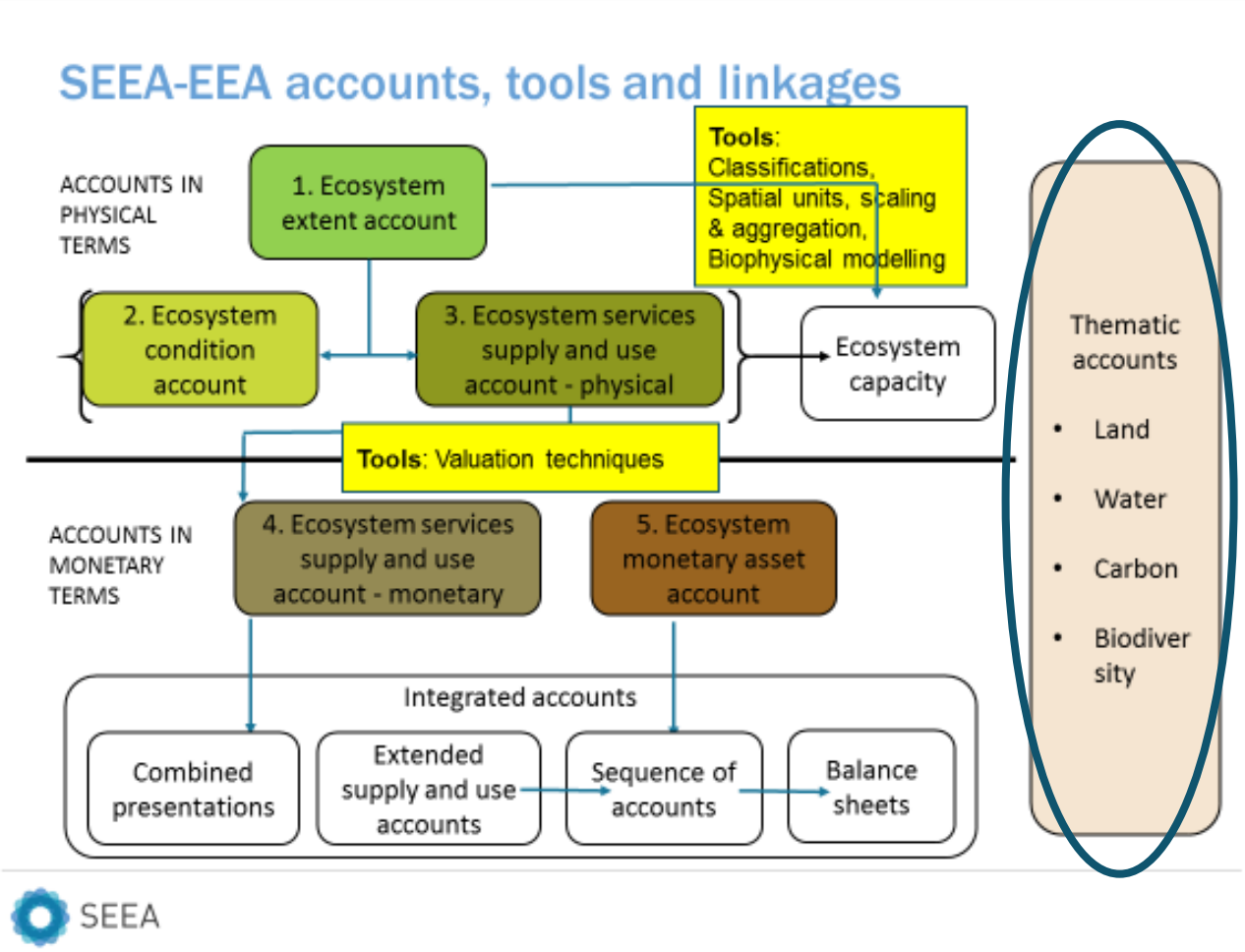
4. Valuation

- **What is the purpose?**
  - To integrate environmental issues in economic decision making and development planning

