Coastal Management – A Systems Approach

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Overview

1. Background: Need for a Systems Approach
2. The Systems Approach Framework (SAF)
3. Issue Identification
4. System Design
5. System Formulation
6. System Assessment
7. Implementation
8. Monitoring & Evaluation
9. Summary

1. Background: The Need for a Systems Approach

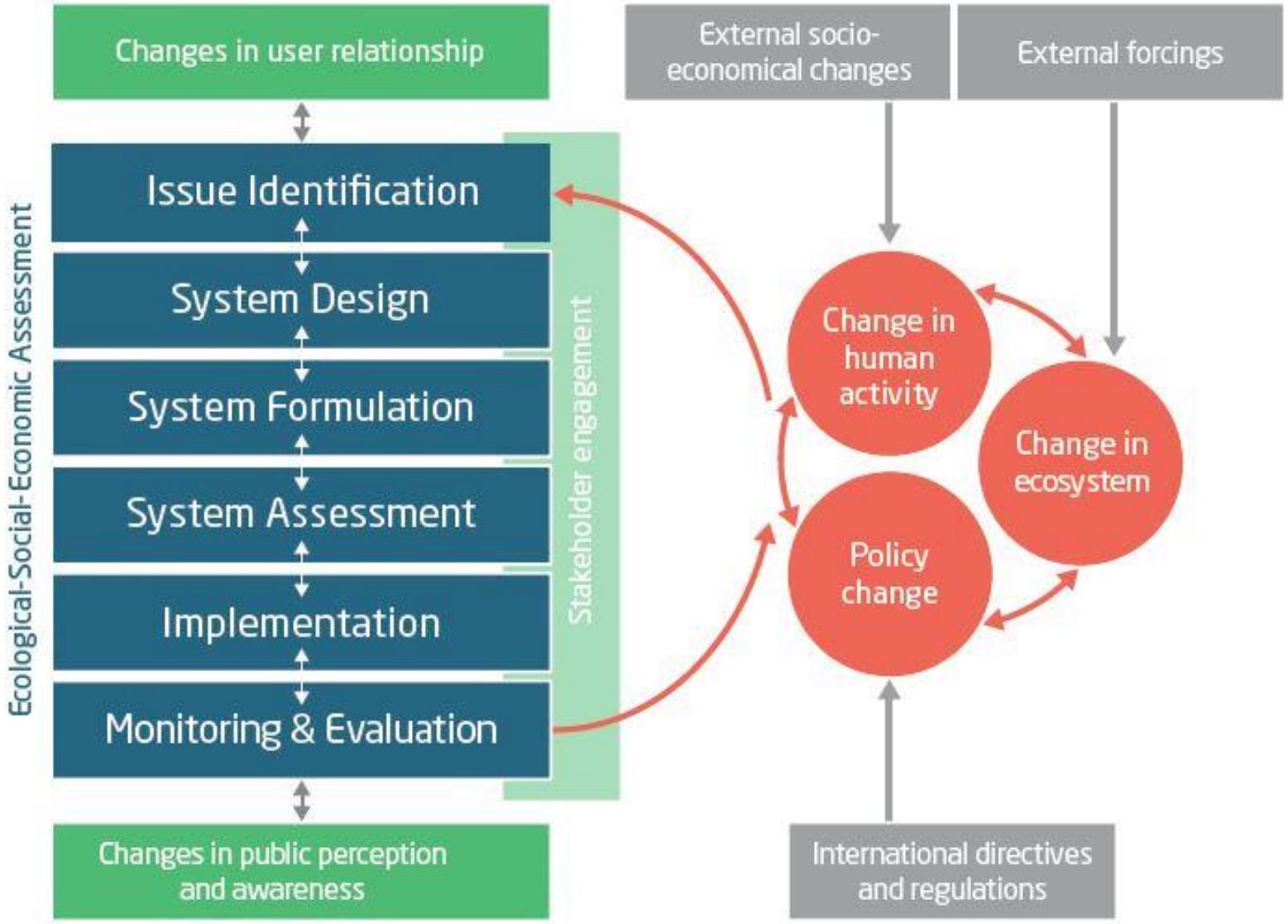
- Integrated coastal zone management (ICZM) is an iterative and multidisciplinary process that **promotes sustainable development** of coastal areas and defines **principles for sound management and planning**
- Several ICZM elements are already commonly applied (e.g. environmental impact assessments and public information and participation)
- Yet, **common weaknesses** of ICZM case studies include:
  - Lack of a holistic approach → one-sectorial solutions
  - Late and unbalanced stakeholder involvement → public protest
  - Long durations from the recognition of a problem to the implementation of a solution (often decades) → increasing pressure require faster action

→ Despite a large amount of literature on ICZM the approach remained too vague

→ A systematic and stepwise approach is needed to enable practical applications

Støttrup et al. 2017, 2019

2. The Systems Approach Framework (SAF)



- **Holistic approach** which is based on systems thinking
- Provides a systematic and **stepwise** guidance to address an issue

