



System of
Environmental
Economic
Accounting

Session 7: Ecosystem condition overview

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Countries of Latin America and the Caribbean

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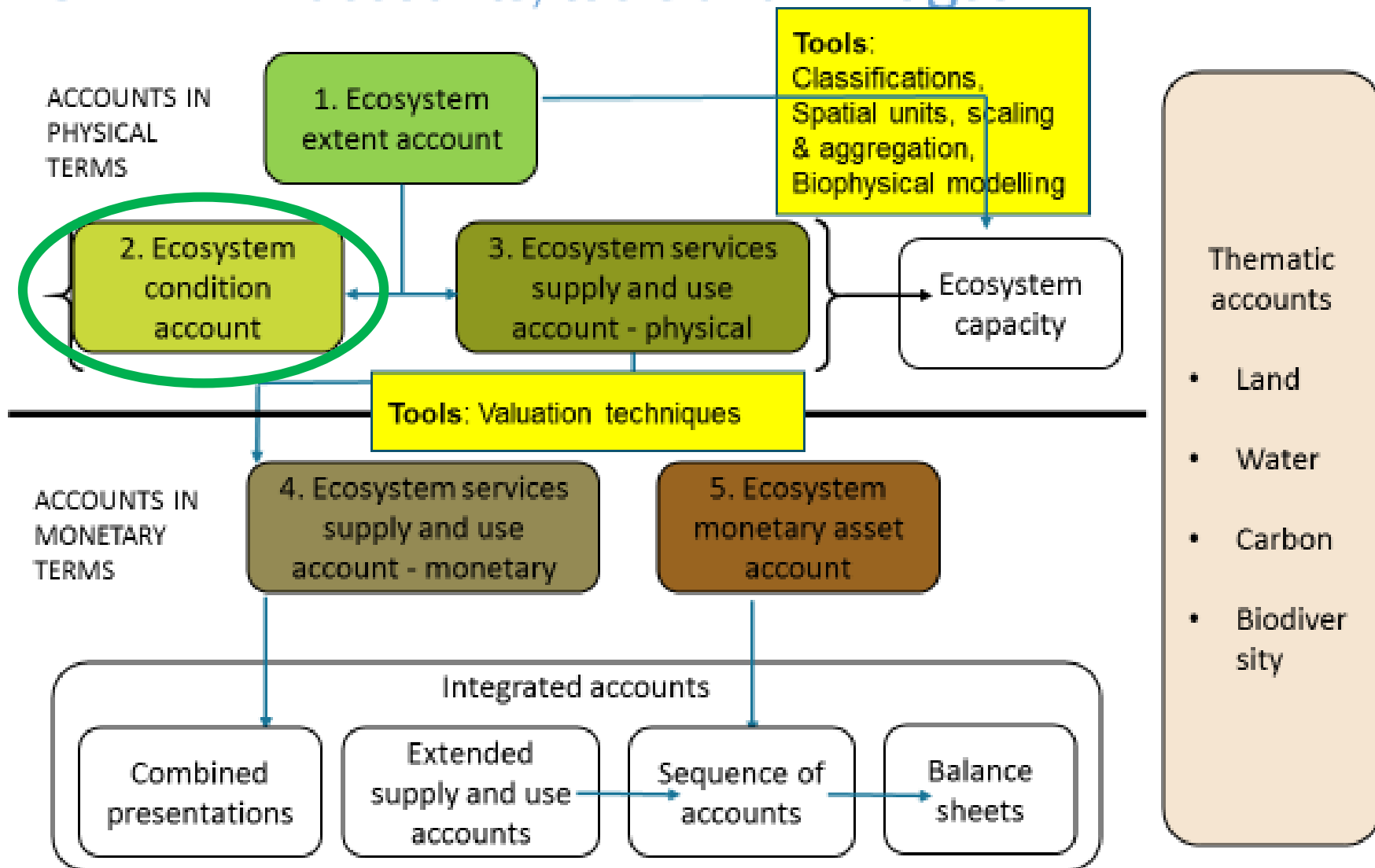
United Nations

Outline

- Methodology
 - > Why ecosystem condition?
 - > Basic definitions
 - > Purposes
 - > Condition account
 - > Aggregation and reference condition
 - > Indicators and data sources
- Examples:
 - > Examples of accounts
 - > Examples of mapping condition data
 - > Example of aggregation

Methodology

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 working definition of ecosystem condition is “*the overall quality of an ecosystem asset in terms of its characteristics.*”
 - > 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.
- Both top-down and bottom-up approaches to measurement, and across different scales:
 - > indicators for **individual characteristics** for a single ecosystem type
 - > comparable **indicators across ecosystem types** with multiple characteristics.

