

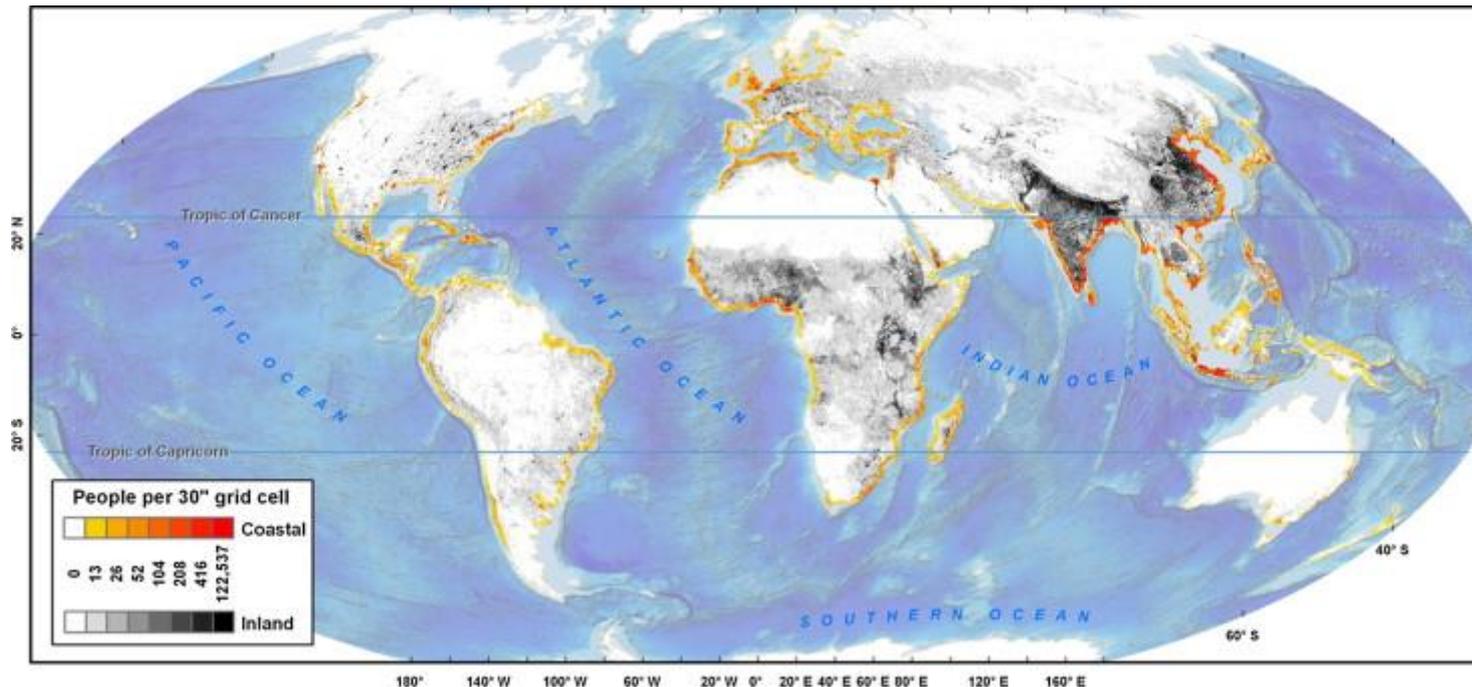
# Ecosystem Services - Background

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[www.baltcoast.net](http://www.baltcoast.net)

**A SYSTEM APPROACH FRAMEWORK FOR  
COASTAL RESEARCH & MANAGEMENT**

## *Coastal areas in a global anthropogenic perspective*



Sale et al, 2014

Coastal zones occupy around **20% of the earth's surface**

Host more than **45% of the global population**

75% of the world's **largest urban agglomerations**

## *Why are coastal zones so important?*



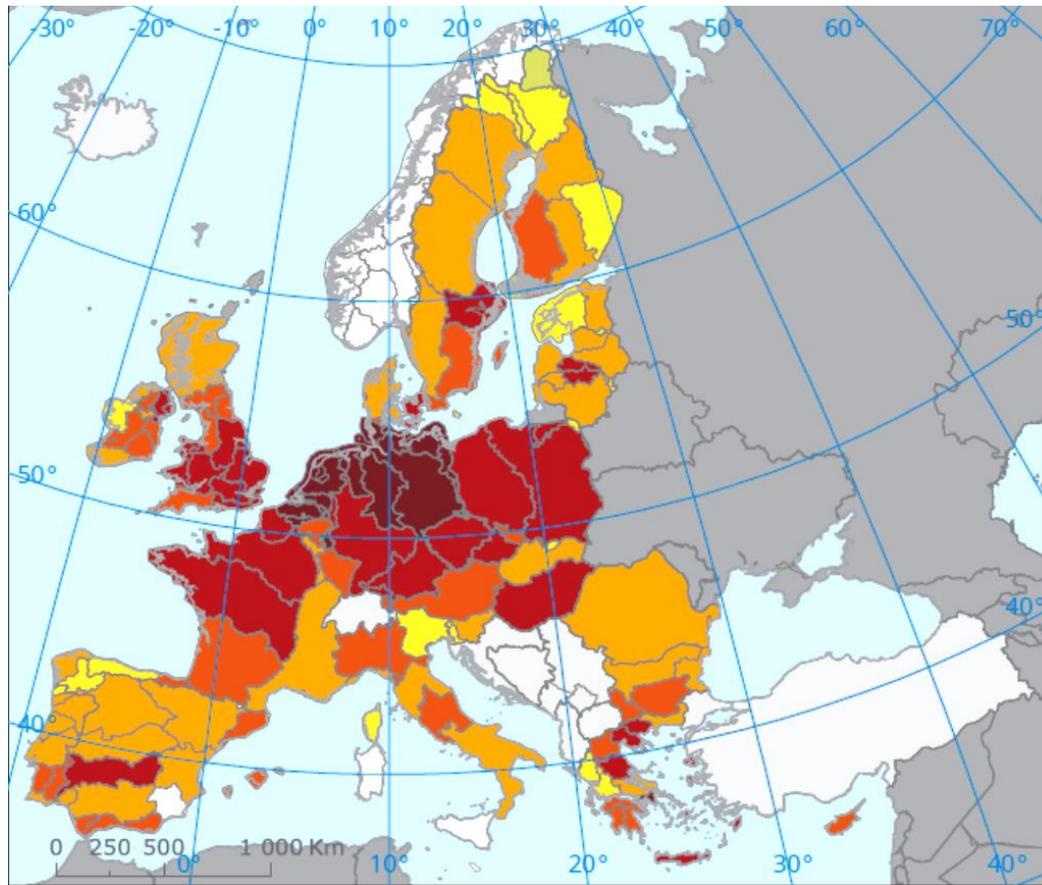
## *Why are coastal zones so important?*



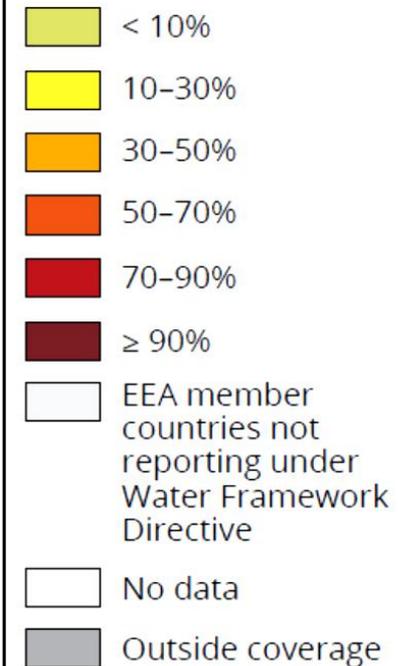
## *Which conflicts occur?*



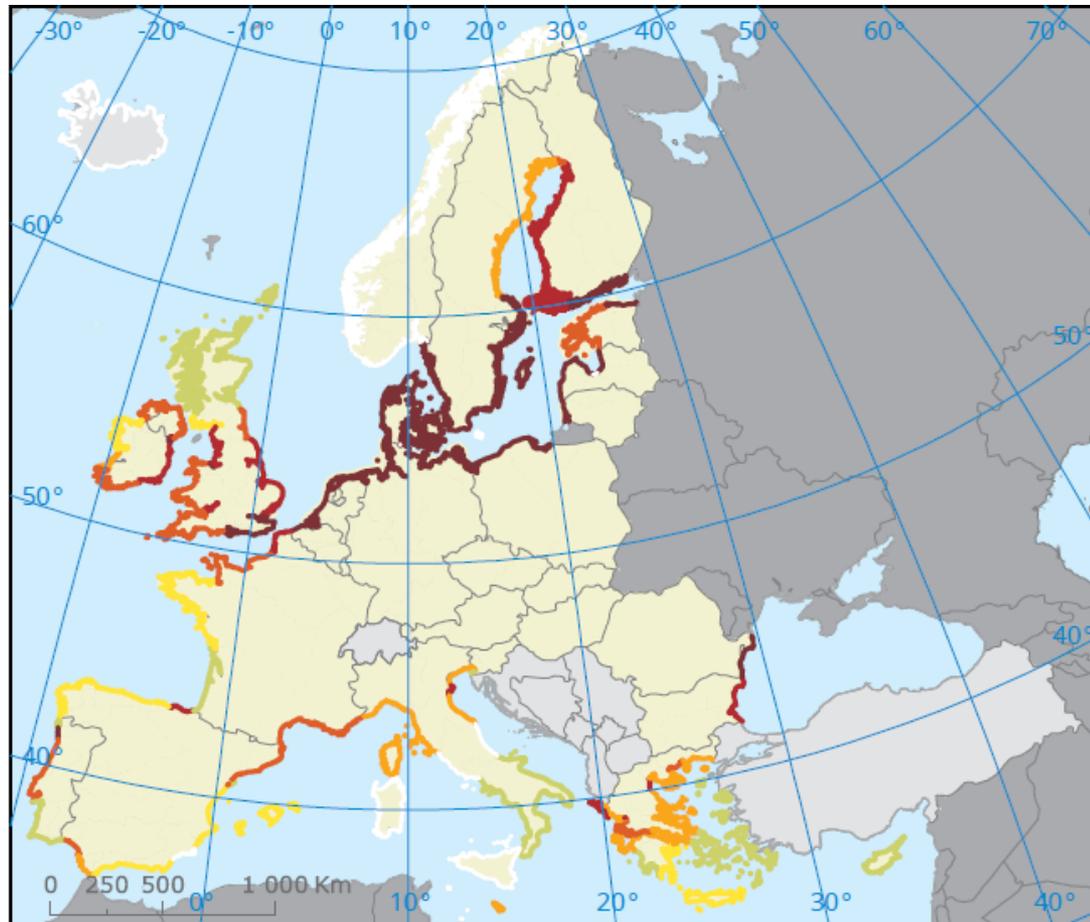
## What are the consequences?



