STATE OF THE ENVIRONMENT REPORT 1/2017 | 21.3.2017

How well is water protected in the Land of a Thousand Lakes?

WATER RESOURCES

187,888 lakes
total area 33 350 km^2

336,000 km of shoreline

178,947 islands

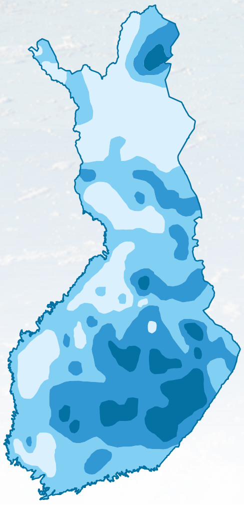
32,383 springs

647 rivers

Freshwater reserves

108,000 Mm^3/a

21,000 m^3/a/capita



Proportion of water in the area

Water protection measures in Finland have resulted in many success stories. But in many places nutrient loads from farmland, intensifying land use, climate change and chemicalisation are still reducing water quality, threatening aquatic biodiversity, and hampering the recreational use of lakes, rivers and the sea.

Our river basins and water bodies have been shaped by the ice age. The land that emerged from under the ice more than 10,000 years ago was characterised by many shallow hollows and valleys. Such features have given rise to our intricate indented coastline, and our thousands of lakes, rivers and islands.

Finland's many water bodies provide us with a wide variety of ecosystem services, including food, settings for recreation, clean water and high quality groundwater. Due to Finland's liberal rights of access to the land, everyone can quite freely enjoy our lakes and rivers. Recreational activities related to water are extremely popular. More than half of the population live within 500 metres of a river, lakeshore or seashore. In monetary terms, the recreational value of Finland's many lakeside and riverside second homes has been estimated at 1–1.3 billion euros a year.

Water protection measures have widely improved the quality of Finland's inland waters and the sea. Today about 85% of our lakes are either in good or excellent condition regarding their ecological quality. However, measures are still needed to improve water quality in about a third of our rivers.

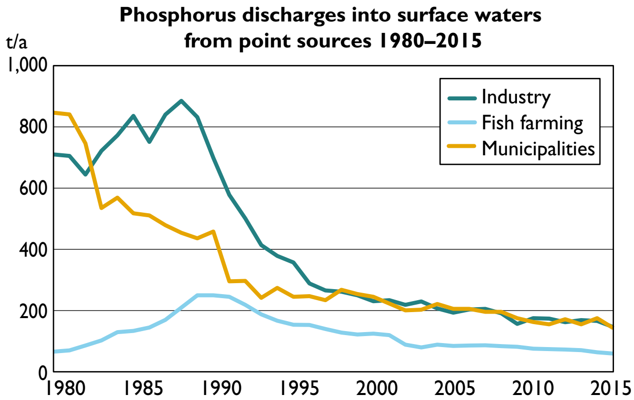
River basins are continuums, with loads in catchment areas also affecting coastal waters

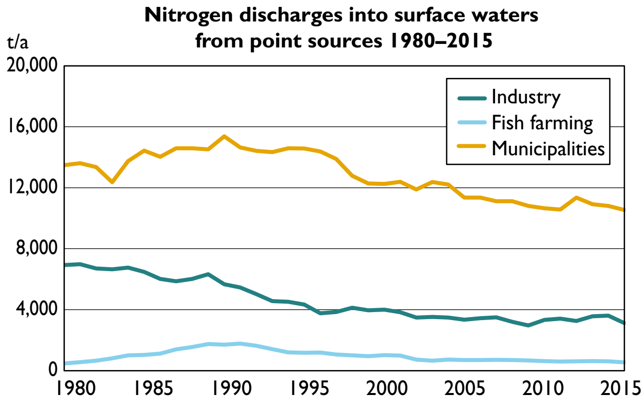
Nitrogen and phosphorus are the main nutrients causing eutrophication. Industrial nutrient emissions are today under control, but loads from agriculture are still significant – in places accounting for up to 80% of nutrient loads. Phosphorus is already effectively removed from municipal wastewater, but nitrogen removal is not yet sufficient.

With regard to loads from farmland, water protection measures have been extensively realised, and agri-environmental subsidies are widely received, but the situation is only improving slowly. Moreover, due to climatic trends, more nutrients are being leached from fields into lakes and rivers due to increased winter rainfall, more frequent snowmelt, and the shorter duration of snow cover. This reduces the availability of nutrients for crops and other plants, since nutrients are ultimately transported all the way to the sea, particularly in river basins with few lakes.

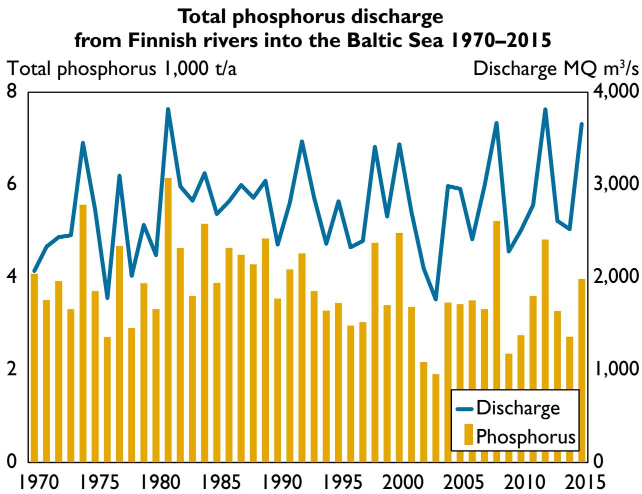
In inland waters, algal growth is limited by the availability of phosphorus. As all the available phosphorus is consumed by the algae, this leaves surplus nitrogen to be transported to the sea, where the situation is different. Algal growth in the sea is generally limited by nitrogen, so nitrogen loads generally have greater impacts in marine waters than in lakes or rivers. Nitrogen loads from rivers are exacerbating eutrophication in most of Finland's coastal waters, from the Bothnian Sea to the Gulf of Finland.

