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Policy Brief 5: Regulations and Policies to Reduce Nutrient Pollution

Aquatic ecosystems are valuable through the many ecosystem services they provide, including drinking water, irrigation water, flood control, food, and the many ways of recreation. The citizens and residents of Nordic and Baltic countries have a **right to healthy aquatic environments**. Aquatic ecosystems and species also have value beyond humans.

Nitrogen (N) and phosphorus (P) emissions cause eutrophication, which again may lead to algal blooms, oxygen depletion, and the deterioration of aquatic ecosystems. **Nutrient pollution must decline** to enhance the status of Nordic and Baltic waters and the condition of aquatic ecosystems. The Water Framework Directive (WFD; 2000/60/EC), the Marine Strategy Framework Directive (2008/56/EC), and the Nature Restoration Law (2024/1991/EU) set binding targets for the EU member states.

There are promising examples on how land use changes, mitigation measures and nature-based solutions are effectively mandated and supported by national regulations and policies to reach **water quality, biodiversity, and climate targets**. Food systems have a key role in this nexus.



Source: SYKEs image bank

The targets

The EU WFD aims at a **good environmental status of all European waters**. The planning towards the overarching goal is strictly regulated. Member states make river basin management plans under the Water Framework Directive which applies to rivers, lakes, transitional waters, coastal waters and groundwater, and marine management plans under the Marine Strategy Framework Directive (2008/56/EC; MSFD), both with action plans that list the measures needed. Plans for curbing nutrient emissions are also specifically required by the Nitrates Directive (91/676/EEC) and the Common Agricultural Policy (CAP).



Under the EU Nature Restoration Law (2024/1991/EU), which is based on the Global Biodiversity Framework under the UN Convention on Biological Diversity, EU Member States “shall put in place the restoration measures that are necessary to improve to good condition areas of habitat types listed in Annex I which are not in good condition” (Article 4(1)). Fennoscandian natural rivers are among the dozens of habitat types listed in Annex I. **Restoration measures shall be put in place on at least 30 % of the total area of habitats not in good condition by 2030** (and 60 % by 2040 and 90 % by 2050). In addition, for species protected under the Habitats Directive (92/43/EEC) Annexes II, IV and V and the Birds Directive (2009/147/EC), Member States shall put in place additional restoration measures that are necessary to improve the quality and quantity of their habitats (Article 4(7)). For marine ecosystems, the restoration duties are set by Article 5(1), and ecosystem types listed in Annex II. National restoration plans are the mandatory instrument under which nature restoration measures shall be planned and evaluated (Articles 14 and 15) and submitted to the EU Commission for evaluation (Articles 16 and 17).

Although the EU sets the targets, **concrete norms and incentives** to support the adoption of mitigation measures and nature-based solutions that improve water quality and the health of aquatic ecosystems are set by **national governments**. This includes regulations for diffuse nutrient pollution and environmental licensing for point-source polluters.

Promising examples

Finnish farms and rivers

Despite its relatively small surface area (7.5 %, 2 million ha), agriculture is the largest source of diffuse nutrient loads in Finland, especially in coastal river basins. EU’s Common Agricultural Policy, including agri-environmental measures in Rural Development Programmes have been the main tool to control the agricultural nutrient loads with water protection as one of the main objectives. Through voluntary agri-environmental measures in Finland, more than 90% of farmers have been subsidized for environmentally sound cultivation practices since 1995.

The measures with the highest impacts on nutrient loadings to waters have been 1) maximum limits of fertilization for crops, rules applying both to artificial fertilizers and to manure 2) winter vegetation cover of fields, and 3) nature management field grasslands and biodiversity fields, which are primarily thought of as measures to increase biodiversity, but they also have a favorable effect on water quality due to the vegetation cover and limited use of fertilizers. These measures have proven to be effective, and the WFD nutrient concentration targets for Finnish rivers are now within reach in many regions.

