Using a Systems Approach in the Planning and Implementation of Natural and Nature-Based Features

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Key Messages

System thinking means considering physical, biological and social processes, and their interactions.

An understanding of the actors and processes within a system are a prerequisite to create a suitable, sustainable and well-functioning NNBF solution, promoting innovative partnerships and potential leveraging of resources.

NNBF solutions for flood risk reduction develop over time and space. An understanding of natural system dynamics is essential.

System thinking enables the assessment of multiple potential outcomes, supports multifunctional design, and facilitates direct engagement with stakeholders.

System thinking can be used to implement NNBF solutions on a large system scale (‘think big’) or to integrate many small projects (‘start small’).

Systems Approach?

Physical Geography: 'A system is a structured set of objects and/or attributes. These objects and attributes consist of components or variables (i.e. phenomena which are free to assume variable magnitudes) that exhibit discernible relationships with one another and operate together as a complex whole, according to some observed pattern." Chorley and Kennedy, 1971

Ecology: "An interlocking complex of processes characterized by many reciprocal cause-effect pathways". Watt, 2013

Engineering: "Systems Engineering is the science of designing complex systems, by the efficient use of resources in the form of men, money, machines and materials, so that the individual sub-systems making up the overall system can be designed, fitted together, checked and operated so as to achieve the overall objective in the most efficient way". Jenkins, 1969

Principles for Using a Systems Approach in Flood Risk Management

Principle 1: Life safety is where flood risk management begins, but not where it ends

Principle 2: Flood risk management is nested in an interconnected socio-ecological landscape

Principle 3: Sustainable systems are resilient to disturbances

Principle 4: System-wide planning is a process worth the investment

Principle 5: Short-term benefits are balanced with long-term outcomes

Contextualize: 1. Society

Who needs to be involved?

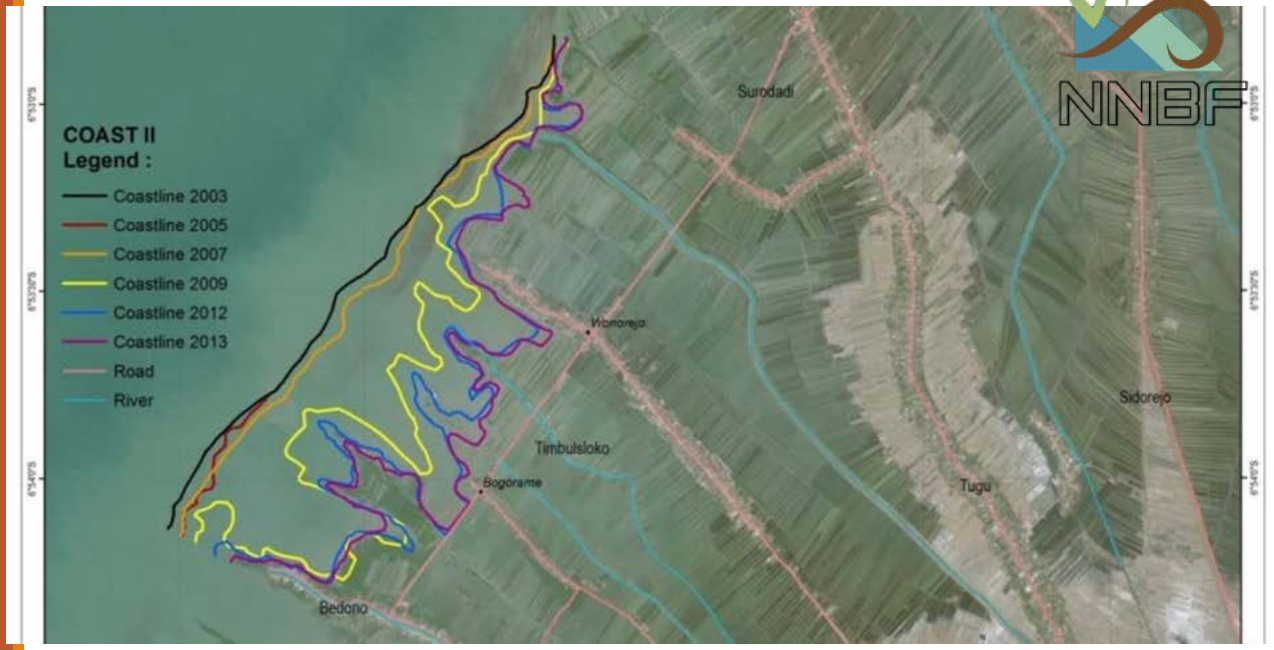
NNBF projects may require more space to be effective than traditional engineering approaches

- understanding current use of the foreshore or floodplain for economic or recreational uses by the community can be important to ensure local support.

