Systems mapping of economy–environment relations

Sustainable Seas National Science Challenge researchers explored the potential of 'systems mapping' to guide decisions that involve economy–environment relations — for example the potential of ecosystem-based marine management to guide the development of a blue economy. This document summarises this research.

Systems maps help visualise relationships

'Systems thinking' can help policymakers, researchers, and stakeholders examine relations between economic activities and ecosystem dynamics. Systems maps are visual representations of systems thinking and can identify and highlight important interconnections and feedback loops within these relationships.

These maps can support ecosystem-based management and the development of regulatory practices for the sustainable and responsible use of marine resources in a blue economy. Connolly and Lewis (2019) explain that 'system maps' have been widely used to help broaden the understanding of resource management in place.

Systems maps built for fishing and eco-tourism activities

Connolly and Lewis (2019) used findings from Sustainable Seas research to map marine economy–environment relations, including research from the blue economy theme of the Challenge. Making a series of assumptions about the nature and stability of marine-economy relationships, they built systems maps that identify three sectors of marine economy activity (wild fisheries, farmed fisheries, and eco-tourism) and ecosystem dynamics.

These maps visualise and model effects at points and sites at which activities within these sectors impact on key ecosystem dynamics. The maps identify marine-economic relations where positive change might be imagined and brought about.

The research demonstrated the value of systems mapping as a regulatory tool and provided a set of key insights for regulators establishing ecosystem-based management for a blue economy.

- For modelling purposes, the broad drivers of resource use for all sectors can be accommodated in a four capitals Living Standards Framework (natural, human, social, and financial capital).
- Regulatory interventions may have a positive impact on all four capitals in the longer term, even if they can generate negative impacts in the short term.
- Wild fishing and fish farming can have negative impacts on their supporting ecosystems.
- Enhancing economy–environment relations in wild fisheries involves ecosystem dynamics associated with the health of the fish stock. Enhancing economy–environment relations in fish farming involves reducing waste and other negative impacts of farming such as other species interactions.
- Eco-tourism involves both consumptive and non-consumptive activities and aims to enhance economy–environment relations and restrict impacts in all interactions.
- Eco-tourism is exposed to risks by negative environmental impacts in both wild fishing and fish farming.

Operators can use systems maps to decide actions and interventions

The maps highlight potential actions to enhance economy-environment relations through win-win actions.

- Fishing companies limit their catch (eg by fishing for abundance) and improve their fishing methods (eg deduce by-catch by improving target precision of their netting).
- Fish farms attract capital from a green investment fund – increasing the volume of fish farming but restricting environmental impact.
- Local tourism operators work with local authorities to cap tourist numbers, reducing pressures on environmental resources and improving product quality.

The system maps demonstrate the value of a four capitals Living Standards Framework as a device to support decision-making tools, for example for:

- testing pressures on social licence to operate
- supporting win-win solutions and associated narratives
- emphasising the potential of the concept of just transitions as a decision framework.

Systems maps can also be used to explore feedback loops between increases in natural and financial capital. They can also help to identify potential interventions to foster value and increase the potential positive impacts of increasing social and environmental capital through ecosystem-based management, just transitions, and restoring ecosystems.

Research results suggest that:

- eco-tourism is the most prominent example of cascading positive effects in multi-use environments
- the extent and limits of a social license to operate depend on the mix of economic uses in any setting and impacts on the four capitals, which can be modelled through systems thinking
- systems mapping of economy–environment dynamics with the four capitals offers a working framework for examining environmental justice and evaluating transitions towards a blue economy.

Future maps could be enriched and extended

These findings could be refined, and the value of the tool enhanced by further research that lays the maps over each other to better explore multi-use relationships and effects, especially those associated with transitions to a blue economy.

Maps could be extended to mining, shipping, or blue-tech sectors that rely on environmental resources. Each of the maps individually, or laid over each other, would benefit from empirical research with participants to validate the risk assessments.

Any further systems analysis must extend to terrestrial economy–environment relations and their interactions with marine ecosystems and resource use. Systems mapping of terrestrial and marine economy–environment relations, supported by empirical research to impose risk calculations, has significant potential to guide decision-making frameworks at all scales and to support regulatory change or interventions.

References

Connolly, J. D., & Lewis, N. I. (2019). Conceptual system maps of 'blue economy' activities. Sustainable Seas National Science Challenge (A report for the University of Auckland). https://www.sustainableseaschallenge.co.nz/tools-and-resources/conceptual-system-maps-of-blue-economy-activities/