In recent years, **cultivated land area has slightly decreased** in the Finnish NORDBALT-ECOSAFE study catchments, as well as the area of fallows, while the area of **grass cultivation has increased**. A decrease occurred when agricultural policy favored fallows and set-aside land. Reflecting fertilizer use, both **P and N balances have decreased** in Finland during the implementation of the agri-environmental measures. Presently, the total phosphorus (TP) balances are near to 0 kg/ha in several areas, which means soil phosphorus content is not increasing. This has clearly contributed to the reduced total phosphorus (TP) concentrations in waters, even though P pools in soil are still high in several parts of the country. Nutrient concentrations have started to decline in most rivers flowing into the Gulf of Finland and the Bothnian Bay. Grass cover, fallows, uncultivated nature management fields, reduced tillage, no-till, and gypsum treatment of fields have contributed to reduced TP and total nitrogen (TN) concentrations. In rivers flowing into the Gulf of Finland, the concentration of TP has been declining already since the mid-1980s, and that of TN started to decline in the 2000s. The decrease in TP concentration in 2010-2023 was 19% (Gulf of Finland), 20% (Archipelago Sea), and 5% (Bothnian Sea). Decrease in TN concentration was 15%, 18% and 10%, correspondingly.



However, nutrient concentrations of rivers in Southwest Finland that flow into the Archipelago Sea are only slightly decreased. Animal husbandry seems to be the main reason. More demanding requirements for surface winter cover have been set to protect these vulnerable areas. Further efforts beyond the present agri-environmental measures are needed to reduce particularly the N balance in the catchment area of the Archipelago Sea. Further changes in land use may be needed to reach water quality targets as well as the climate and biodiversity goals.

Danish farms and rivers

Denmark is one of the most intensively farmed countries in the world with 61% of total land area cultivated, more than 2 million ha. In the past, a 36 % reduction in N losses from Danish agriculture from 1990 to 2004 was a world record, achieved through **an extensive list of mandatory measures**: an obligatory fertilizer accounting system, nitrogen limits for fertilizers, fertilizer quota calculated for the farm (where strict rules were removed in 2015), limits for manure application, bans on applying fertilizers in certain time slots and weather conditions, and catch crop requirements. Since 1998, lake and wetland restoration have been included in the list of measures as nature-based solutions to reduce N and P pollution. During 2011-2014, mandatory 10 m buffer strips along all streams and lakes were demanded (Buffer Strip Act), but this duty was removed in 2016. Since 2016, Denmark has had a targeted catch crop program for vulnerable estuaries, where the farmer can choose in-between crops, set aside land, set aside buffer strips, energy crops, precision farming, and N-quota reductions in replacement of the catch crop duty.

Funding is available for afforestation, rewetting of peat soils, restoration of wetlands and lakes, and Denmark also has a constructed wetland programme. The current plan is to rewet 140,000 ha low-lying organic soils before 2030. In 2024, it was agreed that Denmark will plant a billion trees and transform **15% of the nation's farmland into forests and natural habitats** over the next two decades, which is a multi-billion-euro investment that will significantly alter the Danish landscape. As a result of the land use change, a declining trend in nutrient emissions is expected. Land use change is also a major tool for reaching the climate goals of the Danish LULUCF sector (land use, land use change and forestry, 2023/839/EU) and the biodiversity targets of the EU Nature Restoration Law (2024/1991/EU).

Norwegian farms and rivers

In Norway, only 3.5 % of the country is cultivated. Norway is not a member of the EU, but the country transposed the WFD 2000/60/EC in 2006. Norway has also implemented the Nitrates Directive (91/676/EEC) in parts of the country that drain to the Oslo Fjord.

Norway has not implemented the CAP, but the country has its own regional system of subsidies for environmental measures (called the Regional Environment Plans). In addition to water protection measures, this financing covers activities to improve the cultural landscape and heritage, recreation, plant health, and climate emissions.

Given the high diversity of the country in terms of climate zones, soils and terrain, the agriculture also varies, and different regions therefore favour different measures. Cereal production is encouraged mainly in the south-east and mid-Norway, whereas animal husbandry and grass production are favoured in areas with less fertile soils (south-west, west, north and the valleys). In areas with cereal production, reduced tilling, including no-till in autumn, is regarded as one of the most important measures, along with cover crops and using fertilisers according to a plan based on the nutrient levels of the soil. In areas with animal husbandry, a new regulation is presently on hearing, where a major implication for farmers is a restriction on the number of animals based on the available area to spread the manure. For both systems, buffer zones and constructed wetlands are important measures to reduce the further transport of nutrients into and downstream in the watercourses.



