Tidal River Development

Project part-financed by the European Union (European Regional Development Fund)

The Interreg IVB North Sea Region Programme

Use of Ecosystem Services Approach for Integrated Estuarine Management

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Challenge for Estuarine Management: Diverse uses

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Fisheries

Harbours

Shipping

Recreation and tourism

Nature protection

Flood protection

Industry

Living / Cities

Brunsbüttel

Cuxhaven

Glückstadt

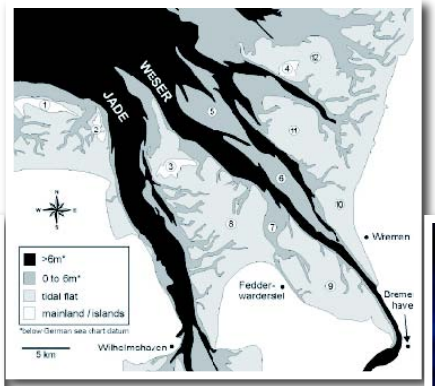
Stade

Example

Elbe estuary

Four estuaries… one project

Scheldt | NL,BE



Weser | DE

Elbe | DE

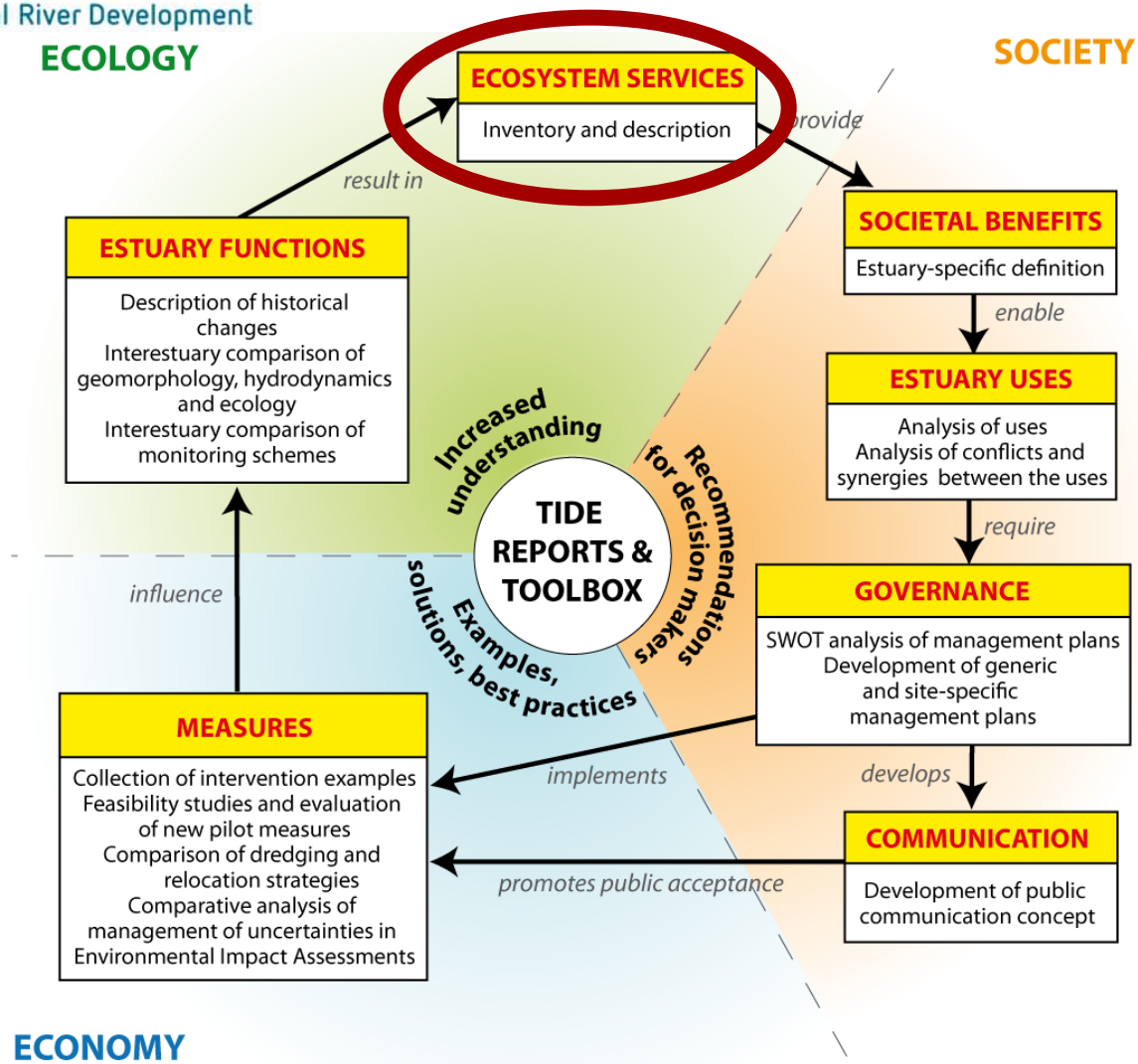
Humber | GB

INTERREG IV B North Sea Region Programme
January 2010 - June 2013

The Interreg IVB North Sea Region Programme
Investing in the future by working together for a sustainable and competitive region