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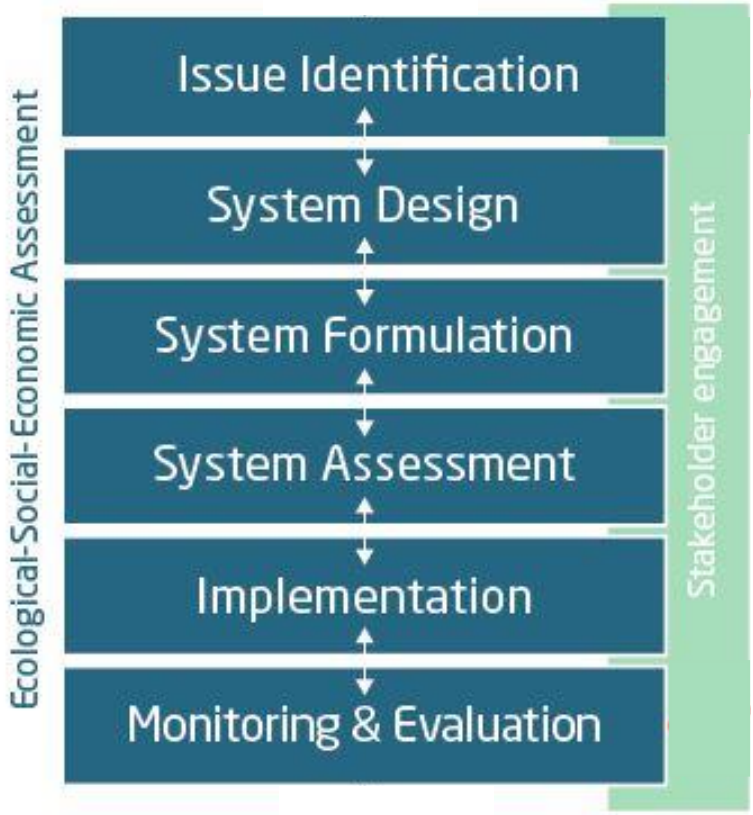
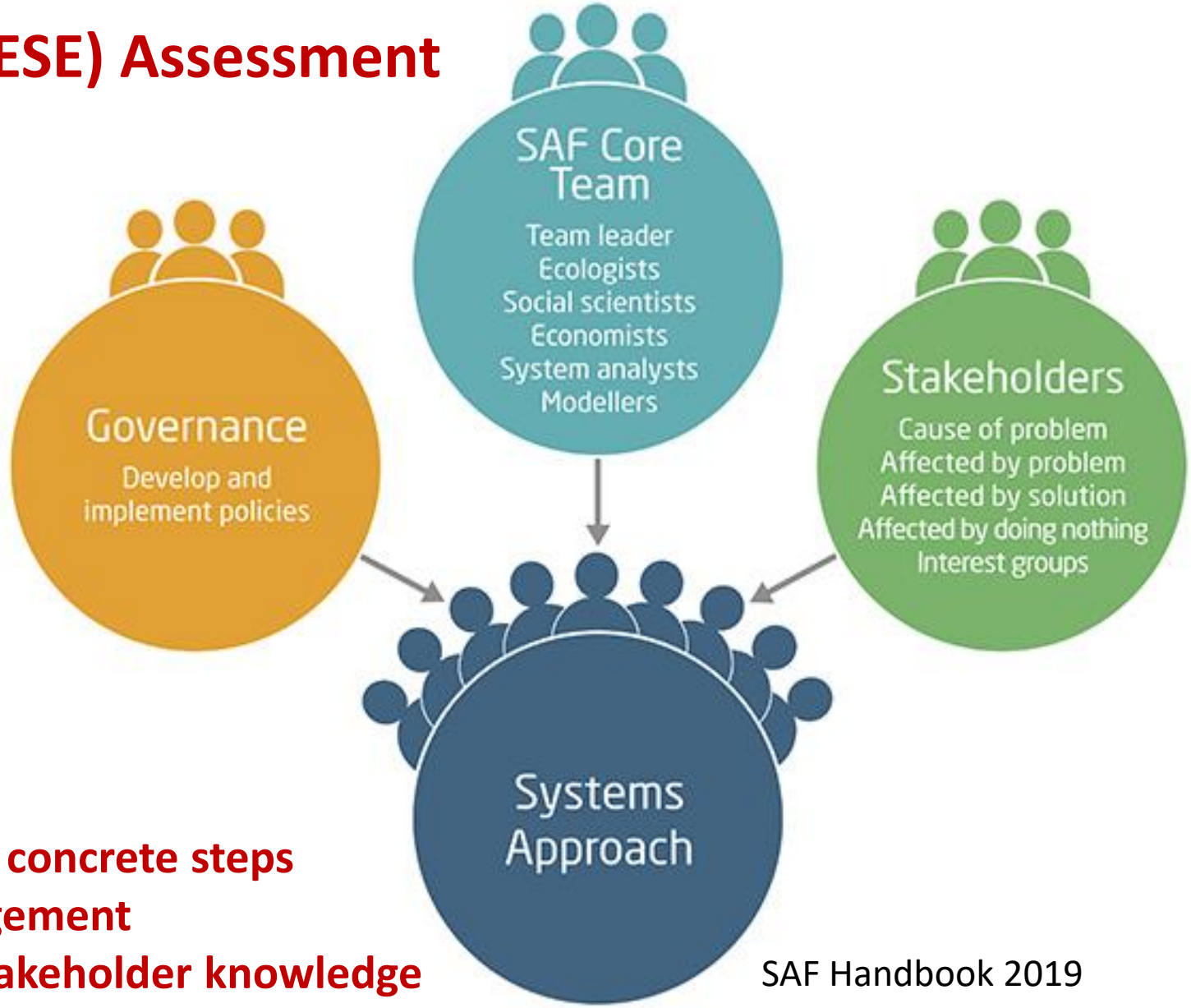
2. The Systems Approach Framework

Ecological-Social-Economic (ESE) Assessment





→ **Breaks down the ICZM cycle into six concrete steps**

→ **Ensures an active stakeholder engagement**

→ **Integrates scientific evidence and stakeholder knowledge into decision-making**

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2. The Systems Approach Framework