Recently, new regional regulations on agricultural mitigation measures have been and are being issued as a response to the ecological disaster in the Oslo Fjord, caused by excess nutrient emissions from agriculture and sewage. New rules include requirements for **buffer zones** with grass cover (or in less critical areas, fields in stubble over winter) and **reduced tillage** especially near drainage systems and in flood and erosion prone areas. There are no regulatory or economic incentives to establish natural buffer zones with trees and bushes.

Traditionally, Norwegian mitigation measures have concentrated on reducing losses of P, since the clay-rich soils in the agricultural areas have high natural contents of P, and since P is the limiting nutrient for freshwaters. However, the ecological problems of the Oslo Fjord has caused a new interest also for N reduction measures. Reduced tillage and **cover crops** are important in this regard, as is **fertilizer planning**. Promising negative trends in P-concentrations and loads have been observed in Norwegian streams and lakes where environmental mitigation measures have been implemented for many years, especially in the south-east and south-west of the country. This indicates that if measures are implemented to a sufficient degree, and over a longer period of time, they will have the wanted effect. However, the **uptake of the measures closely follows the economic incentives**, as a short-lived regulation on reduced tillage clearly demonstrated: Implemented in 2009 in a few catchments, the regulation resulted in up to 80-90% of the fields being left in stubble over winter, but when the regulation was removed in 2013, more fields were ploughed in autumn.

Conclusions and recommendations

Promising examples and experiences from Finland, Denmark and Norway show how regulations and policies effectively change agricultural practices, leading to a declining trend in nutrient pollution. At the same time, the Nordic countries have implemented inconsistent regulations and policies where mitigation requirements have been introduced but then later removed.

Consistent, coherent and binding regulations and economic incentives are needed for reaching the good condition of all European waters, the climate targets of the LULUCF sector, and the biodiversity goals of the EU Nature Restoration Law.

The **land use change** from farmland to forests and wetlands will be significant in Denmark. Other European countries with major farmland percentages and even countries with much lower percentages may need to consider farmland use reforms. The conversion of forests and wetlands to farmland must be discontinued and reversed as forests and wetlands are vital for ecosystem condition and ecosystem services such as water retention, water quality, carbon sequestration, and carbon storage. **Animal husbandry** in vulnerable areas must be disfavoured and **fertilizer use** regulated to avoid excessive nutrient balances of agricultural lands. Binding rules on **cover/catch crops, no-till, and buffer zones** are urgently needed to avoid nutrient runoff to waters.

At the same time, **food consumption must transform to respect the environmental boundaries**. Europe must not externalize the environmental footprints of consumption to other countries. Only sustainably produced food must be exported from the EU and imported to the EU. Globally, food production and consumption systems must be understood as being limited by the local ecology at the production site as well as by the planetary boundaries and everyone's right to a healthy environment and a bearable climate.



NORDBALT-ECOSAFE

A Horizon EU project NORDBALT-ECOSAFE focuses on Nordic-Baltic region, in which an innovative methodology to quantify nitrogen (N) and phosphorus (P) sources and pathways to efficiently reduce nutrient emissions are developed. The project is a coordinated research action, and it includes activities to support the EU agencies and regions for future environmental planning and policies that foster a systemic shift towards a sustainable blue economy that is within safe nutrient boundaries.

The overarching aim of NORDBALT-ECOSAFE is to ensure that N and P concentrations and load remain within safe ecological boundaries and are reduced in water bodies in the Nordic-Baltic region. The project aims to develop and demonstrate innovative methods and establish best practices to improve river basin management and governance. The project develops advanced solutions to support regional governance to implement the most suitable mitigation and environmental measures to reach the safe ecological nutrient boundaries.

The NORDBALT-ECOSAFE consortium consists of eight institutes: the Finnish Environmental Institute (Syke), Aarhus University, Norwegian Institute for Water Research (NIVA), Norwegian Institute of Bioeconomy Research (NIBIO), Swedish University of Agricultural Sciences, University of Oulu, Warsaw University of Life Sciences, and Latvia University of Life Sciences and Technologies. The research is conducted in six river basins in Denmark, Norway, Sweden, Finland, Latvia, and Poland. The project reaches out to regional and national stakeholders at regional meetings in six catchments in the six partner countries.

This policy brief has been developed within the Work Package 6 “Governance models and policy tools”.