Understanding TIDE

Tidal River Development

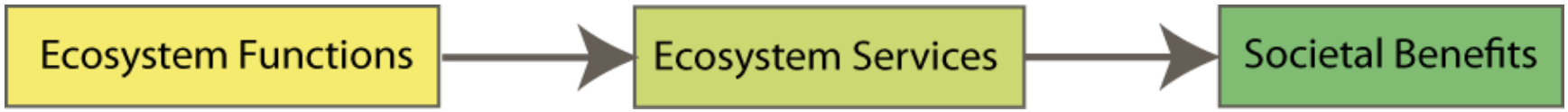


Ecosystem Services Approach

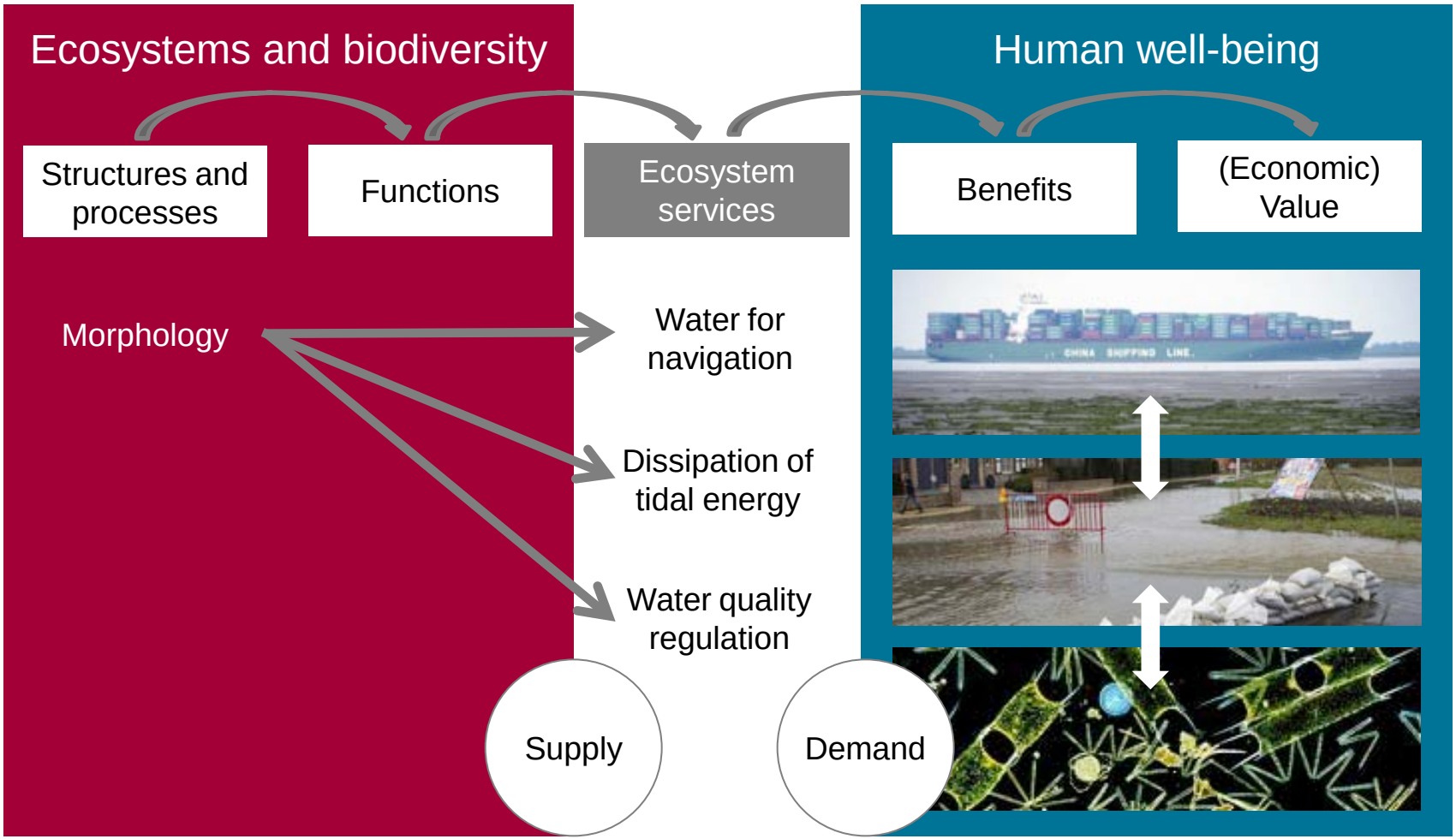
- Concept has high potential to link different ecosystem parts and tie it to socio-economic system

- Explore underlying relations between ecosystem functions, resulting ecosystem services and derived societal benefits

