Coastal Management – Supporting tools and methods

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Overview

1. Background
2. Decision Support Tools - Examples
3. Applications within the Systems Approach
4. Summary

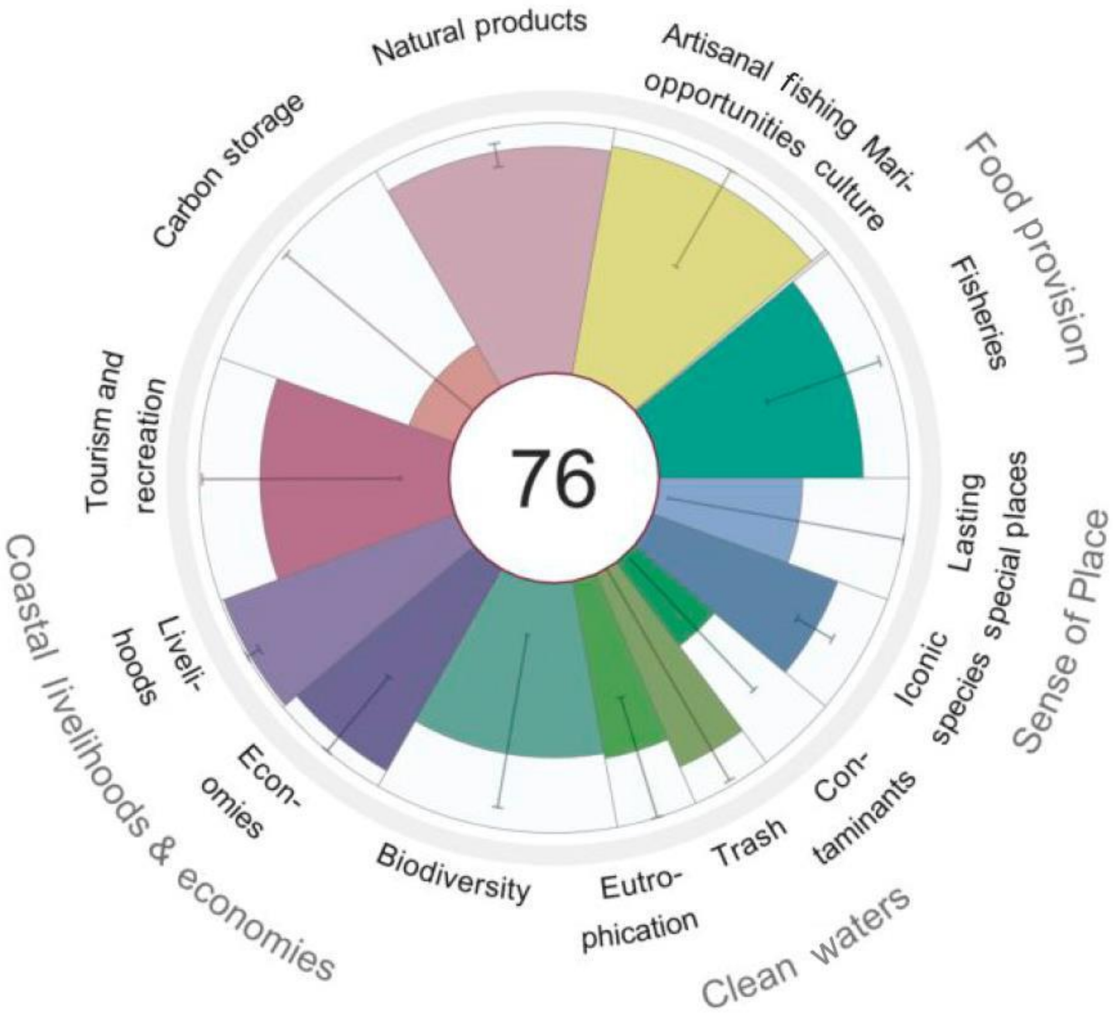
1. Background

Decision support tools (DST)

- Are beneficial for supporting policy implementation:
  - Incorporation of scientific information
  - Ensuring comparability
  - Facilitation of participatory processes
  - Serving as knowledge base
- Can be defined as any computer-based tool that condenses information in order to support decision-making

➡ **Cover a variety of tools and address different target groups**

2. DST – Examples: Baltic Health Index (BHI)



(Blenckner et al. 2021)

- Holistic **indicator-based assessment** of the Baltic Sea and its sub-regions
- Focused on benefits that oceans provide to humans
- Integrates a large amount of environmental, ecological and socio-economic data
- Monitors the current status and progress towards defined management targets

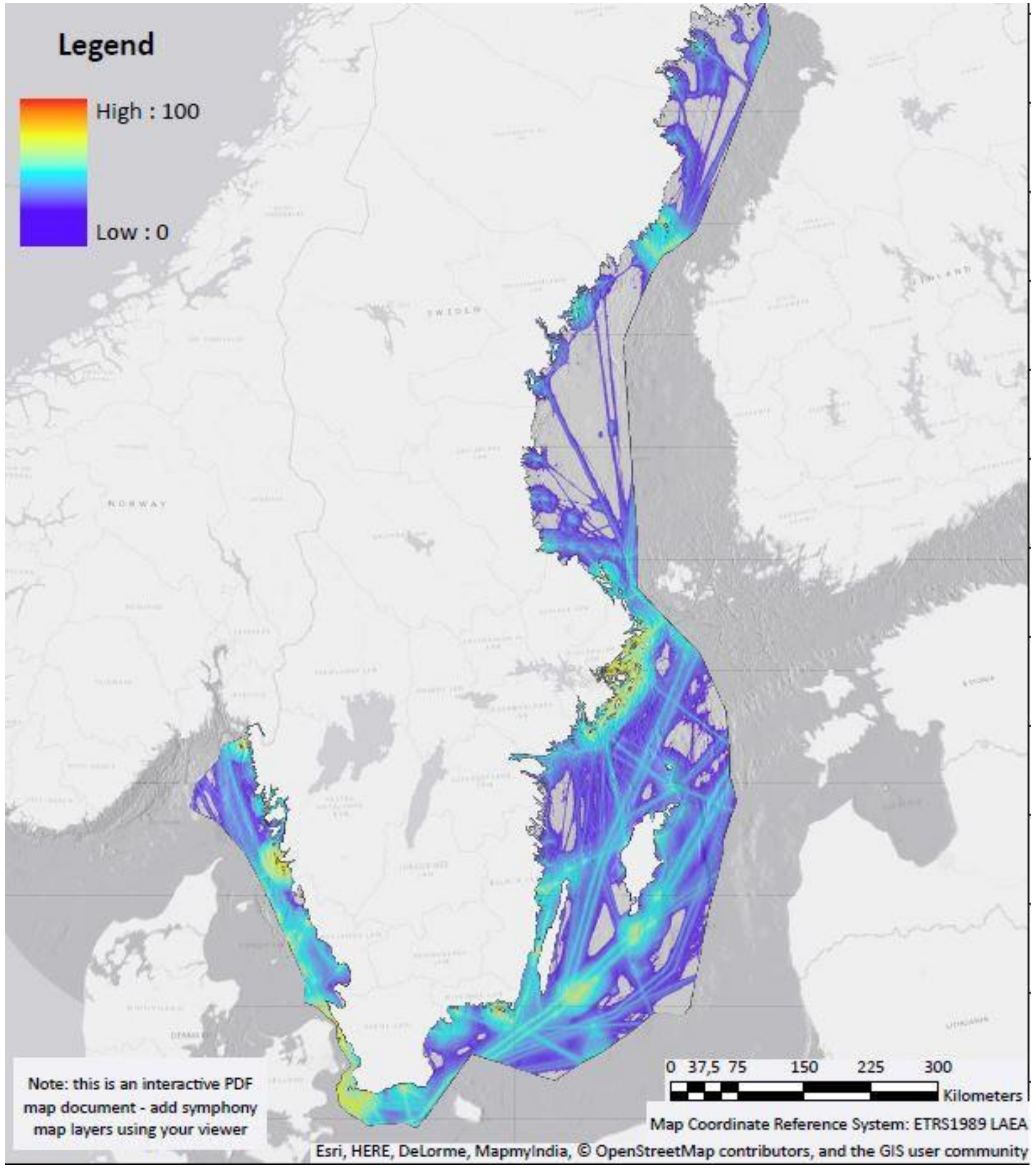
→ Supports the fulfilment of Sustainable Development Goals

