

System of  
Environmental  
Economic  
Accounting

# Overview of the SEEA Experimental Ecosystem Accounting with examples from the Netherlands

Sjoerd Schenau  
Statistics Netherlands



Centraal Bureau  
voor de Statistiek



WAGENINGEN  
UNIVERSITY & RESEARCH



# Outline

- Overview of the SEEA Experimental Ecosystem Accounting
- Core accounting model
  - > Accounting for ecosystem extent
  - > Accounting for ecosystem condition
  - > Accounting for ecosystem services
  - > Thematic accounts



# 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



# 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

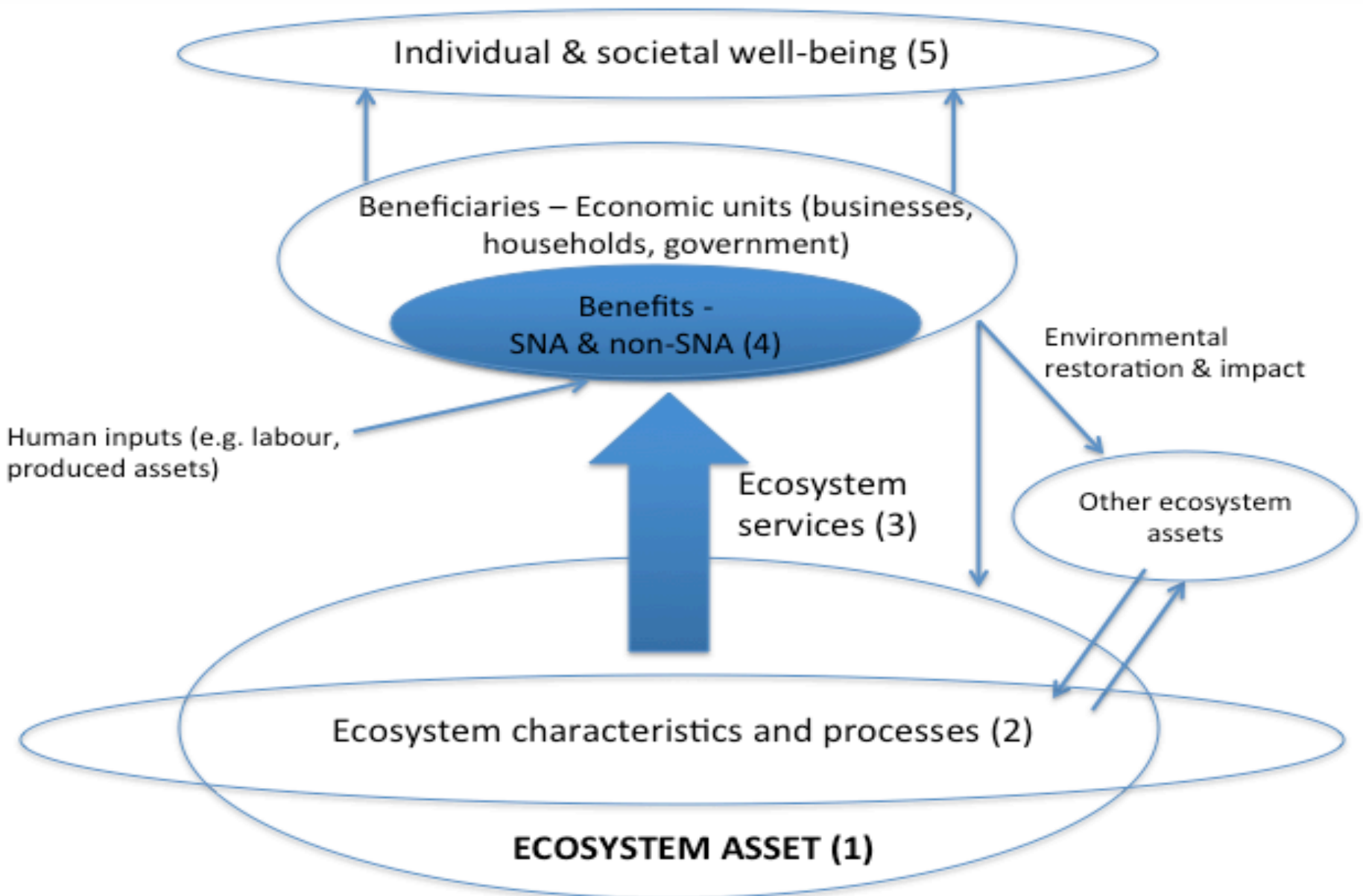


**SEEA Experimental Ecosystem Accounting (SEEA-EEA)** starts with ecosystems and links their services to economic and other human activity