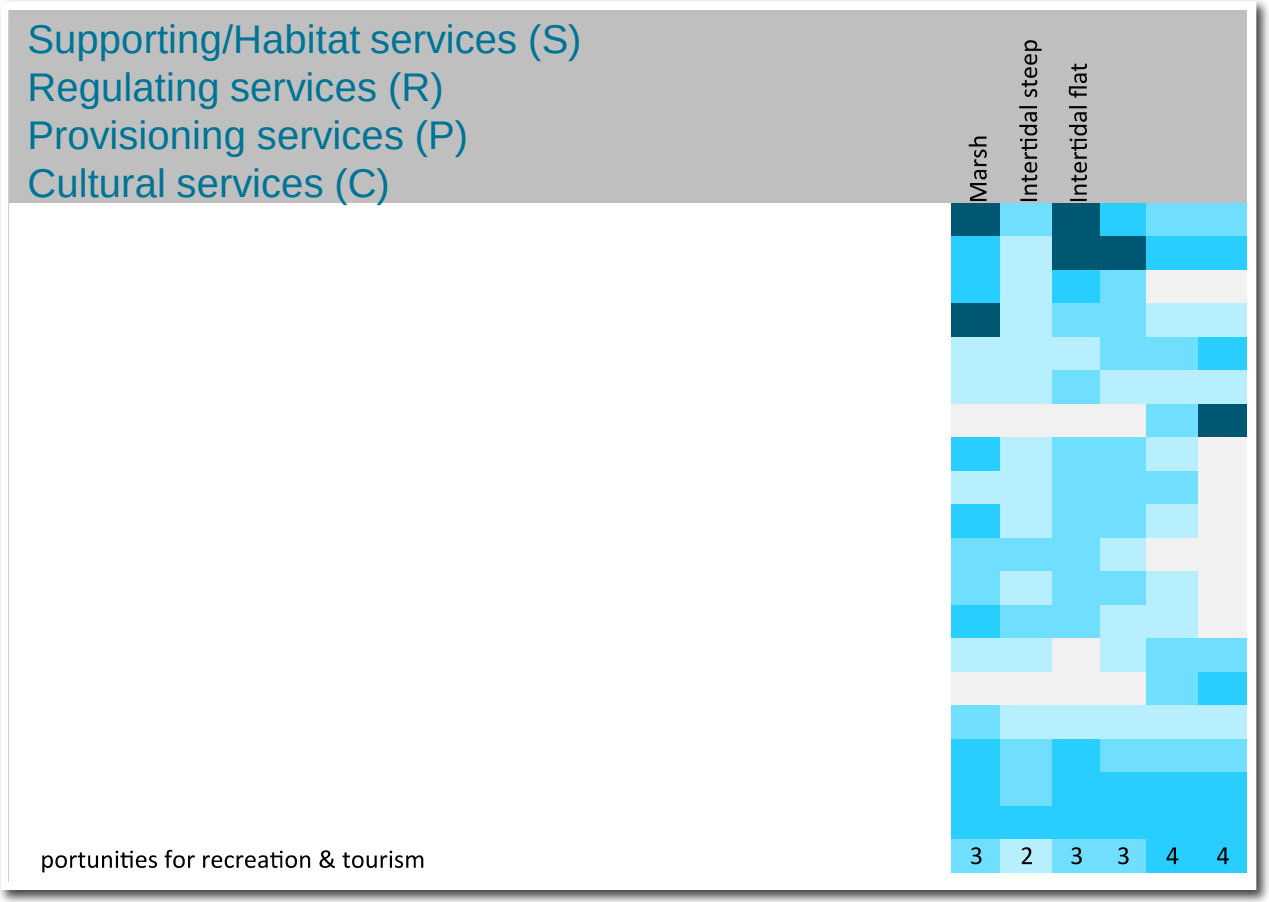
- Understand the way of how human interventions affect these inter-relations



Ecosystem Services Approach



Ecosystem service supply per habitat type



Score	Habitat has…in supply of ES
1	no importance
2	very low importance
3	moderate importance
4	Importance
5	Essential importance