→ Helps to identifiy management priorities

→ Enables comparisons

→ Lacking data and missing reference levels hamper the assessment of some goals

2. DST – Examples: Symphony



A mapping tool for ecosystem-based marine spatial planning (MSP)

- Estimates and maps cumulative impacts of human pressures on ecosystem components based on a sensitivity matrix
- Informs about baseline conditions
- Shows potential effects of planning options and climate change on the cumulative impacts in different areas

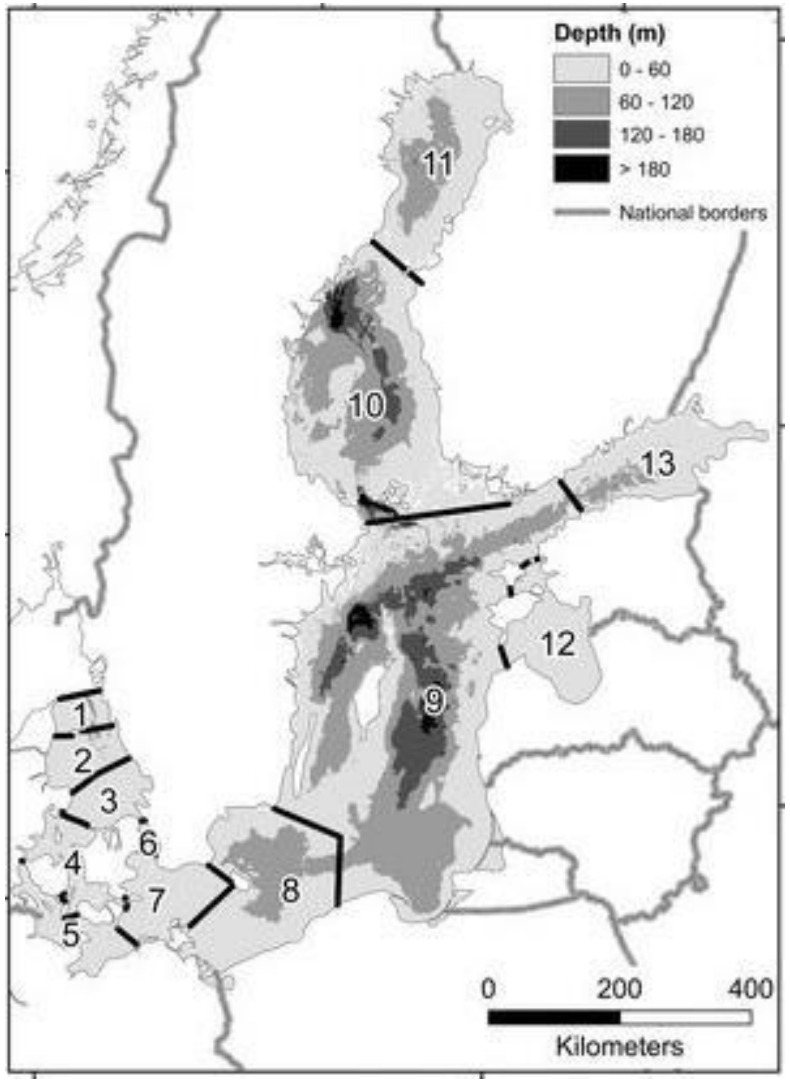
→ Applied for MSP implementation in Sweden
→ Transferable to other areas

→ Simplifications and uncertainties
→ Costly

https://www.msp-platform.eu/practices/symphony-tool-ecosystem-based-marine-spatial-planning

2. DST – Examples: BALTSEM

BAltic sea Long-Term largeScale Eutrophication Model



(Gustafsson et al. 2017)

- ➢ Coupled physical-biogeochemical model
- ➢ Divides Baltic Sea into 13 connected sub-basins
- ➢ High vertical resolution
- ➢ Used to determine maximum allowable nutrient inputs and country allocations for the Baltic Sea Action Plan (BSAP)

→ Fast simulations

→ Integrated in decision support system NEST

→ Supports implementation of the Marine Strategy Framework Directive (MSFD) in the Baltic Sea