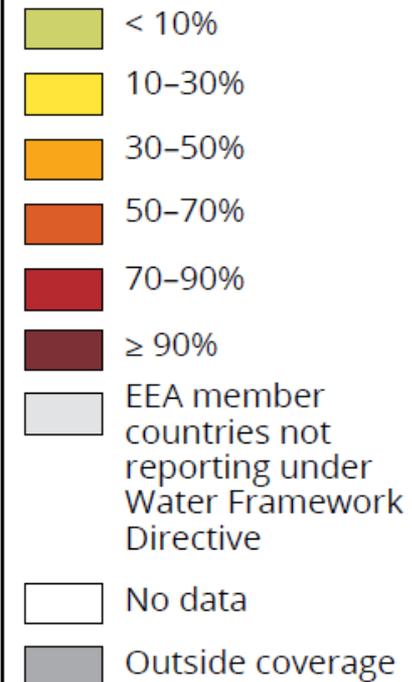
**Percentage of classified water bodies in less than good ecological status or potential in rivers and lakes**



## What are the consequences?



**Percentage of classified water bodies in less than good ecological status or potential in coastal and transitional waters**



*What are the benefits for humans?*

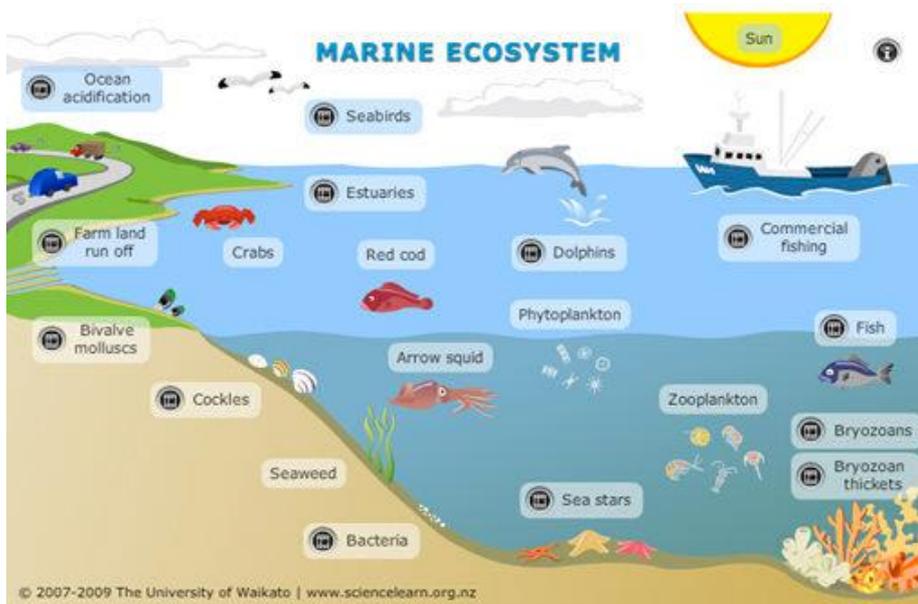
## Ecosystem Goods and Services



## Ecosystem Service

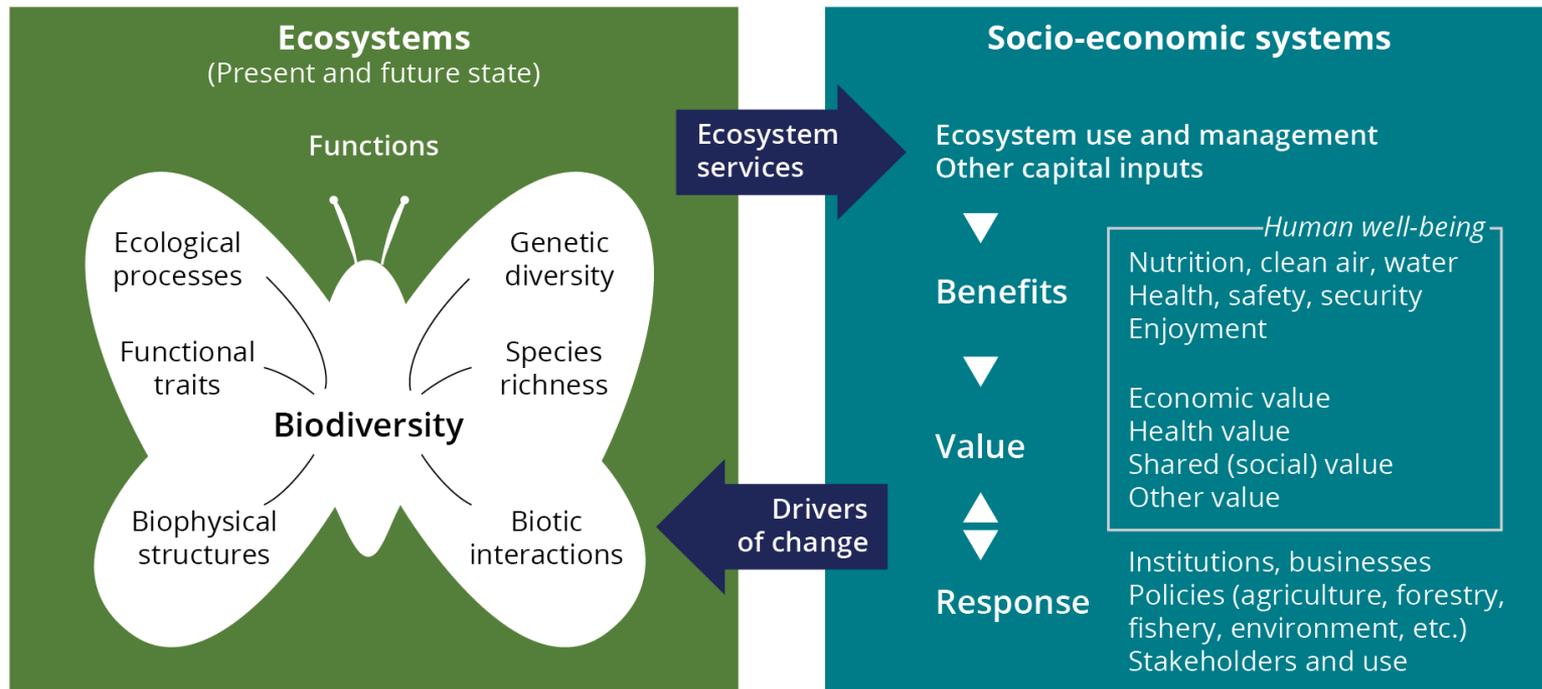
Ecosystem

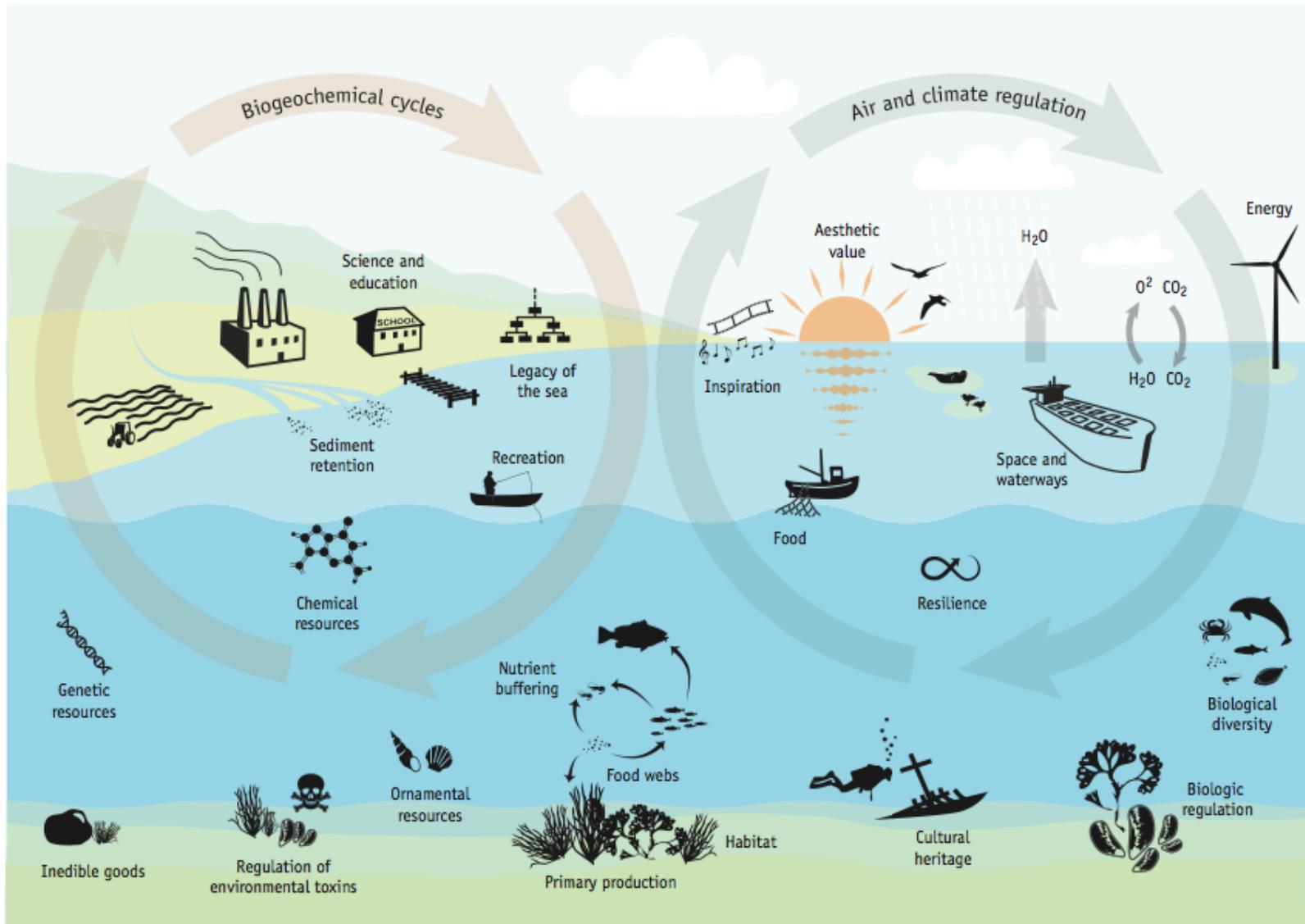
Service



## Ecosystem services:

“benefits that people take from the ecosystem” (MEA, 2005)





## Different definitions of ES but all most similar:

- “Ecosystem services are the **outputs of ecosystem** from which people derive **benefits**” (*National Ecosystem Services assessment, 2011 and Millennium Ecosystem Services Assessment, 2005*)
- “the **aspects of ecosystems** utilized (actively or passively) to produce **human well-being**” (*Fisher et al. 2009*)
- “The direct and indirect **contributions of ecosystems** to **human well-being**. The concept of ecosystem goods and services is synonymous with ecosystem services (*The Economics of Ecosystems and Biodiversity: TEEB, 2010*)
- Ecosystem services are **made up of tangible goods** (e.g. food and raw materials) and **intangible services** (e.g. the regulation of our climate and the remediation of waste). (*Hattam et al 2016*)

## Ecosystem services:

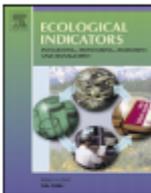
“contributions of ecosystem structure and function – in combination with other inputs – to human well-being”  
(Burkhard et al., 2012)



Contents lists available at [ScienceDirect](#)

**Ecological Indicators**

journal homepage: [www.elsevier.com/locate/ecolind](http://www.elsevier.com/locate/ecolind)



Mapping ecosystem service supply, demand and budgets

Benjamin Burkhard<sup>a,\*</sup>, Franziska Kroll<sup>a</sup>, Stoyan Nedkov<sup>b</sup>, Felix Müller<sup>a</sup>

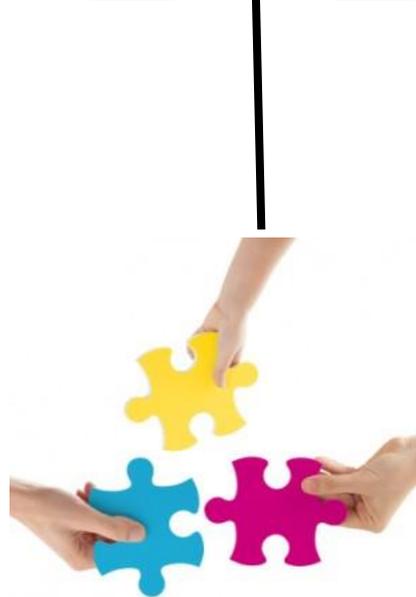
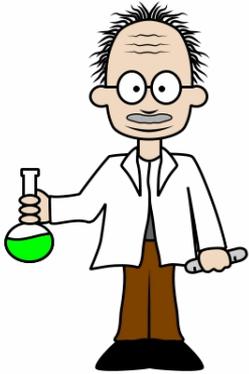
According to Nahlik (2012) the concept of ES should be:

1. **definition and classification of ecosystem services classes** including those issues such as **double-counting** are added;
2. **trans-disciplinary** – providing for the integration of collaboration **between disciplines**, including them in the development of the framework and ensuring that the **terminology used is appropriate for all**;
3. **community engagement** – dialog with local stakeholders and scientist;
4. **resilient** – adaptable and responsive to changing conditions, experience and improved knowledge, to **ensure that they are operational over the long-term**;
5. **cohesive and coherent** – conceptually sound and organized logically, realistically and its use demonstrated
6. **policy-relevant** – the framework should include **policy objectives as a major component of the framework**

**Environmental**

**Social**

**Economic**





***How this all work?***

State



Function



Service



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\$

# Ecosystem Services - Classification



The need to access **Nature's "capital value"** lead to the need of performing assessment of ecosystem services

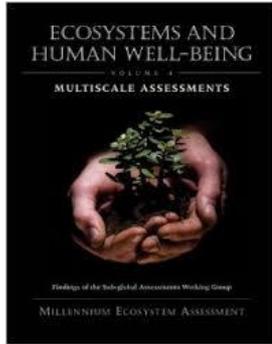
**But...**

There was no name for the services neither **how to classify them** in categories or so

