Understanding the coupled land-sea system dynamics in coastal regions through a participatory approach: A Baltic case study

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Aims of the COASTAL Project

COASTAL (COllaborative lAnd-Sea inTegrAtion pLatform) is organized around six interacting case studies spread over the European Union (EU), to analyze the socio-environmental and economic land-sea interactions in a collaborative System Dynamics (SD) framework, taking into consideration the short-, mid- and long-term impacts of decision making and feedback mechanisms on coastal and rural development.

1. Belgian Coastal Zone

2. South-West Messinia

3. Norrström/Baltic

4. Charente River Basin

5. Danube Mouth and River Basin

6. Mar Menor Coastal Lagoon

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Norrström Drainage Basin/Baltic Sea Region

Sustainability considerations:

- Agricultural, urban, industrial activities in the *hinterland*
- Increasing population density and tourism development in the *coastal area*
- Ongoing-future climate change

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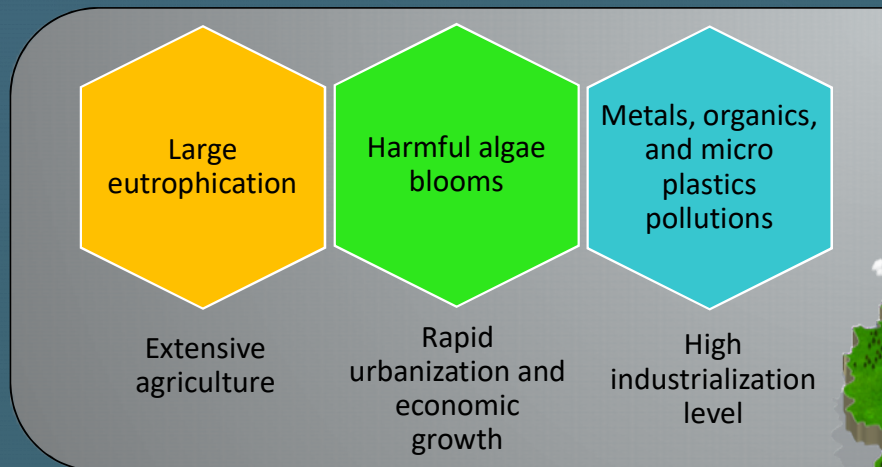
Norrström Drainage Basin/Baltic Sea Region

This regional basin is representative for the relatively densely populated (due to Swedish capital Stockholm), mixed urban, agricultural and industrial areas around the Baltic Sea, resulting in large eutrophication and water quality issues as well as other types of water pollution, e.g. by metals, organics, pharmaceuticals and microplastics in the Baltic Sea.

The continued nutrient releases from legacy sources accumulated in the soil, groundwater and sediments over time contribute to the nutrient loading into and eutrophication of the Baltic Sea.

Hydro-climatic changes and human-induced interventions such as land and water use changes in the contributing catchments also affect the land-sea interactions and pose additional risks to the health of the Baltic Sea.

These environmental pressures are well recognized but still unresolved problems in the Norrström drainage basin and the Baltic Sea region.

Aims

- Employing a participatory approach, the following research questions were addressed:

(i) What are the key land-sea system elements and their interlinkages?

(ii) What are the most relevant and important change scenarios for land-sea system behavior evaluation?

(iii) What are the main challenges and opportunities for sustainable coastal development?

Participatory Approach, and Systems Thinking

- Participatory approaches support stakeholder involvement in integrated, adaptive, and collaborative natural resources management, through which stakeholders can share experiences, learn about other perspectives (in case of a group participation), and (qualitatively or quantitatively) examine their perceptions to better understand system behavior.

- Systems thinking helps in understanding behaviors of a complex system by identifying its elements, their cause-effect interconnections, and feedback structures.