→ Low resolution, problematic in the western Baltic Sea

2. DST – Examples: ERGOM

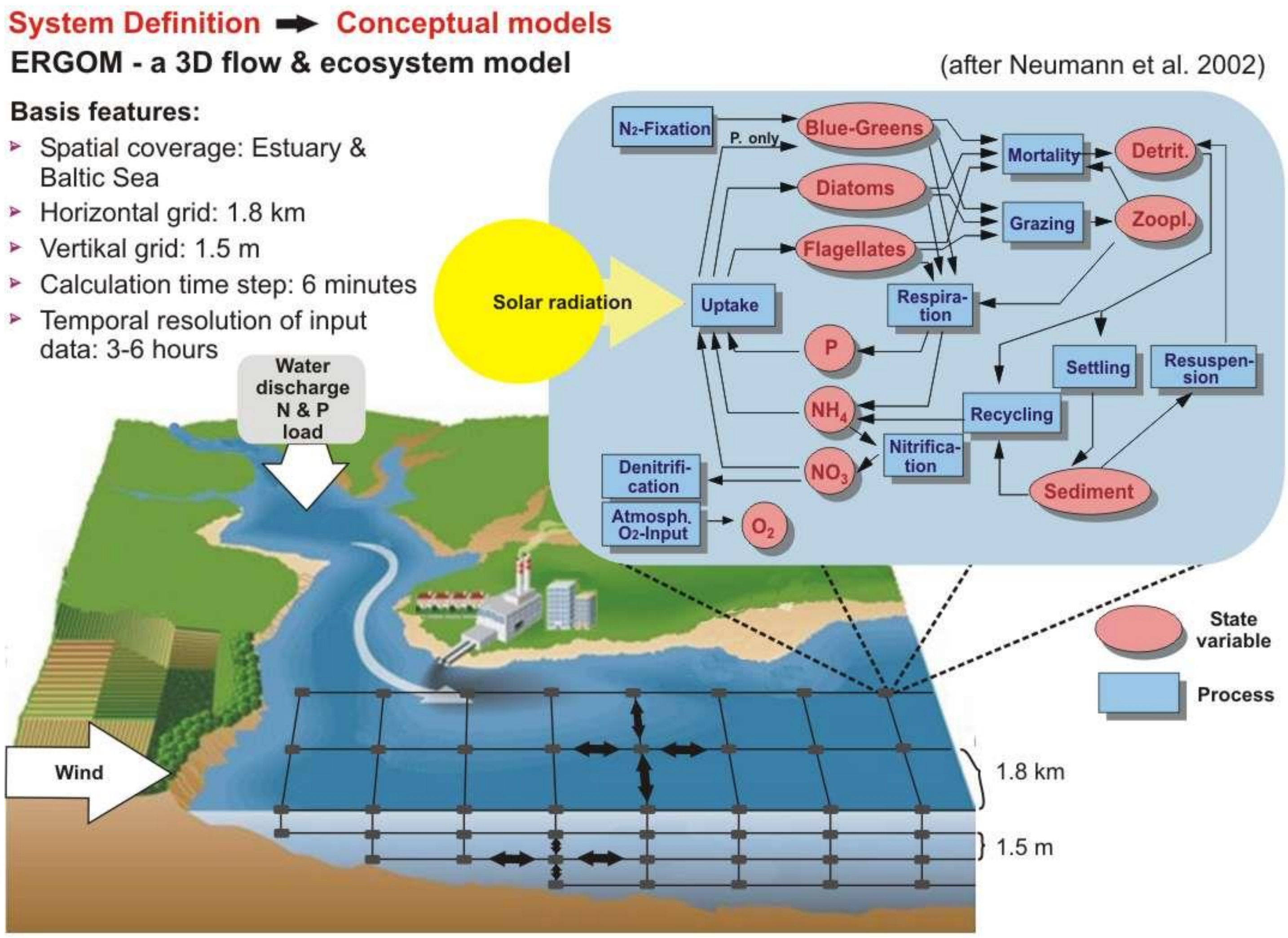
3D Ecosystem model of the Baltic Sea

- High and flexible spatial and temporal resolution
- Suitable for wide range of applications (incl. areas with strong gradients)
- Long-term stability

→ Enables tailor-made applications (e.g. definition of water quality targets (MSFD/BSAP))