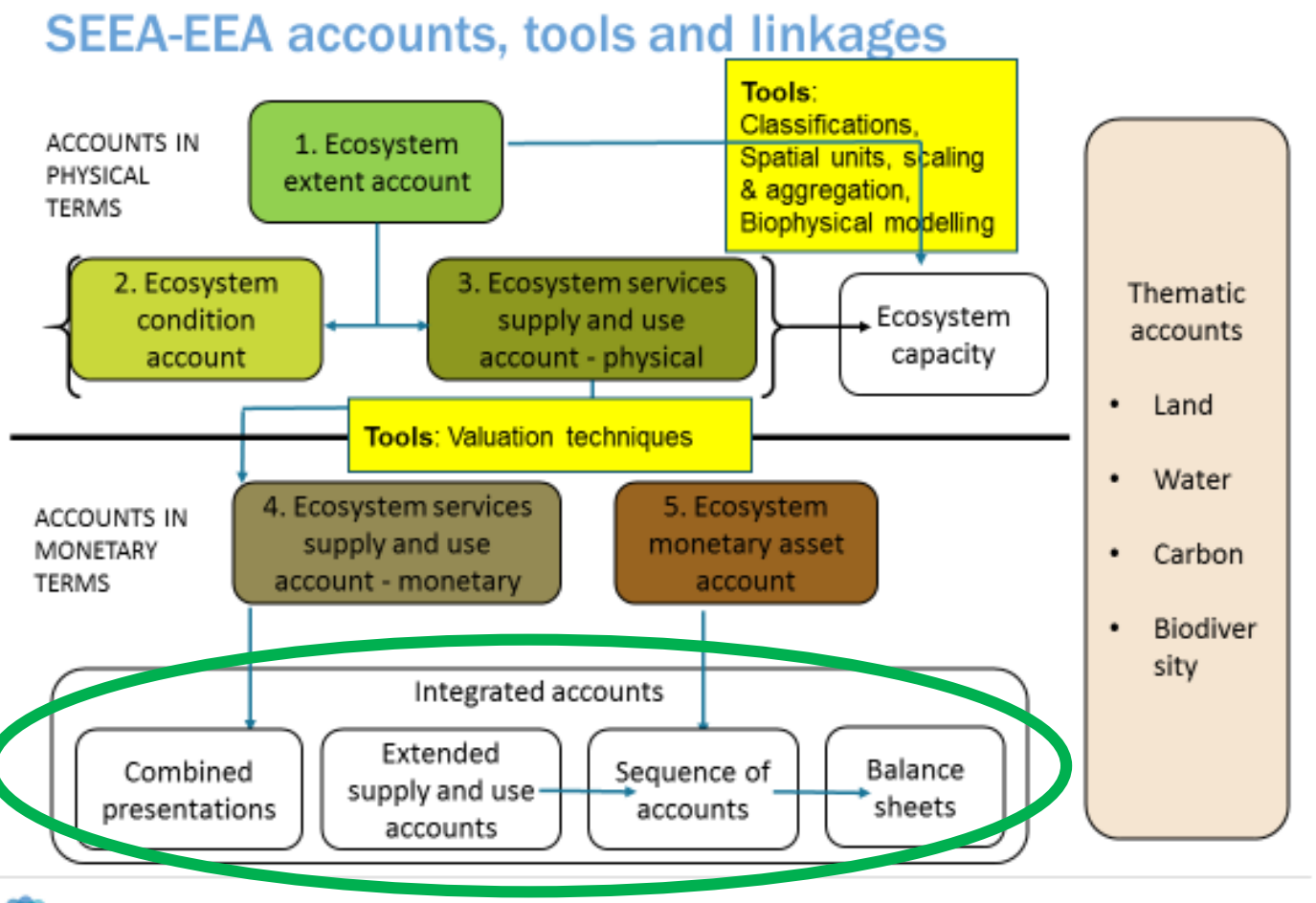
- **What are we trying to value?**
  - Ecosystem services
    - Flows: during the year
  - Ecosystem capital
    - Assets: value at beginning/end of year and changes therein
  - Degradation of ecosystems
    - The decline in the condition of ecosystem assets as a result of economic and other human activity

