Methodological framework for the assessment of Ecosystem Services in Bulgaria and its relation to water management

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Introduction

- In the context of global changes, the biodiversity loss and degradation of ecosystems and their services are the bigest ***problems*** of the planete now

- -> So, effective societal responses needed to manage complex ***socio-ecological (SE) interactions***.

Key questions

Knowledge base:

What **drives** the major European ecosystems and socio-ecological systems?

Information of policy and management:

How can Ecosystem Services be **sustainably secured** across all scales?

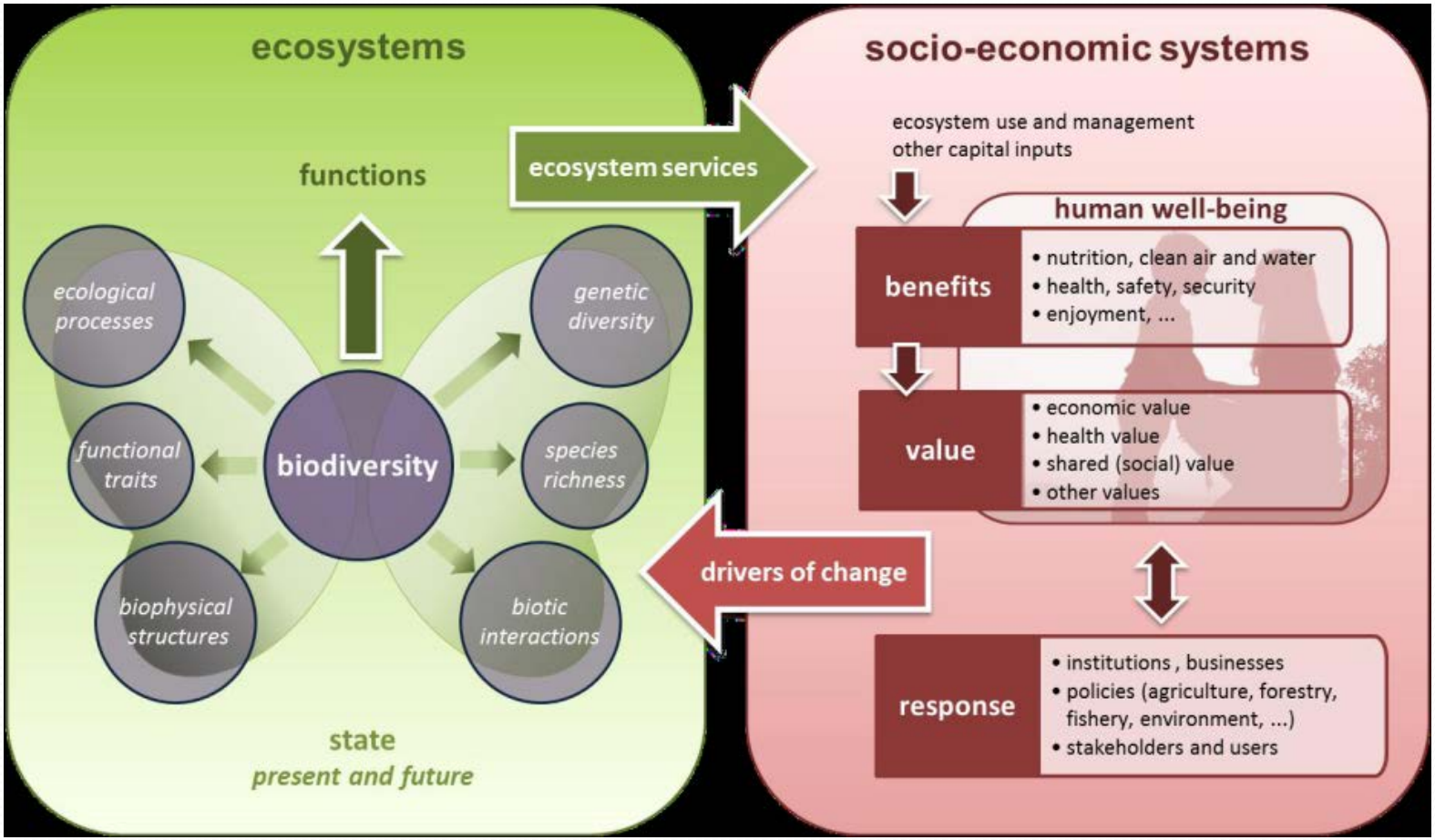
Context

- **Action 5 of the EU Biodiversity Strategy** to 2020 foresees that Member States will map and assess the state of ecosystems and their services in their national territory by 2014.
- The Working Group **MAES-EC**, which steers the implementation of Action 5 decided to test it based on the outcomes of six thematic pilots.

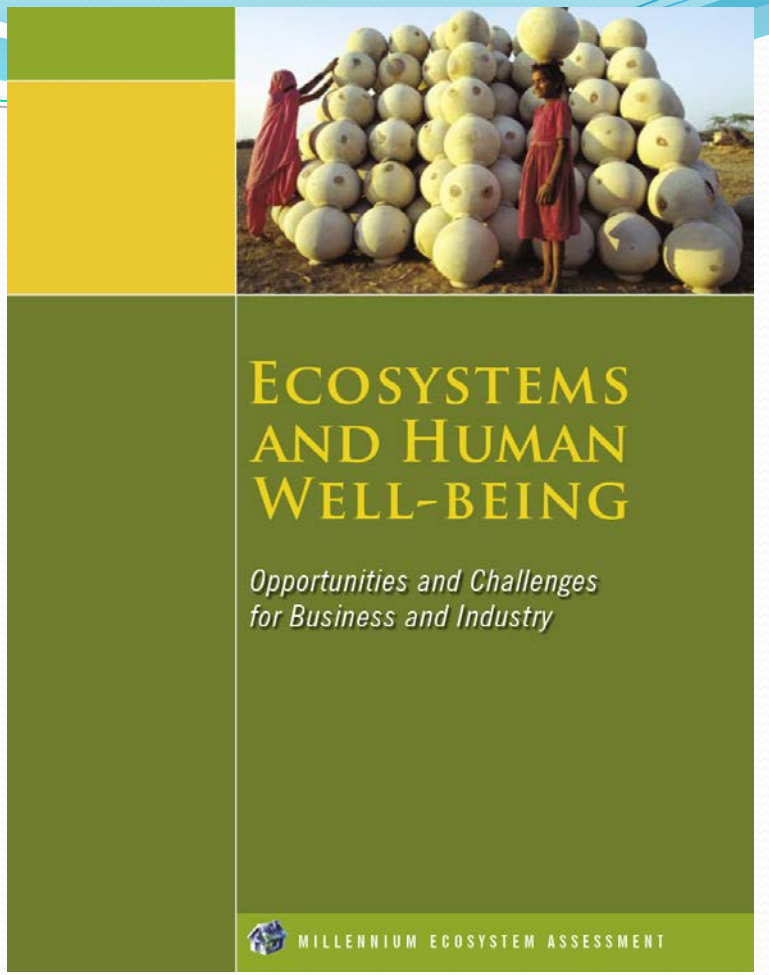
Context

- Four of the pilots focused on Europe's main ecosystem types: **agro-ecosystems, forest ecosystems, freshwater ecosystems and marine ecosystems.** A further pilot focused on the use of conservation status data for assessing the state of ecosystems and of the associated delivery of services. The final pilot addressed the challenge of natural capital accounts.
- In these pilots EU institutions worked hand in hand with Member States to make a review of national and European data and indicators to assess the condition of ecosystems, to quantify biodiversity and to map and assess their services.

