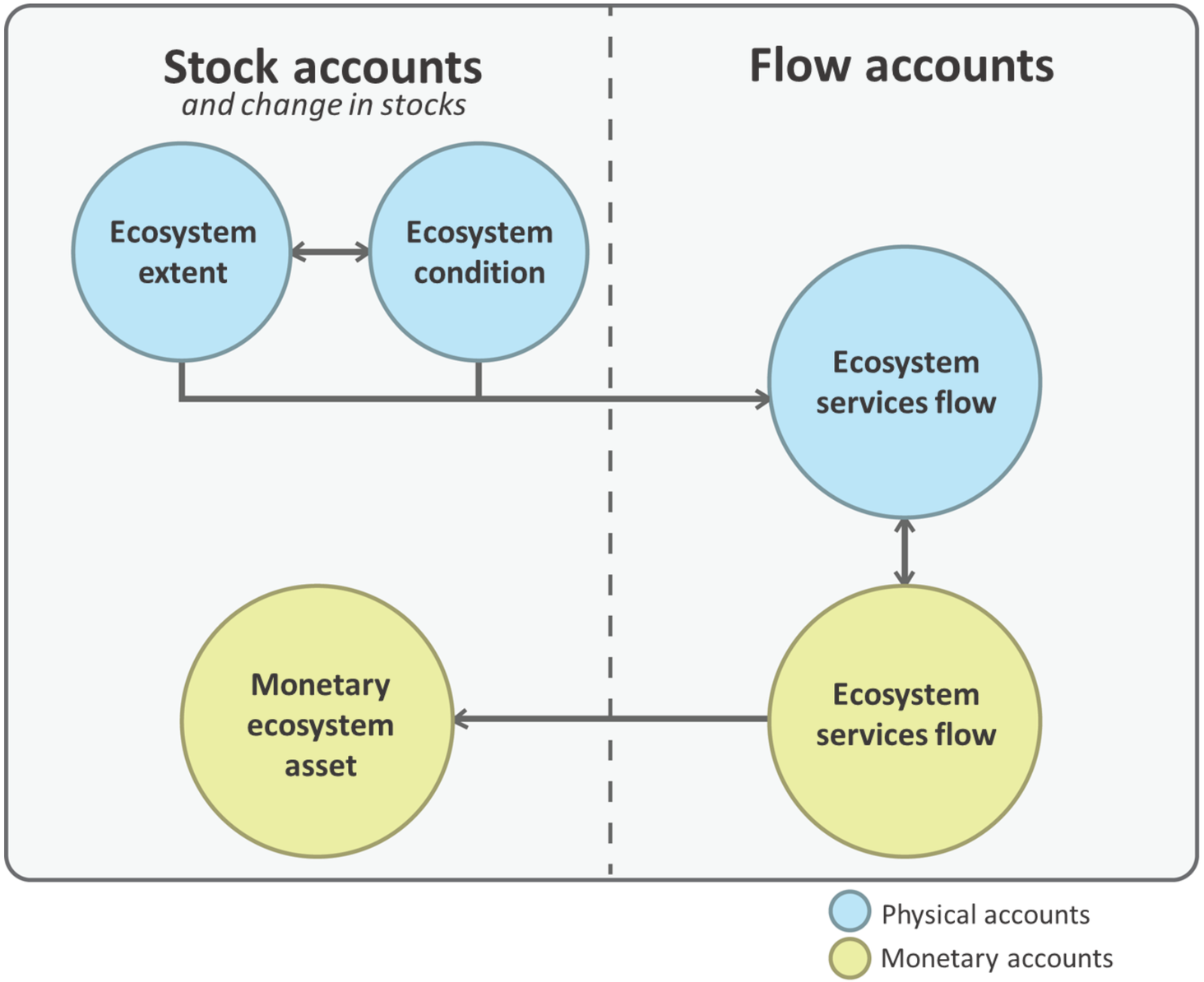
System of Environmental Economic Accounting