5. Thematic accounts

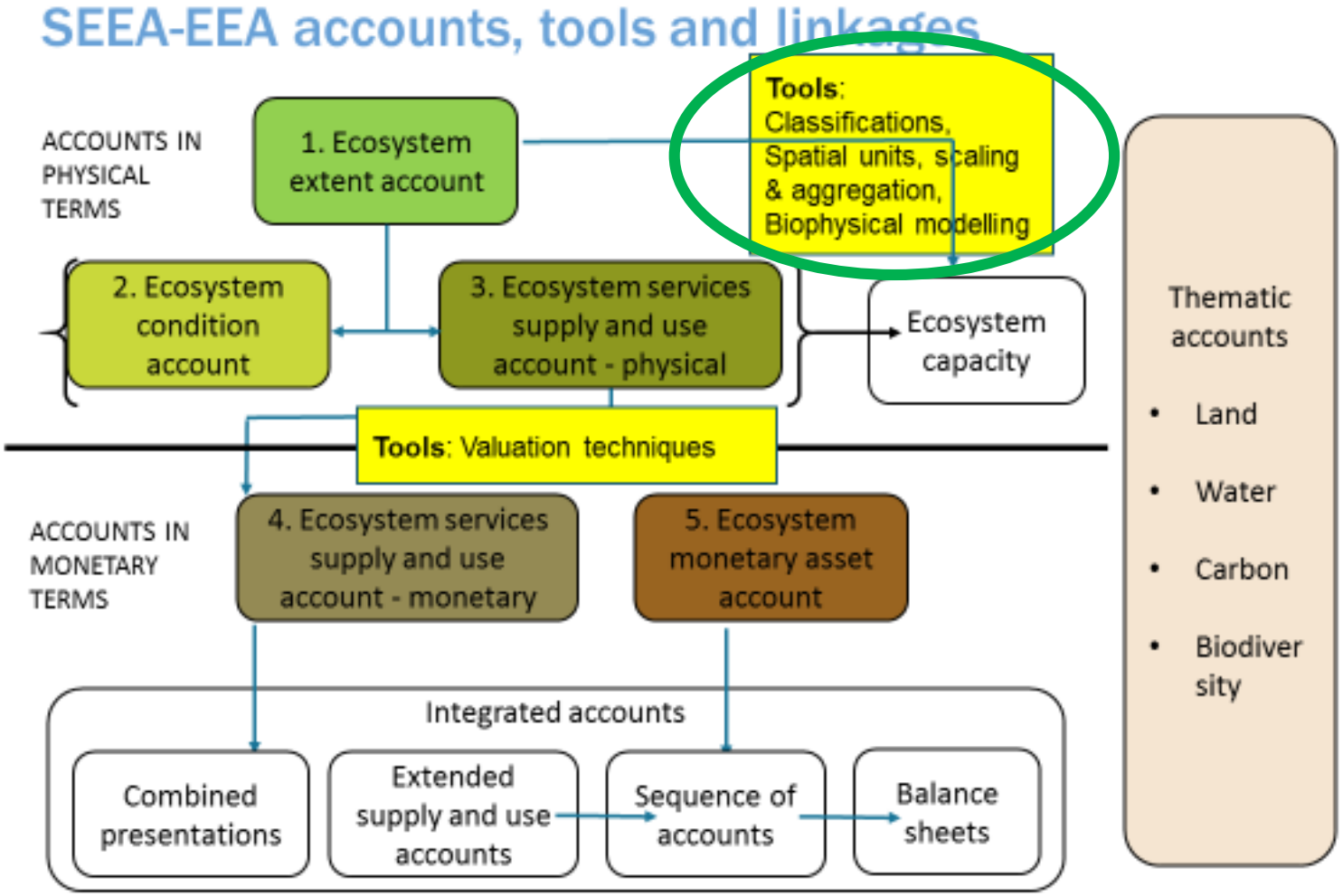
- Standalone accounts on topics of interest in their own right
- Direct relevance in the measurement of ecosystems and in assessing policy responses.
- Thematic accounts include accounts for land, carbon, water and biodiversity.