Two traditions at work

- Condition as an assessment of the **state of the ecosystem**
 - > w.r.t. to reference conditions
 - > “Disturbance” or change from reference condition
 - > Either generic indicators or indicators per ecosystem type
- Condition indicators **linked to services** or functions
 - > Condition depends on the use/function (e.g. water used for drinking water other requirements than water for navigation)
 - > Link to ecological production functions, service models
 - > Indicators selected to reflect an area’s **capacity** to generate services

Ecosystem condition 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
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															

Aggregation

- Thematic aggregation:
 - > Composite indicators
 - > Aggregating different indicators into one
 - > E.g. soil condition; texture, nutrients, pH, soil organic matter content and other factors
- Spatial aggregation:
 - > One measure may be representative of a larger area
 - > “Average soil quality” may hide erosion in certain spots





Reference state or reference condition

- Two types of reference condition:
 - > Natural (unmodified state)
 - Which period? (pristine state; earliest available information)
 - > Compare with “standard” for use or “ideal”
 - E.g. drinking, recreation, livestock, wildlife, irrigation
 - Linked to the services provided
- Not to be confused with target condition – determined as a function of economic, environmental and social considerations



Your annual physical check-up

Which questions?

Indicators				
Units	yes/no	kg	mm Hg	beats/min
Type	pressure	state	state	performance
Reference	no	$19 < \text{BMI} < 25$	120/80	60-200
Aggregate		healthy	unhealthy	

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_{2.5}, NO_x, SO₂...) 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:
 - i. 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

Wetland accounts, UK

Table 1 - Wetland ecosystems assets account

Indicators	Ecosystem Characteristics of condition					
	Land cover	Ecological condition		Accessibility		
		Wetland birds	Mean species richness	Mean total nitrogen stock	Mean carbon conc ⁶	Accessible wetlands - population with access to wetlands within X kilometres ¹
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 ⁻¹)	-
Year 2008	2833 (2007) ²	4666	39.1 (2007)	1.5 (2007)	401.2 (2007)	-
Net change ³	0	163	-5.4	⁴ -0.2	-17.2	-
Year 2012	2833 ⁵	4829	33.7	1.3	384.0	-

