

System of Environmental Economic Accounting

# **Session 5: Ecosystem condition**

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#### SEEA-EEA accounts, tools and linkages





### **Basic definitions**

- The **main purpose** of condition account is to assess how ecosystem assets change over time, and how this change influences the flow of ecosystem services.
- The current definition of ecosystem condition is *"the quality of an ecosystem that may reflect multiple values, measured in terms of its abiotic and biotic characteristics across a range of temporal and spatial scales"*
- In particular, condition is relevant:
  - > Combine with measures of ecosystem extent to provide an overall measure of the state of an ecosystem asset.
  - > **Changes** in ecosystem condition will (most likely) impact on expected ecosystem service flow, through capacity.



## **SEEA EEA Conceptual Framework**





# Multi-purpose approach to ecosystem condition accounting

	ECOC	entric	
	Ecosystem condition is understood as the <b>integrity</b> of the ecosystem in terms of its structure, function and composition.	Ecosystem condition is understood as <b>capacity</b> of ecosystems to deliver <b>intermediate</b> ecosystem services to natural entities and collectively to ecosystems.	
Intrinsic	Ecosystem condition is understood as a way to describe the <b>state</b> of a system relative to a desired management <b>target or</b> <b>reference</b> condition.	Ecosystem condition is understood as <b>capacity</b> of ecosystems to deliver <b>final</b> ecosystem services to humans and the economy.	nstrumental
	Anthrop	ocentric	



#### **Components of an ecosystem condition account**





#### **Reference condition and reference levels**

- **Reference condition** sets the scaling used for comparison of ecosystem condition indicators allowing conversion of metrics to a common scale (such as, between 0 and 1), which can then be used in aggregation.
  - > a point against which to compare past, present or future condition, but does not imply a policy goal, target or desired state
  - > represents the condition of an ecosystem to maintain ecological integrity
  - > reference condition as the natural state is preferred
- **Reference level** is the value of the variable at the reference condition, and thus is used to derive an individual indicator
- Not to be confused with **target condition** determined as a function of economic, environmental and social considerations



## Aggregation

- Generate a single or simplified index for a specific ecosystem asset
- 3 types of aggregation:
  - > Spatial aggregation:
    - <sup>-</sup> One measure may be representative of a larger area, by ET
    - <sup>-</sup> "Average soil quality" may hide erosion in certain spots
  - > Temporal aggregation
    - for example financial year economic data, or growing seasons for particular plants
  - > Thematic aggregation, two options:
    - <sup>-</sup> (1) aggregating the same indicator across ecosystem types,
    - (2) combining different indicators within the same ecosystem type (or group of types).



#### **Ecosystem condition account**

#### **Ecosystem condition variable account**

Class	Variables	Ecosystem types						
		Ecosystem type 1			Ecosystem type 2			
		Year 1	Year 2	Year 3	Year 1	Year 2	Year 3	
Class 1	Variable 1							
	Variable 2							
	Variable 3							
Class 2	Variable 4							
	Variable 5							
	Variable 6							

#### **Ecosystem condition indicator account**

Class	Indicators	Ecosystem types							
		Ecosystem type 1			Ecosystem type 2				
		Reference condition =			Reference condition =				
		Reference	Year 1	Year 2	Year 3	Reference	Year 1	Year 2	Year 3
		level				level			
Class 1	Indicator 1								
	Indicator 2								
	Indicator 3								
Class 2	Indicator 4								
	Indicator 5								
	Indicator 6								

# Typology for ecosystem condition variables

	Types of characteristics	Classes of condition variables and indicators			
	Abjotic characteristics	Physical state			
	Abiotic characteristics	Chemical state			
		Composition (including species-based indicators)			
Ecosystem condition	Biotic characteristics	Structure (including vegetation, biomass, food chains)			
		Classes of condition variables and indicators         Physical state         Chemical state         Composition (including species-based indicators)         Structure (including vegetation, biomass, food chains)         Function (including ecosystem processes, disturbance regimes)         Landscape diversity of biotic or abiotic characteristics         Spatial distribution of characteristics such as connectivity, fragmentation			
	Landscape and seascape level characteristics	Landscape diversity of biotic or abiotic characteristics			
		Spatial distribution of characteristics such as connectivity,			
		fragmentation			



### **Types of condition data**

- **Direct** indicators of quality:
  - > Water quality is often an index based on selection of indicators (BOD, COD, pH, metals...) according to fitness for use (drinking, recreation, livestock, wildlife, irrigation...)
  - > Air quality (Ozone, PM<sub>2.5</sub>, NO<sub>x</sub>, SO<sub>2...</sub>) is often measured only in urban areas and indexed on effects on human health
  - > Soil quality (moisture, texture, contaminants) should be available from soil inventories
- Indirect measures: pressures exerted (e.g. acidification -> nutrient balances)
- **Derived** measures (e.g. fragmentation) can be estimated from satellite and administrative data (e.g., roads)