**Then...**

Some classifications started to be developed and in 2005 the Ecosystem Services concept started to be better developed with the **Millennium Ecosystem Assessment (MEA)** which is still one of the most widely used classifications of ecosystem services

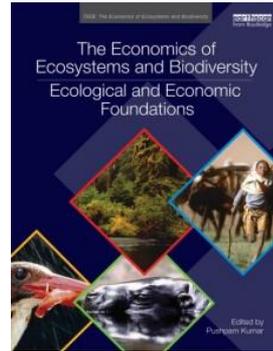
## MEA



4 Categories  
21 Sections

Classification  
accepted and used  
in global sub  
global  
assessments

## TEEB



4 Categories  
22 Sections

Updated  
classification based  
on MA, used in  
ongoing national  
TEEB studies across  
Europe

## CICES

3 Categories  
30 Sections

Build on MA and  
TEEB, hierarchical  
system tailored to  
accounting

## Common International Classification for Ecosystem Services (CICES)

- Build on the **need of standardization for the development of accounting methods** and at the same time with the objective of allowing comparisons
- CICES has been **evolving following** the idea that besides the standardization this **classification should work on mapping and valuing ES** and ecosystem
- CICES does this in a more **hierarchical** and systematic approach of assessing ES.
- This classification is the “officially” accepted by EU, mainly connected with “Mapping and assessment of ecosystems and their services”, which forms part of EU Biodiversity 2020 Strategy

CICES Classification divides the Ecosystem in 3 major categories (sections):

- Provisioning
- Regulation & Maintenance
- Cultural

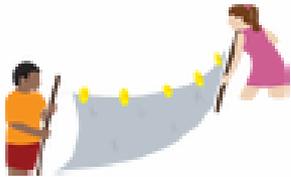
This classification is further divided into:

- Division
- Group
- Class
- Class type

<i>CICES for ecosystem accounting</i>				Note this section is open in that many class types can
Section	Division	Group	Class	Class type
<i>This column lists the three main categories of ecosystem services</i>	<i>This column divides section categories into main types of output or process.</i>	<i>The group level splits division categories by biological, physical or cultural type or process.</i>	<i>The class level provides a further sub-division of group categories into biological or material outputs and bio-physical and cultural processes that can be linked back to concrete identifiable service sources.</i>	<i>Class types break the class categories into further individual entities and suggest ways of measuring the associated ecosystem service output.</i>
<b>Provisioning</b>	Nutrition	Biomass	Cultivated crops	<i>Crops by amount, type</i>
			Reared animals and their	<i>Animals, products by amount,</i>
			Wild plants, algae and their outputs	<i>Plants, algae by amount, type</i>
			Wild animals and their outputs	<i>Animals by amount, type</i>
			Plants and algae from in-	<i>Plants, algae by amount, type</i>
			Animals from in-situ aquaculture	<i>Animals by amount, type</i>
	Water	Surface water for drinking	<i>By amount, type</i>	
Ground water for drinking				

## 3 Categories

**Provisioning  
services**



**Regulating &  
Maintenance  
services**



**Cultural  
services**



## Provisioning services:

- All material and biota-dependent energy outputs from ecosystems
- Tangible things that can be directly exchanged or traded

### 3 Major divisions:

- Nutrition – all ecosystem outputs use directly or indirectly as food
- Material (biotic) – used directly or employed in the manufacture of goods
- Energy (biomass) – biotic renewable energy sources and mechanical energy provided by animals

## Regulating and maintenance services:

- All ways in which ecosystems control or modify biotic or abiotic parameters that define the environment of people
- These services are not consumed directly but affect the performance of individuals communities and populations and their activities

### 3 Major divisions:

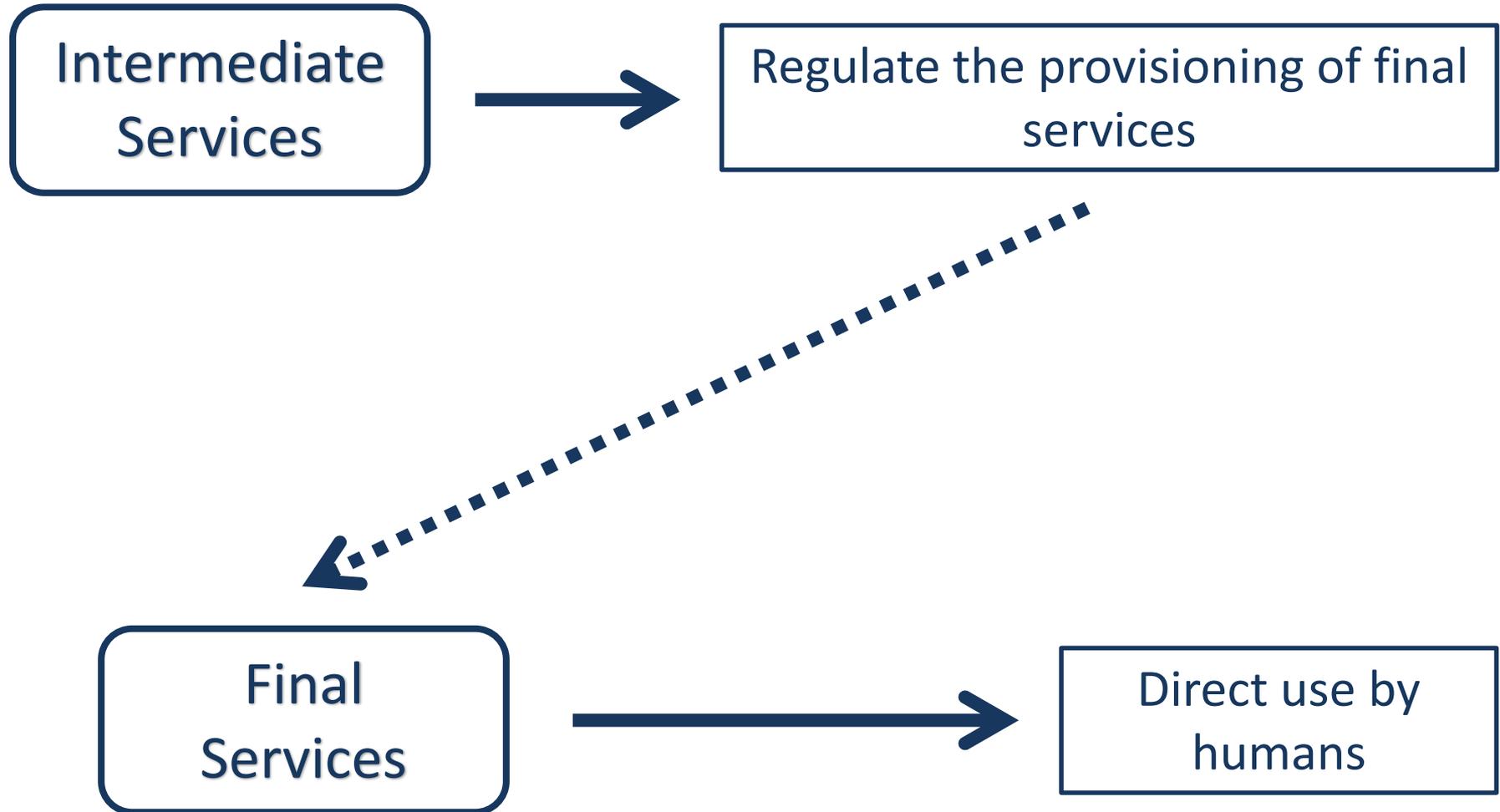
- Mediation of waste, toxics and other nuisances – the services biota ecosystems provide to detoxify or simply dilute substances mainly as result of human action
- Mediation of flows – services such as regulation and maintenance of land and snow masses, flood and storm protection
- Maintenance of physical, chemical, biological conditions – ecosystem provide for sustainable living conditions (climate regulation, soil formation, nursery functions) supporting the provisioning services

## Cultural Services:

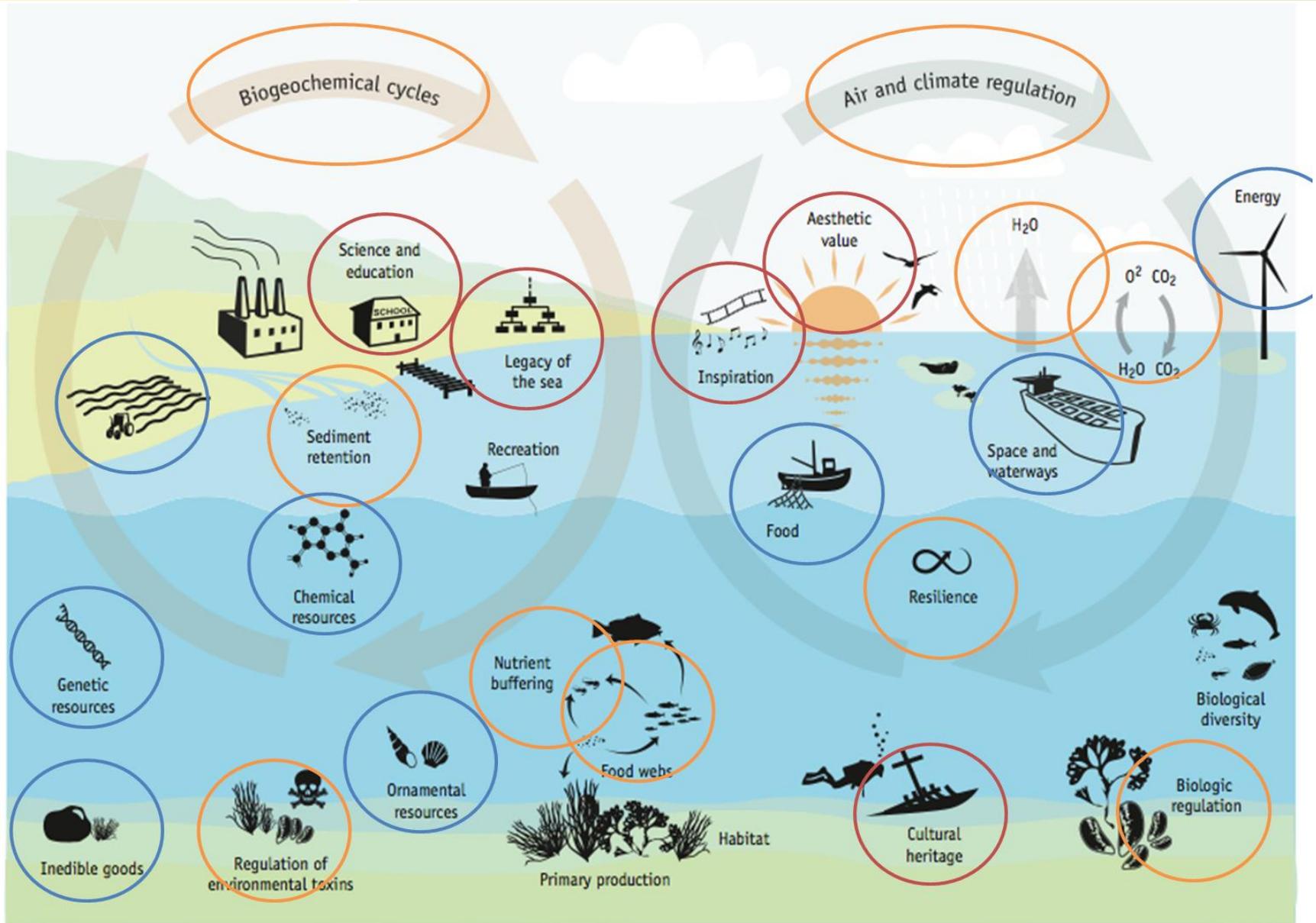
- All non-material ecosystem outputs that have symbolic, cultural or intellectual significance

### 2 Major divisions:

- Physical and intellectual interactions with biota, ecosystems and land-/-seascapes
- Spiritual, symbolic and other interactions with biota, ecosystems and land-/-seascapes



# Ecosystem Services



Concept definition ✓

Classification and categorization ✓

**But...**

How to we access or measure them?

**well...**

To access ecosystem services the best way is to define **indicators** that can represent and somehow measure the service



The best way of assessing ES is through the use of **Indicators**, but since the concept was in general focus on terrestrial assessments there are **few indicator lists available for the marine environment!**

...but, some efforts have been done and the **EU Project MAES**, developed an indicator set for application of ES concept in marine realm!