Ecosystem condition accounts in the SEEA Ecosystem Accounting

United Nations

Ecosystem accounts – core accounts



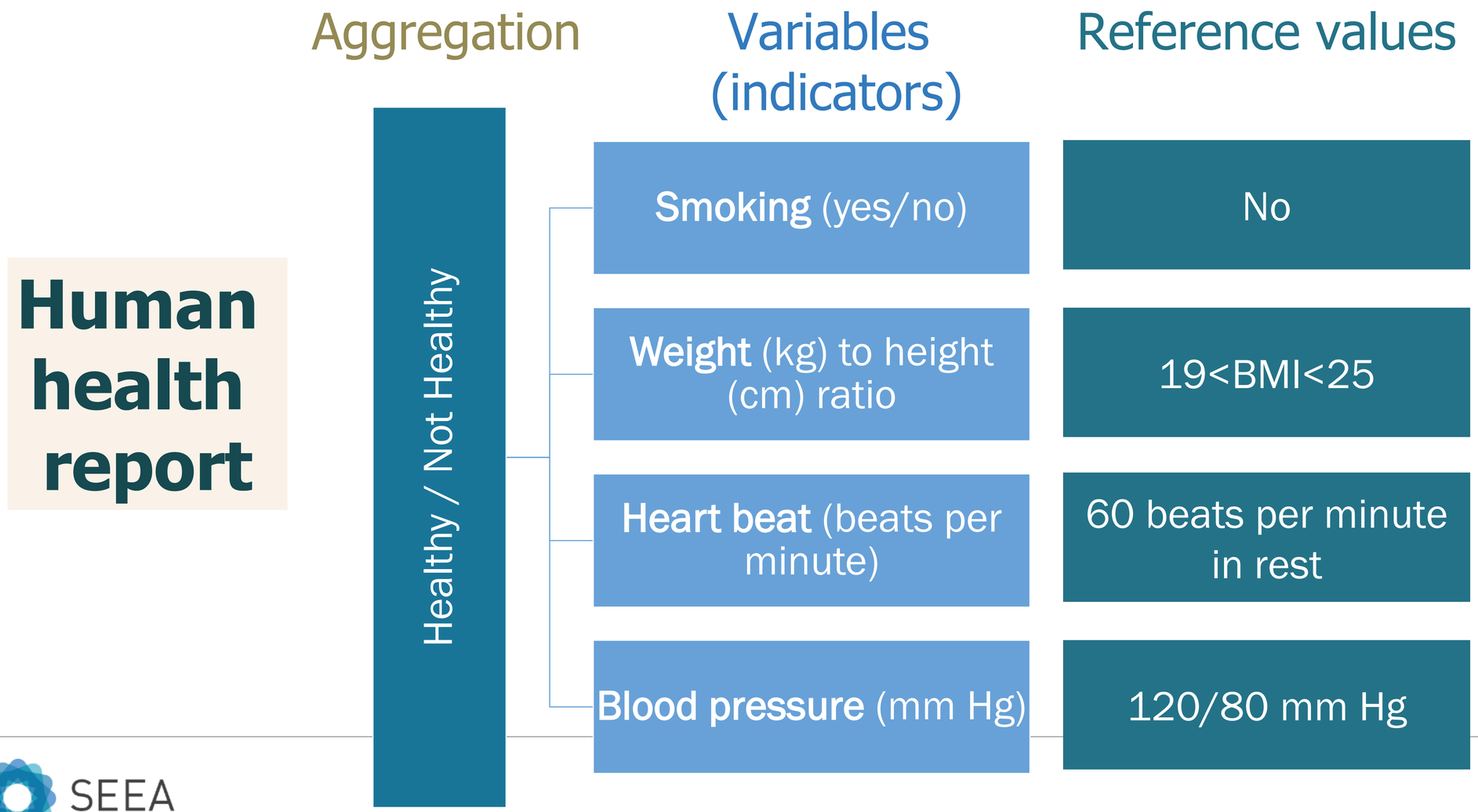
Ecosystem condition: definitions

- **Ecosystem characteristics** are the system properties of the ecosystem and its major abiotic and biotic components (water, soil, topography, vegetation, biomass, habitat and species)