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

# Ecosystem Accounting model



# Spatial units

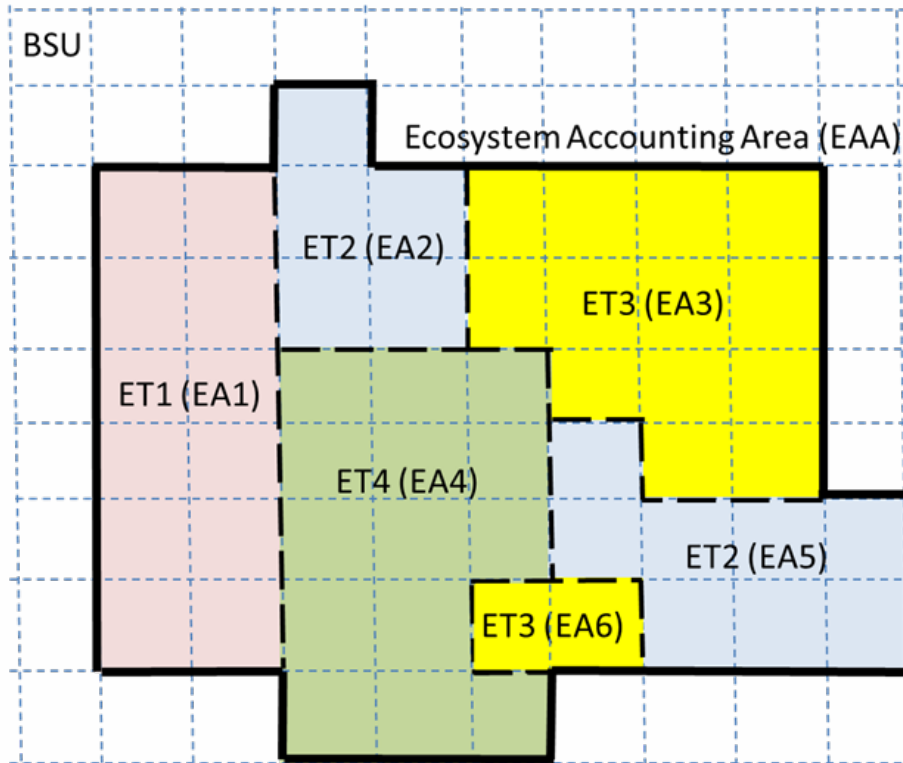
4 types of units

-Basic spatial units (BSU)

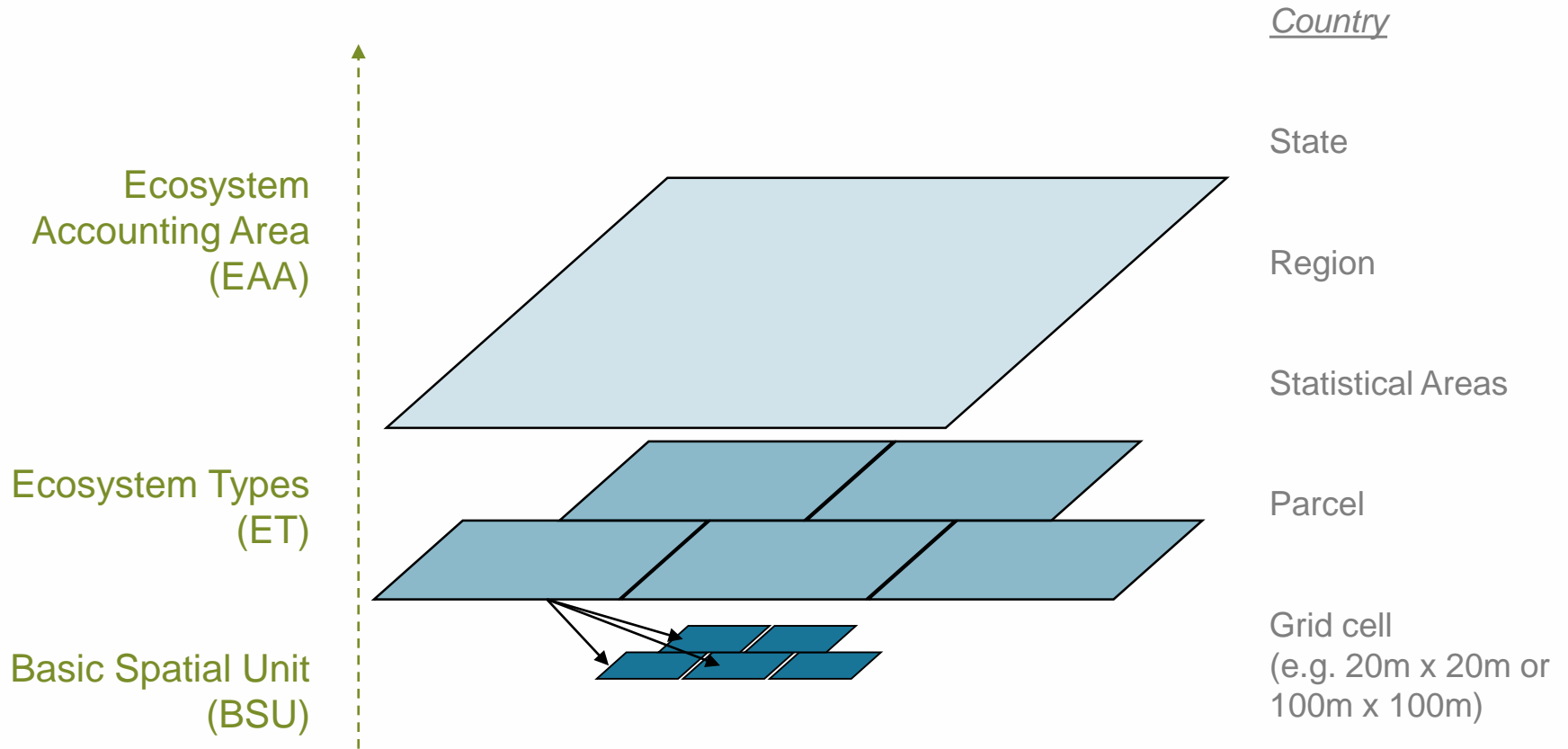
-Ecosystem asset (EA)