Case Study: Establishing Beaches at the Curonian Lagoon Coast

Schernewski et al. 2019

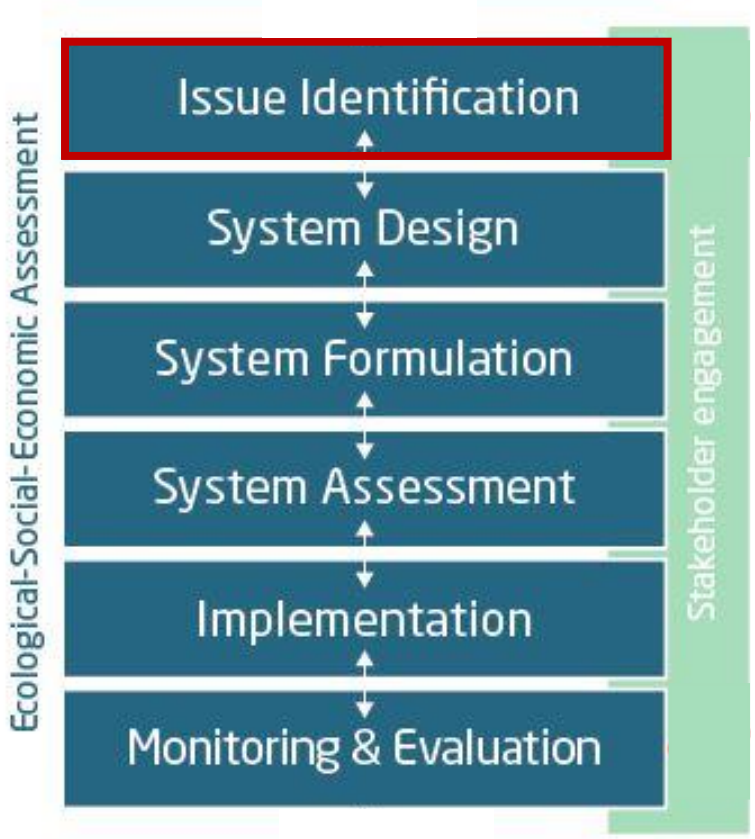
- ➢ Short season with low-income jobs
- → Unsustainable tourism
- → Need to extend tourism season

- ➢ Bathing tourism strongly concentrated along the Baltic coast
- ➢ Nutrient load reduction and improved water treatment
- → Improved water quality

→ Is it feasible to establish bathing sites at the Curonian Lagoon Coast?
→ Is the SAF suitable to support the process and implement the ideas of ICZM?

3. Issue Identification

Actions & Supporting Tools



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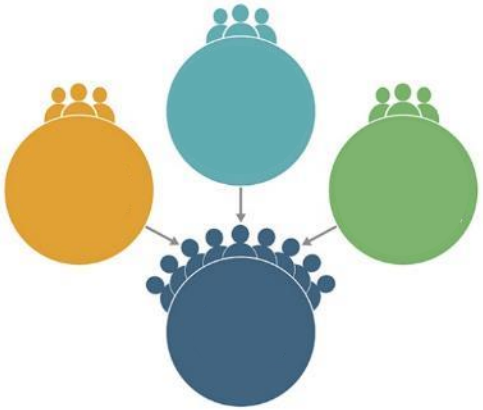
- List human activities
- Identify potential issue(s)
- Map institutions & stakeholders
- Map ecosystem services
  - MESAT
- Map stakeholder preferences
  - StakePrefTool
- Prioritize, select and define the issue(s)
  - DPSIR, CATWOE
- Identify relevant environmental, social, economic elements
- Is a SAF application needed?
  - Public Participation Tool

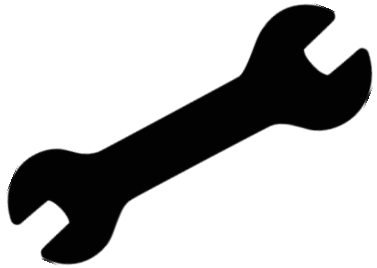
→ At the end of the Issue Identification step you have decided if a full SAF cycle is necessary, formed a core SAF team and engaged stakeholders that will be involved in the application

3. Issue Identification

Case Study Application



- Establishment of an **interdisciplinary research team**
- **Identification of key stakeholders & institutions**: state ministries and agencies, district representatives, tourism association, local mayor, fisheries and nature protection NGOs



- **Supporting tools** were applied to get a better understanding of causes and effects of the issue and to map stakeholders
- Results were presented and discussed at a **first workshop**