Indicators for ecosystem services delivered by marine ecosystems

Division	Group	Class	Marine inlets and transitional waters	Coastal waters	Shelf waters	Open Ocean
Nutrition	Biomass	Cultivated crops				
		Reared animals and their outputs				
		Wild plants, algae and their outputs	● Harvest (ton/a)			
		Wild animals and their outputs	● Landings (ton)	● Landings (ton)	● CPUE (ton)	
		Plants and algae from in-situ aquaculture	● Harvest (ton/a)			
		Animals from in-situ aquaculture	● Harvest (ton/a)			
	Water	Surface water for drinking				
	Ground water for drinking					

## Mapping and Assessment of Ecosystems and their Services

Indicators for ecosystem assessments under Action 5 of the EU Biodiversity Strategy to 2020

# Marine ecosystem services: Linking indicators to their classification

Caroline Hattam<sup>a,\*</sup>, Jonathan P. Atkins<sup>b</sup>, Nicola Beaumont<sup>a</sup>, Tobias Börger<sup>a</sup>,  
Anne Böhnke-Henrichs<sup>c</sup>, Daryl Burdon<sup>d</sup>, Rudolf de Groot<sup>c</sup>, Ellen Hoefnagel<sup>e</sup>,  
Paulo A.L.D. Nunes<sup>f</sup>, Joanna Piwowarczyk<sup>g</sup>, Sergio Sastre<sup>h</sup>, Melanie C. Austen<sup>a</sup>

## Typology and indicators of ecosystem services for marine spatial planning and management

Anne Böhnke-Henrichs<sup>a,\*</sup>, Corinne Baulcomb<sup>b</sup>, Rebecca Koss<sup>c</sup>, S. Salman Hussain<sup>b</sup>,  
Rudolf S. de Groot<sup>a</sup>

# The UK National Ecosystem Assessment

Synthesis of the Key Findings



Concept definition ✓

Classification and categorization ✓

Indicators ✓

**Now ...**

**...is all about choosing  
the methodology**



# Ecosystem Services - Methodology

There are different approaches and methodologies for ES assessment, although there is no standard one to follow!

different kinds of approaches

## Qualitative



## Semi-Quantitative

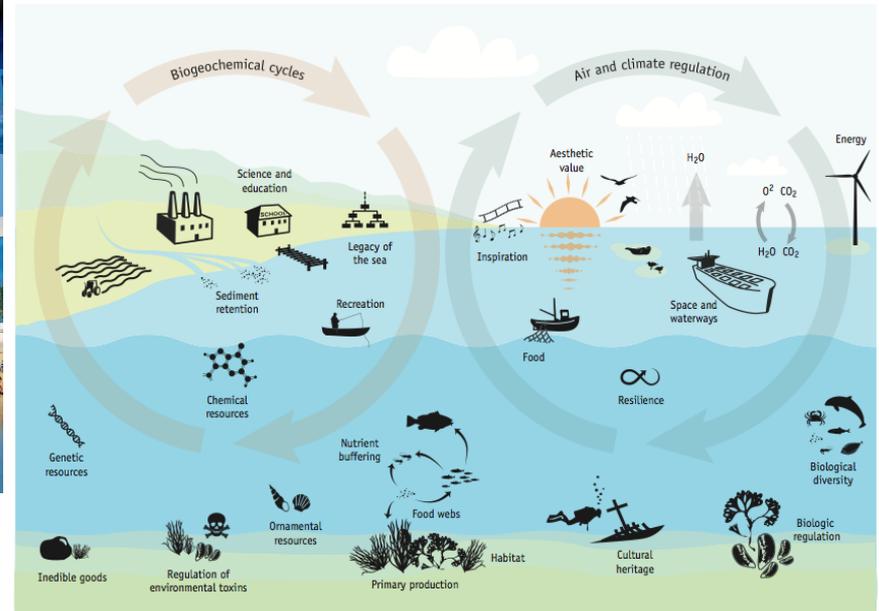


## Quantitative



Which approach to take depends on the scope of the assessment

## Decide on the number of services to be assessed



# Ecosystem Services - Methodology



Assessing the functions and parameters that  
define the ecosystem

Understand how they work and how they  
can be quantified

Market Values:

**travel cost method** (how much do  
you pay to go to the beach)

**hedonic price** (value of house  
when close to the beach)

**replacement costs** (how much cost  
to simulate the service mechanically)

**market prices**

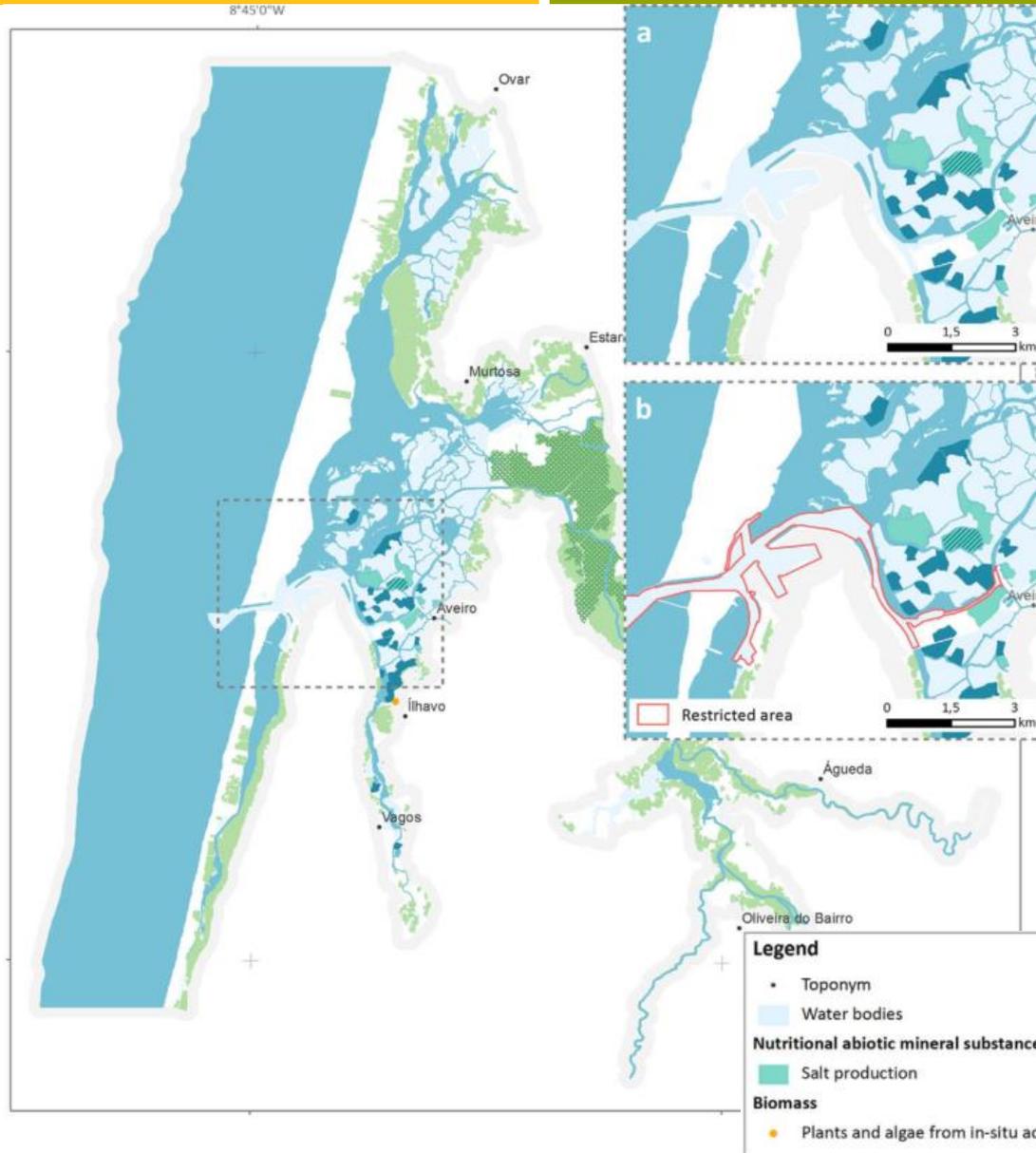
Non-market Values:

**Willingness to pay**

**Choice modelling**



# Ecosystem Services - Methodology



## Ecosystem services provided by a complex coastal region: challenges of classification and mapping

Lisa P. Sousa<sup>1</sup>, Ana I. Sousa<sup>2</sup>, Fátima L. Alves<sup>3</sup> & Ana I. Lillebø<sup>2</sup>

**NUTRITION**

## The “Matrix” Approach!



Developed by  
**Benjamin Burkhard**  
& colleagues from Kiel  
University

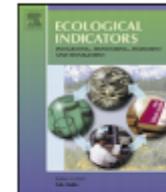
Many applications not  
only in Europe  
but also already applied in  
Indonesia!



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**Ecological Indicators**

journal homepage: [www.elsevier.com/locate/ecolind](http://www.elsevier.com/locate/ecolind)



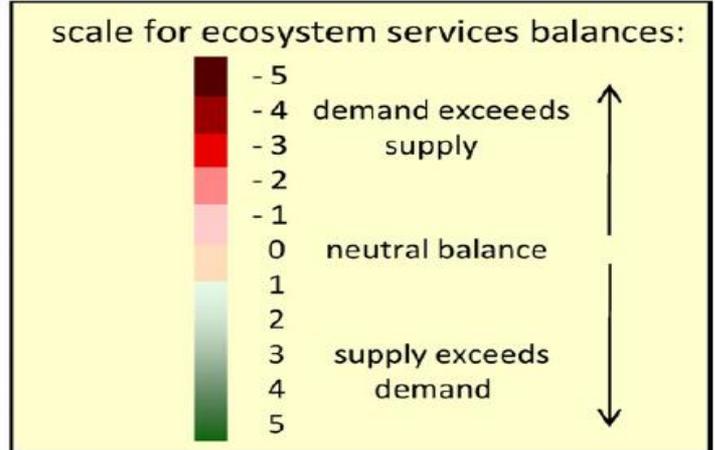
Mapping ecosystem service supply, demand and budgets

Benjamin Burkhard<sup>a,\*</sup>, Franziska Kroll<sup>a</sup>, Stoyan Nedkov<sup>b</sup>, Felix Müller<sup>a</sup>