Indicators

Opening stock

Closing stock

River accounts, South Africa

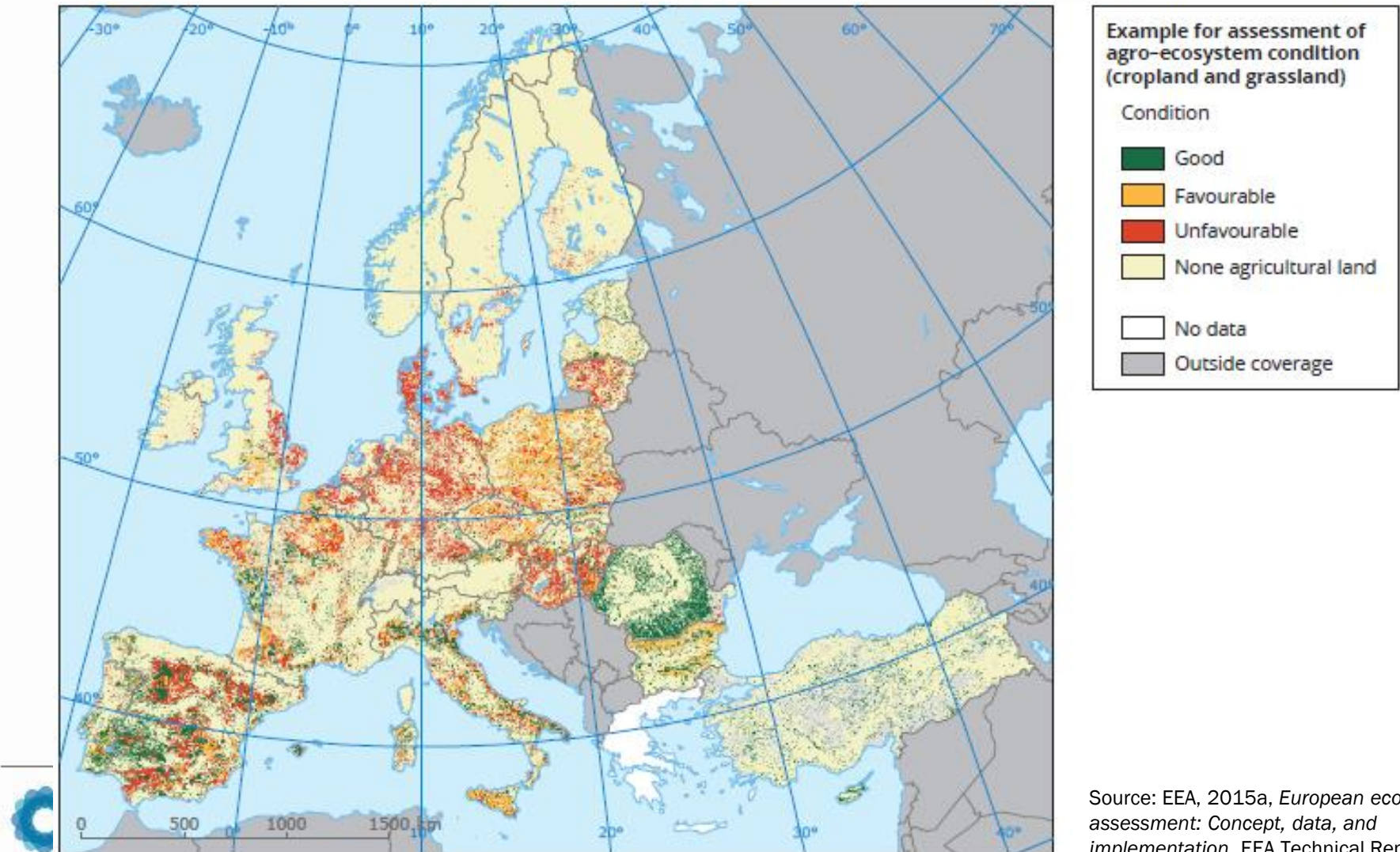
Table E: Ecosystem condition account for rivers based on the aggregated ecological condition category, for main rivers, tributaries and all rivers

Kilometres	Degree of modification from natural					Total
	Natural	Moderately modified	Heavily modified	Unacceptably modified	No Data	
MAIN RIVERS						
Opening stock 1999	46 541	22 315	2 791	1 026	3 637	76 310
Opening stock as a % total river length	61	29	4	1	5	100
Increase/decreases	-24 100	9 467	13 168	1 465		
Increases/decreases as % opening stock	-52	42	472	143		
Opening stock 2011	22 441	31 782	15 960	2 492	3 637	76 310
Opening stock as a % total river length	29	42	21	3	5	100
TRIBUTARIES						
Opening stock 1999	40 294	7 470	2 084	328	37 047	87 223
Opening stock as a % total river length	46	9	2		42	100
Increase/decreases	-17 062	11 339	4 766	957		
Increases/decreases as % opening stock	-42	152	229	292		
Opening stock 2011	23 232	18 809	6 850	1 285	37 047	87 223
Opening stock as a % total river length	27	22	8	1	42	100
ALL RIVERS						
Opening stock 1999	86 835	29 784	4 875	1 354	40 684	163 533
Opening stock as a % total river length	53	18	3	1	25	100
Increase/decreases	-41 163	20 806	17 935	2 422		
Increases/decreases as % opening stock	-47	70	368	179		
Opening stock 2011	45 673	50 591	22 810	3 776	40 684	163 533
Opening stock as a % total river length	28	31	14	2	25	100



Source: Nel, J.L., Driver, A. (2015). National River Ecosystem Accounts for South Africa. Discussion document for Advancing SEEA Experimental Ecosystem Accounting Project. South African National Biodiversity Institute, Pretoria