- A coherent **analytical framework** has been developed to be applied by the EU and its Member States in order to ensure consistent approaches. It contributes to the ongoing discussion on the conceptual framework for sub-global assessments of ecosystems and ecosystem services under the Intergovernmental Platform on Biodiversity and Ecosystem services (IPBES).
- The **second technical report** proposes indicators that can be used at European and Member State's level to map and assess biodiversity, ecosystem condition and ecosystem services.


ecosystems
functions
ecological processes
genetic diversity
functional traits
biodiversity
species richness
biophysical structures
biotic interactions
state
present and future
ecosystem services
drivers of change
socio-economic systems
ecosystem use and management
other capital inputs
human well-being
benefits
• nutrition, clean air and water
• health, safety, security
• enjoyment, ...
value
• economic value
• health value
• shared (social) value
• other values
response
• institutions , businesses
• policies (agriculture, forestry, fishery, environment, ...)
• stakeholders and users

The institutional capacities to manage the earth's ecosystems are evolving more slowly than man's overuse of the same systems.



Ecosystem services

"***The capacity of ecosystems to provide services derives directly from the operation of natural biogeochemical cycles that in some cases have been significantly modified***".

Millennium Ecosystem Assessment, 2000,2005

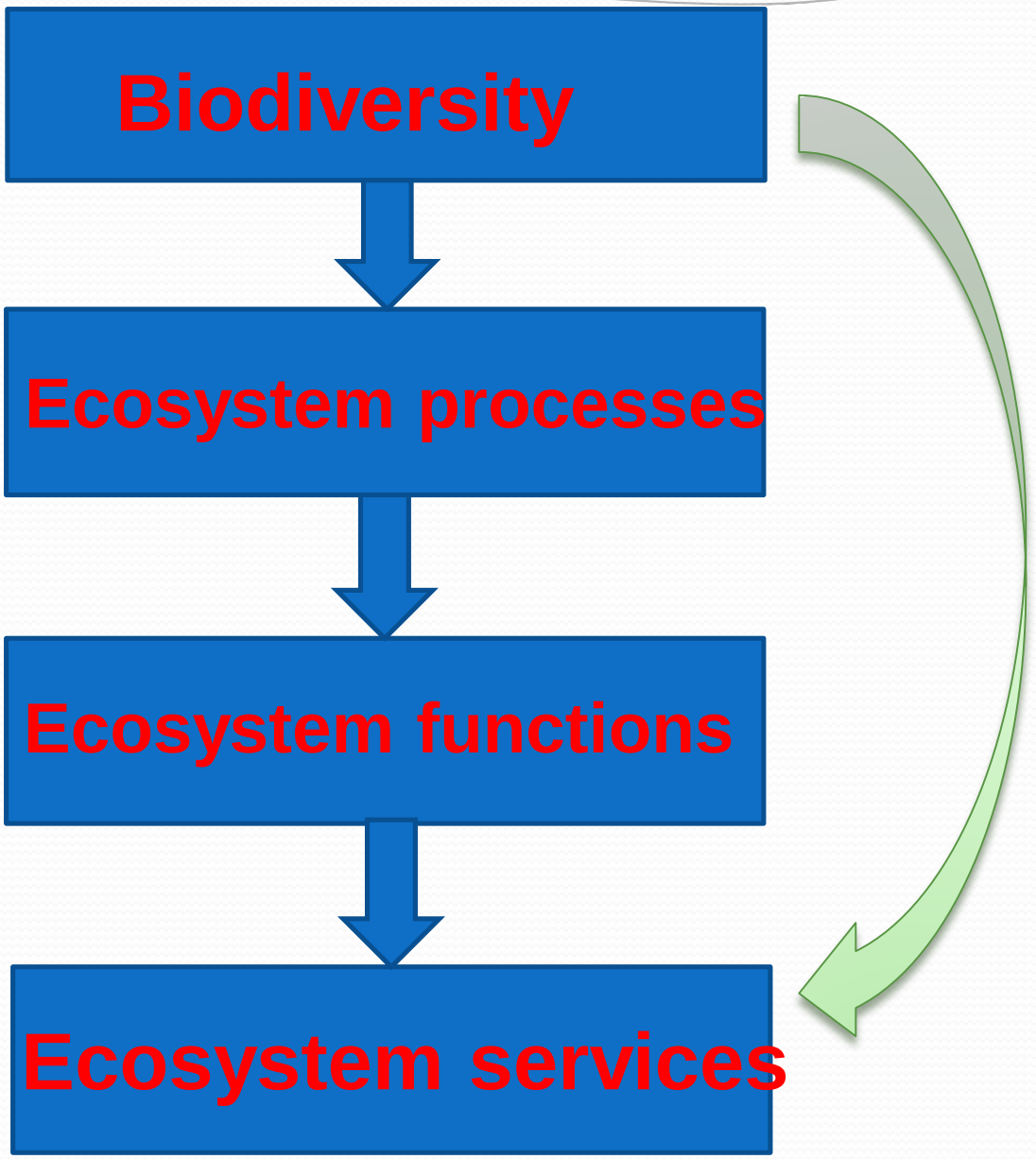
Ecosystem services

- **ES are the benefits that people obtain from biodiversity, ecosystems and their functions.**
- **Biodiversity** has multiple roles supporting the delivery of ecosystem services and assessment the status of ecosystems. Connecting biodiversity to ecosystem state but also to particular ecosystem functions and ecosystem services entails thus defining multivariate combinations of these different dimensions of biodiversity and using them for mapping and assessment. (MAES 1&2)

Introduction –some definitions

- Ecosystems are shaped by the interaction of communities of living organisms with the abiotic environment.
- Biodiversity - the variety of all life on earth - plays a key role in the structural set-up of ecosystems which is essential to maintaining basic ecosystem processes and supporting ecosystem functions.
- Ecosystem functions are defined as the capacity or the potential to deliver ecosystem services.
- Ecosystem services are, in turn, derived from ecosystem functions and represent the realized flow of services for which there is demand.