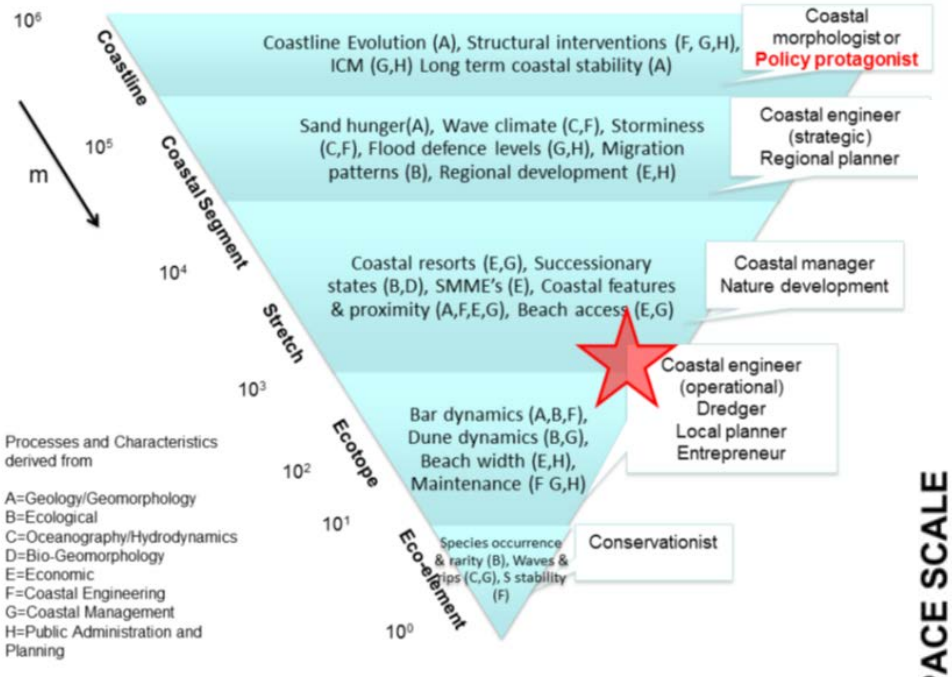
Example – Demak in Northern Java

Sea level rise will result in flooding 6 kilometres inland by 2100, affecting over 70,000 people and 6000 hectares of aquaculture ponds. In the long run 30 million people may be affected by coastal erosion

