

Science for Environment Policy

Baltic nutrient abatement measures identified by hybrid ecological-economic model

Policies to manage marine ecological quality can be improved by combining economic and ecological concerns, finds a new study. Using this integrated perspective, researchers developed a model which identified the most cost-effective options for reducing nutrient pollution in the Baltic Sea within a 40-year time-span. The total cost of meeting the commonly agreed targets is estimated to be €1,487 million annually.

The Baltic Sea supports a unique [ecosystem](#), which is threatened by many human activities. The most severe threat is from excess nutrients, which enter the Sea in runoff from agricultural and urban communities. These can lead to eutrophication and threaten important ecosystem services, such as those that underpin recreational activities, and thus the livelihoods of those dependent on these services. The problem highlights the conflicts that decision makers face in balancing necessary activities, such as [agriculture](#), which can pollute the environment, with the benefits of preserving a healthy marine ecosystem.

The Baltic Sea Action Plan (BSAP), developed by the Baltic Marine Environment Protection Commission, sets limits on nutrients entering different drainage areas discharging into the Baltic Sea, aiming to return it to a 'good environmental status' by 2021. Many different measures to reduce nutrient pollution, such as changes to waste [water](#) treatment or restoring wetlands, offer ways of meeting these limits. Determining which measures are the most effective at reducing nutrient levels within different drainage areas requires an ecosystem-based approach, and an economic assessment is needed to identify and assess the most cost-effective measures.

The researchers in this study explored cost-effective measures to meet the BSAP goal of good environmental quality within 40 years, from 1981. They evaluated the costs and long-term effects of reducing pollution on nutrient and phytoplankton levels in the Baltic Sea by combining economic and ecological research into a single model.

The model results suggest that aiming to achieve a good environmental status of the Sea, rather than aiming to meet the BSAP load targets for each sea region, was the most cost-effective approach. It allowed more expensive measures in one area to be replaced with cheaper options in other areas.

The study suggests there should be a larger reduction of phosphorus and smaller reductions of nitrogen than is outlined in the Action Plan. The researchers suggest two reasons for this. The first is economic: measures to reduce phosphorus, such as improving wastewater treatment, are cheaper to put in place than measures to reduce nitrogen, such as restoring wetlands. The second is ecological: some phytoplankton species 'fix' nitrogen from the air and can add significant amounts of nitrogen to the Baltic Sea. However, these species require phosphorous and lower phosphorous concentrations reduce the amount of such phytoplankton, and consequently nitrogen levels in the Baltic Sea.

The cost of the most cost-effective outcomes from the model for reaching a good environmental status within 40 years was €1,487 million annually in future prices (assuming an interest rate of 3.5%), compared to earlier estimates ranging from €3,000 to €4,500 million. However, the authors note that these earlier figures were estimated based on older data and statistics and higher initial loads.

By integrating economic and ecological factors into a single model, this research provides a new tool for analysing and optimising policies designed to protect the Baltic Sea. The researchers believe that the model could also be useful for other purposes, such as performing cost-benefit analysis and optimisation for international environmental agreements.



October 2014
Thematic Issue 46

Coastal Zones

Subscribe to free
weekly News Alert

Source: Ahlvik, L., Ekholm, P., Hyytiäinen, K., *et al.* (2014). An economic-ecological model to evaluate impacts of nutrient abatement in the Baltic Sea. *Environmental Modelling & Software*, 55, 164–175.
DOI:10.1016/j.envsoft.2014.01.027

Contact:
lassi.ahlvik@mtt.fi

Read more about:
[Marine ecosystems](#),
[Biodiversity](#), [Water](#)

The contents and views included in *Science for Environment Policy* are based on independent, peer-reviewed research and do not necessarily reflect the position of the European Commission.

To cite this article/service: "[Science for Environment Policy](#)": European Commission DG Environment News Alert Service, edited by SCU, The University of the West of England, Bristol.