Ecosystem functions and biodiversity



The biodiversity has a crucial role in the ecosystem processes

Sustainable development in the context of global change dynamic of SE system

Mitigation and adaptation to climate change

Ecological Resilience and adaptive capacity to global changes

Biodiversity

Ecosystem functions and ecosystem services

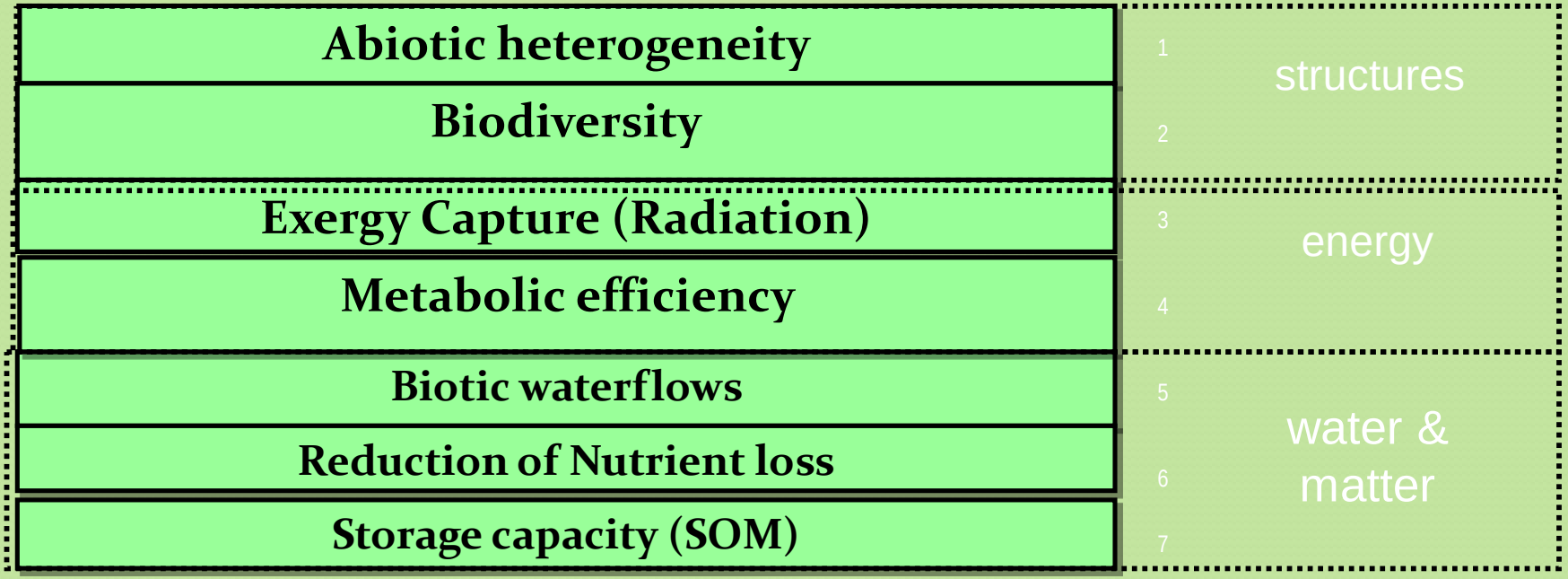
- The concepts to analyse complex SE interactions: ***ecosystem integrity, resilience and ecosystem services***

- The objective: to develop framework to assess ***resilience of ecosystem services, based on DPSIR, indicators and scenarios***

Ecosystem integrity - definition

The ability of ecosystem for self organization and self maintenance of ecosystem structures and functions

Ecosystem structures & functions = Ecosystem integrity



Indicators

Definitions of integrity components: potential indicators:

The provision of **suitable habitats** for different species, for functional groups of species and for processes is essential for the functioning of ecosystems.	habitat diversity indices heterogeneity indices, e.g. humus contents in the soil number/area of habitats
The presence or absence of selected species, (**functional**) **groups** of species or species composition.	Indicator species representative for a certain phenomenon or sensitive to distinct changes.
Referring to the **water cycling** affected by plant processes in the system.	transpiration / total evapotranspiration
Referring to the **amount of energy** necessary to maintain a specific biomass, also serving as a stress indicator for the system.	respiration / biomass (metabolic quotient)
The capability of ecosystems to enhance the **input of usable energy**. **Exergy** is derived from thermodynamics and measures the energy fraction that can be transformed into mechanical work. In ecosystems, the captured exergy is used to build up biomass (e.g. by primary production) and structures.	Net primary production Leaf area index LAI
Referring to the irreversible output of elements from the system, the **nutrient budget and matter flows**.	Leaching of nutrients e.g. N, P
Is referring to **the nutrient, energy and water budgets** of the system and the capacity of the system to store them when available and to release them when needed.	Solved organic matter N, C_{org} in the soil N, C in biomass

Resilience of ecosystems

The resilience of ecosystems broadly refers to the capacity of an ecosystem to tolerate disturbance without collapsing into a qualitatively different state that is controlled by a different set of processes.

Focal questions:

- *"resilience of what to what? (Carpenter et al. 2001)"*
- *"resilience for whom"* (Lebel et al. 2006).
- Additional question: *"resilience by whom and how"?*

Ecosystem services (ES)

- Four types of services:

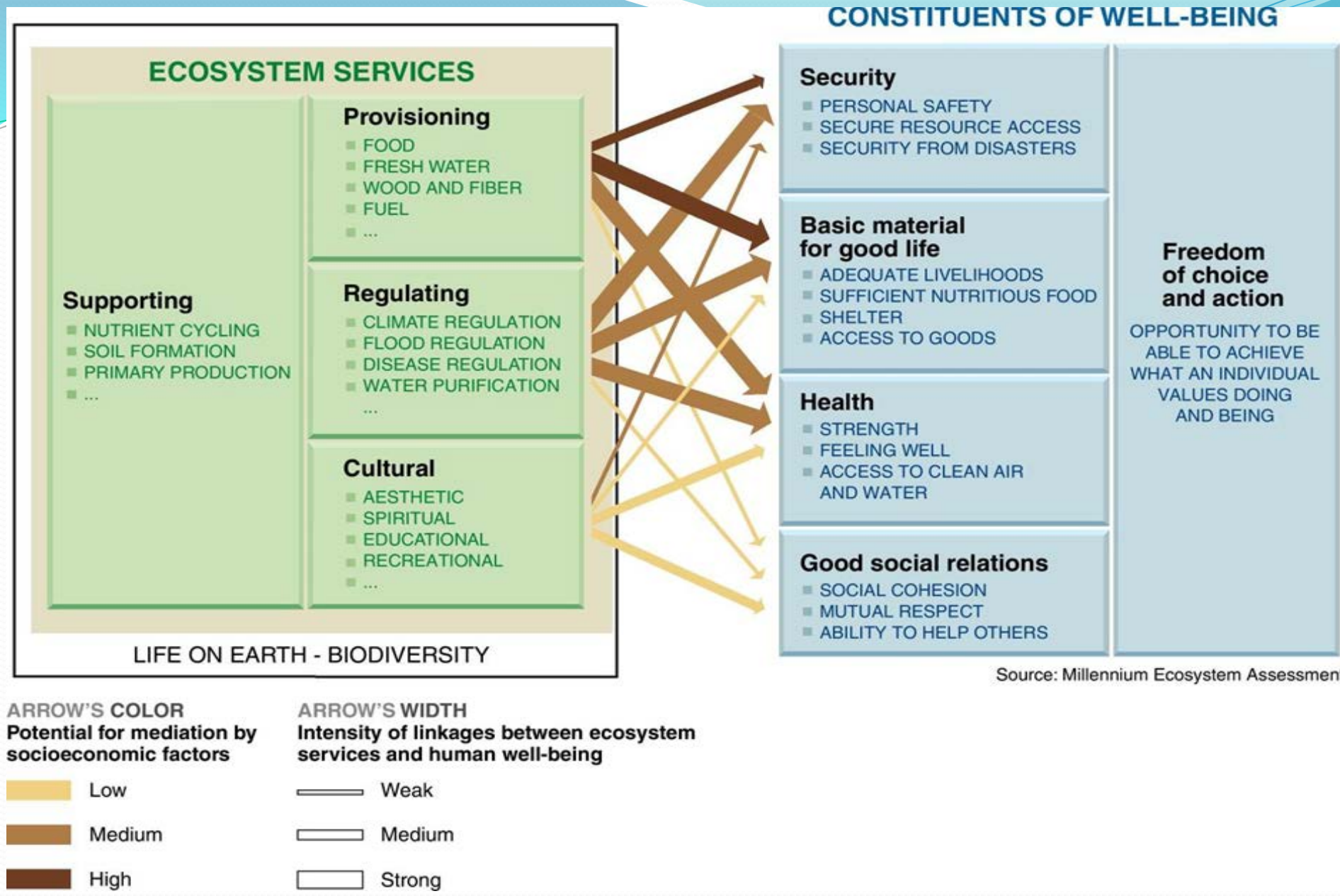
  1) **provisioning** (products obtained from ecosystems e.g. food, wood, water),