ES supply score per habitat type estimated by TIDE working groups

20 Ecosystem Services most important out of 46 (TEEB)

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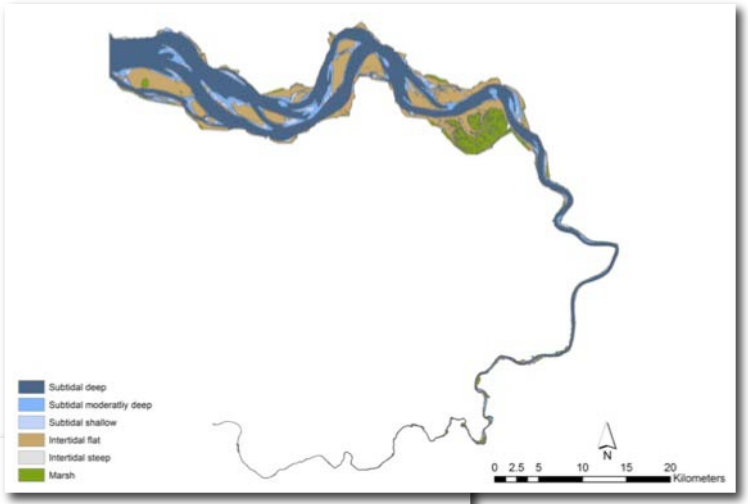
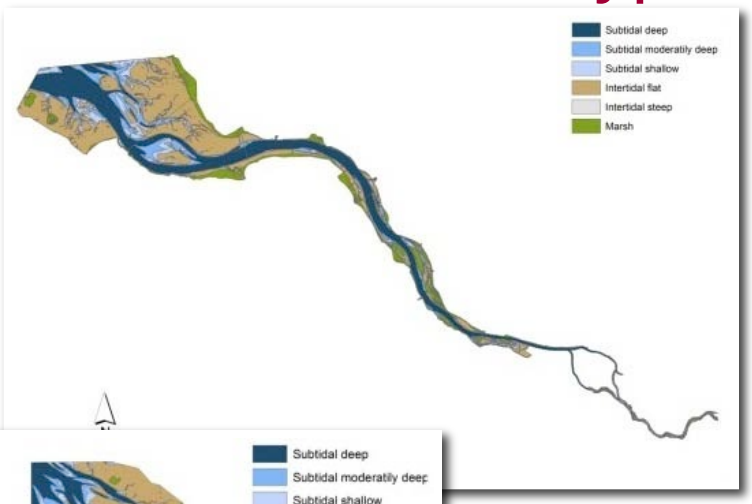
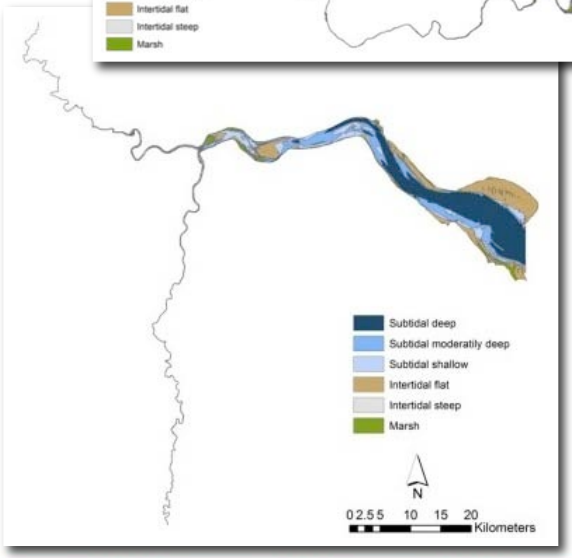
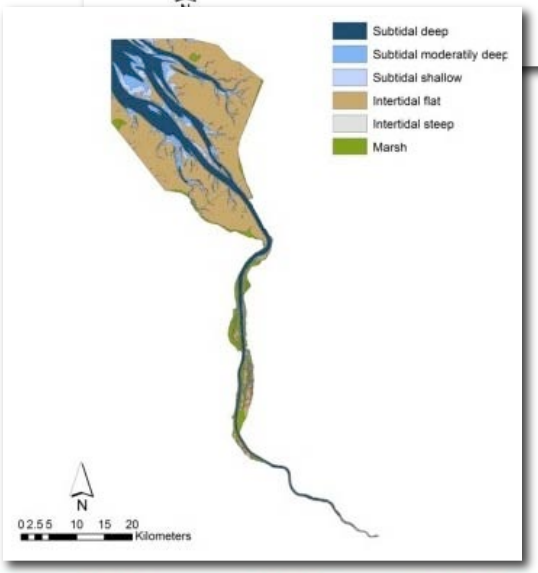
Estimate area sizes of similar habitat types