-Ecosystem type (ET)

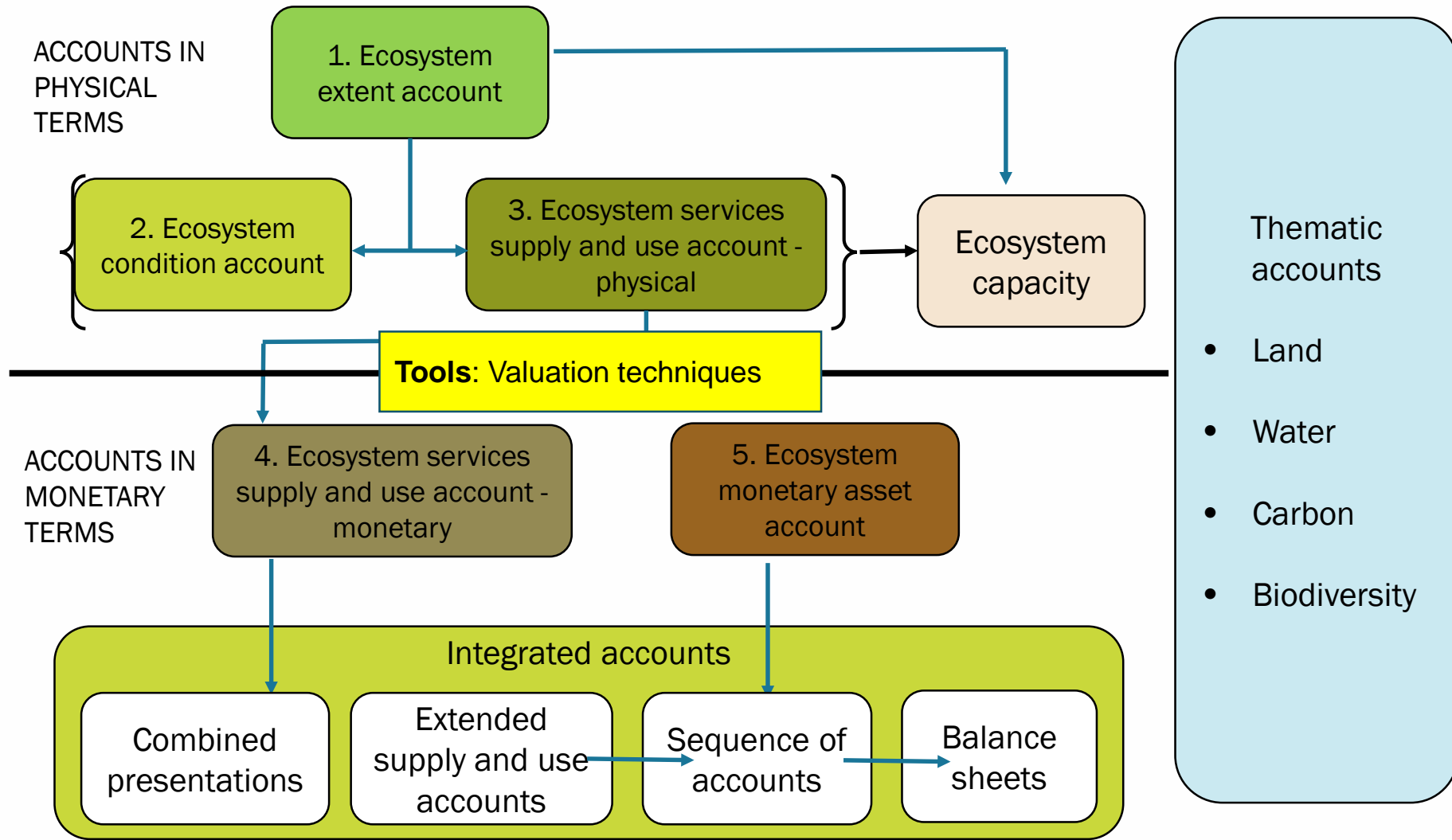
-Ecosystem Accounting Area (EAA)