→ Very high computational effort

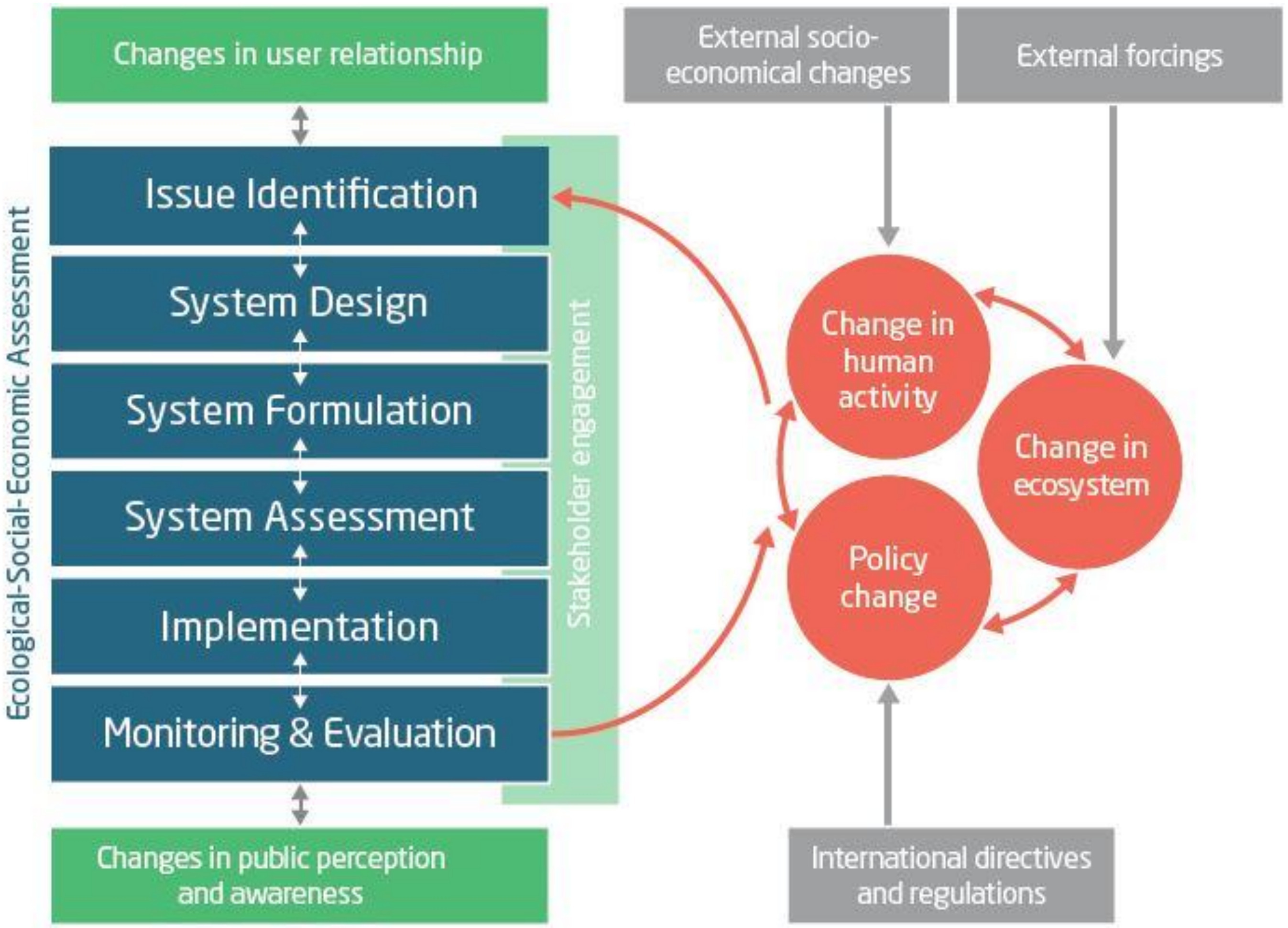
→ Restricted predictive capacity



(Schernewski et al. 2008)

3. Applications within the Systems Approach

Systems Approach Framework (SAF)



- **Lacking guidance** and vague requirement hampered practical application of integrated coastal zone management (ICZM)
- The SAF provides a **systematic and stepwise approach** with concrete actions to address coastal issues
- Several **supporting tools** were developed

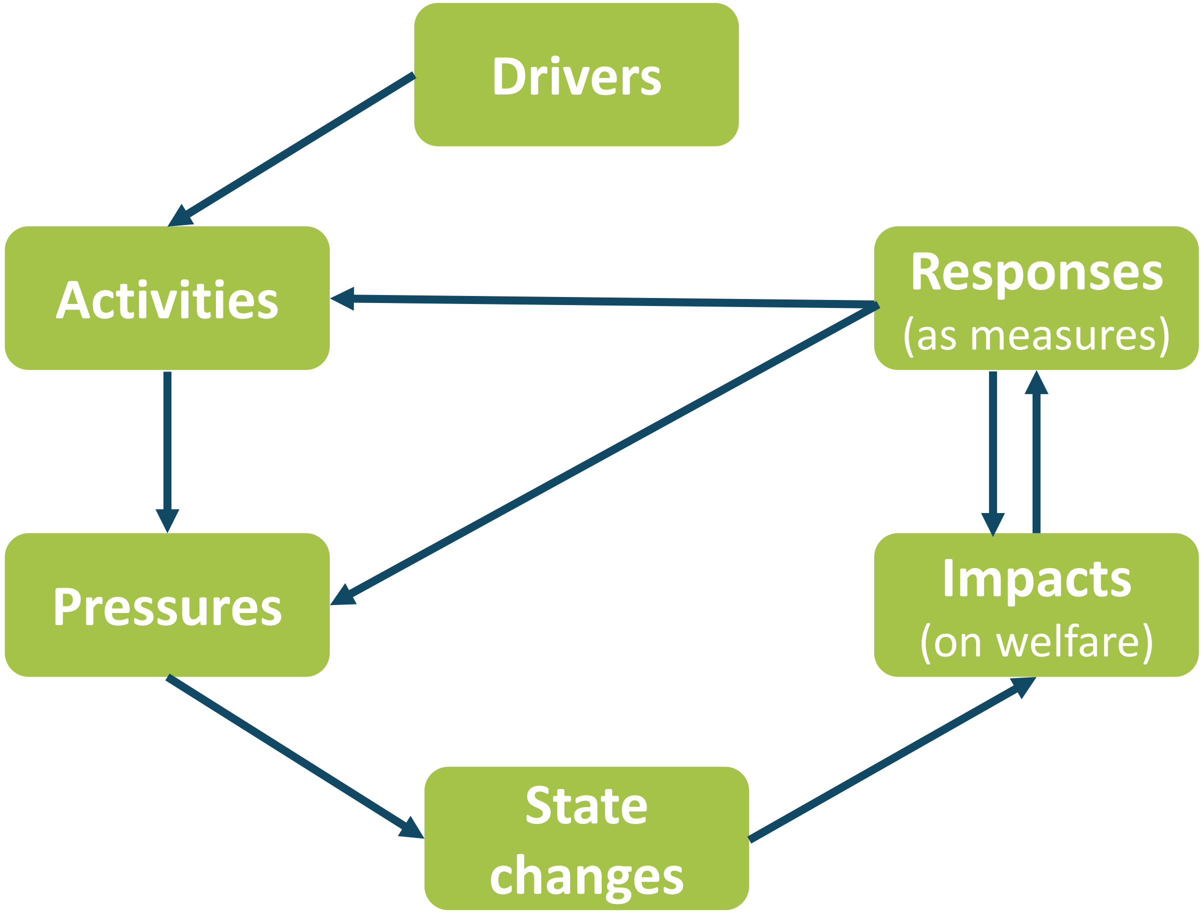
(SAF Handbook 2019)

3. DPSIR / DAPSI(W)R(M) Framework

e.g. need for food, energy, shelter

e.g. agriculture, sewage discharge

e.g. improved river basin management & internal measures



e.g. nitrogen and phosphorous enrichment by input of fertiliser and sewage

e.g. fish kills, beach closures, failure to meet policy requirements (WFD)

e.g. high chl-a concentrations, low water transparency, hypoxia

➡ **Generates a common understanding of an issue, its causes and effects**

3. CATWOE Analysis

Customers

- **Victims or beneficiaries of T**
- Coastal communities, tourism, government, fishermen

Actors

- **Those who would do T**
- Environmental agencies, investors

Transformational Process (T)

- **Conversion of input to output**
- Increased nutrient retention and decreased resuspension by mussel farms and macrophytes

Worldview

- **(meaningful) context of T**
- Fighting eutrophication is global problem of many coastal waters

Owners

- **Those who can stop T**
- Local authorities, fishermen, misinformed public

Environment

- **Unchangeable elements outside the system**
- Attraction of non-indegenous species, heat waves

➡ **Gain a broad understanding of an issue**

➡ **Identify stakeholders that need to be involved**

3. Stakeholder Preference & Planning Tool (StakePrefTool)

Legend for the Weighting System of the Criteria

Criteria Y		COMPARED TO			Criteria X	IS
less important ←				→ more important		
much	more	slightly	equal	slightly	more	much
1/7	1/5	1/3	1	3	5	7