I. Ecosystem services supply: Comparison

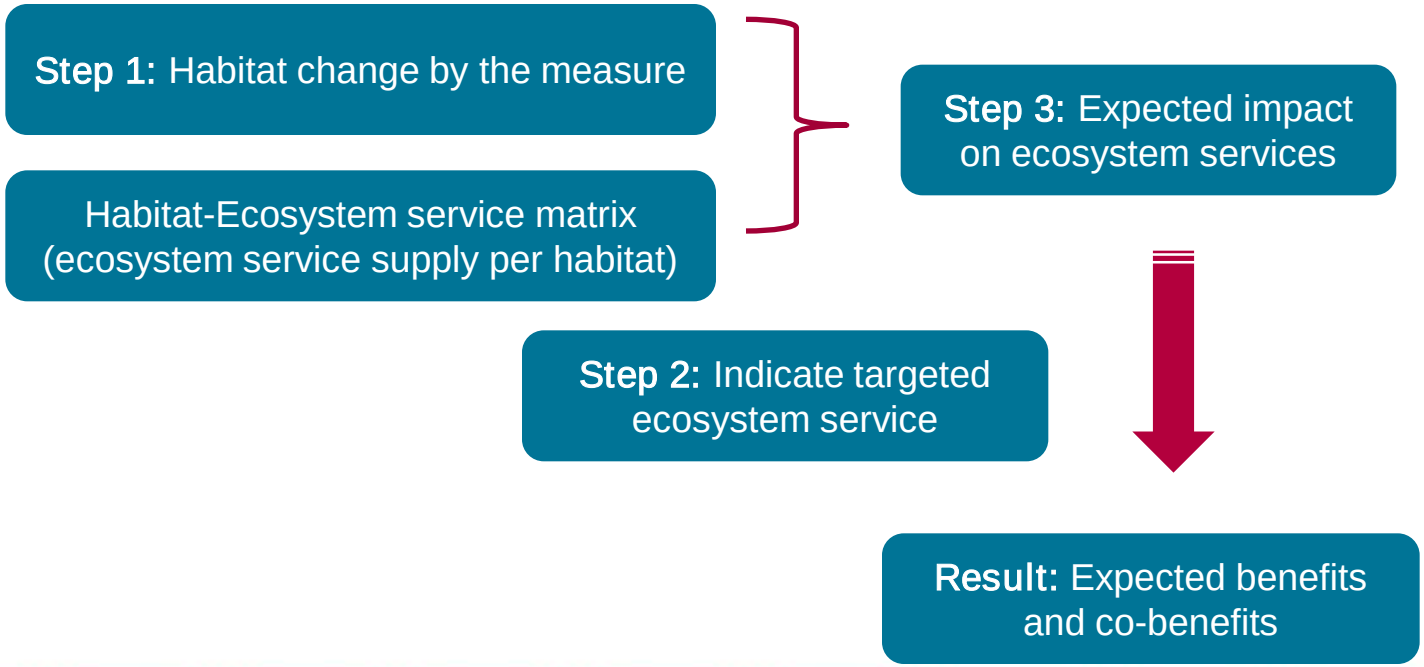
Category	ES	Elbe	Weser	Humber	Scheldt	Location or factor of prime importance
Provisioning services	Food: animals	3	1	4	2	Saline zones
Regulating services	Water for navigation	1	2	4	2	Subtidal deep
	Climate regulation: C buffering	2	1	4	3	Tidal marshes
	Water quality regulation: transport of pollutant & excess nutrients	2	1	3	4	Residence time, tidal asymmetry
	Water quantity regulation: dissipation of tidal/river energy	4	3	1	2	Location of max. tidal amplitude more downstream

1 = estuary providing the highest supply , 4 = lowest supply

II: From Ecosystem Services to management practice

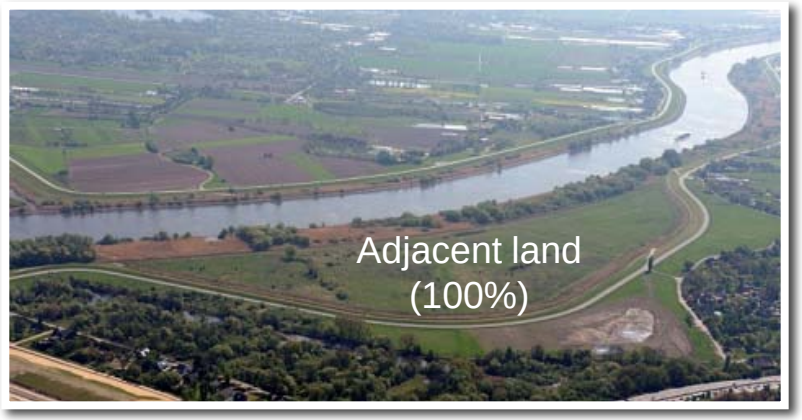
Can ES help us to decide on which management measures to take?

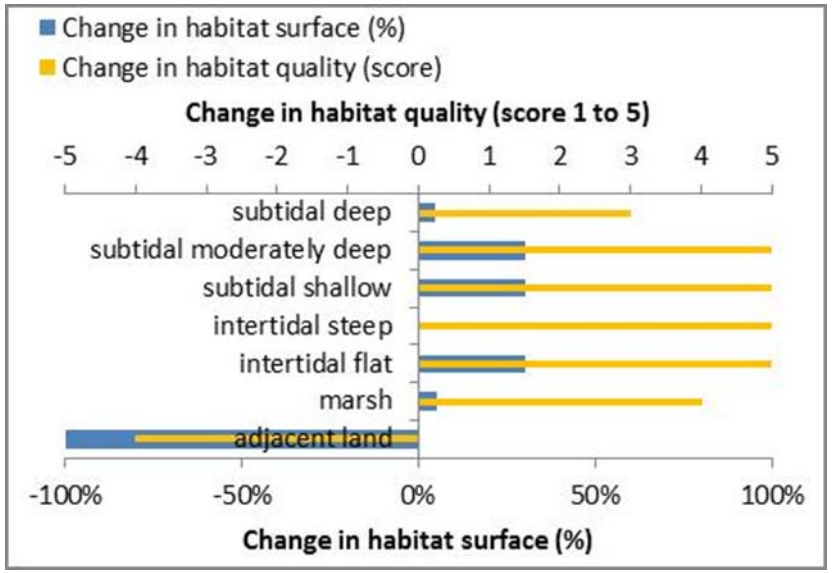
APPROACH: Expected impact of management measures on ES



Step 1: Habitat Change caused by Management Measure

Spadenlander Busch/Kreetsand (Elbe)





Surface and quality habitat change :

- Marsh (5%)
- Intertidal steep (0.5%)
- Intertidal flat (30%)
- Subtidal shallow (30%)
- Subtidal moderately deep (30%)
- Subtidal deep (4.5%)