- **Ecosystem condition** is the quality of an ecosystem measured in terms of its abiotic and biotic characteristics

- **Ecosystem integrity** is the ecosystem's capacity to maintain it characteristic composition, structure, functioning and self-organization over time within a natural range of variability

Measuring ecosystem condition is very similar to measuring human health



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SEEA Ecosystem Condition Typology

The SEEA ecosystem condition typology (ECT) is a hierarchical typology for organizing data on ecosystem condition characteristics

ECT groups and classes
Group A: Abiotic ecosystem characteristics
Class A1. Physical state characteristics: physical descriptors of the abiotic components of the ecosystem (e.g. soil structure, water availability)
Class A2. Chemical state characteristics: chemical composition of abiotic ecosystem compartments (e.g. soil nutrient levels, water quality, air pollutant concentrations)
Group B: Biotic ecosystem characteristics
Class B1. Compositional state characteristics: composition/diversity of ecological communities at a given location and time (e.g. presence/abundance of key species, diversity of relevant species groups)
Class B2. Structural state characteristics: aggregate properties (e.g. mass, density) of the whole ecosystem or its main biotic components (e.g. total biomass, canopy coverage, annual maximum normalized difference vegetation index (NDVI))
Class B3. Functional state characteristics: summary statistics (e.g. frequency, intensity) on the biological, chemical and physical interactions between the main ecosystem compartments (e.g. primary productivity, community age, disturbance frequency)
Group C: Landscape-level characteristics
Class C1. Landscape and seascape characteristics: metrics describing mosaics of ecosystem types at coarse (landscape, seascape) spatial scales (e.g. landscape diversity, connectivity, fragmentation)

Measuring and reporting ecosystem condition in three stages

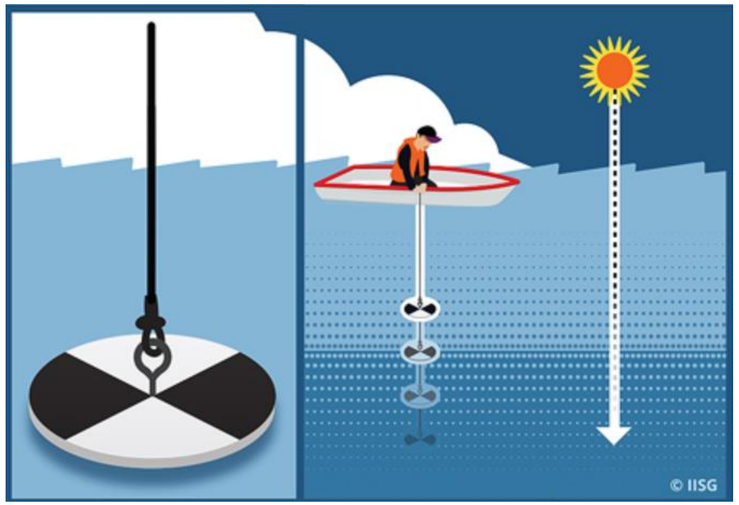
1. Select appropriate ecosystem variables to measure ecosystem condition
2. Define a reference condition, reference levels, and rescale ecosystem variables to ecosystem condition indicators
3. Aggregate the indicators to a single ecosystem condition index

Step 1: Ecosystem condition variables

Ecosystem condition **variables** are quantitative metrics describing individual **characteristics** of an ecosystem asset

Water clarity = **characteristic**

Secchi disk depth (meter) = **variable**



Example of step 1: Ecosystem condition variable account for forests

SEEA ECT class		Variable descriptor	Measurement unit	Variable values (observed)		
				Opening	Closing	Change
(1)	(2)	(3)	(4)	(5)	(6)	(7)
Abiotic characteristics	Physical state	Vegetation water content (NDWI)	Index (-1 to 1)	0.31	0.29	-0.02
	Chemical state	Soil organic carbon stock	tC/ha	100	95	-5
		Foliar or litter nitrogen concentration	mg N/g dry weight	18	17	-1
Biotic characteristics	Compositional state	Tree species richness	Number	6	5	-1
	Structural state	Tree cover	%	81	75	-6
	Functional state	Vegetation index (NDVI)	Index (-1 to 1)	0.65	0.63	-0.02
Landscape/seascape characteristics		Forest area density	%	74	59	-15