# Hierarchical (nested-grid) aggregation



# SEEA-EEA accounts





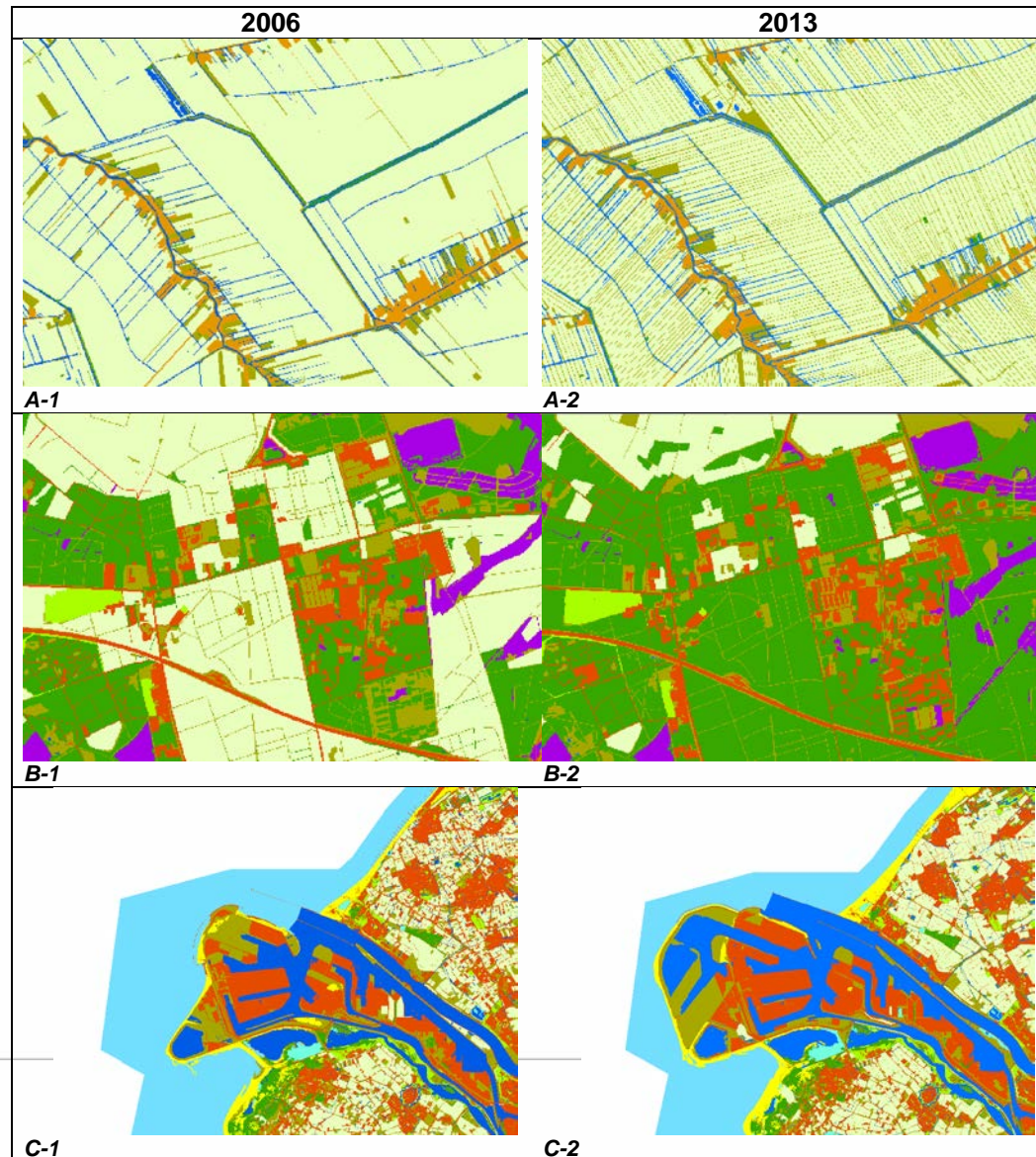
# Ecosystem extent account

	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	
<b>Opening extent</b>																
Additions to extent																
Managed expansion																
Natural expansion																
Upward reappraisals																
Reductions in extent																
Managed regression																
Natural regression																
Downward reappraisals																
Net change in extent																
<b>Closing extent</b>																

# Example: Ecosystem Type map for the Netherlands



# Ecosystem extent 2006 - 2013



# Ecosystem extent account, 2006 - 2013

Ecosystem Unit	Area (km <sup>2</sup> )			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
<b>The Netherlands</b>	<b>41539</b>	<b>41539</b>	<b>0</b>			<b>0,00</b>