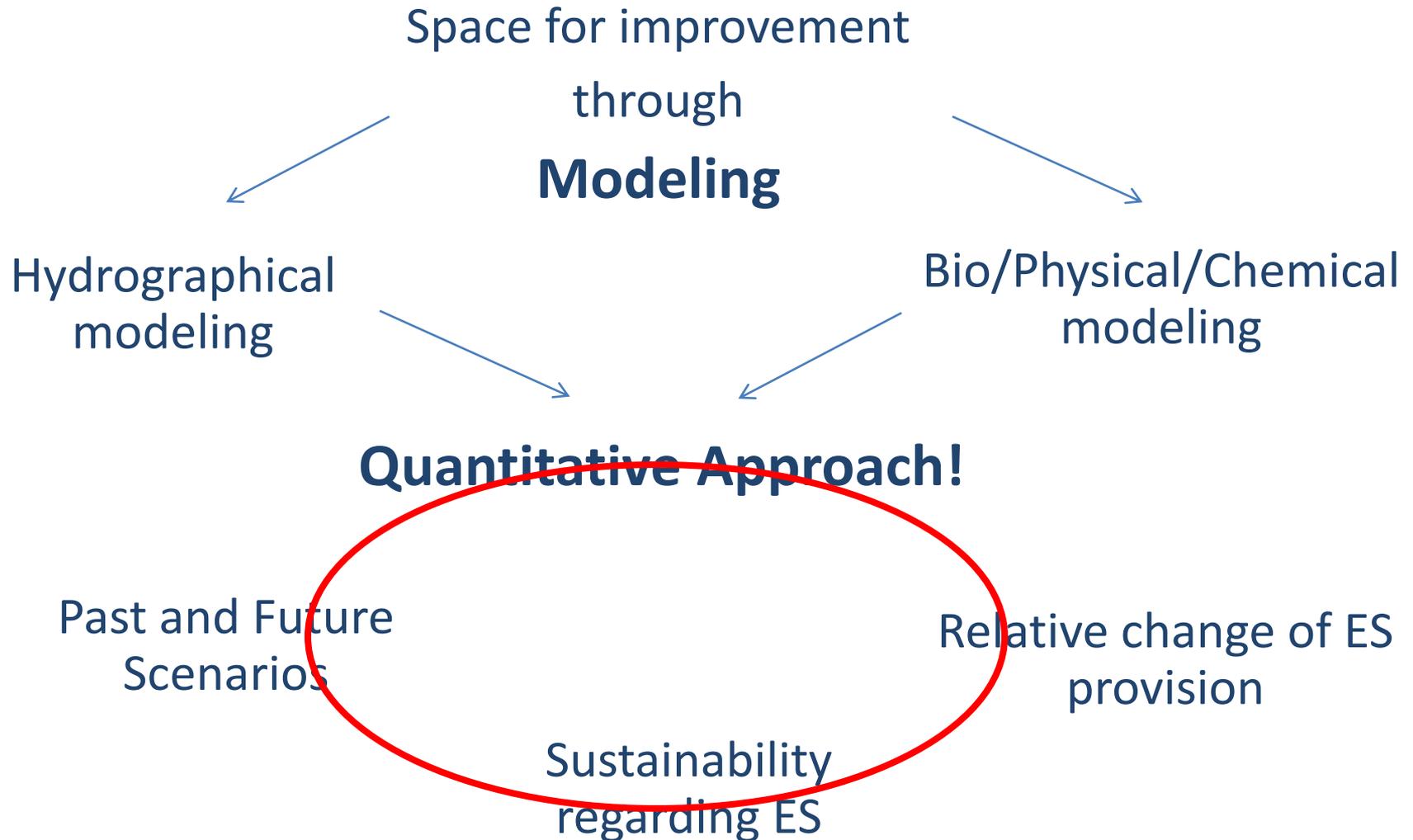
# Ecosystem Services - Methodology



CORINE land cover type:	Regulating services								Provisioning services								Cultural services									
	Local climate regulation	Global climate regulation	Flood protection	Groundwater recharge	Air Quality Regulation	Erosion Regulation	Nutrient regulation	Water purification	Pollination	Crops	Livestock	Fodder	Capture Fisheries	Aquaculture	Wild Foods	Timber	Wood Fuel	Energy	Biochemicals / Medicine	Freshwater	Recreation & Aesthetic Values	Intrinsic Value of Biodiversity				
Continuous urban fabric	-5	-3	-4	-5	-5	-1	-1	-1	-3	5	5	-1	5	5	-3	-2	-4	-5	-5	-4	-3					
Discontinuous urban fabric	-5	-3	-5	-5	-5	-1	-2	-2	-4	3	-4	-1	-4	-4	-3	-3	-3	-3	-5	-5	-4	-3				
Industrial or commercial units	-1	-5	-4	-5	-5	-1	-3	-3	-4	5	5	5	-4	-4	-4	-5	-5	-4	-5	-5	-1	-1				
Road and rail networks	-2	-4	-4	-1	-4	-3			-1						-2	-4					-2					
Port areas	-2	-3	-2	-2	-2	-4			-1	-2	-2	-2	-2	-2	-1	5	-2	-5	-1	-3	-1	-1				
Airports	-2	5	-1	-1	-4	-1	-1	-2		-2	-2	1	-1	-1	-1	-1		5	-1	3	-1	-1				
Mineral extraction sites			-2	-4		-4									-2		2		-2							
Dump sites	-2	-2		-2	3			-2										0		-2						
Construction sites	-2		-2		-1	-2	-2	-2							-4		-4			-2						
Green urban areas	0	1		1	0	2	1	1	-1	-1	-1			1		1	-1			-2	-1					
Sport and leisure facilities	-1	1		0	-2	1	1	0	1	-2	-2	-1	-2	-2	-1	-1	-3	-3	-3		2					
Non-irrigated arable land	0	-1	-1	1	-1	-2	3		3	4	5	5						1	0		1					
Permanently irrigated land	1	-1	-1	5	-1	-2	3	-5	-3	4	5	2						-1	0	-5	1					
Ricefields	-1	-4	5	3	-1	5	3	5	-1	4		2						-2	-1	5	1					
Vineyards	-4	-1		-2	-1	5	-3	-4	-2	3											5					
Fruit trees and berries	0	1	2	-1	1	1	-2	-1	0	4								3	4	-1	-2	-3				
Olive groves	-1	0	0	0	1	-1	-1	-2		3								4	4	0	-2	-1				
Pastures	0	-2	0	1		4	-1	-2			4	2						0	-1	-2		3				
Annual and permanent crops	1	0	0	0	0	-5	-2	-2		4	5	5						-1	0	-1		1				
Complex cultivation patterns	1	0	0	0	-1	-1	-5	-2	-3	3		3						-1	1	-1		2				
Agriculture & natural vegetation	2	0	1	1	0	2	3	-1	-2	2	3	2						3	3	3	0	-2	2	3		
Agro-forestry areas	1	0	1	0	0	-2	-2	-1	1	2	3	2						3	3	1	-1	-2		3		
Broad-leaved forest	5	4	3	2	5	5	5	5	5			1						4	4	4	1	5		5	5	
Coniferous forest	5	4	3	2	5	5	5	5	5			1						4	4	4	1	5		5	5	
Mixed forest	5	4	3	2	5	5	5	5	5			1						4	4	4	1	5		5	5	
Natural grassland	2	3	1	1							3							2					3	3		
Moors and heathland	4	3	2	2			3	4	2		2							1		2	2			5	5	
Sclerophyllous vegetation	2	1	1	1					2		2							1		2	1	3			2	4
Transitional woodland shrub	1								2		2							1		2	1				2	2
Beaches, dunes and sand plains			5	1																1					4	1
Bare rock			1	1			1																		4	
Sparsely vegetated areas	1		1	1																						
Burnt areas	1																									
Glaciers and perpetual snow	3	3		4																5					5	5
Inland marshes	2	2	4	2			4				2	5														
Peatbogs	4	5	3	3			3	4	2										2						4	4
Salt marshes	1		5				2				2														3	2
Salines	2																								2	
Intertidal flats	1		5				1																		4	4
Water courses	1		2	1			3	3																	5	5
Water bodies	2	1	1	2			1																		5	4
Coastal lagoons	1		4																						5	4
Estuaries			3				3	3																	4	3
Sea and ocean	3	5					5																		4	2



## The “Matrix” Approach



## Ecosystem Services Assessment Tool (ESAT)

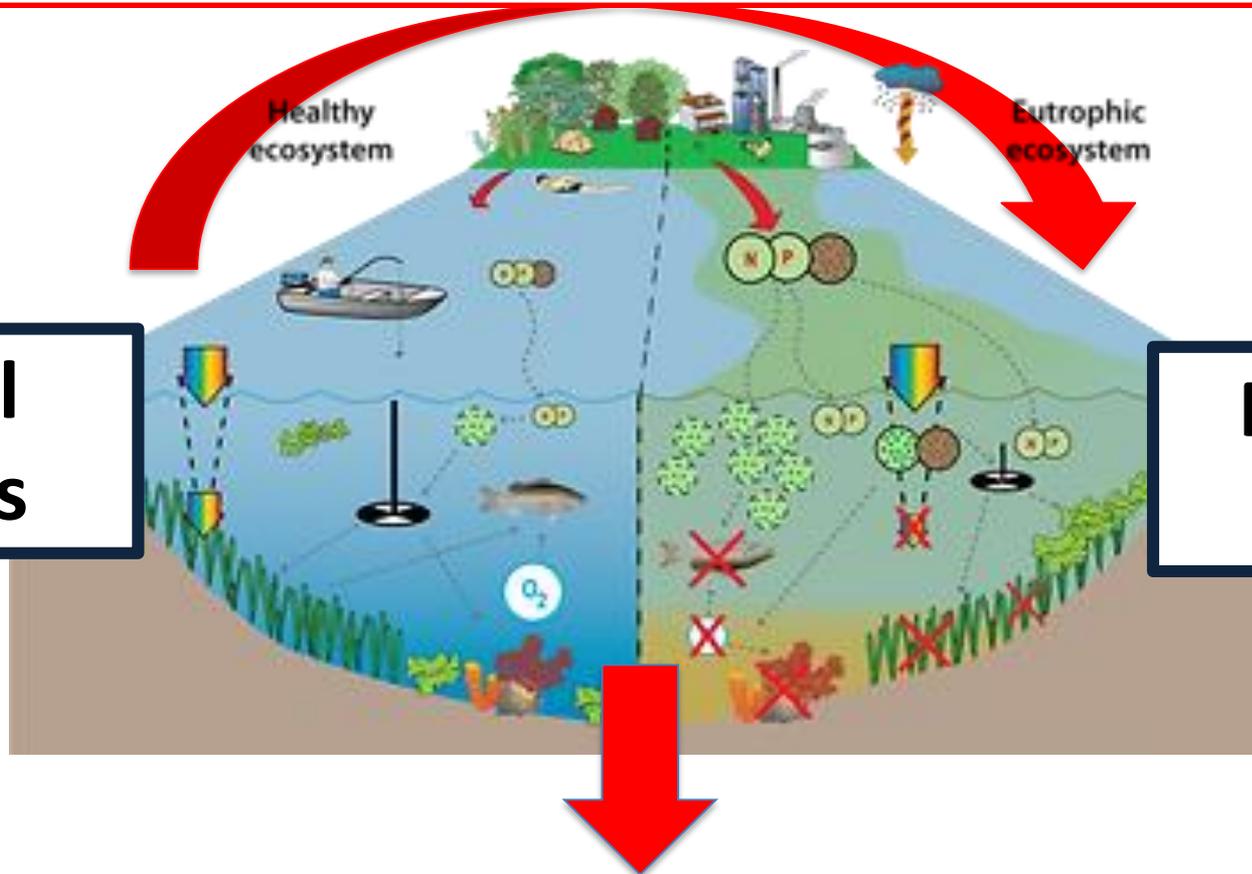
easy to apply tool for ecosystem  
services assessment in the  
marine environment