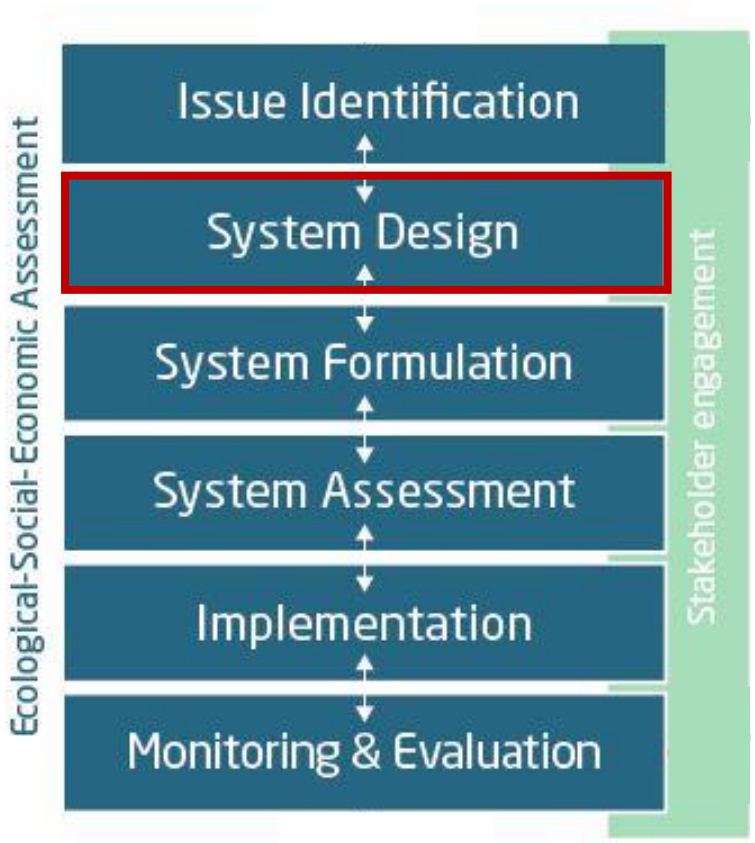
- Beach establishment confirmed to be of high relevance and stakeholder interest
- **Opportunities**: Attractive bathing sites for families & extension of bathing season
- **Concerns**: Risk of beach closures and loss of reputation

→ **SAF very suitable!**

Schernewski et al. 2019

4. System Design

Actions & Supporting Tools



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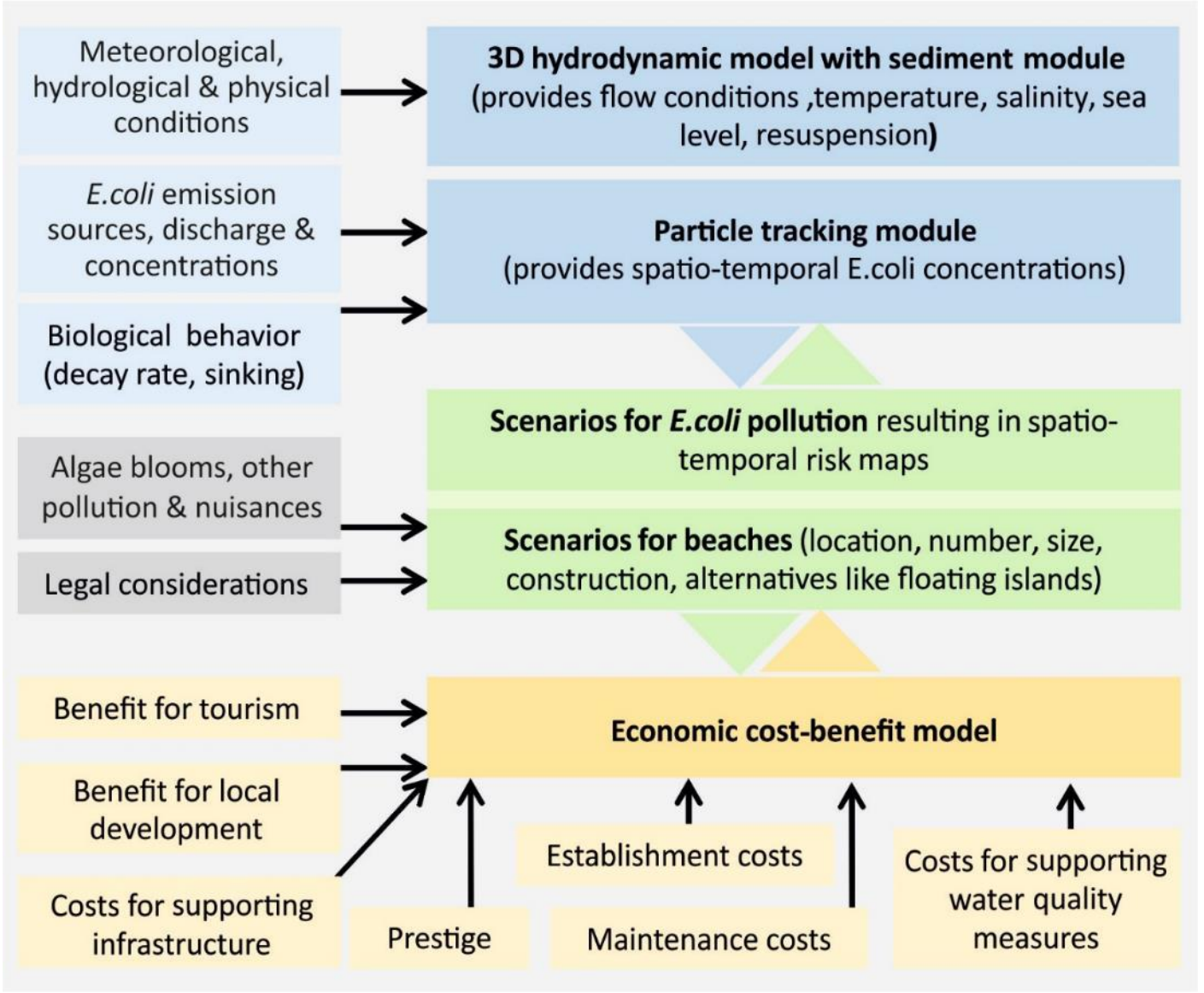
- Develop conceptual model
- Identify ESE linkages
- Assess data availability, modelling methods and resources
- Define administrative and virtual system boundaries
- Identify external hazards
- Define success criteria and indicators
  - InSAT
- Assess system state (e.g. sustainability & ecosystem services)
- Ensure all relevant stakeholders and institutions are represented and all input incorporated
- Discuss potential management scenarios with stakeholders