# Ecosystem condition account

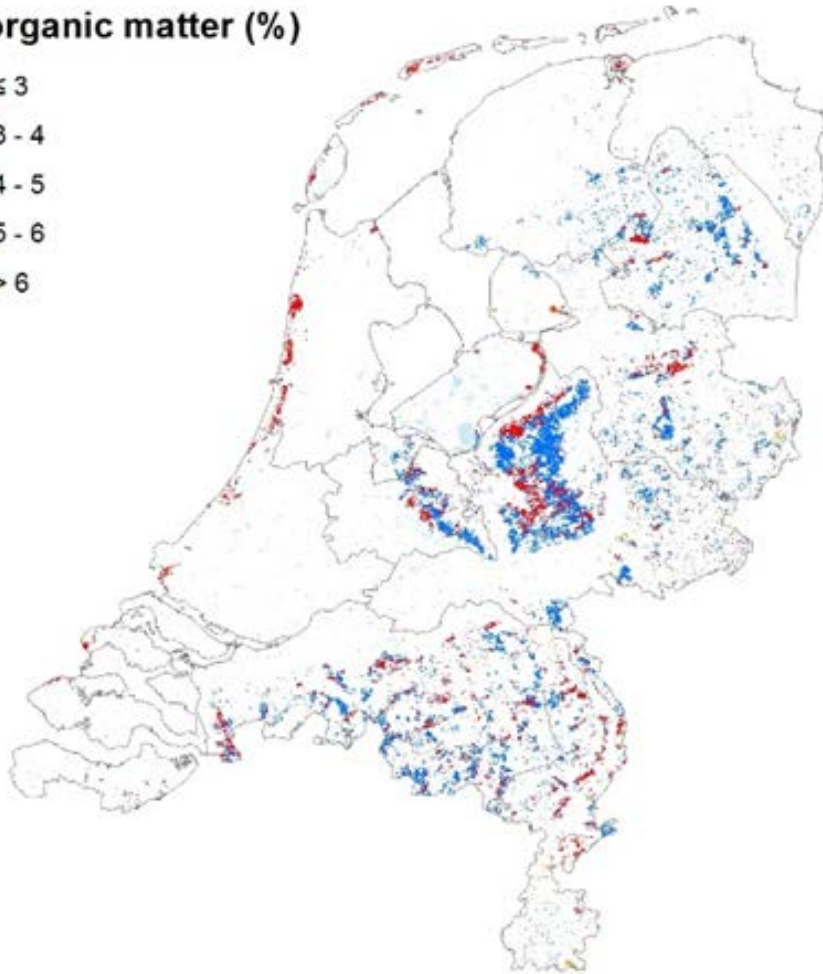
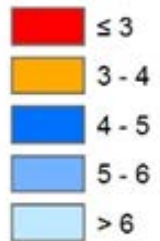
(End of accounting period)

		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
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															

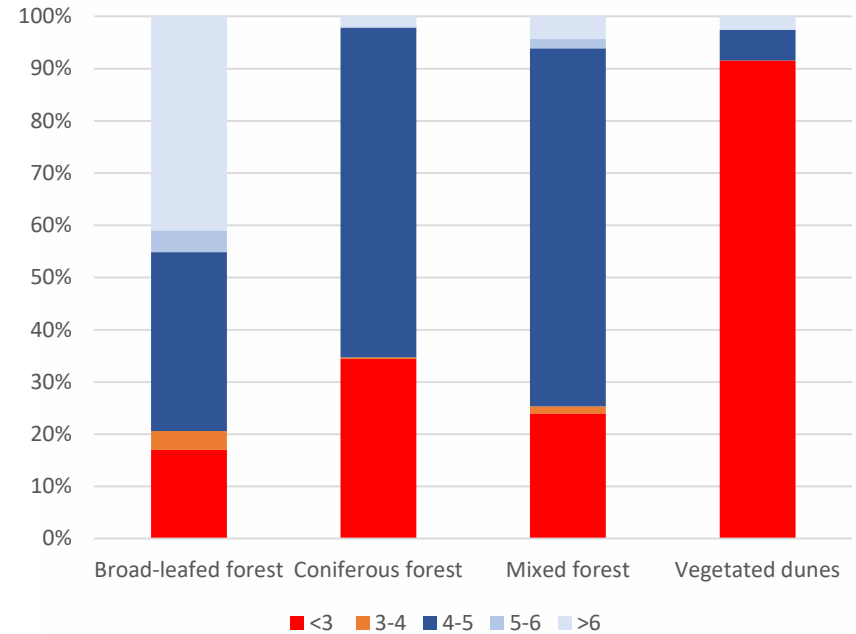
# Example: soil organic matter in forests



Soil organic matter (%)