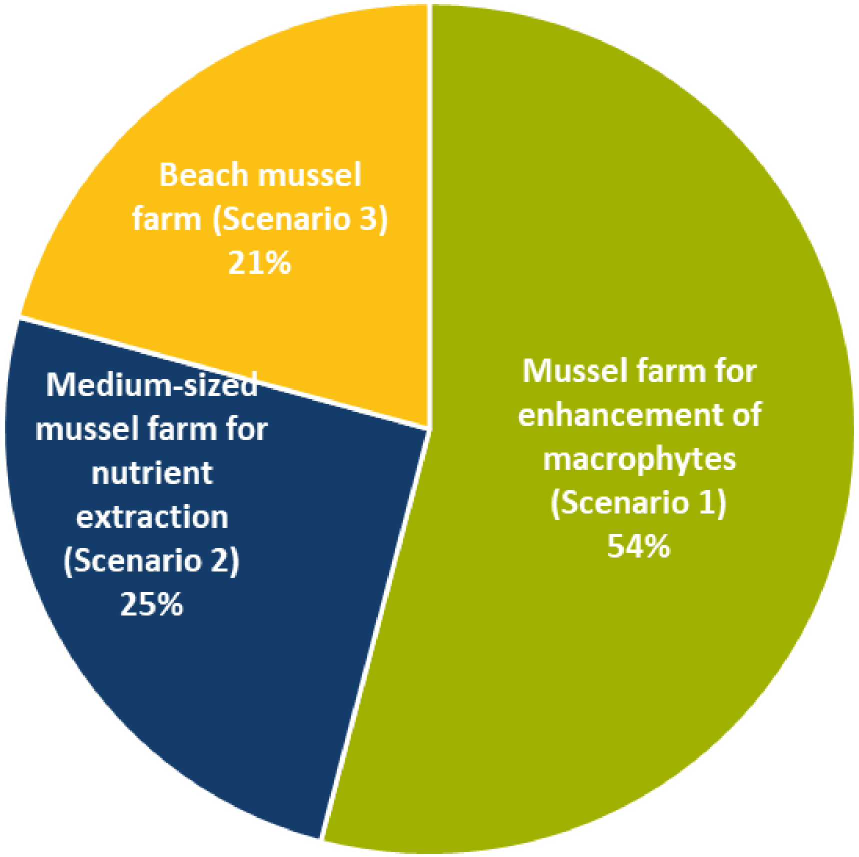
COEF	Success criteria (please list below) ↓	Minimal spatial conflicts	High public acceptance	Enhancing quality of life	Sustainable
0,07	Minimal spatial conflicts	1	1	1/5	1/7
0,09	High public acceptance	1	1	1/3	1/5
0,23	Enhancing quality of life	5	3	1	1/5
0,60	Sustainable	7	5	5	1

➡ **Devleop a future development vision**

➡ **Enables thematically focused and guided discussions**

3. Stakeholder Preference & Planning Tool (StakePrefTool)

Criterion	Weight Coef. Criterion	Scenario	Weight Coef. Scenario	Final Score
Minimal spatial conflicts	0,36	Scenario 1	0,43	0,16
		Scenario 2	0,43	0,16
		Scenario 3	0,14	0,05
High public acceptance	0,24	Scenario 1	0,63	0,15
		Scenario 2	0,11	0,03
		Scenario 3	0,26	0,06
Improved quality of life of local inhabitants	0,21	Scenario 1	0,47	0,10
		Scenario 2	0,21	0,04
		Scenario 3	0,32	0,07
Sustainability of the measure	0,20	Scenario 1	0,71	0,14
		Scenario 2	0,14	0,03
		Scenario 3	0,14	0,03



➡ **Evaluates measures based on stakeholder preferences**

3. Indicator-based sustainability assessment tool (InSAT)

Sustainability assessment

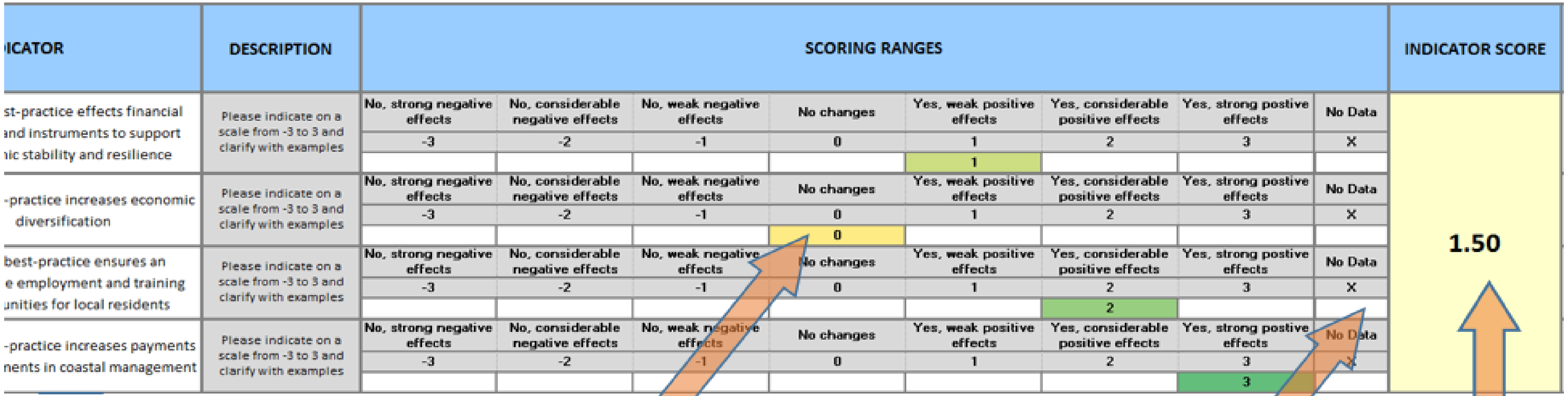
ENVIRONMENTAL QUALITY (13)

ECONOMICS (9)

SOCIAL WELL-BEING (9)

SAF Process

GOVERNANCE (PROCESS INDICATORS) (14)