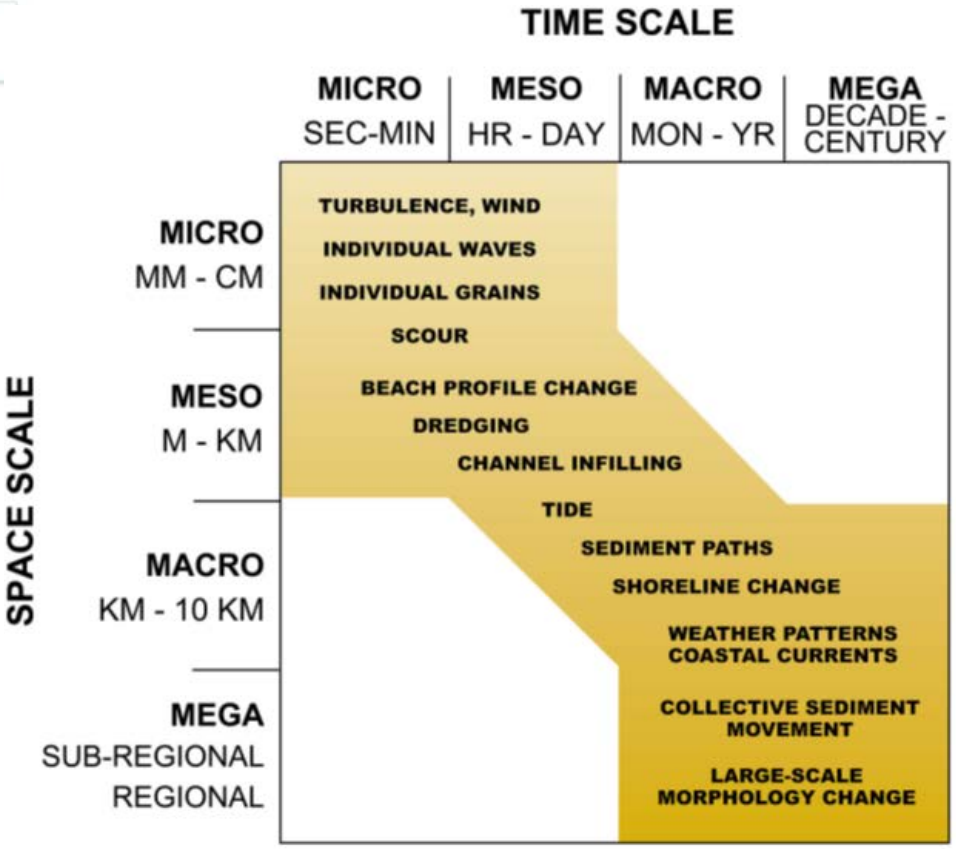
Bio-Rights agreement



Contextualize:
2. Time and Space



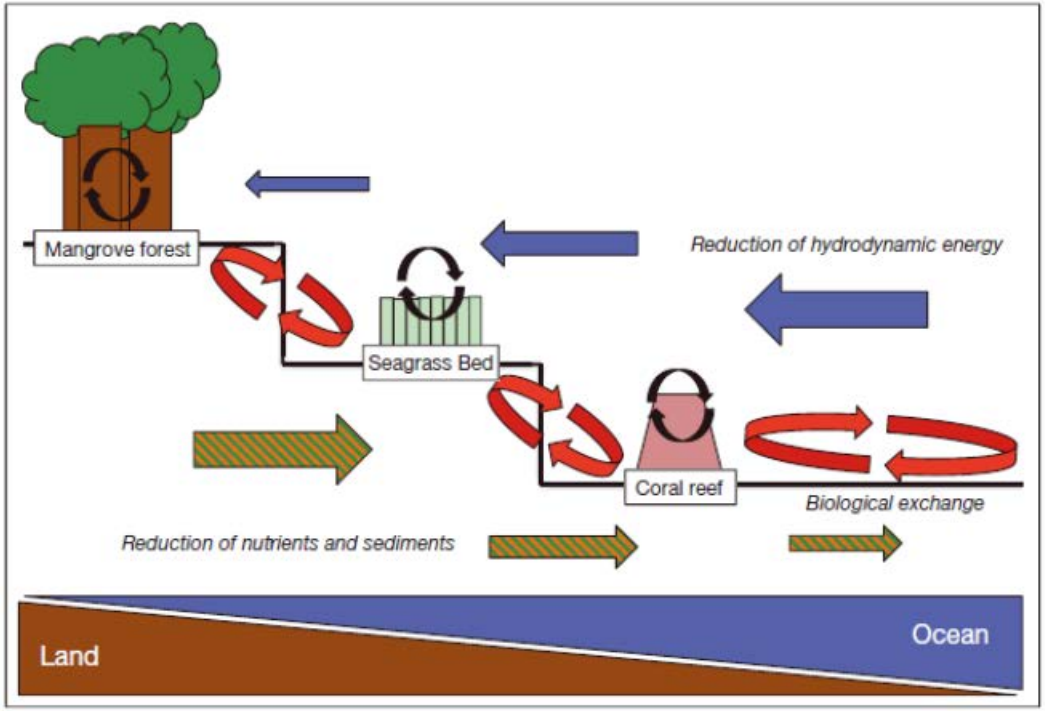
Slinger et al., 2012



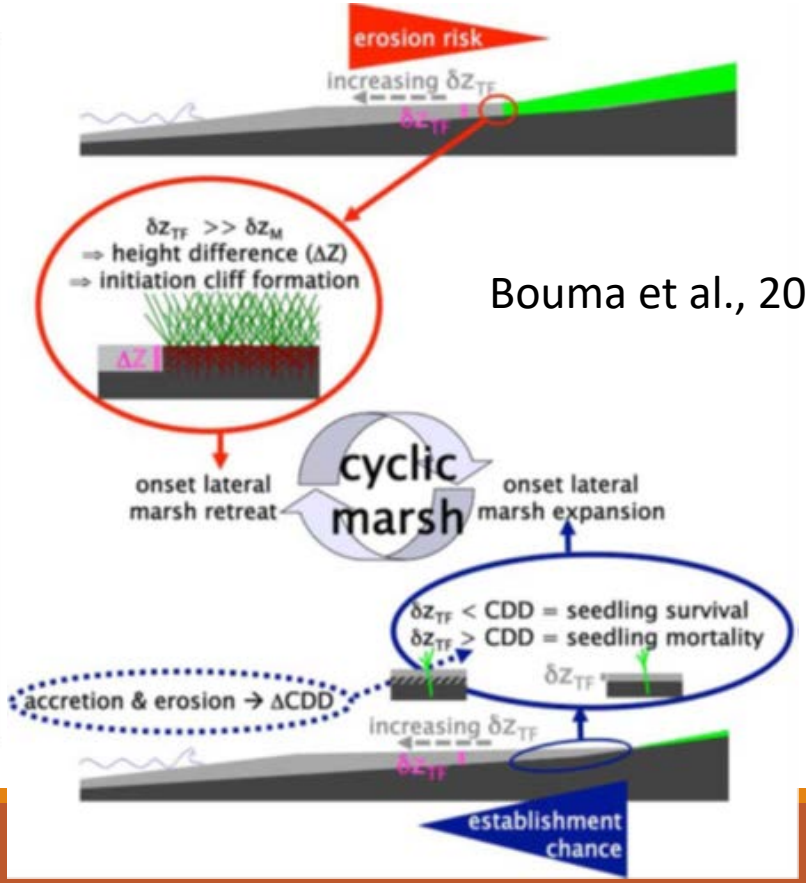
Larsen and Kraus, 1995

Analyze

The approach to analysis must be tailored to the needs of the problem, the system and the project.



Gillis et al., 2014

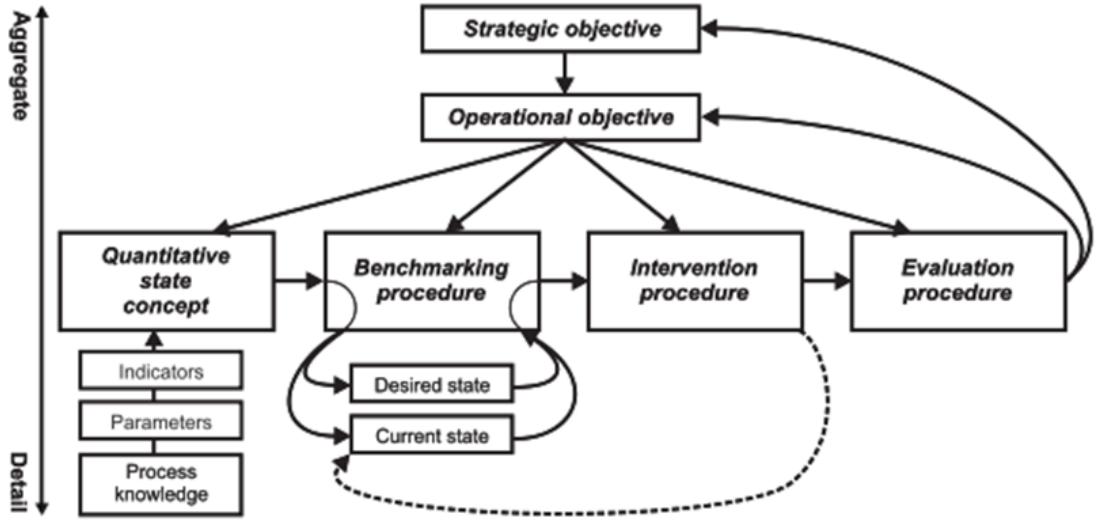


Bouma et al., 2016

Decide and Manage

A broader view of costs and benefits

Frame of Reference approach can link high level policy with on the ground action



van Koningsveld and Mulder, 2004

Concluding Thoughts

System thinking is an essential component in developing sustainable long-term vision in any setting

- requires consideration of the interactions and feedback mechanisms that influence flood risk and how different interventions might shape long-term development.
- identifies opportunities to create added value that might have been overseen if a narrow problem-solving approach was adopted.

Scale matters

- Who is involved?
- What do we need to consider?

Concluding Thoughts

Decision making in a systems context is not easy - it introduces an array of project implications, both positive or negative.

Can make analyses more complex and for some long-term flood risk problems it will require additional research or data collection.

Efficiencies in project implementation that can result from such understanding justify the effort.

Taking a systems approach creates more support and commitment with the local stakeholders.