  2) **regulating** (moderate or control of environmental conditions e.g. flood control; water purification by aquifers, carbon sequestration by forests, species balance),

  3) **cultural** (non-material benefits obtained from ecosystems e.g. recreation, education, aesthetics), and

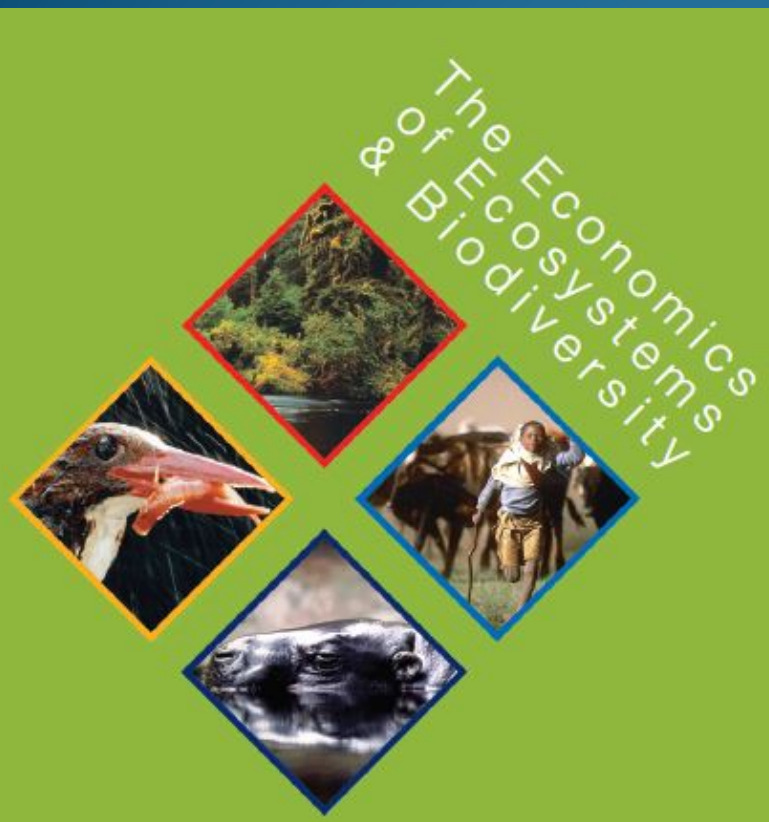
  4) **supporting** (maintain all other services by for example primary production, soil formation, and water cycling) (MA 2003).

  Choosing what ecosystem services to enhance is **political** ->trade-offs between changing societal objectives at local, national ore regional scale



Millennium ecosystem assessment, 2000, 2005

TEEB, 2010



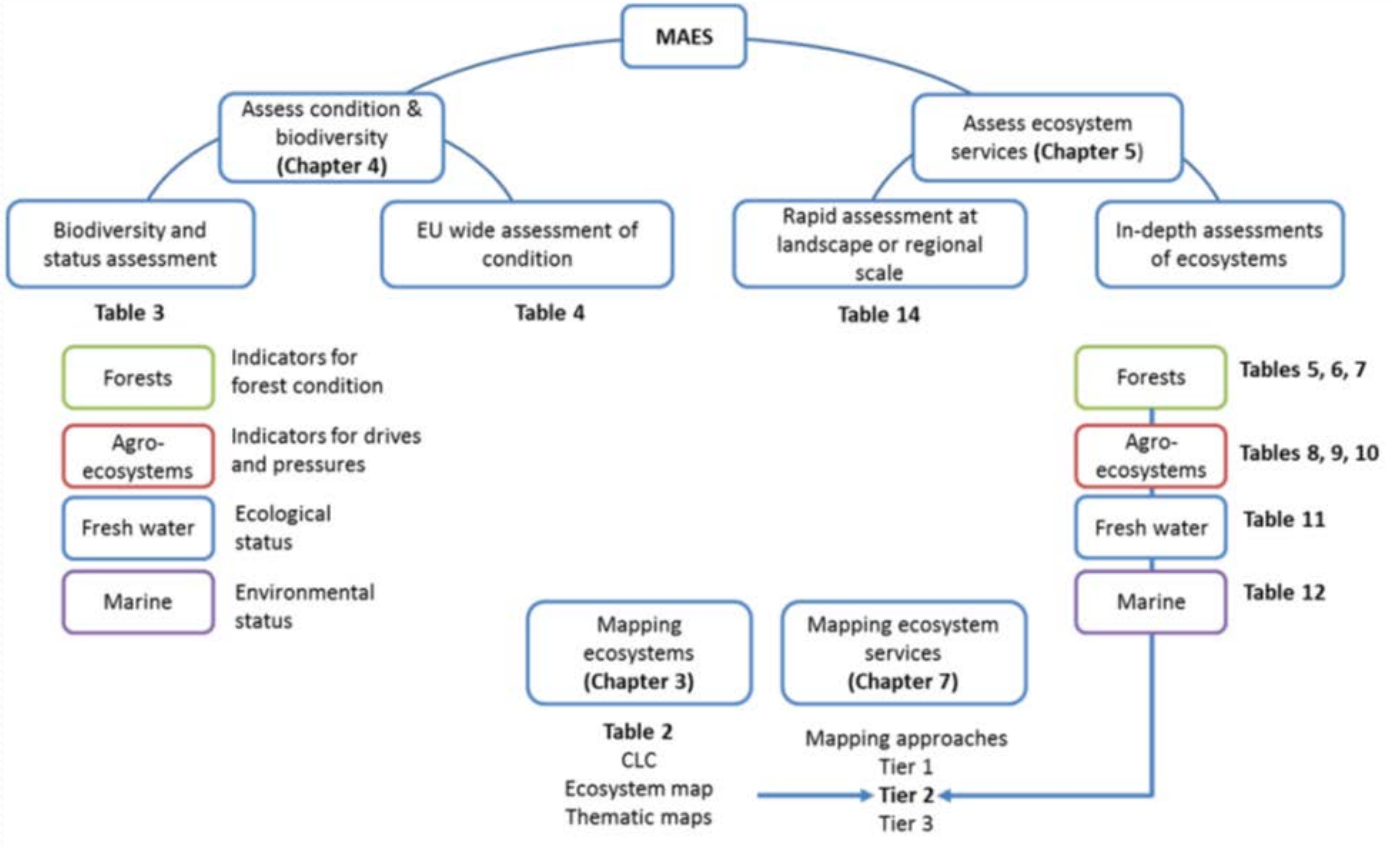
	TEEB classification
	PROVISIONING
1	Food
2	Water (2
3	Raw materials
4	Genetic resources
5	Medicinal resources
6	Ornamental resources
	REGULATING
7	Air purification
8	Climate regulation (incl. C-sequestration)
9	Disturbance prevention or moderation
10	Regulation of water flows
11	Waste treatment (esp. water purification)
12	Erosion prevention
13	Maintaining soil fertility
14	Pollination
15	Biological control
	HABITAT
16	Lifecycle maintenance
17	Gene pool protection
	CULTURAL
18	Aesthetic information
19	Recreation & tourism
20	Inspiration for culture, art and design
21	Spiritual experience
22	Information for cognitive development