Soil organic matter content



# Example: Condition account for Dutch forests, 2013

	Indicator	Unit	Deciduous forest	Coniferous forest	Mixed forest	Mixed forest (Dunes)	
<b>EXTENT</b>							
	Extent	ha	109,142	81,923	118,571	15,943	
<b>STATE INDICATORS</b>	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 <sub>10</sub> /m <sup>3</sup>	19.9	20.2	20.1	17.2	
	Air pollution – PM2.5	µg PM <sub>2.5</sub> /m <sup>3</sup>	12.8	13.0	12.9	10.8	
	Air pollution – NO2	µg NO <sub>2</sub> /m <sup>3</sup>	16.0	15.7	15.5	12.3	
Air Pollution – SO2	µg SO <sub>2</sub> /m <sup>3</sup>	0.9	0.8	0.8	1.2		
<b>PRESSURE INDICATORS</b>	Urbanisation	% paved surface	13	6	8	9	
	Temperature change	°C increase	0.10	0.02	0.05	0.04	
	Acidification	mol H <sup>+</sup> /ha/ yr	2368	2724	2663	1887	
	Eutrophication	mol N/ha/ yr	1713	2025	1982	1220	
	Drainage organic soils	cm	67	97	85	29	



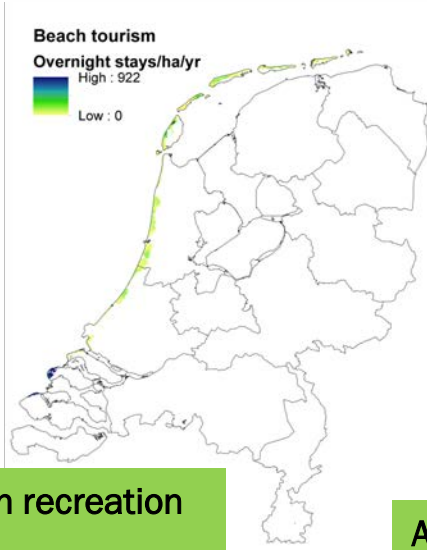


# Ecosystem services use table

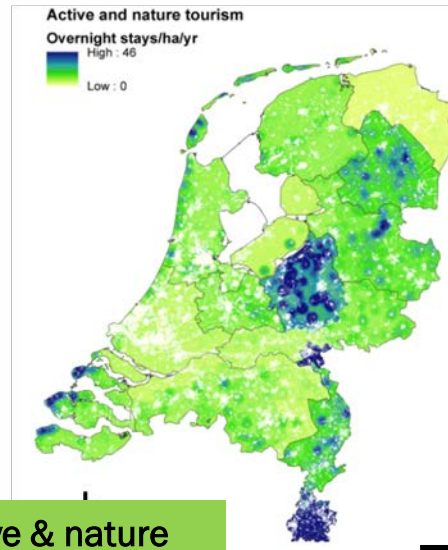
ECOSYSTEM SERVICES USE TABLE

	Measurement Units	Type of economic unit								Proxy ecosystem type (based on land cover)							TOTAL USE								
		Agriculture, forestry and fisheries	Electricity, gas supply	Water collection, treatment and supply	Other industries	Governments	Households	Accumulation	Rest of the world - Exports	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
										1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	
Ecosystem services (detail corresponding to supply table)																									
Provisioning services																									
Regulating services		<b>E</b>								<b>F</b>															
Cultural services																									
Products		<b>G</b>																							

