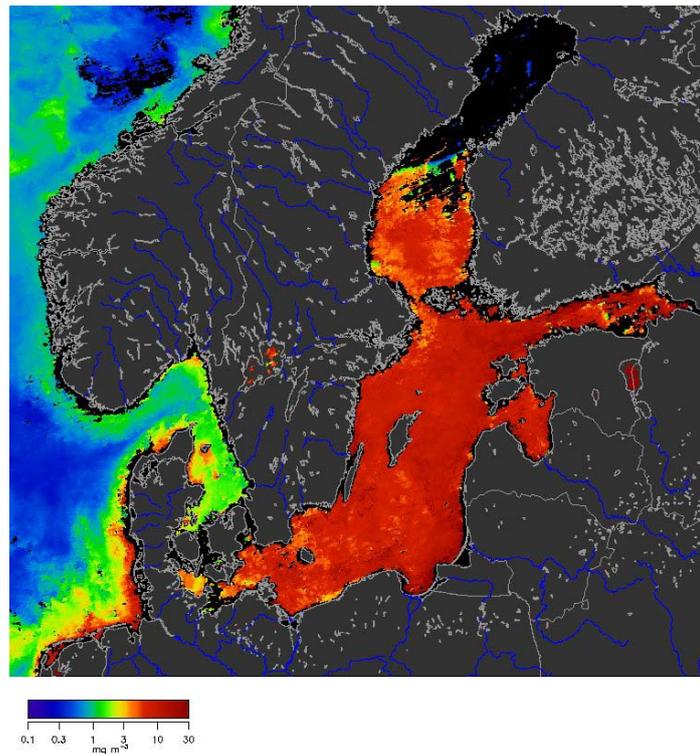


Impacts of nitrogen use in Finland

Key messages: Nitrogen is vital for our food production, and in its different forms nitrogen is important for the industry and our economy. However, excess reactive nitrogen is a problem, especially in near-pristine forests, such as those found in Finland since it threatens biodiversity and has a negative impact on ecosystems. The agricultural Baltic Sea region is also threatened from the release of nitrogen into the environment from farming activities although urbanization of the region is also predicted to contribute in the near future. These have an impact on the environment; both air and water quality. The use of good agricultural and forestry practices, sustainable fertilization and rational controls of emissions from traffic and combustion processes are a few of the key actions to control environmental quality in Finland.

- In Finland, boreal forest is the most extensive ecosystem, occupying over 200.000 square kilometres. Boreal forest ecosystems have a low natural level of nitrogen and atmospheric deposition of man-made nitrogen is a notable source of nitrogen to the system.
- Although this deposition is small in Finland compared to Central Europe and actually can it increase the productivity of the ecosystem (a positive response), the deposition may, however, alter or harm soil microbes, which have developed over thousands of years.
- Most of the reactive nitrogen deposited in Finland is from foreign sources. Nitrogen can travel hundreds or thousands of kilometers from the source in the atmosphere. The main source of nitrogen in the atmosphere is industrial combustion processes. Nitrogen deposition is the largest in Southern Finland and is one tenth of southern levels in Lapland.
- Nitrous oxide (N₂O) is a strong greenhouse gas, most of which is produced by soil microbes. In recent years N₂O accounted for one-tenth of the total greenhouse gas emissions in Finland. Emissions originate mainly from agriculture, industrial nitric acid production and from transport, mainly from catalytic converters.
- Emissions of N₂O from agricultural soils have decreased by 22% since 1990 due to reduced use of fertilizers and a decrease in the area of agricultural peat soils. However, N₂O emissions from transport are expected to increase due to the use of biofuels and those from industry are also predicted to increase from the growing number of fluidized bed combustion boilers. As a result, total Finnish emissions of N₂O are estimated to slightly increase during the period to 2020.
- The reactive gases nitrogen oxide and nitrogen dioxide (together NO_x), are emitted from combustion processes and traffic mainly in urban and industrial areas. Elevated atmospheric NO_x concentrations are harmful for health in urban areas, and in more rural downwind areas NO_x contributes to the formation of ground-level ozone, which is harmful for human health and vegetation. Even though atmospheric NO_x concentrations have decreased by 3% during the last 10 years, increasing number of diesel cars will increase emissions from traffic in the near future.

- Extensive drainage and fertilization of peatlands and fertilization of agricultural soils have lead to impacts on aquatic ecosystems in Finland. Improved knowledge, development of draining techniques, improvements and reduction of fertilization have decreased the nitrogen load to a fraction of what it was in the 60s and the 70s. Despite these improvements, however, the Finnish coast of Baltic Sea still has problems of excess nitrogen, leading to the formation of dead zones in Finnish coastal waters. Massive summer toxic algal blooms are driven by excess phosphorous in sea water with nitrogen-limited growing conditions, which favors the nitrogen-fixing algal cyanobacteria.



Map of Chlorophyll-a concentration in the Baltic Sea for July 2008
 showing the extent of marine algae
 (Source: <http://oceancolour.jrc.ec.europa.eu>)

- Eutrophication of the Baltic Sea is an international environmental threat and has economical and social impacts on Baltic countries. Three-quarters of the nitrogen entering the Baltic Sea comes from rivers and sewage outflows, whereas one-quarter of it comes from atmospheric deposition.

The amount of nitrogen entering the Baltic Sea from sewage outflows is decreasing. However, waste waters are an important source of nitrogen and phosphorous to the aquatic ecosystems. Approximately 25% of the nitrogen entering the Baltic Sea originates from municipal waste water treatment plants. Most of the nitrogen entering the Baltic Sea from diffuse sources comes from agriculture. This contribution is estimated to increase in the near future. Most of the nitrogen entering the Baltic Sea through atmospheric deposition is from transport such as shipping and from agriculture. This nitrogen deposition is predicted to increase with the increase of shipping and agricultural activities in the region.

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