# Ecosystem Services - Methodology

**Loss of ecosystem integrity, resilience and overall ecological status**

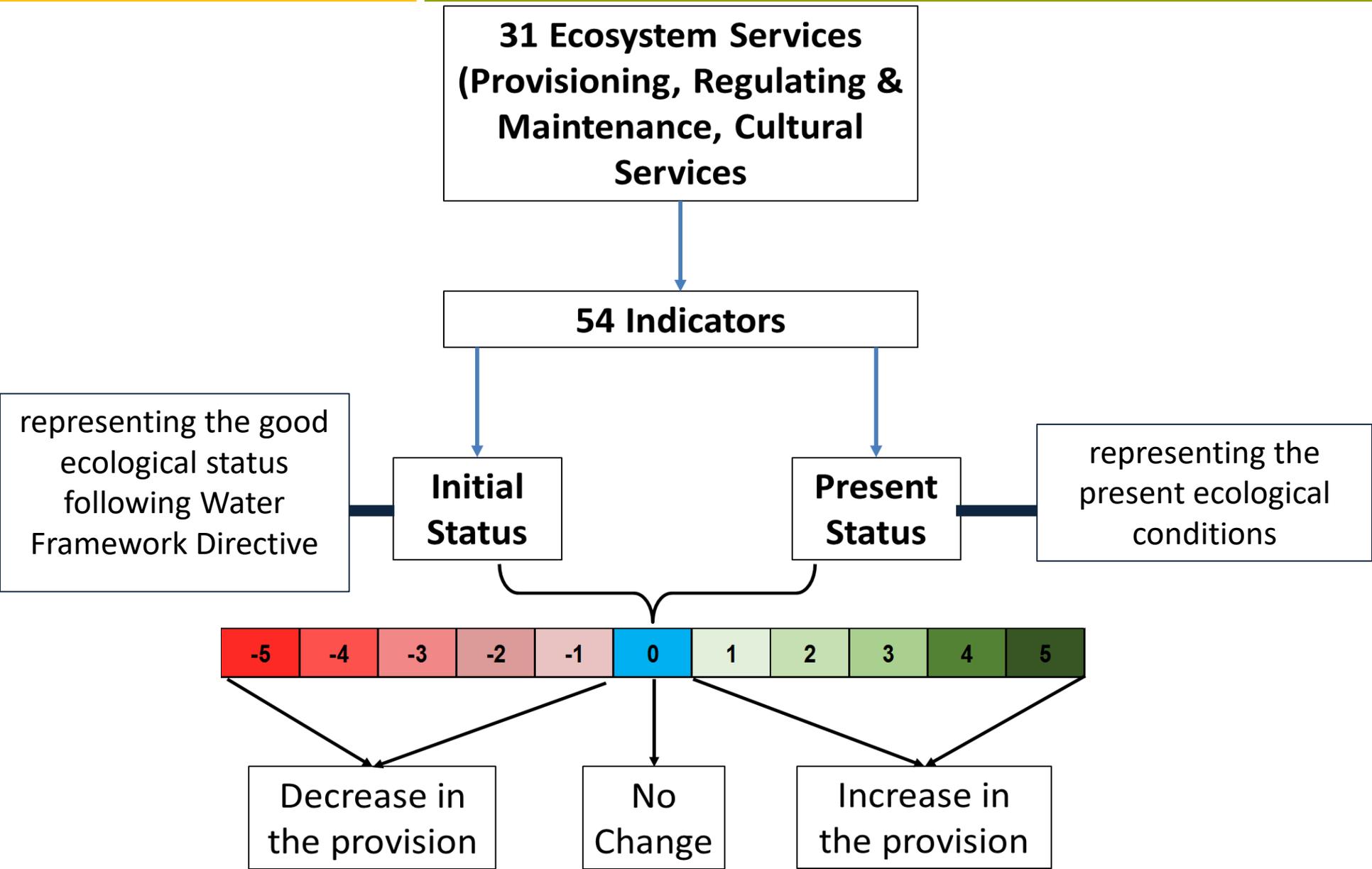
**Initial  
Status**



**Present  
Status**

**Impact on the ecosystem's ability to provide  
ecosystem services**

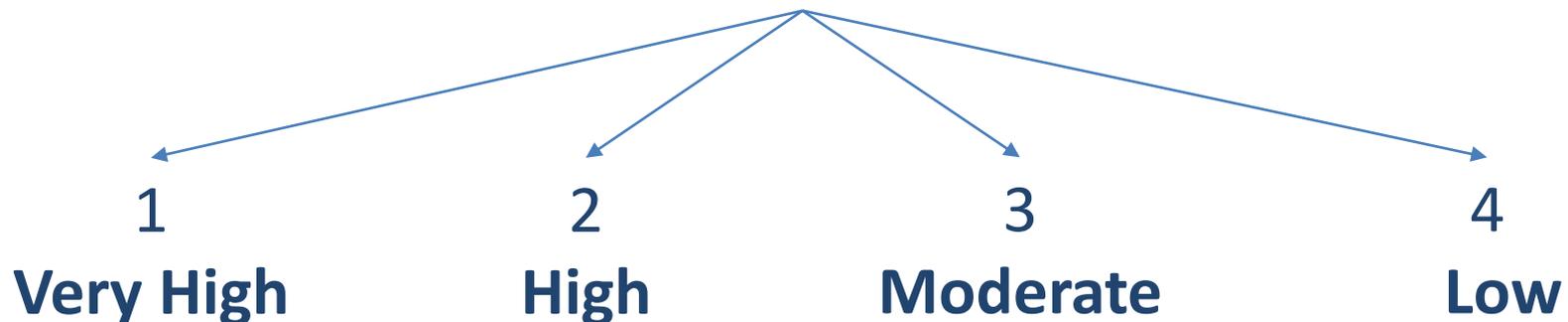
# Ecosystem Services - Methodology



## Incorporate different types of Data

Observational Data	Literature and Reports	Other Sources (Modelling)	Expert Knowledge
-----------------------	---------------------------	------------------------------	---------------------

For each source it is given criteria about  
**Quality / Reliability** of data



Ecosystem Services Classification				Indicators Proposed	
Section	Division	Group	Class	Indicator	Units
<b>Provisioning Services</b>	Nutrition	Biomass	Wild plants, algae and their outputs	Harvest	Ton/yr./km <sup>2</sup>
				Nº of Species	nº/km <sup>2</sup>
			Wild animals and their outputs	Landings	Ton/yr./km <sup>2</sup>
				Landing of key market species	Ton/yr./km <sup>2</sup>
			Animals from in situ aquaculture	Harvest	Ton/a
				Nº of Species	nº/km <sup>2</sup>
		Plants and algae from in situ aquaculture	Harvest	Ton/a	
			Nº of Species	nº/km <sup>2</sup>	
		Water	Surface water for drinking purposes	Amount of water	m <sup>3</sup> /km <sup>2</sup>
		Materials	Biomass	Fibres and other materials from plants, algae and animals for direct use or processing	Harvest
	Materials from plants, algae and animals for agriculture			Harvest	Ton/yr./km <sup>2</sup>
	Water		Surface Water for non-drinking purposes	Amount of water	m <sup>3</sup> /km <sup>2</sup>
	Energy	Biomass-based energy resources	Plant based resources		Ton/yr./km <sup>2</sup>
			Animal based resources	Amount	Ton/yr./km <sup>2</sup>

# Assessment

# Ecosystem Services - Methodology



ES classification **Initial Status** Indicators

Section	Division	Group	Class	Indicator	Units	Value
Provisioning Services	Nutrition	Biomass	Wild animals and their outputs	Landings	Ton/yr./km <sup>2</sup>	4.2
				Landing of key market species	Ton/yr./km <sup>2</sup>	1.3

## Data Sources

Type of Data	Quality / Reliability	
Reports/ Literature	1	Very High
Reports/ Literature	1	Very High

## Classes of ES

< 1/4.1	1/2.5 to 1/4.1		1/1.7 to 1/2.5		1/1.3 to 1/1.7		1/1.1 to 1/1.3		Initial Status		1.1 to 1.3		1.3 to 1.7		1.7 to 2.5		2.5 to 4.1		> 4.1	
< 1/4.1	1/4.1	1/2.5	1/2.5	1/1.7	1/1.7	1/1.3	1/1.3	1/1.1	1/1.1	1.1	1.3	1.1	1.3	1.3	1.7	1.7	2.5	2.5	4.1	4.1
1.024	1.024	1.680	1.680	2.471	2.471	3.231	3.231	3.818	3.818	4.620	4.620	5.460	5.460	7.140	7.140	10.500	10.500	17.220	17.220	
0.317	0.317	0.520	0.520	0.765	0.765	1.000	1.000	1.182	1.182	1.430	1.430	1.690	1.690	2.210	2.210	3.250	3.250	5.330	5.330	

# Ecosystem Services - Methodology

## Present Status

### ES classification

### Indicators

Section	Division	Group	Class	Indicator	Units	Value	Class of change
Provisioning Services	Nutrition	Biomass	Wild animals and their outputs	Landings	Ton/yr./km <sup>2</sup>	3.3601	-1
				Landing of key market species	Ton/yr./km <sup>2</sup>	0.3309	-4

### Data Sources

Type of Data	Quality / Reliability	
Database/ dataset	1	Very High
Database/ dataset	1	Very High

### Classes of ES

< 1/4.1	1/2.5 to 1/4.1		1/1.7 to 1/2.5		1/1.3 to 1/1.7		1/1.1 to 1/1.3		Initial Status	1.1 to 1.3		1.3 to 1.7		1.7 to 2.5		2.5 to 4.1		> 4.1	
< 1/4.1	1/4.1	1/2.5	1/2.5	1/1.7	1/1.7	1/1.3	1/1.3	1/1.1	1/1.1	1.1	1.3	1.3	1.7	1.7	2.5	2.5	4.1	4.1	
1.024	1.024	1.680	1.680	2.471	2.471	3.231	3.231	3.818	3.818	4.620	4.620	5.460	5.460	7.140	7.140	10.500	10.500	17.220	17.220
0.317	0.317	0.520	0.520	0.765	0.765	1.000	1.000	1.182	1.182	1.430	1.430	1.690	1.690	2.210	2.210	3.250	3.250	5.330	5.330

# Ecosystem Services - Methodology

Ecosystem Services Classification						Assessment			Aggregated category							
Section	Division	Group	Class	Indicator	Units	Initial Status	Present Status	Category	Class	Group	Division	Section				
			Wild plants, algae and their outputs	Harvest of wild plants, algae N° of species of wild plants, algae	Ton/yr./km2 n°/km2	not considered / not relevant										
Ecosystem Services Classification						Assessment			Aggregated Category							
Section	Division	Group	Class	Indicator	Units	Initial Status	Present Status	Category	Class	Group	Division	Section				
Ecosystem Services	Mediation of waste, toxics and other nuisances	Mediation by ecosystems	Filtration/sequestration/storage/accumulation by ecosystems	N-fixation	kg/yr./km2	0,1214	0,0629	-3	-2	-1	-1					
				Burial (P)	kg/yr./km2	23,0500	17,0400	-2								
				Denitrification	kg/yr./km2	23634,2240	22755,6790	0								
			Dilution by atmosphere, freshwater and marine ecosystems	Average of beach closures per year	N°/km2	0	0	0	0							
		Mediations of Flow	Mass Flows	Mass stabilization and control of erosion rates	Extent of selected emerged, submerged and intertidal habitats	km2/km2	0,0997	0,0387	-4	-4	-2					
				Buffering and attenuation of mass flows	Sediment accumulation rate	cm/yr.	0	0	0	0		-1				
Ecosystem Services Classification						Assessment			Aggregated Category							
Section	Division	Group	Class	Indicator	Units	Initial Status	Present Status	Category	Class	Group	Division	Section				
Cultural Services	Physical and Intellectual interactions with biota, ecosystems, and land-/seascapes [environmental settings]	Physical and experiential interactions	Experiential use of plants, animals and land-/seascapes in different environmental settings	n° of visitors taking part in activities related to biota	n°/yr/km2			0	0	3	3	3				
				Physical use of land-/seascapes in different environmental settings	N° of tourists (within 1 km of coastal zone)	n°/km2	614,1131499	21229,85719	5				4			
					N° of ship berths in the marinas	n°/km2	0	2,711790393	4				4			
					N° of Tourist Boat	n°capacity/km2	0	0,122743682	3				5			
			Intellectual and representative interactions	Scientific and Educational	Scientific studies, Documentaries, educational publications	N°/yr./km2	0,0032	0,1138	5	5			4	3	3	
					Visits to scientific and artistic exhibits	N°/yr	no data	no data	0	4						
					Heritage, cultural	n° of cultural and heritage sites	n°/km2	0,02195122	0,063414634	4						4
					Entertainment	N° of movies and broadcasts in the area	n°/km2	0	0,008491024	2						2
					Aesthetic	N° of pictures	N°/yr./km2	0,007220217	0,056768559	5						5
					Spiritual and/or emblematic	Symbolic	N° of Red List and iconic species	n°/km2	0,001455604	0,04657933						4
		Spiritual, symbolic and other interactions with biota, ecosystems, and land-/seascapes	Spiritual and/or emblematic	Sacred and/or religious	N° of Religious events (within 1 km of coastal zone)	n°/km2	0	0,03202329	3	3	3	3				
				Existence	N° of offers for health treatments (within 1 km of coastal zone)	n°capacity/km2			0	0						
			Other cultural outputs	Bequest	Extent of marine protected areas	km2 / km2			0	1			5	5		