Conceptual framework

MAES

- According to the description available at the EU website, "… the objective of the EU assessment is to provide a critical evaluation of the best available information for guiding decisions on complex public issues. The work being carried out is important for the advancement of biodiversity objectives, and also to inform the development and implementation of related policies, on water, climate, agriculture, forest, and regional planning. Robust, reliable and comparable data are also important for the planning and implementation of individual projects."
- To achieve these objectives, MAES has so far adopted a **classification of ecosystem services** (in its Analytical framework of April 2013), as well as relevant indicators (Indicators of ecosystem assessment report, February, 2014). A Natural capital accounting guidance document is in its final stages of adoption.

The pilot studies contributed indicators, which can be used for mapping and assessing biodiversity, ecosystem condition and ecosystem services according to the Common International Classification of Ecosystem Services (CICES v4.3). The way information is structured is presented in a graph.



CICES, 2013

Section – 3
Division – 8
Group – 20
Class - 48

CICES for ecosystem service mapping and assessment

CICES for ecosystem accounting

Section	Division	Group	Class
Provisioning	Nutrition	Biomass	Cultivated crops
			Reared animals and their outputs
			Wild plants, algae and their outputs
			Wild animals and their outputs
			Plants and algae from in-situ aquaculture
			Animals from in-situ aquaculture
		Water	Surface water for drinking
			Ground water for drinking
	Materials	Biomass	Fibres and other materials from plants, algae and animals for direct use or processing
			Materials from plants, algae and animals for agricultural use
			Genetic materials from all plants
		Water	Surface water for non-drinking purposes
			Ground water for non-drinking purposes
	Energy	Biomass-based	Plant-based resources
			Animal-based resources
		Mechanical	Animal-based energy
Regulation & Maintenance	Mediation of waste, toxics and other nuisances	Mediation by biota	Bio-remediation by micro-organisms, algae, plants, and animals
			Filtration/sequestration/storage/accumulation by micro-organisms, algae, plants, and animals
		Mediation by ecosystems	Filtration/sequestration/storage/accumulation by ecosystems
			Dilution by atmosphere, freshwater and marine ecosystems
			Mediation of smell/noise/visual impacts
	Mediation of flows	Mass flows	Mass stabilisation and control of erosion rates
			Buffering and attenuation of mass flows
		Liquid flows	Hydrological cycle and water flow maintenance
			Flood protection
		Gaseous / air flows	Storm protection
			Ventilation and transpiration
	Maintenance of physical, chemical, biological conditions	Lifecycle maintenance	Pollination and seed dispersal
			Maintaining nursery populations and habitats
		Pest and disease	Pest control
			Disease control
		Soil formation	Weathering processes
			Decomposition and fixing processes
		Water conditions	Chemical condition of freshwaters
			Chemical condition of salt waters
		Atmospheric composition	Global climate regulation by reduction of greenhouse gas concentrations
			Micro and regional climate regulation
Cultural	Physical and intellectual interactions with biota, ecosystems,	Physical and experiential	Experiential use of plants, animals and land-/seascapes in different environmental settings
			Physical use of land-/seascapes in different environmental settings
		Intellectual and representative interactions	Scientific
			Educational
			Heritage, cultural
			Entertainment
			Aesthetic
	Spiritual, symbolic and other interactions	Spiritual and/or	Symbolic
			Sacred and/or religious
		Other cultural	Existence
			Bequest

In Bulgaria, the ecosystems mapping and assessment process is so far organized on ad hoc basis but the need for closer cooperation is being seen by the involved **stakeholders**, notably central administrations and NGOs.

The legal basis is provided by Regulation 691/2011 and (for the forest ecosystems only) by a dedicated chapter in the Forestry law and its sublegislation.

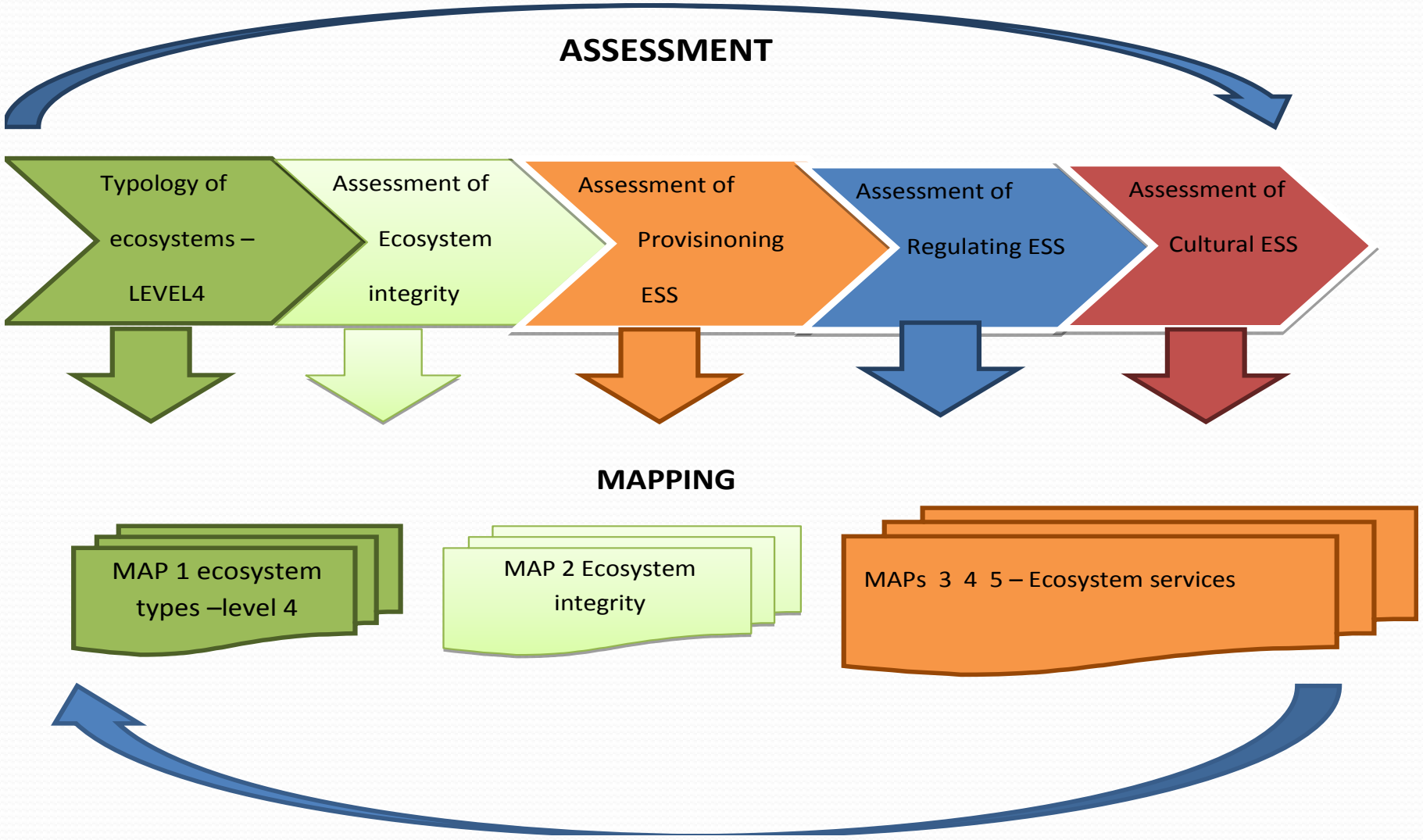
BG 03 Biodiversity and ecosystem services - EEA