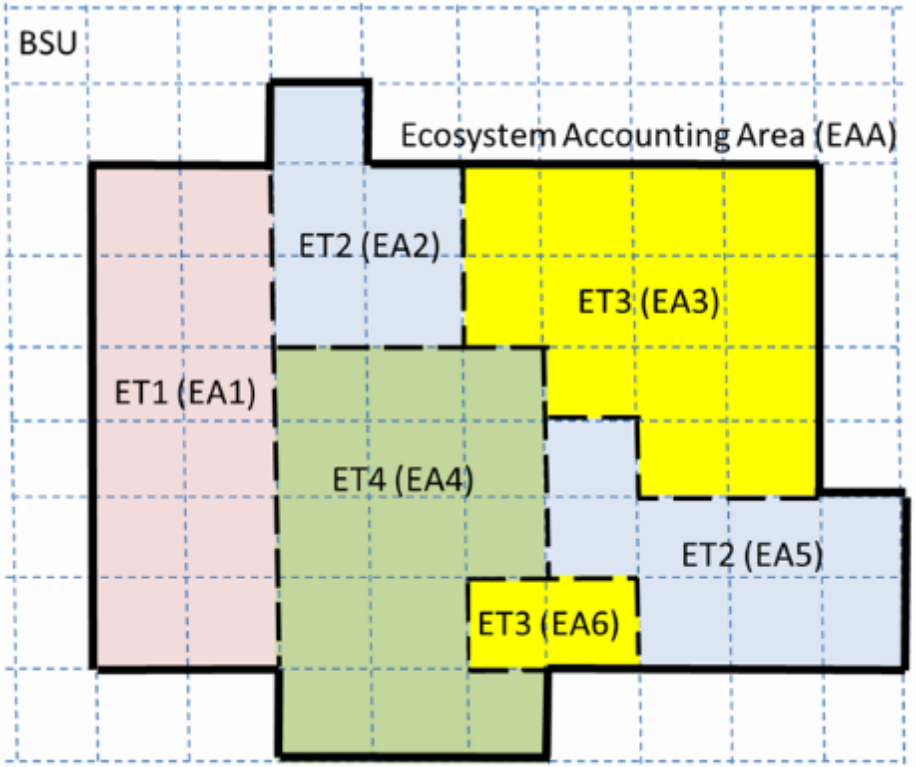
6. Integrated accounts



7. Tools


SEEA-EEA accounts, tools and linkages
ACCOUNTS IN PHYSICAL TERMS
1. Ecosystem extent account
Tools: Classifications, Spatial units, scaling & aggregation, Biophysical modelling
2. Ecosystem condition account
3. Ecosystem services supply and use account - physical
Ecosystem capacity
Tools: Valuation techniques
ACCOUNTS IN MONETARY TERMS
4. Ecosystem services supply and use account - monetary
5. Ecosystem monetary asset account
Integrated accounts
Combined presentations
Extended supply and use accounts
Sequence of accounts
Balance sheets
Thematic accounts
Land
Water
Carbon
Biodiversity

7.a Spatial units



4 types of units

-Basic spatial units (BSU)

-Ecosystem asset (EA)

-Ecosystem type (ET)

-Ecosystem Accounting Area (EAA)

THANK YOU

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Group exercise

Discussion

- Prepare for group exercise…think about:
  - What are your priority accounts?
  - What are the opportunities to produce them?
    - Stakeholders?
    - Institutional mechanisms?
    - Current activities?
  - What are the constraints?
    - Data?
    - Capacity?