→ At the end of the System Design step you have developed a conceptual model with clear linkages between the ecological, social and economic model components, defined boundaries of the virtual system and defined management options

4. System Design

Case Study Application



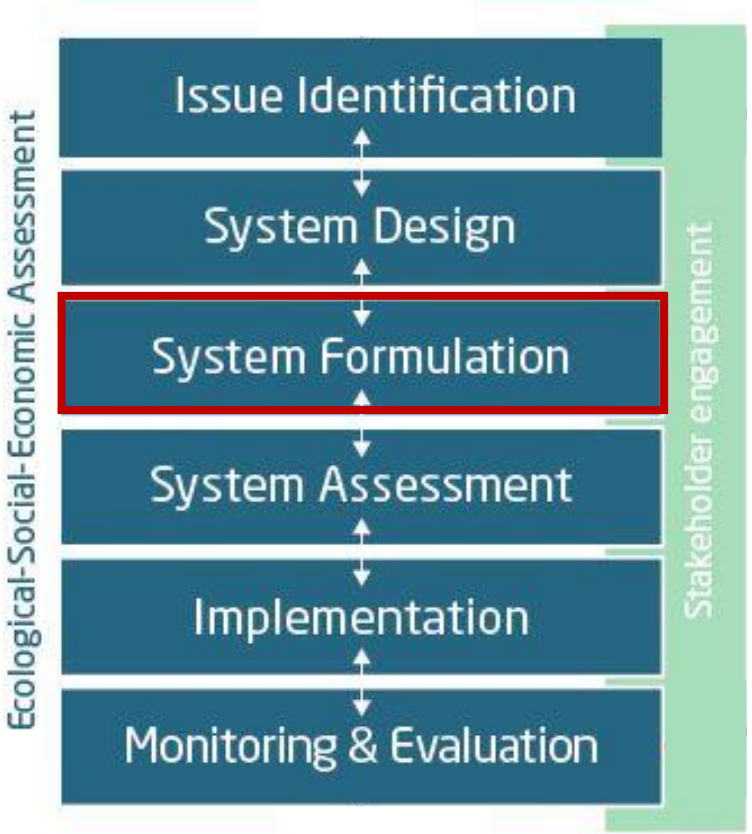
→ **Approach needs to be tailor-made**

→ **Different types of models are needed**

Schernewski et al. 2019

5. System Formulation

Actions & Supporting Tools



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- Assemble data inputs and variables
- Formulate, document, calibrate and validate each of the individual ESE model components and auxiliary models
- Discuss model components with stakeholders
- Link ESE model components into a complete ESE model
- Test sensitivity
- Validate system model if possible
- Run scenario simulations

→ At the end of the System Formulation step you should have an integrated ESE model and simulation results for the analysed scenarios

5. System Formulation
Case Study Application

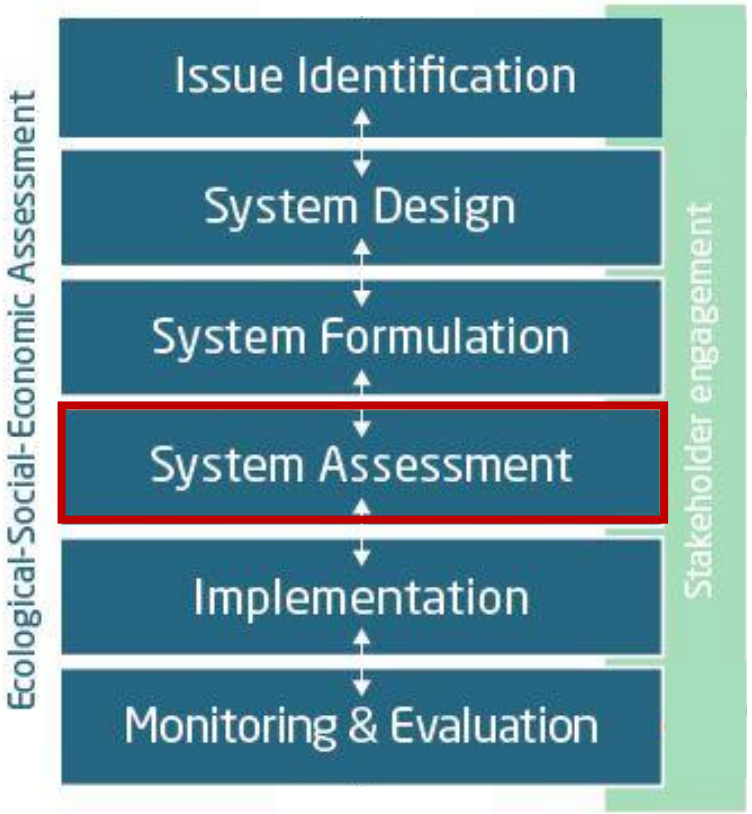
- Discussion of the model components with stakeholders
- Restriction of the virtual system to the Curonian Spit
- Definition of alternative scenarios (with decreasing spatial scale)
  - Beach locations (bathing water quality)
  - Microbial pollution risk scenarios for Nida (wind, river loadings, sewage system)
  - Beach establishment (infrastructure, maintenance, marketing)