PDP2 Methodological assistance for ecosystem assessment and biophysical valuation

Based on:

- EEA Technical report No 1/2014 - Terrestrial habitat mapping in Europe: an overview - Joint MNHN-EEA report
- MAES – documents – 2 Reports 2013,2014
- Concept of ecosystem integrity - ENVEurope Project – 2010-2013
- Burhard's matrix – 2009, 2010, 2013,2014

3 The process of mapping and assessment of ES and ESS – BOX4 – MAES



(1) Map ecosystems

Urban
Cropland
Grassland
Woodland and forest
Heathland and shrub
Sparsely vegetated land
Wetlands
Rivers and lakes
Marine inlets and transitional waters
Coastal
Shelf
Open ocean

Land use land cover data, e.g.
Corine Land Cover
Copernicus high resolution data
Elevation data
Seabed maps
National datasets

Models for spatially delineating wetlands or natural, unmanaged ecosystems

(2) Assess the condition of ecosystems

Indicators	*Data*
Conservation status of habitats and species	Art.17 assessment
Ecological status of water bodies	WFD assessment
Environmental status of seas	MSFD assessment
Ecosystem status and biodiversity	data including air pollutant concentration, habitat connectivity, land use change, soil degradation, …

(3) Assess the ecosystem services delivered by ecosystems

Indicators	*Data and models*
Supply indicators: Indicators for stock and flow of ecosystem functions and ecosystem services	Different sources of environmental data and models
Demand indicators: Indicators for the human demand for ecosystem services	Different socio-economic statistics

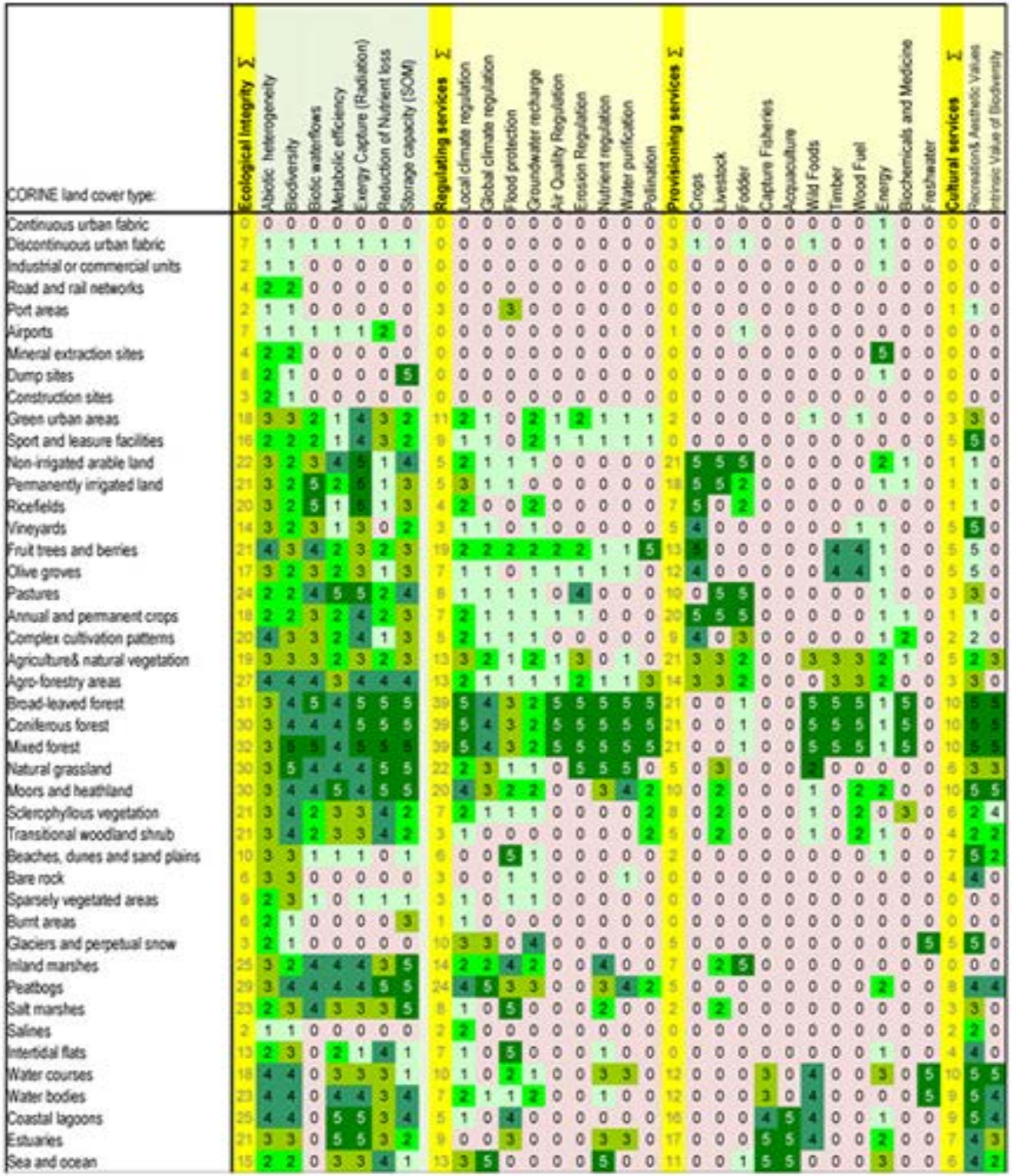
(4) Integrated ecosystem assessment

How does condition relate to service provision?
How do the various ecosystem types interact to provide their services?

