Realm: Freshwater | **Biodiversity threat:** Nutrient pollution | **Stakeholders/sectors:** Agriculture, fishing, tourism
Strengths: Policy coordination, Stakeholder processes, Resilience

Case Study 6 Understanding eutrophication processes and restoring good water quality in Lake Ringsjön – Rönne å Catchment in Kattegat, Sweden

Nutrient pollution affecting lake biodiversity:

Due to nutrients from agriculture and household sewage, Lake Ringsjön experiences eutrophication, which has made it a target for restoration efforts by local municipalities. Situated in an agricultural landscape with a growing human population, the lakes provide multiple ecosystem services (including fish and recreational opportunities) that are valued by different stakeholders. These ecosystem services increase – along with biodiversity - when the water is clear. We investigated how the local society and ecosystems co-produce these ecosystem services. We also investigated the interactions between the social and ecological aspects of the lake system together with stakeholders to suggest how water governance might be improved.

Where and what are the challenges?

The Rönne å catchment is located in Southern Sweden in a landscape that is witnessing a transition from an agricultural to a multi-functional landscape. The main pressures affecting freshwater quality are agricultural activities and insufficient sewage treatment. Swedish regulations are implemented at different levels: from river basin to county to municipality. Water councils, a group of stakeholders including municipalities and water users, have developed their own bottom-up solutions in the past, and are increasingly involved in the governance system through the Water Framework Directive.

What was done?

Our research was co-designed with stakeholders, decision makers, civil servants and practitioners in three workshops and eight follow-up interviews, and complemented stylised social-ecological modelling. We used the AQUCROSS Assessment Framework alongside insights from resilience thinking to focus on the social aspects of policymaking and implementation – particularly the governance-related resilience principles and processes of change. We used these to develop future scenarios that explore two perspectives along which decision making in water governance could develop differently from the expected baseline: a) by changing the time horizon of restoration effects, and b) by changing the geographical space and institutions involved in collaboration on managing the lake.

Local recommendations:

We qualitatively evaluated the scenarios using the resilience principles and a stylised social-ecological model that simulates social time lags and their effect on lake restoration and resulting ecosystem services. Our analysis shows: 1) consideration of the time lags between management actions and an improvement in the ecosystem can lead to stronger reinforcing feedbacks and larger improvements; and 2) an increase in the geographical and institutional scale of management allows more collaboration between water councils and across different sectors, though the final outcome would depend on which ecosystem service trade-offs are explicitly considered.

General lessons learned for managing biodiversity:

Resilience thinking helps to identify feedback processes and interactions between society and the ecosystem that determine long-term outcomes of lake restoration. There is a need to consider time lags and different dynamics within the system, as well as how the social aspects interact with the ecological aspects. Collaboration is necessary between different levels of water governance, and across different sectors and geographical regions in order to reach the full potential for managing eutrophication in the catchment.

Local impact:

The stakeholder process motivated an improved collaboration between practitioners and decision-makers in local freshwater management to take more ecosystem service interactions into account - *"it's about physically sitting down at a table with all these actors and discussing a common interest"* (civil servant municipality of Höör and member of Ringsjön's water council).

Find out more about Case Study 6 on the AQUACROSS Information Platform and aquacross.eu

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