EU: assessment of cropland condition

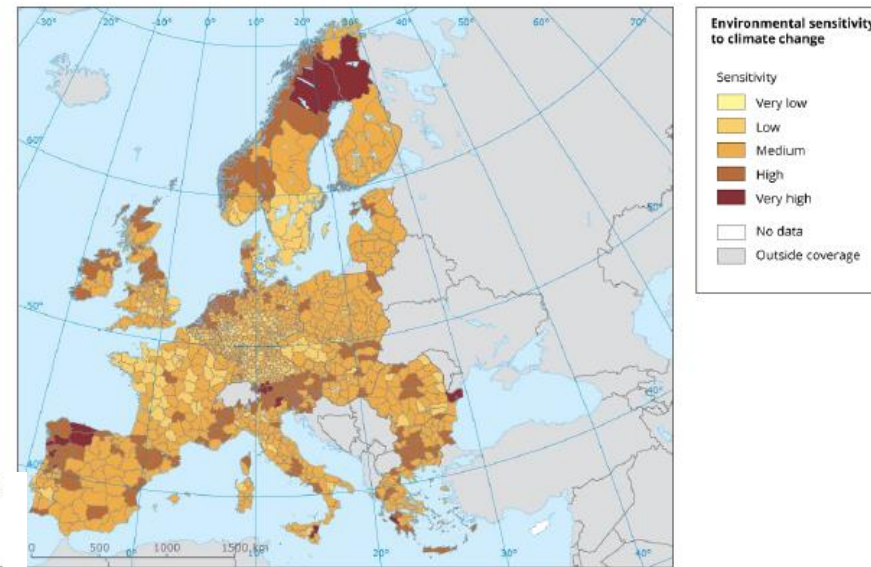


Source: EEA, 2015a, *European ecosystem assessment: Concept, data, and implementation*, EEA Technical Report No 6/2015, European Environment Agency

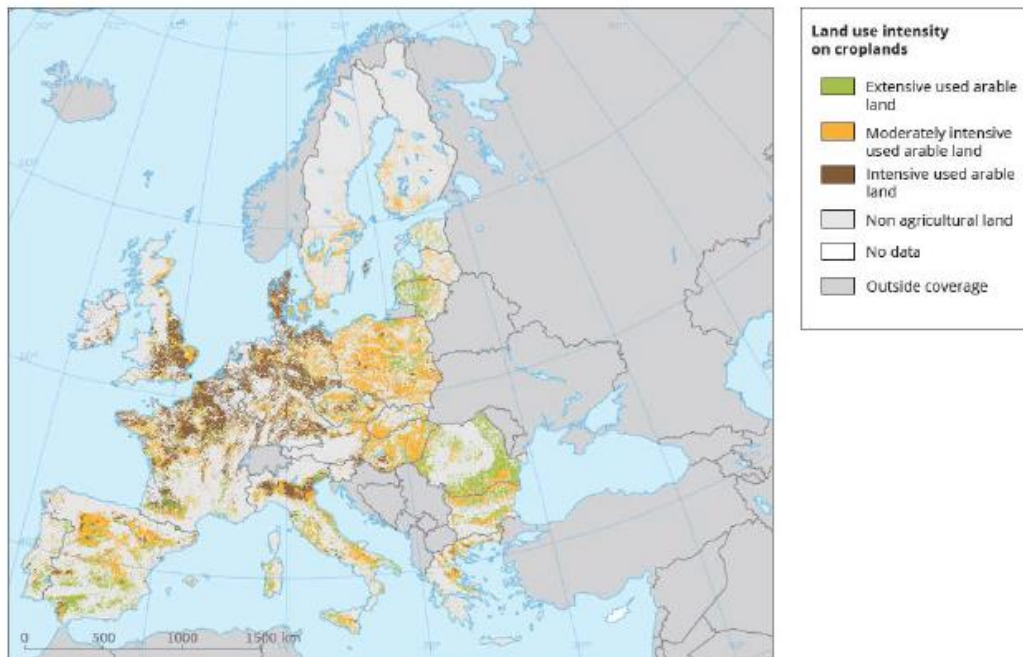
EU: Pressures on ecosystems

- An indirect approach through pressures exerted on ecosystems
 - > Climate change
 - > Overexploitation

Map 4.3 Environmental sensitivity to climate change



Map 4.4 Land use intensity on arable land (non-permanent crops) derived from crop yields and nitrogen fertiliser application