Indicators for assessment of ecosystem state

- Ecosystem integrity – *Burchard&Muller* (2009, 2013) – ENVEurope Project
- SEBI
- WFD, MSFD
- MAES

Ecological integrity indicators				Ecosystem types - level 2																								
				Ecosystem types - level 3 (попълва се от всяка работна група)																								
Ecosytem structure	Biotic diversity		flora diversity	v			v			v						v	v										
			fauna diversity				v			v						v	v										
			habitat diversity							v						v	v										
			additional variable (invasive species)																								
			additional variables (naturalness)	v	v	v	v	v	v	v	v	v	v	v	v	v	v	v	v	v	v	v	v	v	v	v	v
	Abiotic heterogeneity		soil heterogeneity	v			v																				
			water heterogeneity																								
			air heterogeneity	v																							
			habitat heterogeneity																								
			additional variables (pollution)	v	v	v	v	v	v	v	v	v	v	v	v	v	v	v	v	v	v	v					
Ecosystem processes	Energy balance	input	exergy capture	v						v						v	v										
		storage	exergy storage																								
		output	entropy production																								
		other state variables	meteorology	v	v	v	v	v	v	v	v	v	v	v	v	v	v	v	v	v	v	v	v	v	v	v	v
		efficiency measures	metabolic efficiency																								
	Matter balance	input	matter input																								
		storage	matter storage	v			v																				
		output	matter loss	v																							
		other state variables	regeneration																								
		other state variables	element concentrations							v						v	v										
		efficiency measures	nutrient cycling				v																				
	Water balance	input	water input				v																				
		storage	water storage				v																				
		output	water output																								
		other state variables	element concentrations				v																				
		efficiency measures	biotic water flow	v																							



CORINE land cover type:	Ecological integrity Σ	Abiotic heterogeneity	Biodiversity	Biotic waterflows	Metabolic efficiency	Exergy Capture (Radiation)	Reduction of Nutrient loss	Storage capacity (SOM)	Regulating services Σ	Local climate regulation	Global climate regulation	Flood protection	Groundwater recharge	Air Quality Regulation	Erosion Regulation	Nutrient regulation	Water purification	Pollination	Provisioning services Σ	Crops	Livestock	Fodder	Capture Fisheries	Aquaculture	Wild Foods	Timber	Wood Fuel	Energy	Biochemicals and Medicine	Freshwater	Cultural services Σ	Recreation& Aesthetic Values	Intrinsic Value of Biodiversity
Continuous urban fabric	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
Discontinuous urban fabric	7	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	3	1	0	1	0	0	1	0	0	1	0	0	0	0
Industrial or commercial units	2	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
Road and rail networks	4	2	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Port areas	2	1	1	0	0	0	0	0	3	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0
Airports	7	1	1	1	1	1	2	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0
Mineral extraction sites	4	2	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	0	0	0	0	0
Dump sites	8	2	1	0	0	0	0	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
Construction sites	3	2	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Green urban areas	18	3	3	2	1	4	3	2	11	2	1	0	2	1	2	1	1	1	2	0	0	0	0	0	1	0	1	0	0	0	3	3	0
Sport and leasure facilities	16	2	2	2	1	4	3	2	9	1	1	0	2	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	5	5	0
Non-irrigated arable land	22	3	2	3	4	5	1	4	5	2	1	1	1	0	0	0	0	0	21	5	5	5	0	0	0	0	0	2	1	0	1	1	0
Permanently irrigated land	21	3	2	5	2	5	1	3	5	3	1	1	0	0	0	0	0	0	18	5	5	2	0	0	0	0	0	1	1	0	1	1	0
Ricefields	20	3	2	5	1	5	1	3	4	2	0	0	2	0	0	0	0	0	7	5	0	2	0	0	0	0	0	0	0	0	1	1	0
Vineyards	14	3	2	3	1	3	0	2	3	1	1	0	1	0	0	0	0	0	5	4	0	0	0	0	0	0	1	1	0	0	5	5	0
Fruit trees and berries	21	4	3	4	2	3	2	3	19	2	2	2	2	2	2	1	1	5	13	5	0	0	0	0	0	4	4	1	0	0	5	5	0
Olive groves	17	3	2	3	2	3	1	3	7	1	1	0	1	1	1	1	1	0	12	4	0	0	0	0	0	4	4	1	0	0	5	5	0
Pastures	24	2	2	4	5	5	2	4	8	1	1	1	1	0	4	0	0	0	10	0	5	5	0	0	0	0	0	1	0	0	3	3	0
Annual and permanent crops	18	2	2	3	2	4	2	3	7	2	1	1	1	1	1	0	0	0	20	5	5	5	0	0	0	0	0	1	1	0	1	1	0
Complex cultivation patterns	20	4	3	3	2	4	1	3	5	2	1	1	1	0	0	0	0	0	9	4	0	3	0	0	0	0	0	1	2	0	2	2	0
Agriculture& natural vegetation	19	3	3	3	2	3	2	3	13	3	2	1	2	1	3	0	1	0	21	3	3	2	0	0	3	3	3	2	1	0	5	2	3
Agro-forestry areas	27	4	4	4	3	4	4	4	13	2	1	1	1	1	2	1	1	3	14	3	3	2	0	0	0	3	3	2	0	0	3	3	0
Broad-leaved forest	31	3	4	5	4	5	5	5	39	5	4	3	2	5	5	5	5	5	21	0	0	1	0	0	5	5	5	1	5	0	10	5	5
Coniferous forest	30	3	4	4	4	5	5	5	39	5	4	3	2	5	5	5	5	5	21	0	0	1	0	0	5	5	5	1	5	0	10	5	5
Mixed forest	32	3	5	5	4	5	5	5	39	5	4	3	2	5	5	5	5	5	21	0	0	1	0	0	5	5	5	1	5	0	10	5	5
Natural grassland	30	3	5	4	4	4	5	5	22	2	3	1	1	0	5	5	5	0	5	0	3	0	0	0	2	0	0	0	0	0	6	3	3
Moors and heathland	30	3	4	4	5	4	5	5	20	4	3	2	2	0	0	3	4	2	10	0	2	0	0	0	1	0	2	2	0	0	10	5	5
Sclerophyllous vegetation	21	3	4	2	3	3	4	2	7	2	1	1	1	0	0	0	0	2	8	0	2	0	0	0	1	0	2	0	3	0	6	2	4
Transitional woodland shrub	21	3	4	2	3	3	4	2	3	1	0	0	0	0	0	0	0	2	5	0	2	0	0	0	1	0	2	1	0	0	4	2	2
Beaches, dunes and sand plains	10	3	3	1	1	1	0	1	6	0	0	5	1	0	0	0	0	0	2	0	0	0	0	0	0	0	0	1	0	0	7	5	2
Bare rock	6	3	3	0	0	0	0	0	3	0	0	1	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	4	4	0
Sparsely vegetated areas	9	2	3	1	0	1	1	1	3	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Burnt areas	6	2	1	0	0	0	0	3	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Glaciers and perpetual snow	3	2	1	0	0	0	0	0	10	3	3	0	4	0	0	0	0	0	5	0	0	0	0	0	0	0	0	0	0	5	5	5	0
Inland marshes	25	3	2	4	4	4	3	5	14	2	2	4	2	0	0	4	0	0	7	0	2	5	0	0	0	0	0	0	0	0	0	0	0
Peatbogs	29	3	4	4	4	4	5	5	24	4	5	3	3	0	0	3	4	2	5	0	0	0	0	0	0	0	0	2	0	0	8	4	4
Salt marshes	23	2	3	4	3	3	3	5	8	1	0	5	0	0	0	2	0	0	2	0	2	0	0	0	0	0	0	0	0	0	3	3	0
Salines	2	1	1	0	0	0	0	0	2	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	2	0
Intertidal flats	13	2	3	0	2	1	4	1	7	1	0	5	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	4	4	0
Water courses	18	4	4	0	3	3	3	1	10	1	0	2	1	0	0	3	3	0	12	0	0	0	3	0	4	0	0	3	0	5	10	5	5
Water bodies	23	4	4	0	4	4	3	4	7	2	1	1	2	0	0	1	0	0	12	0	0	0	3	0	4	0	0	0	0	5	9	5	4
Coastal lagoons	25	4	4	0	5	5	3	4	5	1	0	4	0	0	0	0	0	0	16	0	0	0	4	5	4	0	0	1	0	0	9	5	4
Estuaries	21	3	3	0	5	5	3	2	9	0	0	3	0	0	0	3	3	0	17	0	0	0	5	5	4	0	0	2	0	0	7	4	3
Sea and ocean	15	2	2	0	3	3	4	1	13	3	5	0	0	0	0	5	0	0	11	0	0	1	5	5	0	0	0	3	0	0	6	4	2

scale for assessing capacities:

0 = no relevant capacity
1 = low relevant capacity
2 = relevant capacity
3 = medium relevant capacity
4 = high relevant capacity
5 = very high relevant capacity

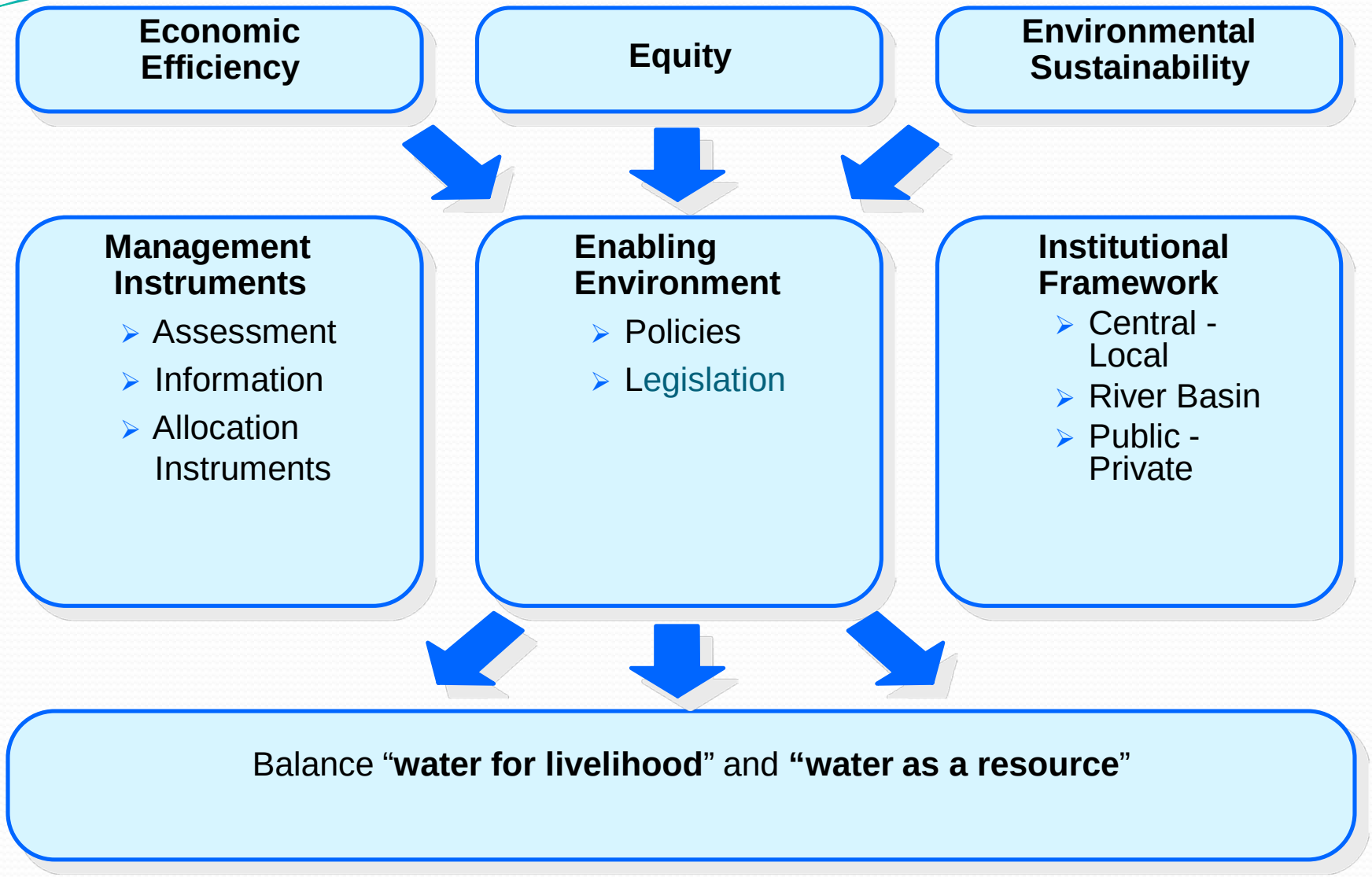
Integrated Water Resources Management (IWRM)

Integrated Water Resources Management (IWRM)

"IWRM is a process which promotes the co-ordinated development and management of water, land and related resources, in order to maximise the resultant economic and social welfare in an equitable manner without compromising the sustainability of vital ecosystems"

(Global Water Partnership, Technical Committee).

- Integrated planning and management of water resources and land
- Takes account of social, economic and environmental factors together
- Integrates surface, groundwater and the ecosystems through which they flow


Economic Efficiency
Equity
Environmental Sustainability
Management Instruments
Assessment
Information
Allocation Instruments
Enabling Environment
Policies
Legislation
Institutional Framework
Central - Local
River Basin
Public - Private
Balance "water for livelihood" and "water as a resource"

Fresh water ***ecosystem typology*** *(Level 3)*

1.		Description	Nomenclature(s)
FRESHWATER ECOSYSTEMS	Rivers = lotic (hydro) ecosystems, incl. riparian zones	Water courses of all kinds (streams, brooks, creeks, irrigation canals)	EUNIS (SEBI, Baseline), WWF, MA
	Lakes (marshes, water reservoirs) = lentic (hydro) ecosystems, incl. littoral zones & fringing communities	Water bodies incl. coastal lakes (without permanent connection to the sea)	Subtype

Indicators ecosystem condition

- State (Conditions) indicators assess environmental states (climatic, chemical, physical, biological state of habitat) in fresh water ecosystems and describe the ecosystem integrity of them.
- We have defined and quantified 44 indicators that are relevant for the fresh water ecosystem conditions. The indicators represent the ecosystems structure and ecosystem processes of fresh water ecosystems types.

Indicators for ES

- Assessment of ecosystem services in fresh water ecosystems focuses on indicators of final ecosystem services as developed in MAES (2013).
- The indicators for most provisioning services provide for a more complete understanding of the service than for most **regulating** and cultural services.

Problems

- Detailed differentiation of ecosystem types – level 4
- Data sets
  - Data availability
  - Data formats
  - Data gaps
- Selection of indicators –state (potential) and services–supply
- Expert assessment
- Coupling state/services

The show go on…


Thank you for your attention