Step 2: Reference condition/levels and rescaling

- The practical basis for assessing ecosystem condition is to measure the **similarity or distance** of a current ecosystem to a reference or least-disturbed ecosystem
- A **reference condition** is the condition against which past, present and future ecosystem condition is compared to in order to measure relative change over time
  - E.g., undisturbed, historical, least disturbed, contemporary, best attainable, etc.
- **Reference level** is the value of a variable at the reference condition, against which it is meaningful to compare past, present or future measured values of the variable
  - Upper reference level
  - Lower reference level
- **Ecosystem condition indicators** are rescaled versions of ecosystem condition variables

Example of step 2: Ecosystem condition indicator account for forests

SEEA ECT class		Variable descriptor	Measurement unit	Variable values (observed)		Reference-level values		Indicator values (rescaled)		
				Opening	Closing	Lower level	Upper level	Opening	Closing	Change
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Abiotic characteristics	Physical state	Vegetation water content (NDWI)	Index (-1 to 1)	0.31	0.29	-1	1	0.66	0.65	-0.01
	Chemical state	Soil organic carbon stock	tC/ha	100	95	0	250	0.40	0.38	-0.02
		Foliar or litter nitrogen concentration	mg N/g dry weight	18	17	4	40	0.39	0.36	-0.03
Biotic characteristics	Compositional state	Tree species richness	Number	6	5	0	10	0.60	0.50	-0.10
	Structural state	Tree cover	%	81	75	0	100	0.81	0.75	-0.06
	Functional state	Vegetation index (NDVI)	Index (-1 to 1)	0.65	0.63	-1	1	0.83	0.82	-0.01
Landscape/seascape characteristics		Forest area density	%	74	59	0	100	0.74	0.59	-0.15

Step 3: Aggregation

- **Ecosystem condition indices** and subindices are composite indicators that are aggregated from the combination of individual ecosystem condition indicators recorded in the ecosystem condition indicator account
  - > Use of different aggregation methods
- Derivation of condition indices is optional

Example of step 3: Ecosystem condition indices account for forests

SEEA ecosystem condition typology class		Variable descriptor	Indicator values (0 - 1)		Indicator weight	Index values		
			Opening	Closing		Opening	Closing	Change[a]
(1)	(2)	(3)	(9)	(10)	(12)	(13)	(14)	(15)
Abiotic characteristics	Physical state	Vegetation water content (NDWI)	0.66	0.65	0.17	0.11	0.11	0.00
	Chemical state	Soil organic carbon stock	0.40	0.38	0.08	0.03	0.03	0.00
		Foliar or litter nitrogen concentration	0.39	0.36	0.08	0.03	0.03	0.00
	Total abiotic				0.33	**0.17**	**0.17**	-0.01
Biotic characteristics	Compositional state	Tree species richness	0.60	0.50	0.17	0.10	0.08	-0.02
	Structural state	Tree cover	0.81	0.75	0.17	0.14	0.13	-0.01
	Functional state	Vegetation index (NDVI)	0.83	0.82	0.17	0.14	0.14	0.00
	Total biotic				0.50	**0.37**	**0.34**	-0.03
Landscape/ seascape characteristics		Forest area density	0.74	0.59	0.17	0.12	0.10	-0.03
	Total landscape/ seascape					**0.12**	**0.10**	-0.03
Total					1.00	**0.67**	**0.16**	-0.06