# Visualization

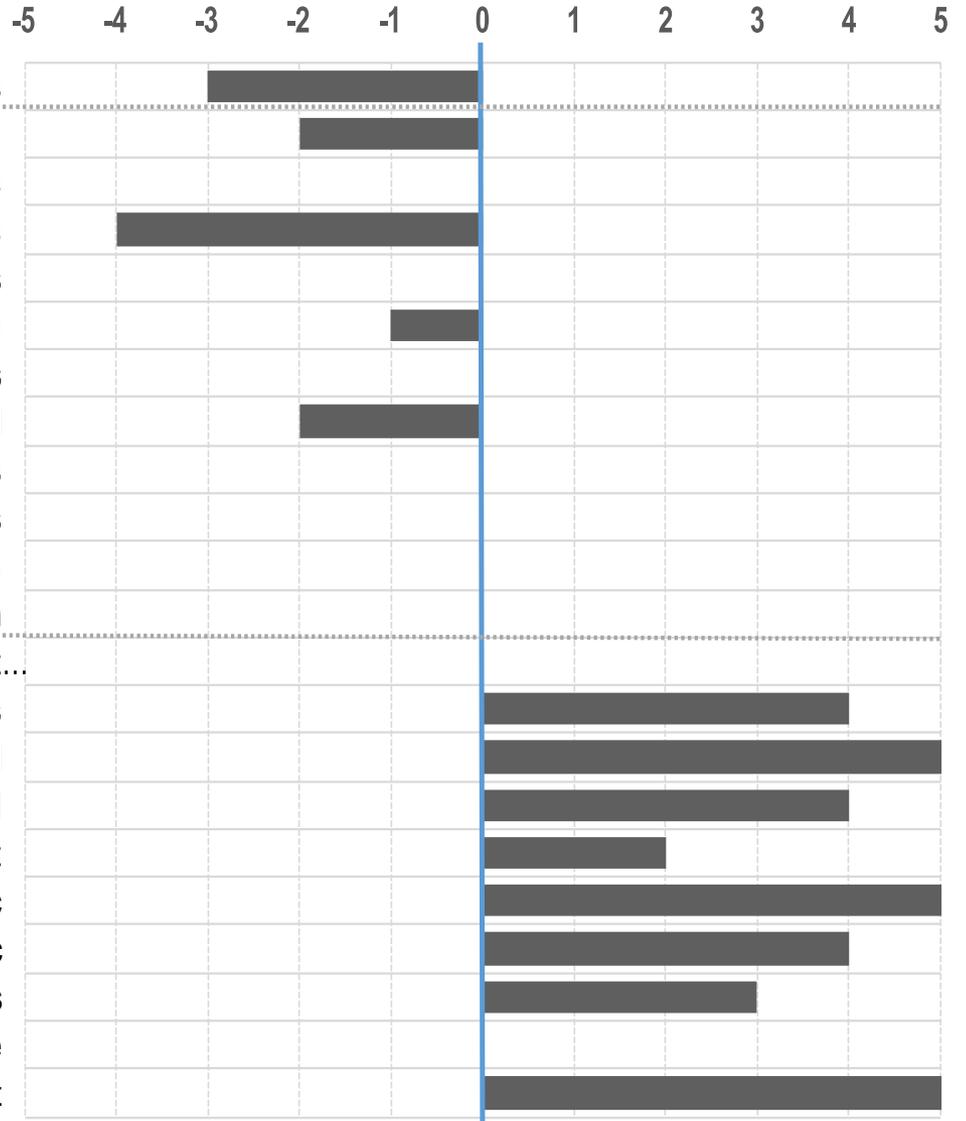
# Ecosystem Services - Methodology



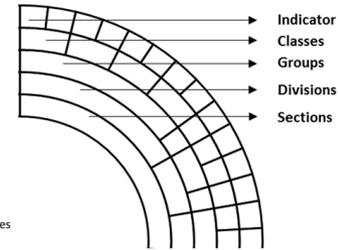
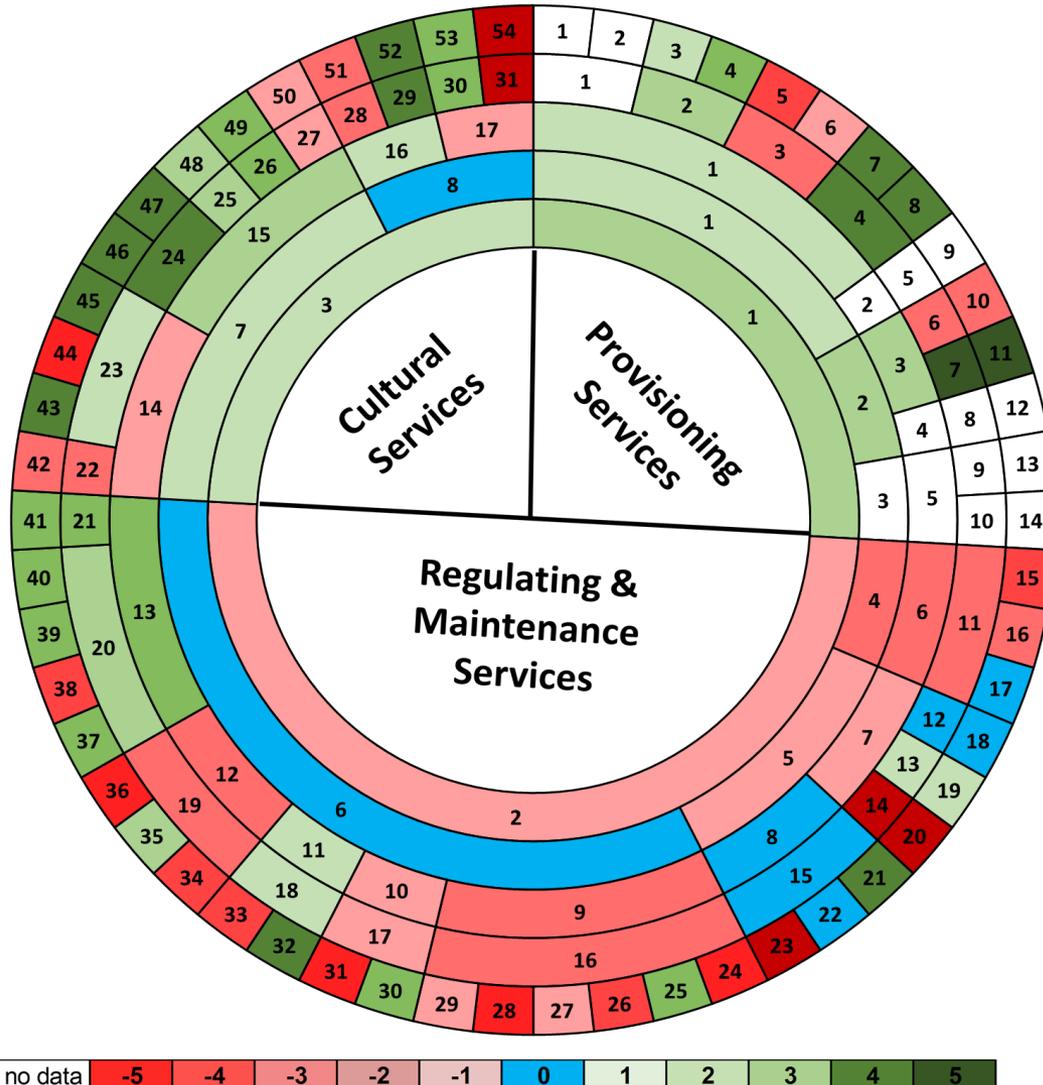
## **Provisioning Services**

## **Regulating & Maintenance Services**

## **Cultural Services**



# Ecosystem Services - Methodology



- Sections**
1. Provisioning Services
  2. Regulating & Maintenance Services
  3. Cultural Services

- Divisions**
1. Nutrition
  2. Materials
  3. Energy
  4. Mediation of waste, toxics and other nuisances
  5. Mediations of Flow

- Groups**
1. Biomass
  2. Water
  3. Biomass
  4. Water
  5. Biomass-based energy resources
  6. Mediation by ecosystems
  7. Mass Flows
  8. Liquid Flows

- Classes**
1. Wild plants, algae and their outputs
  2. Wild animals and their outputs
  3. Animals from in situ aquaculture
  4. Plants and algae from in situ aquaculture
  5. Surface water for drinking purposes
  6. Fibres and other materials from plants, algae and animals for direct use or processing
  7. Materials from plants, algae and animals for agriculture
  8. Surface Water for non-drinking purposes
  9. Plant based resources
  10. Animal based resources
  11. Filtration/sequestration/storage/accumulation by ecosystems
  12. Dilution by atmosphere, freshwater and marine ecosystems
  13. Mass stabilisation and control of erosion rates
  14. Buffering and attenuation of mass flows
  15. Flood Protection
  16. Maintaining nursery populations and habitats

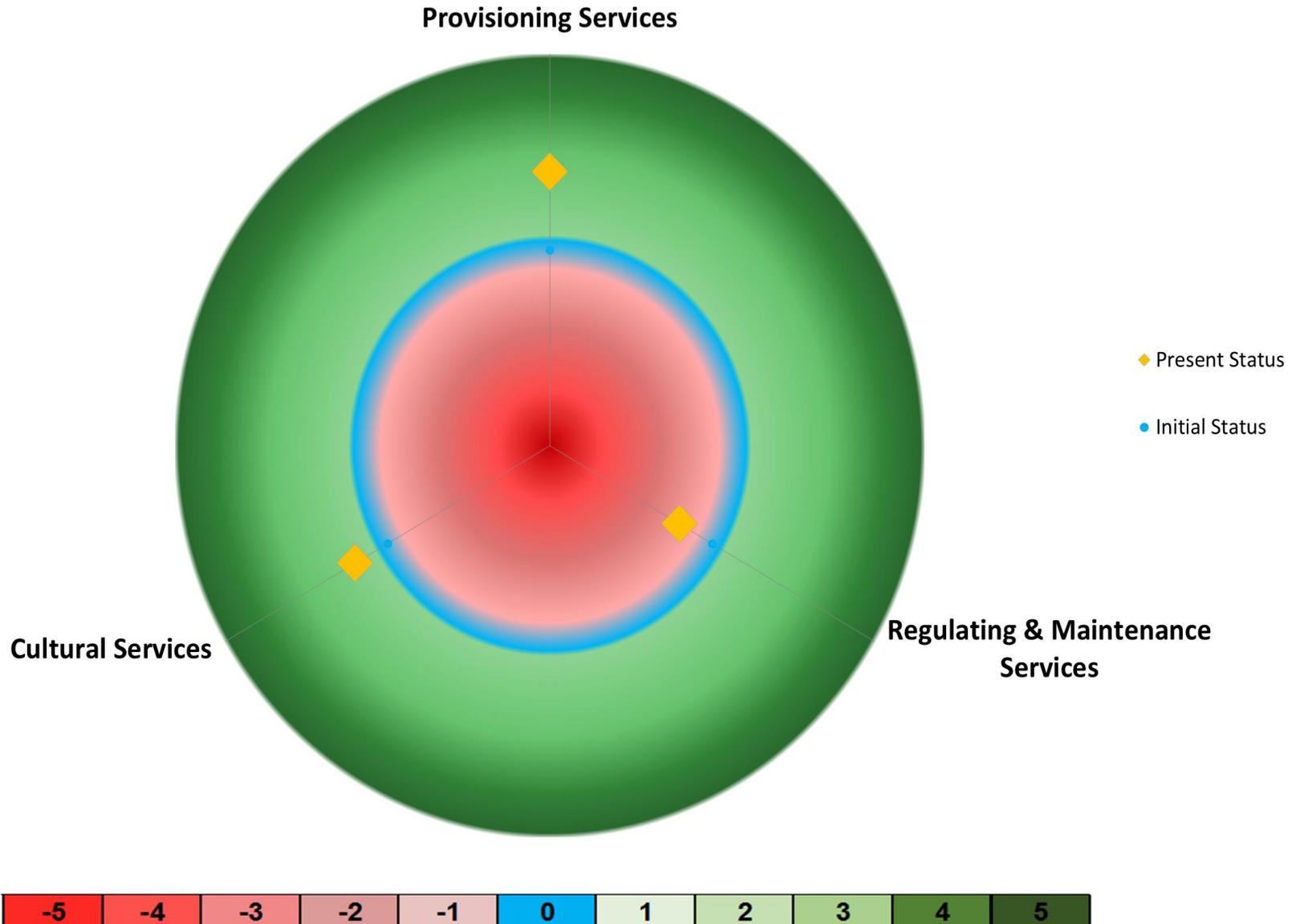
- Indicators**
1. Harvest
  2. Nº of Species
  3. Landings
  4. Landing of key market species
  5. Harvest
  6. Nº of Species
  7. Harvest
  8. Nº of Species
  9. Use of Water
  10. Harvest
  11. Harvest
  12. Use of Water
  13. Use
  14. Use
  15. N-fixation
  16. Burial
  17. Denitrification
  18. Average of beach closures per year
  19. Extent of selected emerged, submerged and intertidal habitats
  20. Sediment accumulation rate
  21. Shoreline erosion rate
  22. Maximum depth (to calculate maximum wave height)
  23. Design-basis Flood
  24. Submerged and intertidal habitats diversity
  25. Occurrence of Oxygen concentration < 6 mg/L
  26. Secchi depth
  27. Species distribution
  28. Nursery areas
  29. % of nursery areas which are protected
  30. Harmful Algal Bloom Outbreaks
  31. Presence of alien species
  32. Nitrogen removal
  33. Water residence time
  34. Nutrients concentration
  35. Salinity
  36. Oxygen Concentration
  37. C stock
  38. C sequestration
  39. pH
  40. PP
  41. Evaporation rate
  42. nº of visitors taking part in activities related to biota
  43. nº of tourists (within 1 km of coastal zone)
  44. nº of ship berths in the marinas
  45. nº of Tourist Boat
  46. Scientific studies, Documentaries, educational publications
  47. Visits to scientific and artistic exhibits
  48. nº of cultural and heritage sites
  49. nº of movies and broadcasts in the area
  50. nº of pictures
  51. nº of Red List and iconic species
  52. nº of Religious events (within 1 km of coastal zone)
  53. nº of offers for health treatments (within 1 km of coastal zone)
  54. Extent of marine protected areas