Step 2 & 3: Impact on Ecosystem Services

Expected impact on ES supply as a consequence of the management measure

Spadenlander Busch/Kreetsand

Cat.	Ecosystem Service	Score
S	"Biodiversity"	3
R1	Erosion and sedimentation regulation by water bodies	3
R2	Water quality regulation: reduction of excess loads coming from the catchment	1
R3	Water quality regulation: transport of polutants and excess nutriënts	1
R4	Water quantity regulation: drainage of river water	1
R5	Erosion and sedimentation regulation by biological mediation	1
R6	Water quantity regulation: transportation	0
R7	Water quantity regulation: landscape maintenance	1
R8	Climate regulation: Carbon sequestration and burial	1
R9	Water quantity regulation: dissipation of tidal and river energy	1
R10	Regulation extreme events or disturbance: Wave reduction	0
R11	Regulation extreme events or disturbance: Water current reduction	1
R12	Regulation extreme events or disturbance: Flood water storage	1
P1	Water for industrial use	1
P2	Water for navigation	0
P3	Food: Animals	0
C1	Aesthetic information	2
C2	Inspiration for culture, art and design	3
C3	Information for cognitive development	3
C4	Opportunities for recreation & tourism	2

Legend: expected impact*	
3	very positive
2	positive
1	slightly positive
0	neutral
-1	slightly negative
-2	negative
-3	very negative

*: Indicative screening based on ES-supply surveys and estimated impact of measures on habitat quality and quantity. Quantitative socio-economic conclusions require local supply and demand data to complement this assessment.

Impact of Management Measures on ES supply

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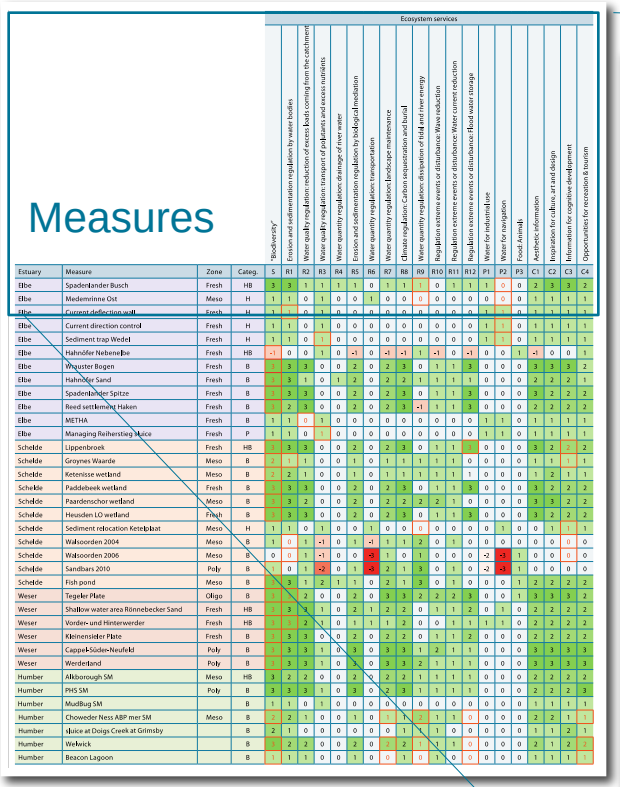
ES

Measures



Legend: expected impact*	
3	very positive
2	positive
1	slightly positive
0	neutral
-1	slightly negative
-2	negative
-3	very negative