→ A spatial down-scaling is beneficial for the stakeholder process

Schernewski et al. 2019

6. System Assessment

Actions & Supporting Tools



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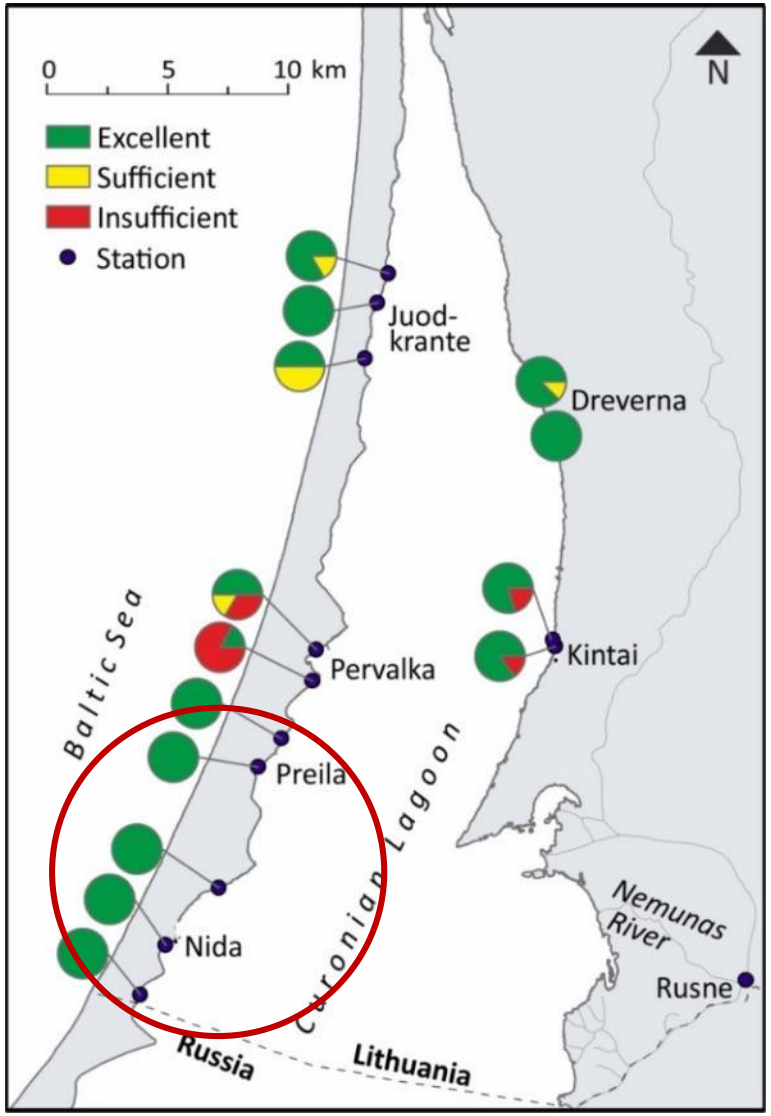
- Prepare scenario results for stakeholders
- Visualize consequences of different results of the ESE model scenario simulations
  - MESAT, InSAT
- Conduct stakeholder meetings to discuss scenario simulation results and consequences of potential management options
  - StakePrefTool, InSAT

→ At the end of this step you should have a good overview about the consequences of potential management options to resolve the issue and about stakeholders' perceptions and potential reactions

6. System Assessment

Case Study Application



Bathing water quality

- Sampling and modelling results showed low risks of insufficient bathing water quality
- Distantant pollution does not pose a risk for bathing sites
- Only a breakdonw of the local sewage system could cause temporary bathing prohibition