ICATOR	DESCRIPTION	SCORING RANGES								INDICATOR SCORE
st-practice effects financial and instruments to support ic stability and resilience	Please indicate on a scale from -3 to 3 and clarify with examples	No, strong negative effects	No, considerable negative effects	No, weak negative effects	No changes	Yes, weak positive effects	Yes, considerable positive effects	Yes, strong postive effects	No Data	1.50
		-3	-2	-1	0	1	2	3	X	
						1				
-practice increases economic diversification	Please indicate on a scale from -3 to 3 and clarify with examples	No, strong negative effects	No, considerable negative effects	No, weak negative effects	No changes	Yes, weak positive effects	Yes, considerable positive effects	Yes, strong postive effects	No Data	
		-3	-2	-1	0	1	2	3	X	
					0					
best-practice ensures an e employment and training unities for local residents	Please indicate on a scale from -3 to 3 and clarify with examples	No, strong negative effects	No, considerable negative effects	No, weak negative effects	No changes	Yes, weak positive effects	Yes, considerable positive effects	Yes, strong postive effects	No Data	
		-3	-2	-1	0	1	2	3	X	
							2			
-practice increases payments nents in coastal management	Please indicate on a scale from -3 to 3 and clarify with examples	No, strong negative effects	No, considerable negative effects	No, weak negative effects	No changes	Yes, weak positive effects	Yes, considerable positive effects	Yes, strong postive effects	No Data	
		-3	-2	-1	0	1	2	3	X	
								3		

e score is indicated by ne scoring bar under the scoring ranges

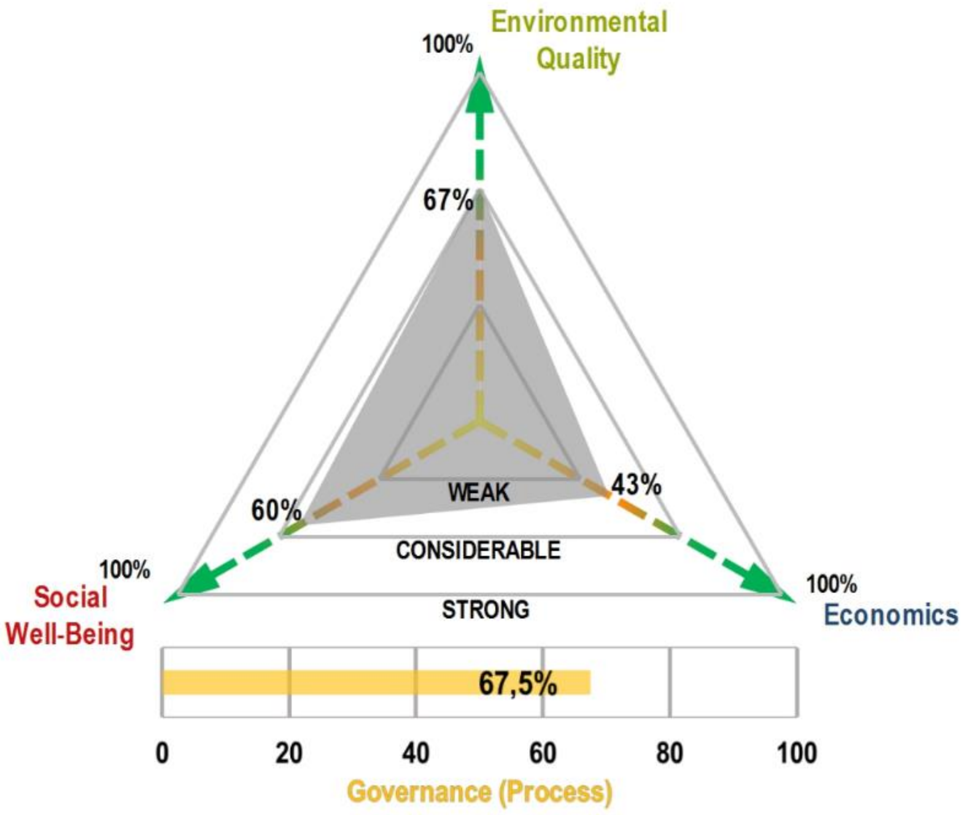
If no data is available, then need 'X' needs to be typed under the "No data" cell

The total indicator score will be automatically calculated

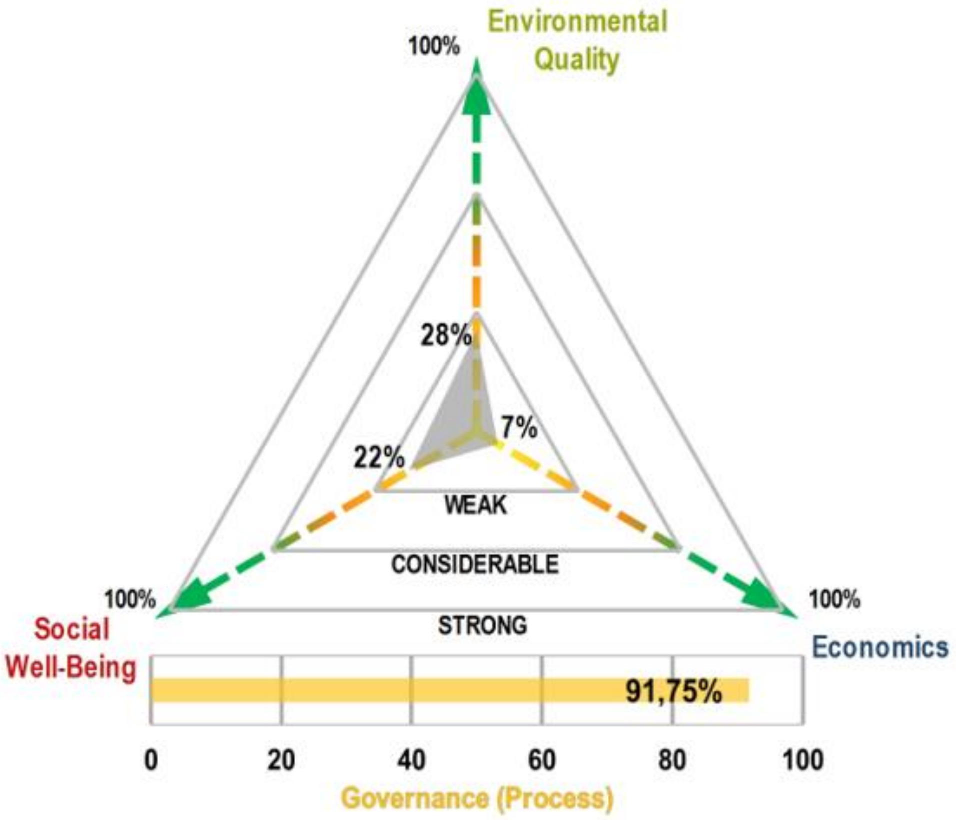
- **Assesses impacts of measures on environmental, social and economic components**
- **Evaluates the use of ICZM principles in the implementation process**