				Ecosystem services											
				"Biodiversity"	Erosion and sedimentation regulation by water bodies	Water quality regulation: reduction of excess loads coming from the catchment	Water quality regulation: transport of polutants and excess nutriënts	Water quantity regulation: drainage of river water	Erosion and sedimentation regulation by biological mediation	Water quantity regulation: transportation	Water quantity regulation: landscape maintenance	Climate regulation: Carbon sequestration and burial	Water quantity regulation: dissipation of tidal and river energy	Regulation extreme events or disturbance: Wave reduction	Regulation extreme events or disturbance: Water current reduction
Estuary	Measure	Zone	Categ.	S	R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	R11
Elbe	Spadenlander Busch	Fresh	HB	3	3	1	1	1	1	0	1	1	1	0	1
Elbe	Medemrinne Ost	Meso	H	1	1	0	1	0	0	1	0	0	0	0	0
Elbe	Current deflection wall	Fresh	H	1	1	0	1	0	0	0	0	0	0	0	0
Elbe	Current direction control	Fresh	H	1	1	0	1	0	0	0	0	0	0	0	0
Elbe	Sediment trap Wedel	Fresh	H	1	1	0	-1	0	0	0	0	0	0	0	0
Elbe	Hahnöfer Nebenelbe	Fresh	HB	-1	0	0	1	0	-1	0	-1	-1	1	-1	0
Elbe	Whuster Bogen	Fresh	B	1	3	3	0	0	2	0	2	3	0	1	1
Elbe	Hahnöfer Sand	Fresh	B	1	3	1	0	1	2	0	2	2	1	1	1
Elbe	Spadenlander Spitze	Fresh	B	1	3	3	0	0	2	0	2	3	0	1	1
Elbe	Reed sentlement Haken	Fresh	B	1	2	3	0	0	2	0	2	3	-1	1	1
Elbe	METHA	Fresh	B	1	1	0	1	0	0	0	0	0	0	0	0
Elbe	Managing Reiherstieg sluice	Fresh	P	1	1	0	-1	0	0	0	0	0	0	0	0
Scheldt	Lippenbroek	Fresh	HB	3	3	3	0	0	2	0	2	3	0	1	1
Scheldt	Groynes Waarde	Meso	B	2	1	1	0	0	1	0	1	1	1	1	1
Scheldt	Ketenisse wetland	Meso	B	2	2	1	0	0	1	0	1	1	1	1	1
Scheldt	Paddebeek wetland	Fresh	B	3	3	3	0	0	2	0	2	3	0	1	1
Scheldt	Paardenschor wetland	Meso	B	3	3	2	0	0	2	0	2	2	2	2	1
Scheldt	Heusden LO wetland	Fresh	B	3	3	3	0	0	2	0	2	3	0	1	1
Scheldt	Sediment relocation Ketelplaat	Meso	H	1	1	0	1	0	0	1	0	0	0	0	0
Scheldt	Walsoorden 2004	Meso	B	1	0	1	-1	0	1	-1	1	1	2	0	1
Scheldt	Walsoorden 2006	Meso	B	0	0	1	-1	0	0	-3	1	0	1	0	0
Scheldt	Sandbars 2010	Poly	B	1	0	1	-2	0	1	-3	2	1	3	0	1
Scheldt	Fish pond	Meso	B	3	3	1	2	1	1	0	2	1	3	0	1
Weser	Tegeler Plate	Oligo	B	3	3	2	0	0	2	0	3	3	2	2	2
Weser	Shallow water area Rönnebecker Sand	Fresh	HB	3	3	3	1	0	2	1	2	2	0	1	1
Weser	Vorder- und Hinterwerder	Fresh	HB	3	3	2	1	0	1	1	1	2	0	0	1
Weser	Kleinensieler Plate	Fresh	B	3	3	3	0	0	2	0	2	2	0	1	1
Weser	Cappel-Süder-Neufeld	Poly	B	3	3	3	1	0	3	0	3	3	1	2	1
Weser	Werderland	Poly	B	3	3	3	1	0	3	0	3	3	2	1	1
Humber	Alkborough SM	Meso	HB	3	2	2	0	0	2	0	2	2	1	1	1
Humber	PHS SM	Poly	B	3	3	3	1	0	3	0	2	3	1	1	1
Humber	MudBug SM		B	1	1	0	1	0	0	0	0	0	0	0	0
Humber	Chowder Ness ABP mer SM	Meso	B	2	2	1	0	0	1	0	1	1	0	1	1
Humber	sluice at Doigs Creek at Grimsby		B	2	1	0	0	0	0	0	0	1	1	0	0
Humber	Welwick		B	2	2	2	0	0	2	0	2	1	1	0	0
Humber	Beacon Lagoon		B	1	1	1	0	0	1	0	0	1	0	0	0

Conclusion

Ecosystem Services Approach

- framework for assessment of importance of different habitats
- targeted benefit plus co-benefits
- insight into impact of changes in estuary
- good communication tool
- But consider:
  - Rough estimation (surface – supply curves may not be linear, expert judgment)
  - Underlying processes of ES have high variability (cross-system, temporally & spatially)
  - Very important to know site specific factors
  - Positive and negative effects (depending on involved habitat types)

Estuarine management is the responsibility of all stakeholders. They/ Society has to decide which benefits (and related ES) are important.