→ Favourable conditions for beach openings

Schernewski et al. 2019

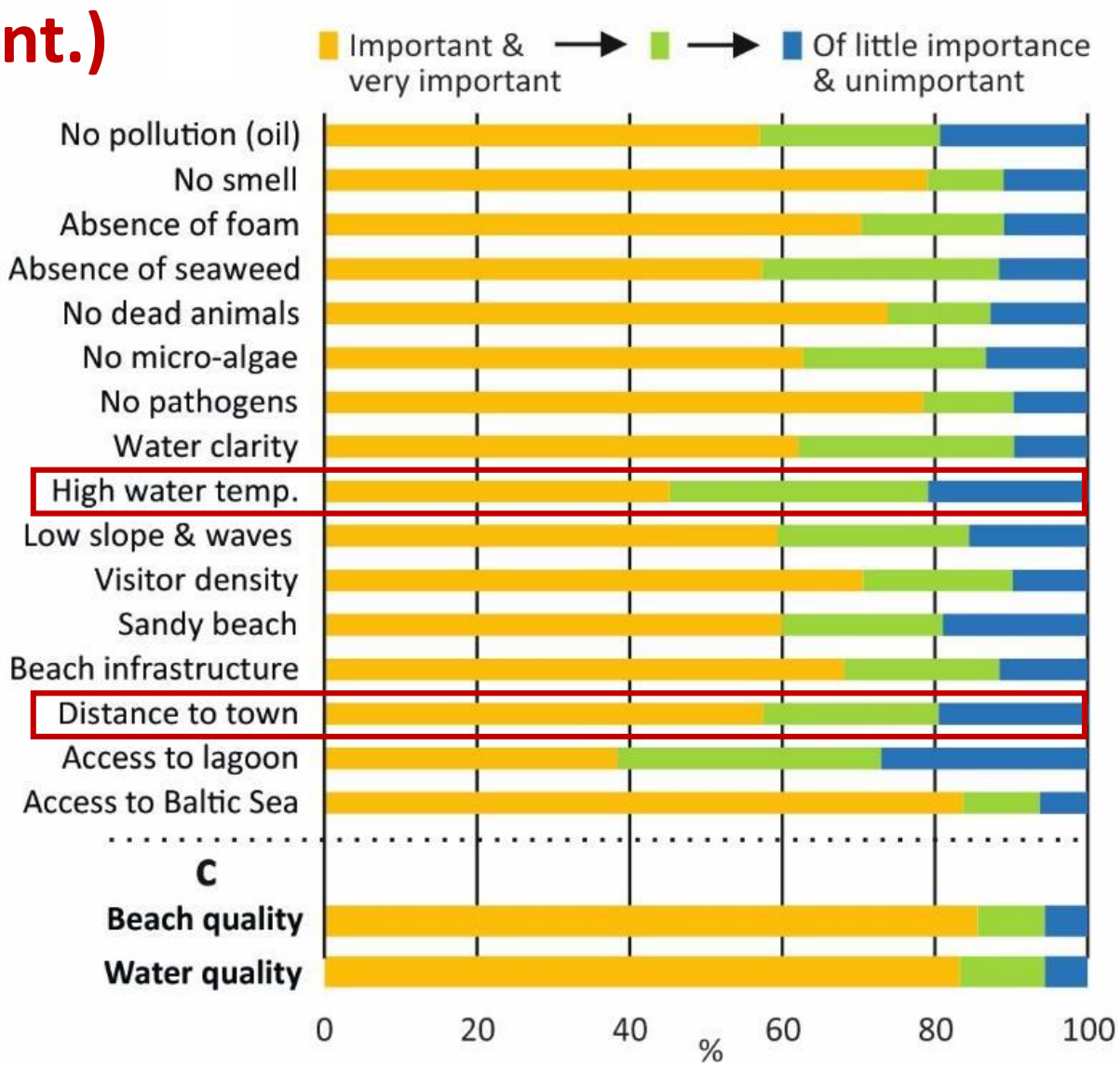
6. System Assessment

Case Study Application (cont.)

Tourism perception & acceptance

- Nature activities more important than water activities
- Benefits of a beach on the lagoon are of lower importance

→ Lagoon bathing site not a priority for visitors



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6. System Assessment

Case Study Application (cont.)

Economic cost-benefit model

- To increase attractiveness of a beach site in Nida, visitors suggested additional services:
  - Showers (80%) → ready to pay <1€
  - SMS alert about water conditions (e.g. temperature & quality) (75%) → < 1€
  - Lockers (49%) → 1-5€
  - Open-air movies, solarium (~45% each) → 1-5€
  - Water tourism, snack places (33% each) → 1-5€
- The maximal potential annual income and establishing and maintenance costs were calculated

→ Theoretically, after several years costs might be compensated

→ More likely, establishing a bathing site would create addiational costs for Nida

Schernewski et al. 2019

6. System Assessment
Case Study Application (cont.)

- Disucssion and priorization of alternative scenarios
  - Nature trails & environmental information
  - Advertisement
  - Reduced prices & events during off-season
  - …

→ Complementary to a beach opening

→ Agreement to utilize a coastal strip near the town centre to open an official beach

→ Low cost to test acceptance

→ **After 1.5 years a decision to establish a beach was reached**

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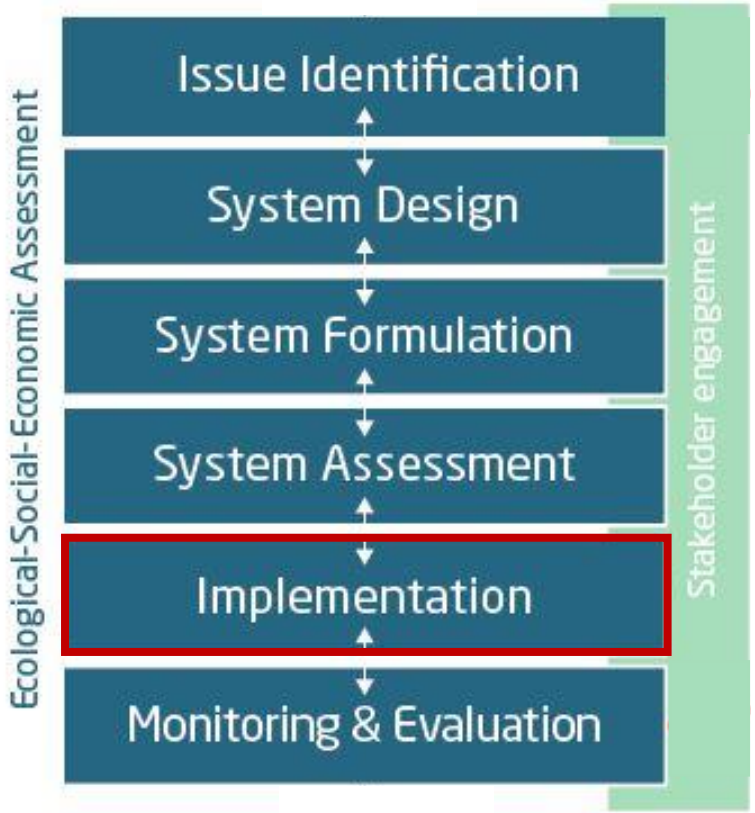
7. Implementation

Actions & Supporting Tools



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- Specify regulatory and financial requirements
- Obtain legal permits
- Identify mitigation measures to reduce, offset or eliminate negative impacts
- Ensure a proactive public information/consultation
- Validate decision

→ At the end of this step a policy decision has been made and implemented

7. Implementation

Case Study Application

- Public announcement of beach opening in the centre of Nida
- Bottom cleaning to a water depth of 1.5 m at the bathing site
- Establishment of floating macrophytes to absorb nitrogen and phosphorous as a eutrophication mitigation measure

VE > Aktualijos

Vakarų ekspresas

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Nidos centre – naujas paplūdimys