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Results: Causal Loop Diagram (CLD)
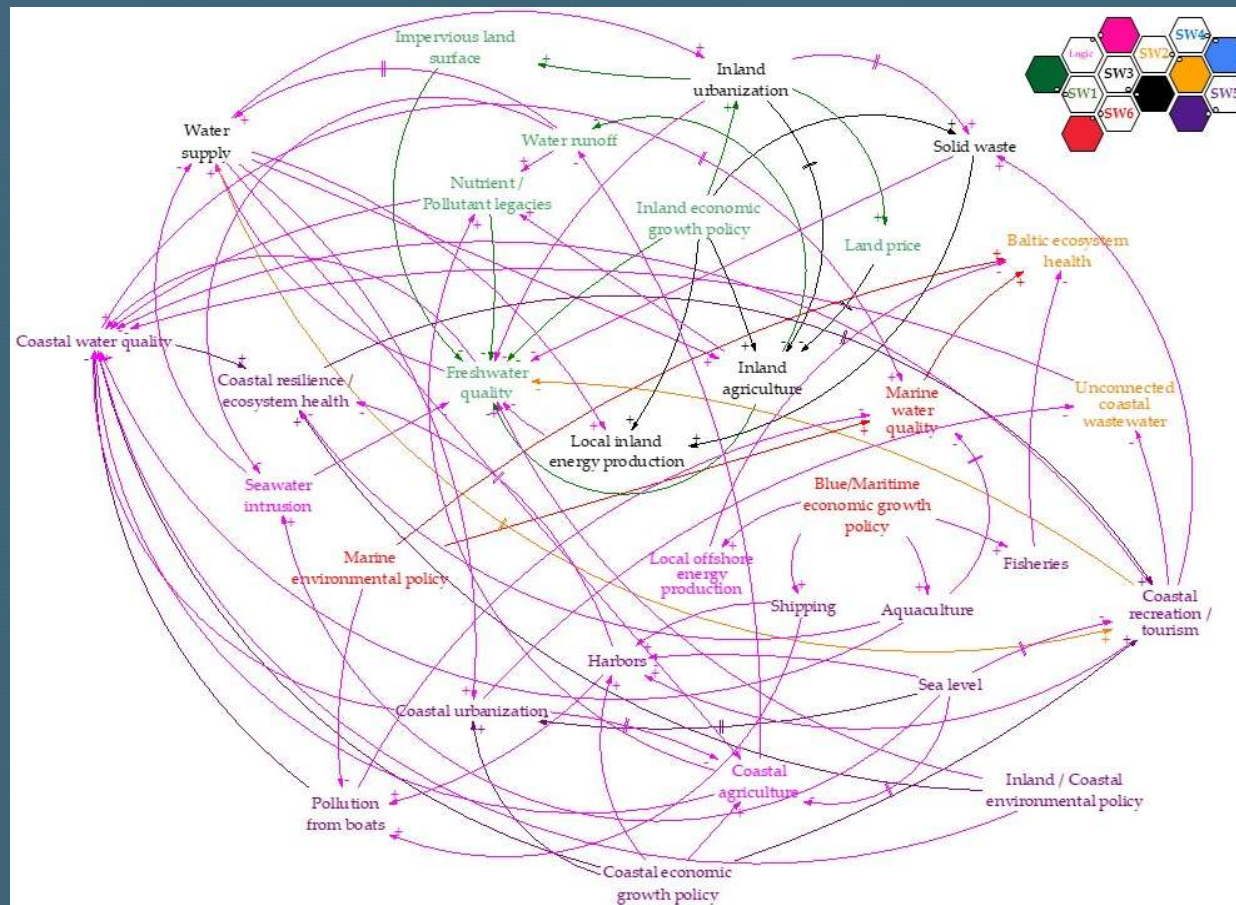
Results: Scenario Analysis

- Scenarios of change for Fuzzy Cognitive Mapping (FCM) of land-sea interactions

- Change in the different driver categories (left, blue box) are exemplified by change scenarios for associated key system elements (right, green/pink box). Values in brackets are the number of different scenarios/sub-scenarios investigated in relation to the various considered key elements.

Scenario results are in publication process.
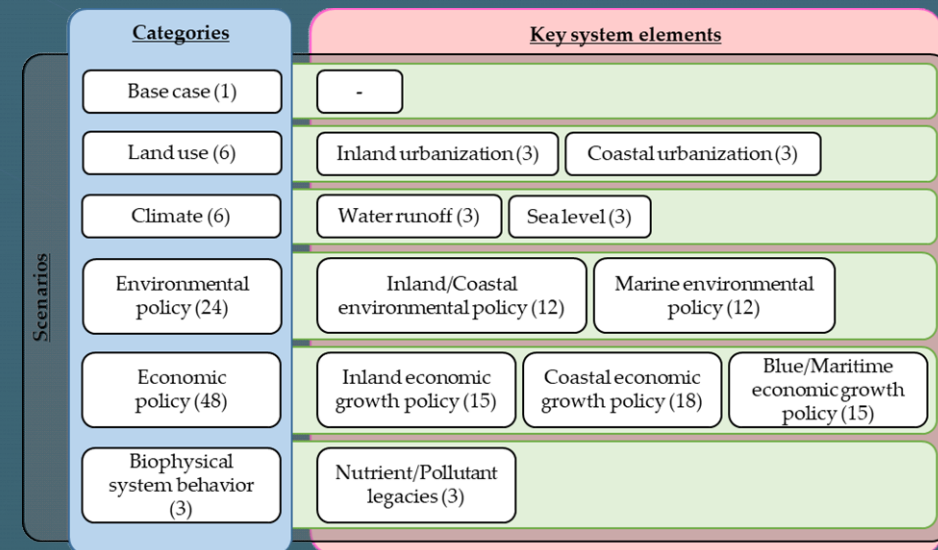
Results: Challenges and Opportunities

Challenges:

- Population and inland/coastal urbanization and their changes over time along with relevant consequences such as land price

- Human activities on land and at sea including e.g., inland/coastal agriculture, shipping, and aquaculture

- Policy fragmentation and power/influence structure

Opportunities:

- Coastal recreation/tourism

- Cross-sectoral communication and collaboration

- Complexity handling capacity

Thank you

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Source: Stockholm Region, EU Office