3. Indicator-based sustainability assessment tool (InSAT)

Geltinger Birk
Coastal realignment & lagoon restoration

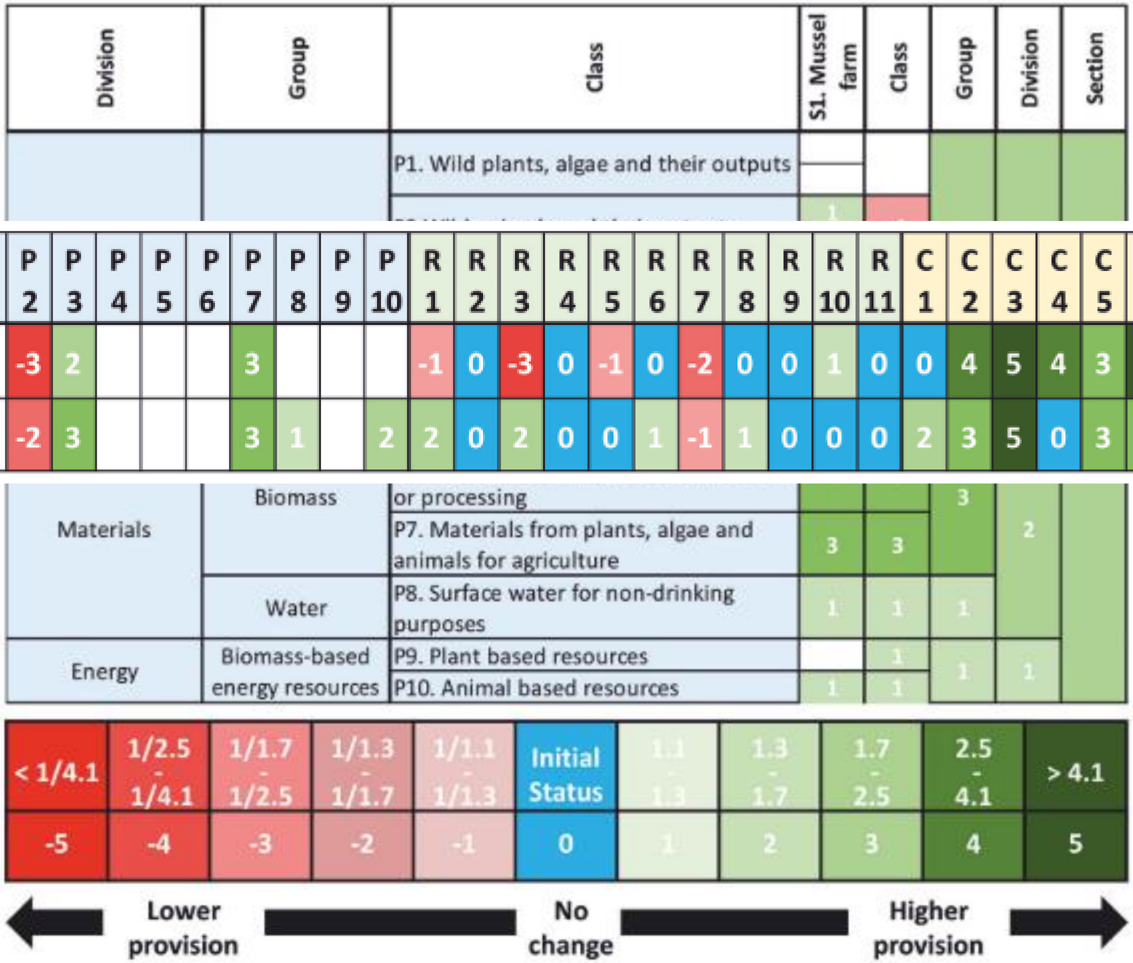


Timmendorf
Integrated flood protection



➡ **Assesses and illustrates strengths and weaknesses of measures**

3. Marine Ecosystem Services Assessment Tool (MESAT)



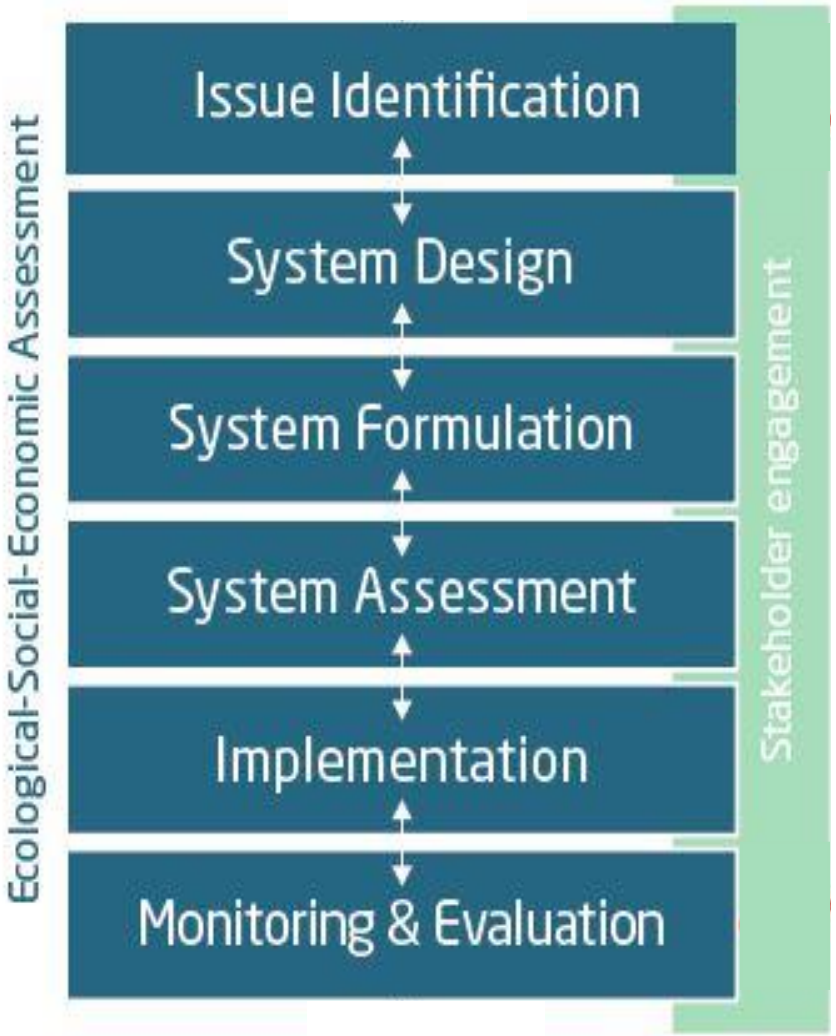
Ecosystem → service class	P 1	P 2	P 3	P 4	P 5	P 6	P 7	P 8	P 9	P 10
Expert1		-3	2				3			
Expert2		-2	3				3	1		2