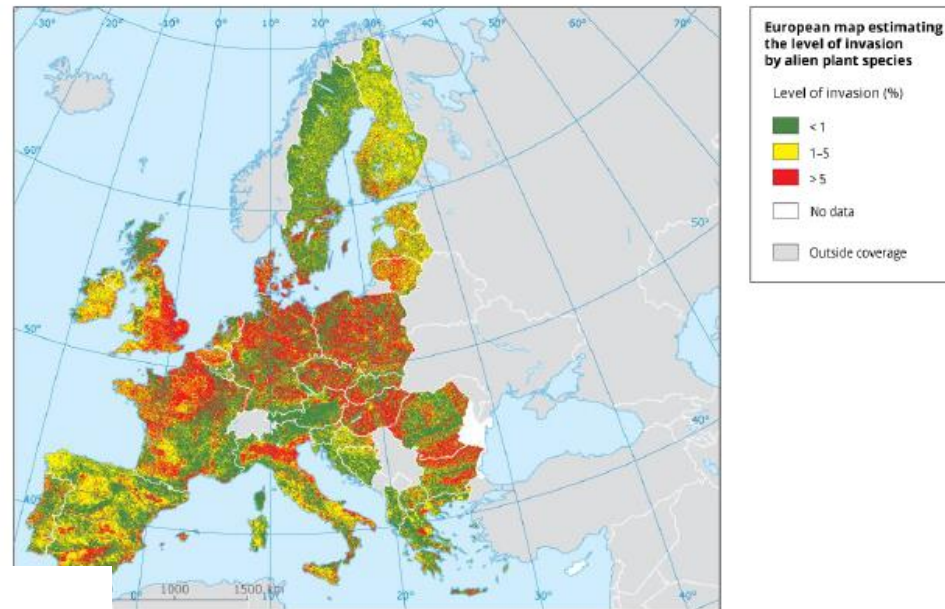


Source: European Commission, Mapping and Assessment of Ecosystems and their Services, 3rd Report – Final, March 2016.

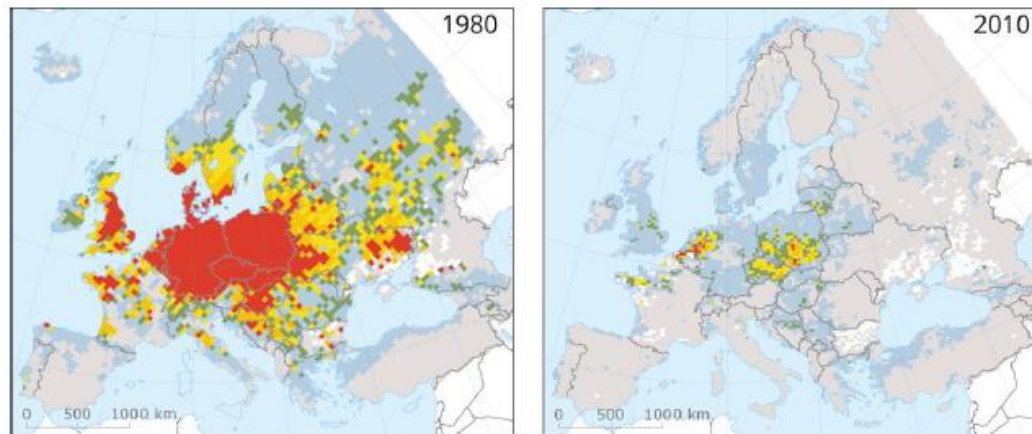
EU: Pressures on ecosystems

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

Map 4.5 Estimation of the level of invasion by invasive alien plant species

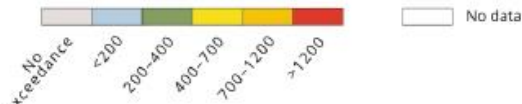


Map 4.6 Exceedance of critical loads of acidification in 1980 and 2010



Exposure of ecosystems to acidification

Average accumulated exceedance of the critical loads for acidification (in equivalents (H⁺ ions) = (mol_{charge}) per hectare and year)



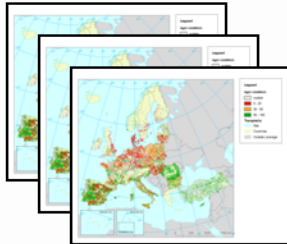
Source: European Commission, Mapping and Assessment of Ecosystems and their Services, 3rd Report – Final, March 2016.