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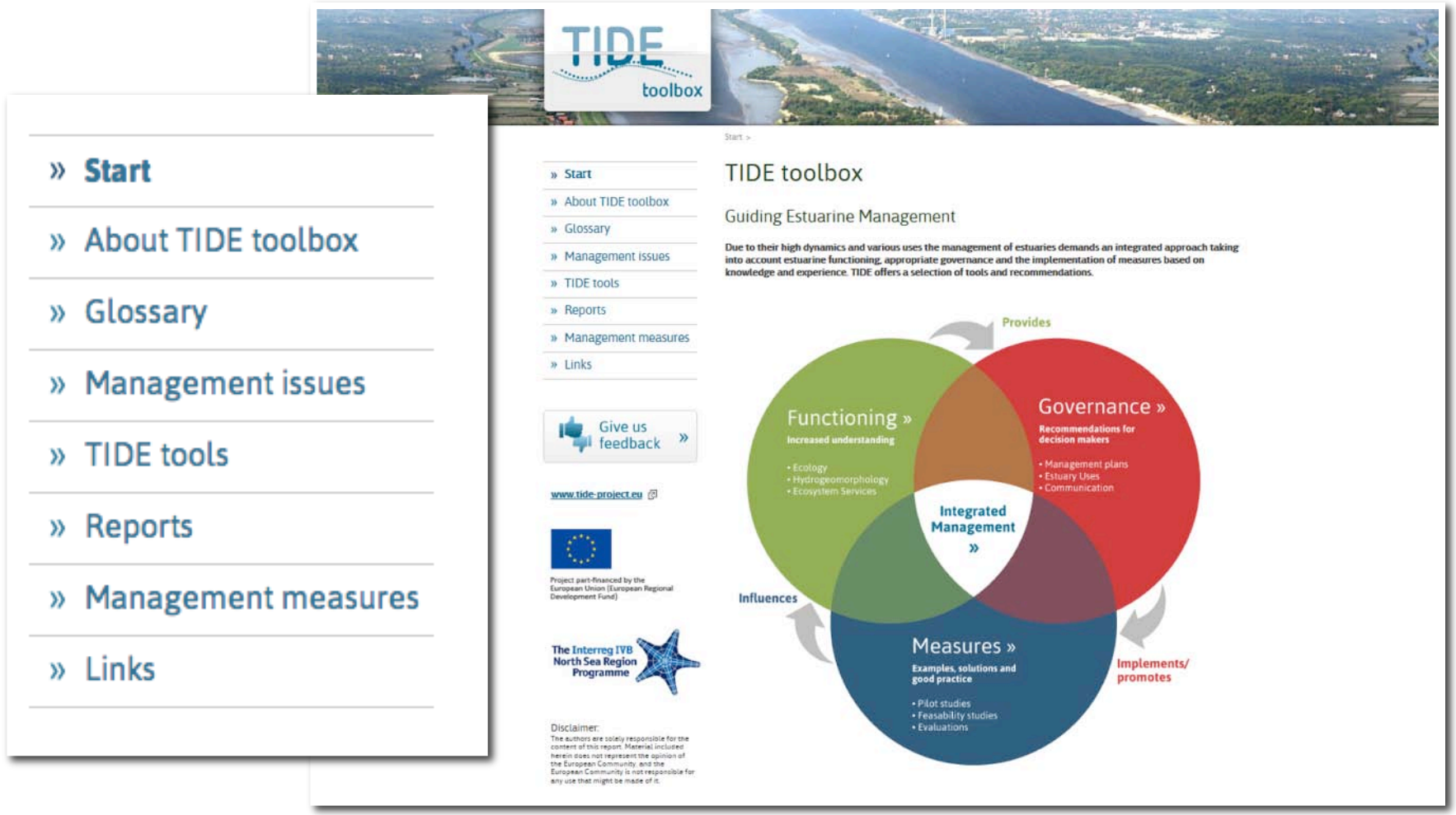

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Step 2. Involved habitat

In a second step, the relative involvement of different habitats was evaluated following the habitat delineation as defined in the frame of TIDE (see JACOBS 2013). The evaluation included both habitat su measure site) and functional quality (score from 1 to 5). Some measures create surface of a certain habitat (sometimes at cost of another) while other measures improve the functional quality of a habit the surface. These factors were evaluated both for the starting situation and the situation after measure implementation. In the latter case, estimations are based on monitoring or modelling results.

Table 2: Step 2 of ecosystem services analysis: Indication of habitat surface and quality before and after measure implementation ***(Example for Fish spawning pond, Scheldt)***

		BEFORE		AFTER	
		surface (%)	Quality (1-5)*	surface (%)	quality (1-5)*
Marsh habitat	above mean high w ater, floods at spring tide	0	0	0	0
Intertidal steep habitat	floods every tide, mainly steep zones at marsh edges	0	0	0	0
Intertidal flat habitat	floods every tide, flat zones	0	0	0	0
Subtidal shallow habitat	never surfaces, less deep than 2m	0	0	100	4
Subtidal moderately deep habitat	never surfaces, 2m-5m	0	0	0	0
Subtidal deep habitat	never surfaces, deeper than 5m	0	0	0	0
ADJACENT LAND	NON FLOODED LAND	100	3	0	0
		100		**100**	

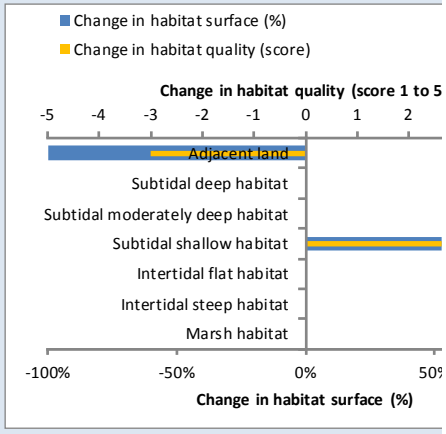
	Change in habitat surface (%)
Marsh habitat	0%
Intertidal steep habitat	0%
Intertidal flat habitat	0%
Subtidal shallow habitat	100%
Subtidal moderately deep habitat	0%
Subtidal deep habitat	0%
Adjacent land	-100%

Fill in: habitat surface (in %) and quality (in score 1 to 5), for every habitat type, before and after implementing your management measure

* Habitat quality score
1 = very low quality
2 = low quality
3 = medium quality
4 = high quality
5 = very high quality

OUTPUT 1:

Figure 1. Step 2 of ecosystem services analysis: Indication of habita change, i.e. situation before versus after measure implementation spawning pond, Scheldt).



Download calculation sheet:

TIDE tools ->
Methodology ->
Ecosystem services impact assessment of management measures

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Thanks for your attention !