# Example: Nature tourism

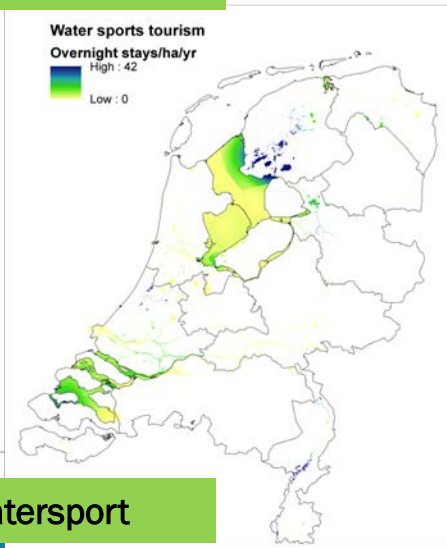


Beach recreation

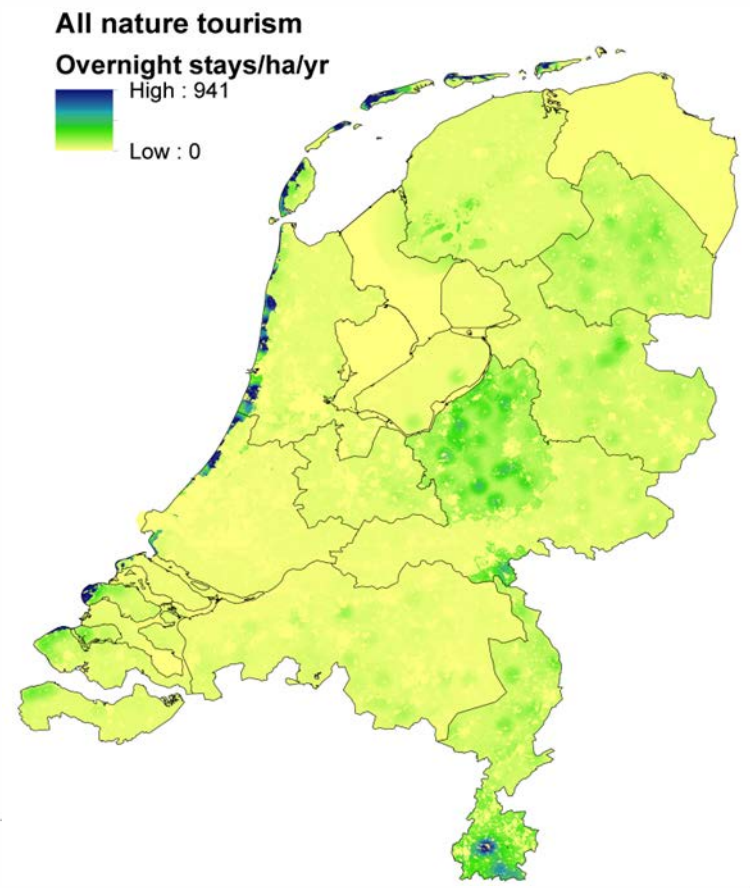


Active & nature

=



Watersport



# Physical Supply table ecosystem services

Ecosystem unit																
Ecosystem service	Unit	Agriculture - annual crops	Agriculture - perennial crops	Agriculture - glass houses	Agriculture - grassland	Agriculture - buffer strips	Agriculture - built-up	Dunes with permanent vegetation	Beach, sand and active dunes	Broad leaved forest	Coniferous forest	Mixed forest	Heath	Sand	Wetlands	Non-agricultural grassland
Area	ha	781.401	79.228	11.790	927.216	36.492	35.491	15.943	33.946	109.142	81.923	118.571	40.813	2.364	34.346	54.010
Crop production	ktons	15.177	1.081	0	0	0	0	0	0	0	0	0	0	0	0	0
Fodder production	ktons	9.517	0	0	6.181	0	0	0	0	0	0	0	0	0	0	0
Wood production	ktons	0	0	0	0	0	0	45	0	502	195	393	0	0	0	0
Biomass production	ktons	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
Drinking water production	mln m3	2.991	453	10	4.845	151	141	3.119	7.742	1.526	2.780	3.809	1.405	83	143	434
Carbon sequestration in biomass	ktons	0	23	0	167	6	0	23	0	158	119	172	8	0	8	10
Pollination	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Natural pest control	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Erosion control	ktons soil	-3	21	6	930	79	47	195	-546	468	317	517	167	-24	32	163
Air filtration	ktons PM10	2.725	287	0	3.266	127	0	463	0	4.063	5.014	5.835	145	114	192	252
Protection against heavy rainfall	mln liters in 1 hour	171.713	23.731	953	193.341	8.166	5.019	10.895	16.799	48.138	57.441	79.896	23.636	1.161	7.156	16.841
Nature recreation (hiking)	x1000 hikers	29.126	5.762	651	42.238	2.103	3.397	11.406	16.922	27.937	25.474	32.975	11.826	703	6.290	6.022
Nature tourism	x1000 tourists	798	97	0	1.042	46	2	367	704	148	168	240	87	6	31	73

# Physical Use table ecosystem services

Ecosystem service	Unit	A - Agriculture, forestry and fishing	B,C - Mining and manufacturing	D - Electricity	E - Water supply	F-H - Construction, wholesale and transportation	I,R - Accommodation and food service, culture, sports and recreation	Other sectors	Export	Households	Government	Investments	Inventories	Environment (Global goods)	Total
Crop production	ktons	16.259													16.259
Fodder production	ktons	16.039													16.039
Wood production	ktons	1.134													1.134
Biomass production	ktons			360											360
Drinking water production	mln m3				41.313										41.313
Carbon sequestration in biomass	ktons													823	823
Pollination	-	x													x
Natural pest control	-	x													x
Erosion control	ktons soil	1.766	30		26	158	129	60		277	1.705				4.150
Air filtration	ktons PM10									23.832					23.832
Regulation against heavy rainfall	mln liter in 1 hour	506.112	2.002	43	689	13.682	22.355	12.255		59.866	288.493				905.497
Nature recreation (hiking)	x1000 hikers									429.526					429.526
Nature tourism	x1000 tourists						4.505								4.505

# 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.

Example: Carbon Accounting in the Netherlands

Mton C	Geocarbon					Biocarbon				Carbon in the economy				Carbon in the atmosphere	Total
	oil	gas and shales	coal	limestone and marl	total geocarbon	Forests	Cropland / meadows	Other ecosystems	Total biocarbon	Inventories	fixed assets, consumer durables	Waste	Total	Total	
Opening stock	54	627	12717		13398	48	206	123	377	24			24	3193	16993
Additions to stock	0	0	0	0	0	0.6	0.2	0.2	1.0	251	2	10	263	64.2	329
Natural expansion						0.6	0.2	0.2	1.0					1.8	3
Managed expansion										50			50	62.4	113
Discoveries	0	0	0		0										0
Upwards reappraisals	0	0	0		0										0
Reclassifications										15	2	6	23		23
Imports										186		4	190		190
Reductions in stock	1	41	0	0	42	0.6	1.3	0.6	2.4	246	0	10	256	9.4	310
Natural contraction						0.1	1.3	0.5	1.9					1.0	3
Managed contraction	1	40	0	0	41	0.5	0.0	0.0	0.5	60		3	62	8.5	113
Downwards reappraisals	0	1	0		1										1
Reclassifications										19	0	5	23		23
Exports										168		3	170		170
Net carbon balance	-1	-41	0	0	-42	0.0	-1.1	-0.4	-1.4	5	2	0	7	54.8	19
Closing stock	53	587	12717		13356	48	205	122	376	30			32	3248	17012