Aggregation

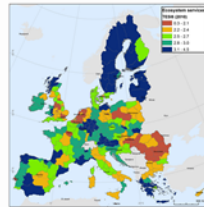
1. Mapping ecosystems



2. Mapping ecosystems condition



3. Thematic aggregation



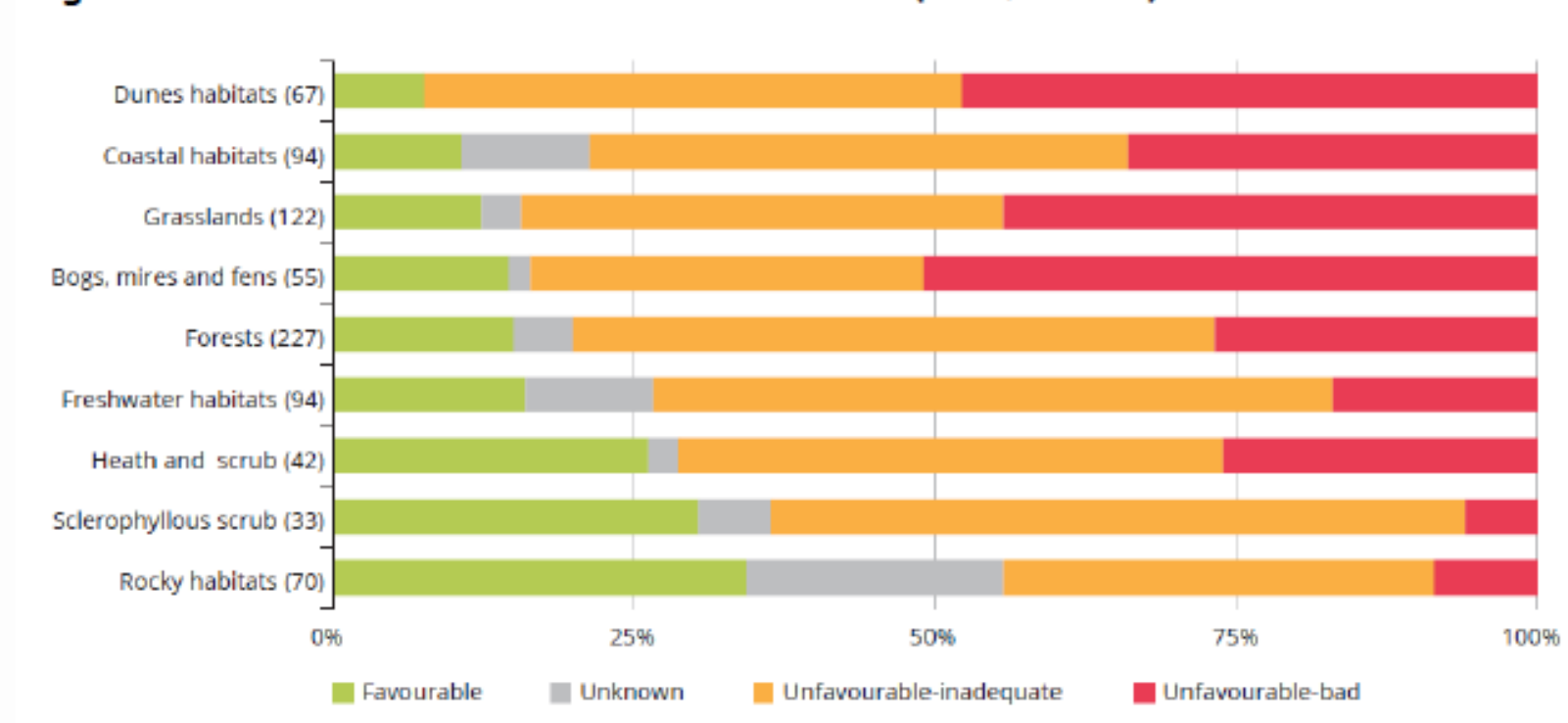
3. Reporting in a table (spatial aggregation)

<i>Grassland</i>	Percentage of ecosystem extent
Poor	5%
Moderate	50%
Good	30%
Excellent	15%

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)





THANK YOU

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