#### **Potential data sources**

- > Departments of Environment: Water quality, air quality, Species diversity indices
- > **Departments of Natural Resources**: Hydrology
- > Departments of Agriculture: Soil type, soil quality, farming practices
- > Departments of Forestry: Forest status, species mix, forest inventory, carbon balances
- > Departments of Fisheries: Coastal and marine water quality, species diversity
- > International sources:
  - FAO: land cover, soil, marine species distributions
  - IUCN: protected areas, red list of threatened species



## **Selection of condition indicators**

Considerations when selecting condition indicators:

- the degree to which the indicator reflects the overall ecological condition of the ecosystem or key processes within it and is able to signal changes in this condition;
- ii. the degree to which the indicator can be linked to measures of **potential ecosystem services supply**;
- iii. how easy it is for policy makers and the general public to understand and correctly interpret the indicator;
- **iv. data availability** and scientific validity of measurement approaches for the indicator; and
- v. the possibility to **generate new data** cost effectively.



#### **Examples of condition accounts**





Your annual physical check-up Which questions?

Indicators









Units	yes/no	kg	mm Hg	beats/min	
Туре	pressure	state	state	performance	
Reference	no	19 <bmi<25< th=""><th>120/80</th><th>60-200</th></bmi<25<>	120/80	60-200	
Aggregate		healthy	unh	ealthy	



#### Wetland accounts, UK

#### Table 1 - Wetland ecosystems assets account

	Ecosystem Extent	Characteris	tics of cond	dition			
	Land cover	Ecological	condition	Soil		Accessibility	
Indicators		Wetland birds	Mean species richness	Mean total nitrogen stock	Mean carbon conc <sup>6</sup>	Accessible wetlands - population with access to wetlands within X kilometres <sup>1</sup>	Indicators
Units of measure	Size of area (hectares in '000)	No. of wetland birds at inland wetland sites in the UK ('000)	Diversity of species per pond	Mean total nitrogen in soil(% of dry soil)	Mean level of carbon in soil in (gram/ kilogram <sup>-1</sup> )	-	
Year 2008	2833 (2007) <sup>2</sup>	4666	39.1 (2007)	1.5 (2007)	401.2 (2007)	-	Opening stock
Net change <sup>3</sup>	0	163	-5.4	<sup>4</sup> -0.2	-17.2	-	
Year 2012	2833 <sup>5</sup>	4829	33.7	1.3	384.0	-	 Closing stock



Source: Khan, J., Din, F. (2015) UK Natural Capital – Freshwater Ecosystem Assets and Services Accounts. Office for National Statistics

#### II.I Cuentas de condición: Agua



CONAGUA. Condición de acuíferos.





#### II.II Cuentas de condición: Suelo

El INEGI ha realizado esfuerzos para conocer la condición del suelo a partir de su erosión, es por ello que cuenta con la **serie de erosión del suelo**.

En el marco del SEEA-EEA Mx esta información ha sido retomada y alineada a la serie de Uso de Suelo y Vegetación Va.

INEGI. Capa de Erosión del Suelo. Serie I. INEGI. Capa de Uso de Suelo y Vegetación. Serie V.

Estable

Extremo

Moderado

No aplicable No disponible

Fuerte Leve



#### II.III Cuentas de condición: Carbono



En el país se cuenta con un ejercicio realizado por la cooperación entre INEGI y CEPAL, que muestra los promedios de carbono por tipo de uso de suelo o vegetación.

INEGI. Cartas de Uso de Suelo y Vegetación. Series III, IV, Va y VI.

INEGI. CONAFOR, PNUD. Carbono orgánico en suelo. Adaptado a las series III, IV, Va y VI de Uso de Suelo y Vegetación.





#### II.IV Cuentas de condición: Biodiversidad

Actualmente se está evaluando la implementación de un estudio realizado por CONABIO que determina la condición de los ecosistemas con base en la relación depredador-presa.

Integridad ecológica Structural equation model

Value Alta : 1.0

Baja : 0

 125
 250
 500
 750
 1,000



Este indicador se conoce como el Índice de Integridad Ecológica



#### **EU: assessment of cropland condition**



#### EU: Pressures on ecosystems Map 4.5 Estimation of the level of invasion by invasive alien plant species

- An indirect approach through pressures exerted on ecosystems
  - > Invasive alien species
  - > Pollution and nutrient enrichment



#### ap 4.6 Exceedance of critical loads of acidification in 1980 and 2010



#### Exposure of ecosystems to acidification

Average accumulated exceedance of the critical loads for acidification (in equivalents (H+ ions) = (mol <sub>charge</sub>) per hectare and year)



No data

Source: European Commission, Mapping and Assessment of Ecosystems and their Services, 3rd Report – Final, March 2016.

### Aggregation





### **EU: Nature Directives**

• The EU Birds Directive and Habitats directive provide an estimation of condition of European ecosystems



Figure 4.2 Conservation status of EU habitats (2007-2012)



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

# THANK YOU

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