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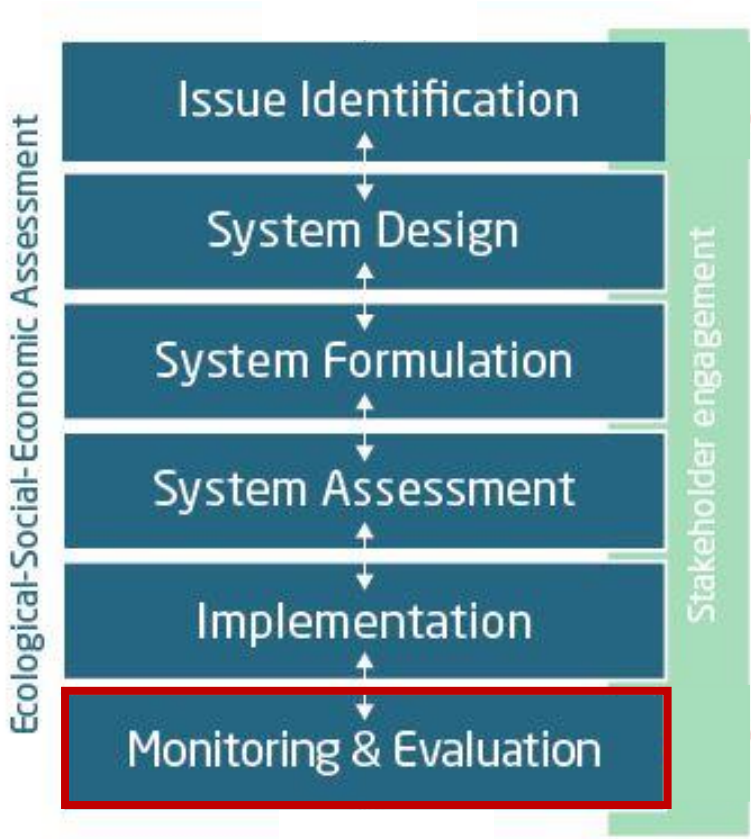
8. Monitoring & Evaluation

Actions & Supporting Tools



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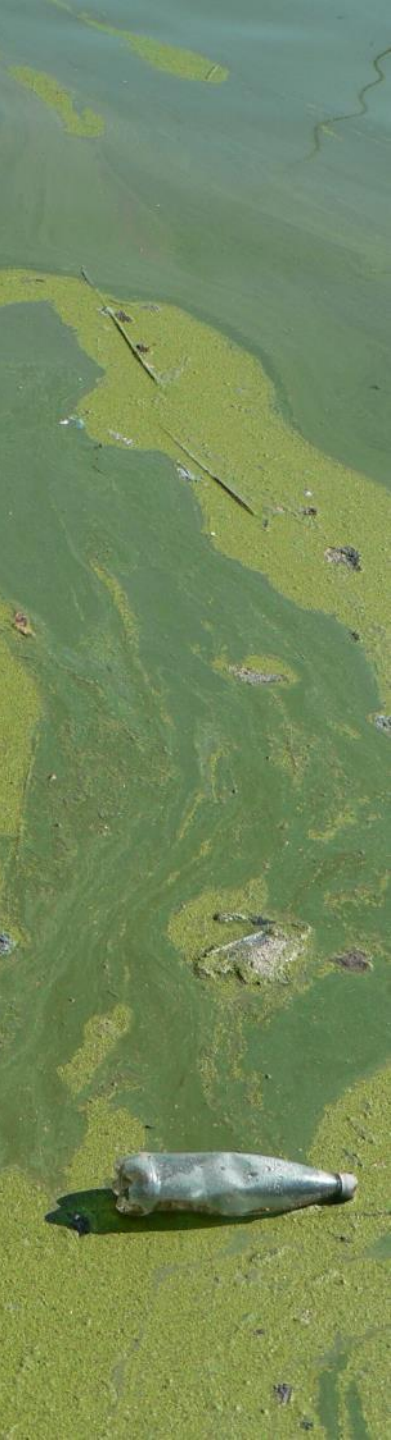
- Ensure the required mitigation measures are implemented
- Agree on the indicators to be used and the appropriate monitoring in place to evaluate the indicators
  - InSAT, Citizen science
- Evaluate the need for additional data requirements
- Evaluate whether mitigation measures are effective
- Assess if the objectives were reached
  - InSAT, MESAT
- Ensure communication with stakeholders on progress
- Evaluate the need to re-iterate the SAF

→ Monitoring can be implemented directly after or ideally before the implementation

→ Evaluation can be carried out beyond the time-frame of the SAF application



8. Monitoring & Evaluation

Case Study Application

- ➢ Water quality and visual nuisances were continuously monitored
- → Dead fish were found during most days (80%)
- → Accumulation of dead beetles caused smells and laborious clean-ups
- ➢ Further monitoring showed elevated levels of cyanobacteria and vibrio
- ➢ The floating macrophytes installed did not lead to the anticipated changes

→ Legal permits to open a beach were not obtained

→ **Iteration of the SAF process needed!**

Schernewski et al. 2019

9. Summary

The **Systems Approach Framework**

- is an important tool to implement ICZM in practice
- breaks the ICZM cycle into six steps with concrete actions and supporting tools
- ensure an active involvement of stakeholders throughout the entire process
- shortens the time from the identification of a problem to the decision on a solution

The **practical application** showed that

- It is suitable in cases with high stakeholder interest
- A tailor-made approach is required for each case study
- An early spatial down-scaling is beneficial for the stakeholder process
- A full SAF cycle can be completed within 12-18 months with an experienced team
- SAF is not a linear process but can require iterations of single steps or the entire cycle

www.safhandbook.net

Thank you for your attention!

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