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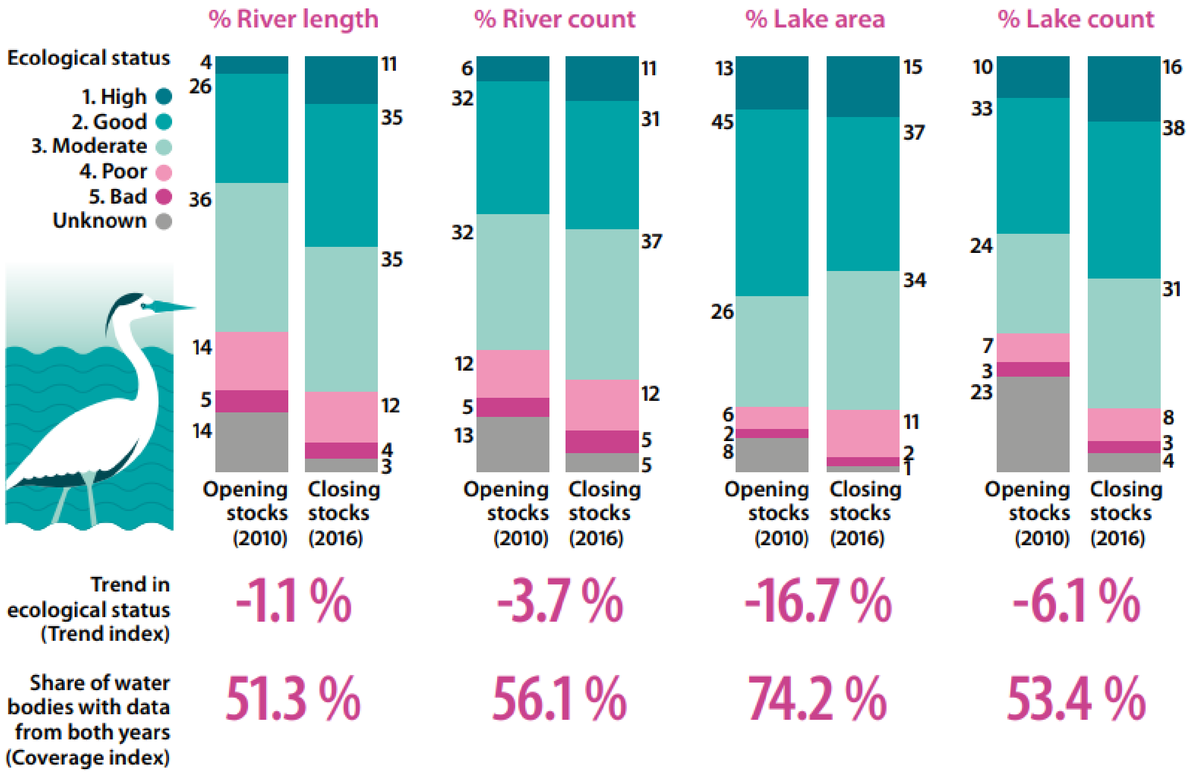
Example of ecosystem condition account in the EU

Table 4: Condition variable account for rivers and lakes, EU28 (spatially averaged values)

Condition class	Descriptor	Units	Opening stock (2010)	Closing stock (2020 - projected)	Change (% per decade)	Confidence
Physical state	Share of artificial areas in riparian land	%	7	7.5	7	high
	Gross water abstraction	million m3/y	204 489	204 448	-2	medium
Chemical state	Ammonia concentration	mg/l	0.131	0.034	-74	high
	Nitrate concentration	mg/l	1.87	1.7	-8	high
	Phosphate concentration	mg/l	0.07	0.05	-28	high
	Total phosphorus concentration	mg/l	0.103	0.059	-43	high
Composition	:	:	:	:	:	:
Structure	Length of rivers achieving good ecological status (1)	%	30	46	44	low
	Area of lakes achieving good ecological status (1)	%	58	52	-14	medium
Function	Biological oxygen demand	mg/l	2.09	1.55	-26	high
Landscape	Dam interception of streamflow	%	60.3	:	:	:



Source: Vysna et al. 2021. Accounting for ecosystems and their services in the EU (INCA). https://ec.europa.eu/eurostat/documents/7870049/12943935/KS-FT-20-002-EN-N.pdf/de44610d-79e5-010a-5675-14fc4d8527d9?t=1624528835061

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