Ecosystem → service class	R 1	R 2	R 3	R 4	R 5	R 6	R 7	R 8	R 9	R 10	R 11
Expert1	-1	0	-3	0	-1	0	-2	0	0	1	0
Expert2	2	0	2	0	0	1	-1	1	0	0	0

Ecosystem → service class	C 1	C 2	C 3	C 4	C 5	C 6	C 7	C 8	C 9	C 10
Expert1	0	4	5	4	3	5	4	3	0	5
Expert2	2	3	5	0	3	3	0	0	0	0

- Analyses changes in ES provision over time (past/future)
- Assesses impacts of management options on ES provision

3. Applications within the Systems Approach



DPSIR, CATWOE, MESAT, StakePrefTool

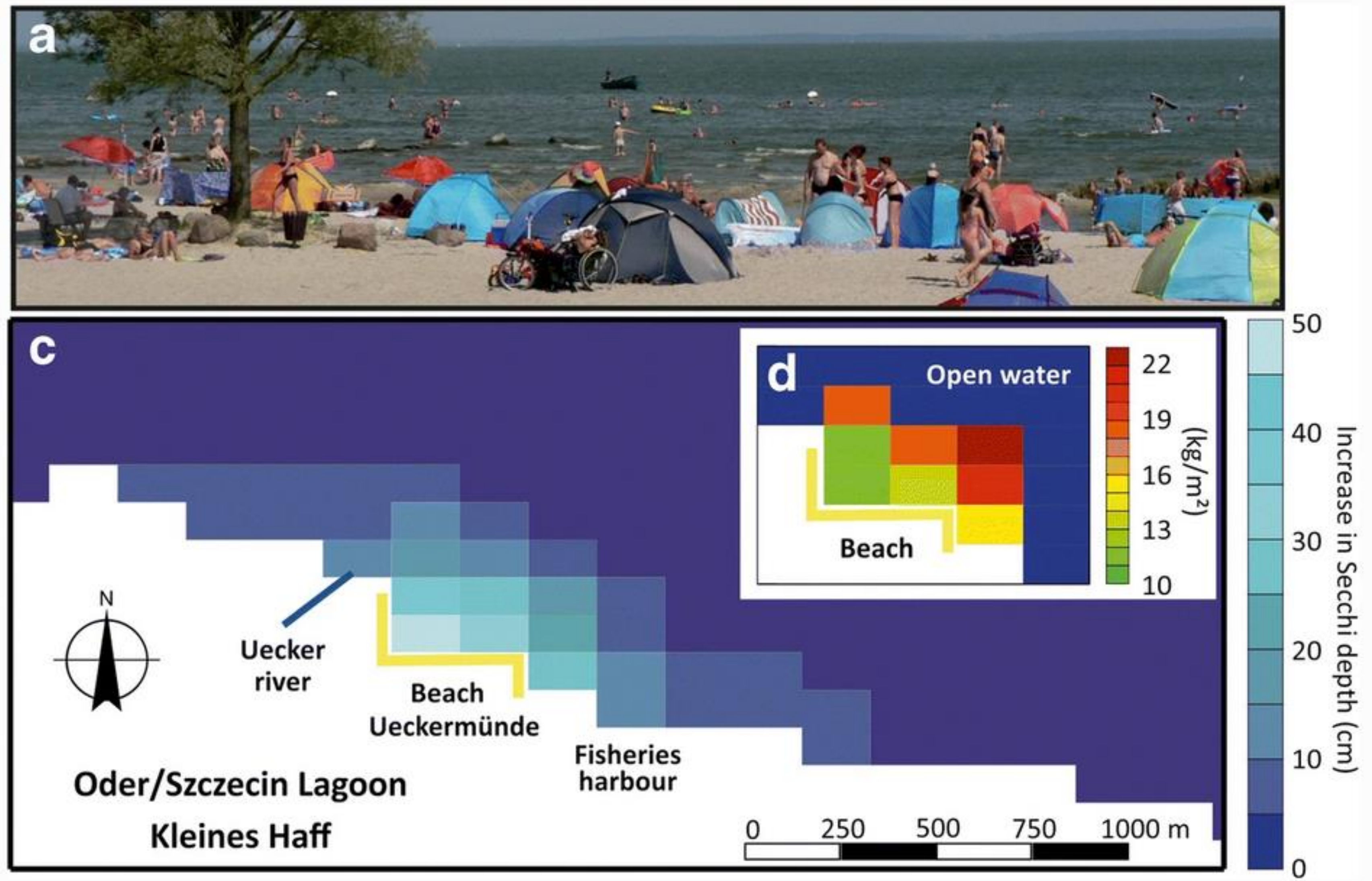
InSAT

MESAT, InSAT, StakePrefTool

MESAT, InSAT

- Tools are applied to support particular actions of the six SAF steps
- Tailor-made tools are needed to support the system formulation

3. Applications within the Systems Approach



(Schernewski et al. 2019)

- **Application of 3D ecosystem model ERGOM** expanded by a mussel module **to assess effects of a beach mussel farm on water transparency**

➡ **High spatial and temporal resolution needed to reflect processes sufficiently**

4. Summary – Decision support tools

- ➢ Numerous tools are available to support coastal and marine management
- ➢ Cover a variety of tool types
- ➢ Address a variety of components
- ➢ Address different target groups

Strengths

- Can ensure comparability
- Support science-policy transfer
- Serve as knowledge base
- Integrate data in a holistic way
- Support coastal and marine management and policy implementation
- Simplify and communicate complex phenomena

Weaknesses

- Lacking comparability due to different approaches
- Subject to (over-)simplifications and uncertainties
- Applications often require expertise
- Lack of funding
- Applications limited to project durations
- Lacking awareness

4. Summary – Supporting tools for SAF

- ICZM addresses a broad range of issues on a local or regional level
- This requires flexible tools that can be adjusted to the local/regional specificities
- Tools that support participatory processes are needed in particular

Strengths

- User-friendly
- Easily applicable by non-experts
- Transferable
- Support participatory processes

Weaknesses

- No direct policy integration
- Lack of additional benefits
- High level of subjectivity
- Limited comparability

DST Database: http://nest.su.se/bonus_dst/

www.safhandbook.net

Thank you for your attention!

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