6. Maintenance of physical, chemical, biological conditions
7. Physical and Intellectual interactions with biota, ecosystems, and land-/seascapes [environmental settings]
8. Spiritual, symbolic and other interactions with biota, ecosystems, and land-/seascapes

9. Lifecycle maintenance, habitat and gene pool protection
10. Pest and disease control
11. Soil formation and composition
12. Water conditions
13. Atmospheric composition and climate regulation
14. Physical and experiential interactions
15. Intellectual and representative interactions
16. Spiritual and/or emblematic
17. Other cultural outputs

17. Pest and Disease control
18. Decomposition and fixing processes
19. Chemical condition of salt waters
20. Global climate regulation by reduction of greenhouse gas concentrations
21. Micro and regional climate regulation
22. Experiential use of plants, animals and land-/seascapes in different environmental settings
23. Physical use of land-/seascapes in different environmental settings
24. Scientific and Educational
25. Heritage, cultural
26. Entertainment
27. Aesthetic
28. Symbolic
29. Sacred and/or religious
30. Existence
31. Bequest

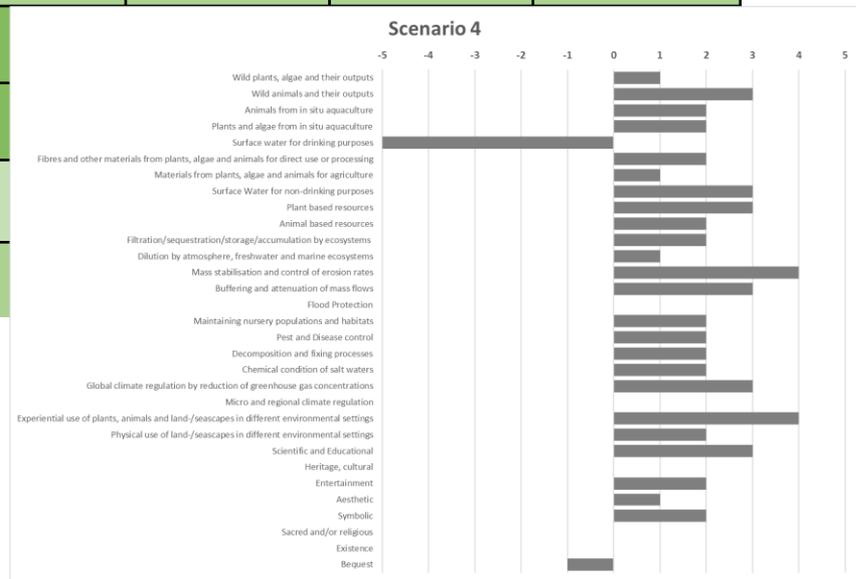
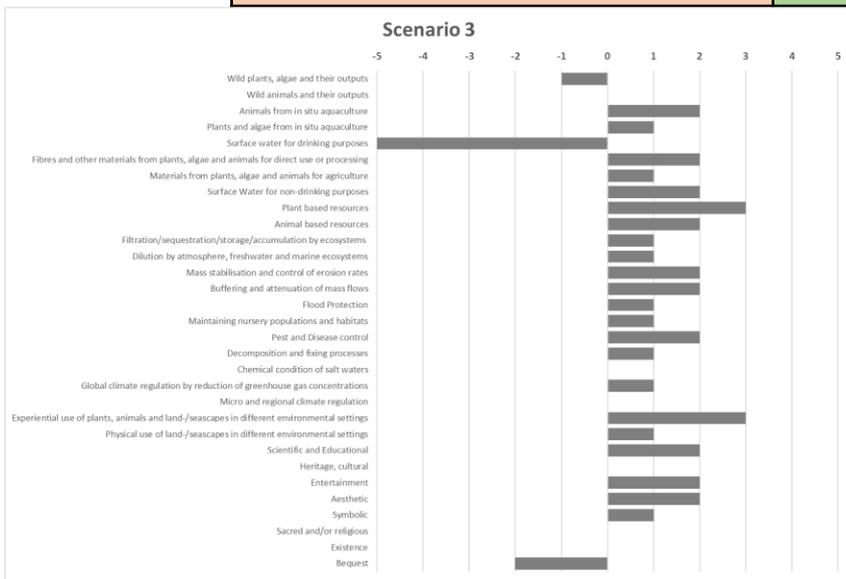
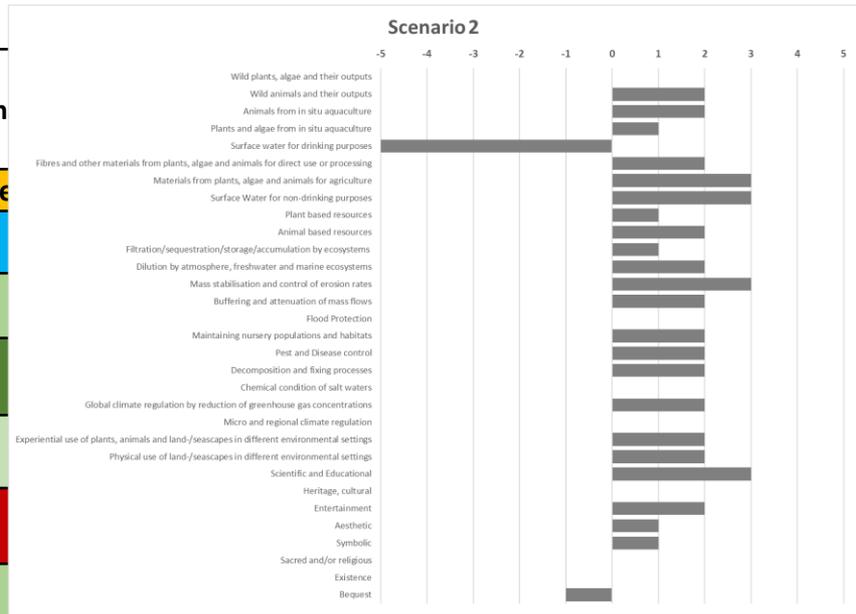
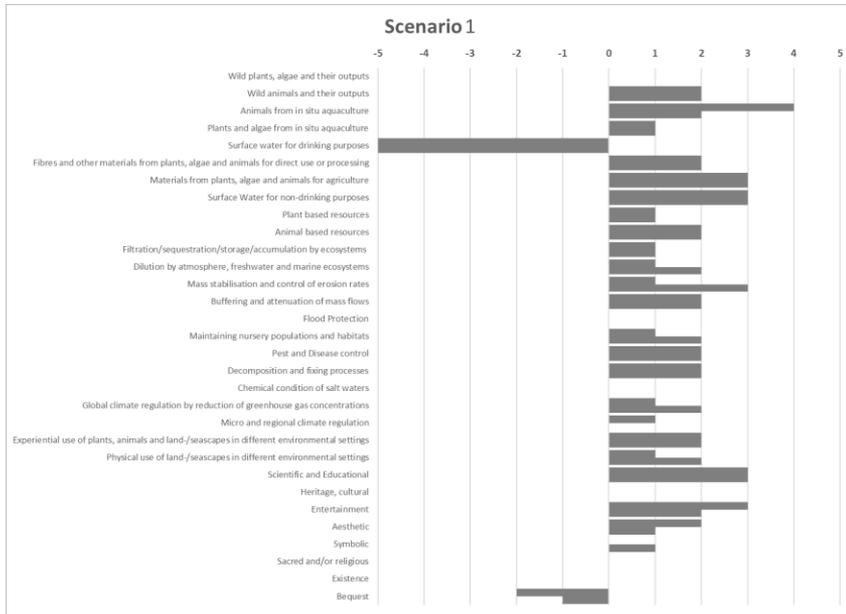
# Ecosystem Services - Methodology



# Ecosystem Services - Methodology

	Scenario 1.	Scenario 2.	Scenario 3.	Scenario 4.
Class	Average	Average	Average	Average
Wild plants, algae and their outputs	0	0	-1	1
Wild animals and their outputs	2	2	0	3
Animals from in situ aquaculture	4	2	2	2
Plants and algae from in situ aquaculture	1	1	1	2
Surface water for drinking purposes	-5	-5	-5	-5
Fibres and other materials from plants, algae and animals for direct use or processing	2	2	2	2
Materials from plants, algae and animals for agriculture	3	3	1	1
Surface Water for non-drinking purposes	3	3	2	3
Plant based resources	1	1	3	3
Animal based resources	2	2	2	2

# Ecosystem Services - Methodology



## ➤ To whom this concept can be relevant?

- Governments
- Managers and Policy makers
- Stakeholders
- Scientists
- NGO's
- General Public



**TARGET 2 Maintain and restore ecosystems and their services**

*External framework conditions*

**Issue Identification**

***Policy & stakeholder mapping, stakeholder dialogue, dysfunction diagnosis, policy & management options, definition of indicators***

**System Design**

Cause & effect chain, definition of 'virtual system', identification of social & economic components, institutional mapping, external hazard analysis

**System Formulation**

Data and tool analysis, creation of conceptual & simulation models, development of alternative management solutions (scenarios)

**System Assessment**

Model calibration & validation, simulations of the scenarios simulations & interpretive analysis

**Implementation**

Preparation of decision taking process, evaluation of scenarios stakeholders & managers dialogues and meetings

**Monitoring & Evaluation**

Plan & measure execution including institutional, legal and financial arrangements

***Social, economic & ecological data collection, indicator based evaluation of process and state***

**Stakeholder engagement**

# Ecosystem Services - Importance



*External framework conditions*

*Issue Identification*

*Policy & stakeholder mapping, stakeholder dialogue, dysfunction diagnosis, policy & management options, definition of indicators*

*System Design*

*System Formulation*

*System Assessment*

*Implementation*

*Monitoring & Evaluation*

*Stakeholder engagement*

Following the services of the **Ecosystem Services Assessment Tool**

Identify which services are **relevant for the study area**

# Ecosystem Services - Importance



*External framework conditions*

*Issue Identification*

*System Design*

*System Formulation*

*System Assessment*

*Implementation*

*Monitoring & Evaluation*

*Stakeholder engagement*

Comparing  
Initial and  
Present Status

Comparing Present  
Status and Future  
Scenarios

Application of the Ecosystem Services  
Assessment Tool

Social, economic & ecological data collection, indicator based  
evaluation of process and state

# Ecosystem Services - Importance

State



Function



Service



Harold Hudson - Florida Keys NMS



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\$

**State**



**Function**



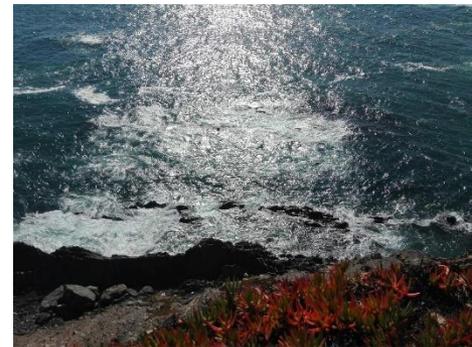
**Service**



\$\$\$\$\$\$\$\$\$\$\$\$

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- Good concept to help raise awareness on the **value of Nature and its contribution to human wellbeing**;
- The increase of assessments and mapping of ES in the oceans will develop our **knowledge about the interaction of economic and social with the ecologic** part of the system
- Development of a **standard methodology and indicators** that fits both land and sea and incorporates land-sea interface;
- **Raise awareness of the Public about the concept!**



# Thank You



## Picture sources:

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- [https://1.bp.blogspot.com/-hs\\_vpLHpqA/VixUIEK\\_rLI/AAAAAAAAABDU/bMEyDNV4XaA/s1600/Elina%2Band%2Bloanna%2Bexploring%2Bseagrass%2Bmeadow.jpg](https://1.bp.blogspot.com/-hs_vpLHpqA/VixUIEK_rLI/AAAAAAAAABDU/bMEyDNV4XaA/s1600/Elina%2Band%2Bloanna%2Bexploring%2Bseagrass%2Bmeadow.jpg)
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