# SEEA EEA Technical Recommendations

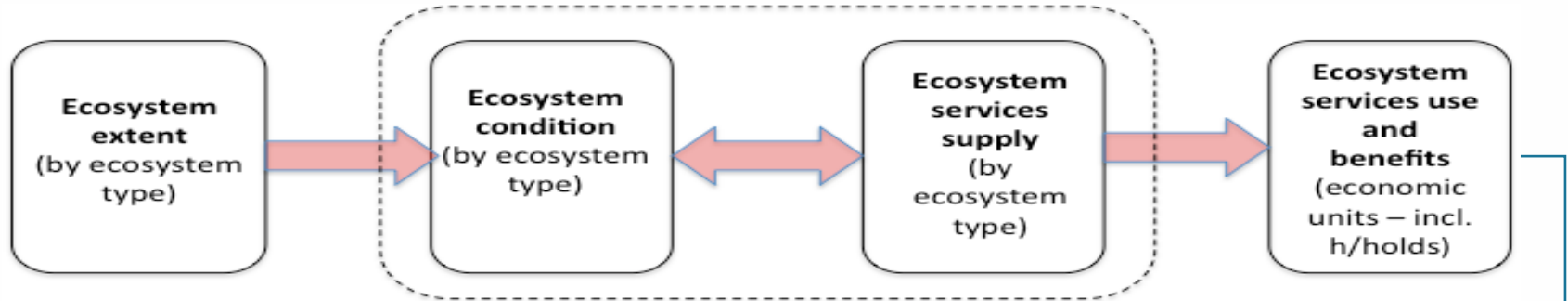
- Complements the SEEA EEA to provides a range of content to support testing and research on ecosystem accounting
- Available at <https://seea.un.org/ecosystem-accounting>

## Topics

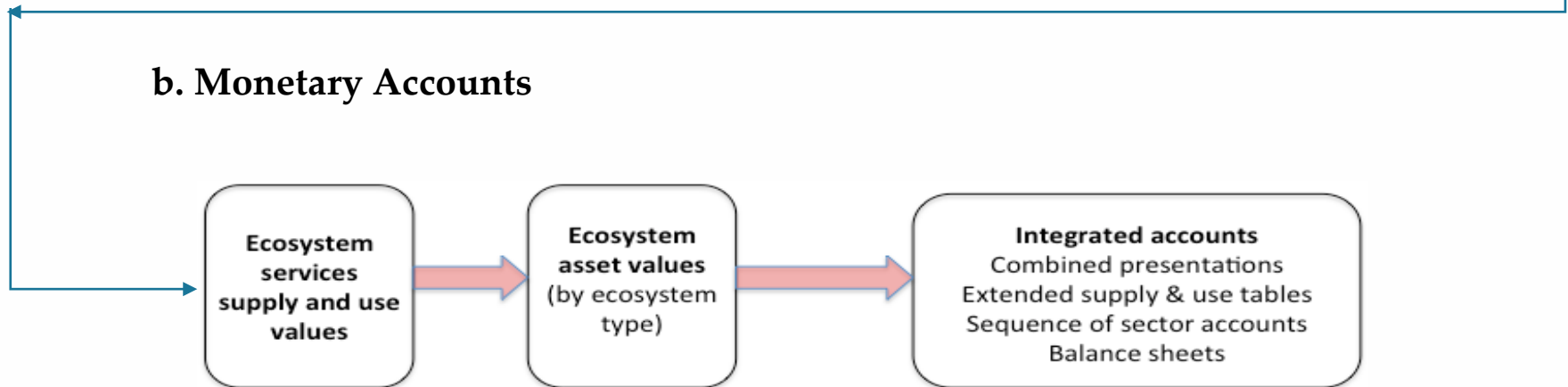
1. Introduction
2. Ecosystem accounts and approach to measurement
3. Organizing spatial data and accounting for ecosystem extent
4. The ecosystem condition account
5. Accounting for flows of ecosystem services
6. Valuation in ecosystem accounting
7. Accounting for ecosystem assets in monetary terms
8. Integrating ecosystem accounting with standard national accounts
9. Thematic accounts – Land, Water, Carbon and Biodiversity

# Broad steps in ecosystem accounting

## a. Physical Accounts



## b. Monetary Accounts





**THANK YOU**

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