The ecological status of our coastal waters is mainly moderate or poor. River-borne nutrient loads particularly affect our innermost bays and archipelagos, but the generally poor state of the whole Baltic Sea affects all of Finland's marine waters. Recent reductions in wastewater loads from St. Petersburg have improved the state of the Eastern Gulf of Finland; but conditions in the Archipelago Sea are only improving very slowly.

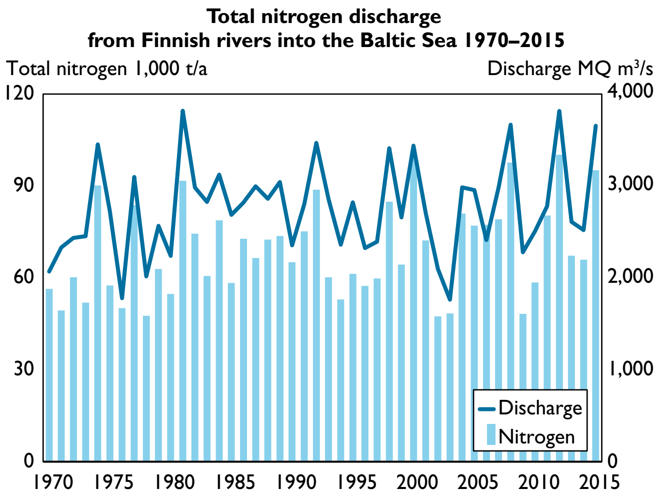




Progress has been made at many wastewater treatment plants, and the nutrient concentration limits required by the EU Wastewater Directive have been widely achieved, but total nitrogen loads still remain high. Source: The Compliance Monitoring Data system, VAHTI. 2017.



Most of the anthropogenic phosphorus load entering the Baltic Sea is transported by rivers. Nutrient loads are linked to changing weather conditions, and especially to water volumes in rivers. More nutrients are washed into water courses during years with higher precipitation than in drier years. Nutrient runoff has increased due to mild winter conditions since 2000, which have reduced the duration of winter snow cover. Source: Finnish Environment Institute SYKE. 2017.



Nitrogen mainly reaches the sea in river water, so nitrogen loads largely depend on river flow volumes. These flow volumes are greatly shaped by weather conditions, though climatic factors also have other impacts, since mild winters speed the decomposition of organic material, thereby increasing the leaching of organic nitrogen from soils. Figures for nitrogen loads are characterised by high annual variations. Source: Finnish Environment Institute SYKE. 2017.

Aquatic ecosystems threatened by climate change, intensive land use, and agricultural nutrient loads

Climate change, changing agricultural practices and other human impacts all influence nutrient loads and the state of aquatic ecosystems. In future, climate change is expected to lead to increases in both natural background nutrient loads, and loads from agriculture and forestry.

Climate change also influences the state of the aquatic environment through changing seasonal flow regimes, ice cover duration and water temperatures. The annual duration of snow- and ice-cover has decreased significantly in recent decades. Today Finland's lakes typically start to freeze over two weeks later than 100 years ago, while in spring their ice cover melts 1–1.5 weeks earlier. This phenomenon has many impacts on ecosystems in lakes.

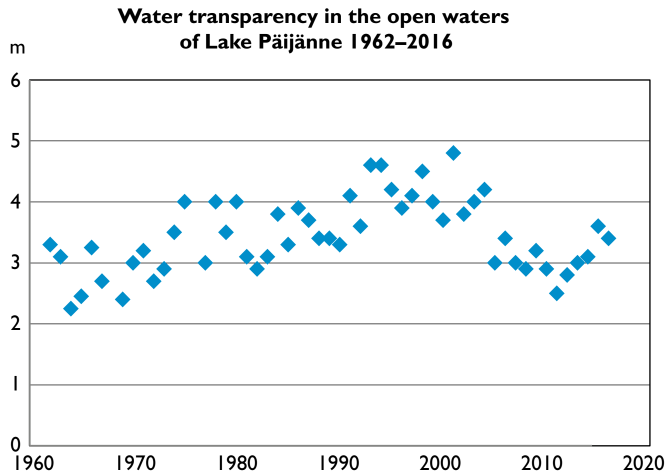
Additionally, in many lakes that earlier had clear water concentrations of organic matter have increased by as much as 20% over the last decade, making the water browner. This significantly impacts aquatic ecosystems, leading to declines in the abundance of aquatic plants and salmonid fishes that thrive in clear water, for instance. Organic matter and humic substances flowing from headwaters all the way to the sea also cause brownification and other qualitative deterioration in coastal waters.

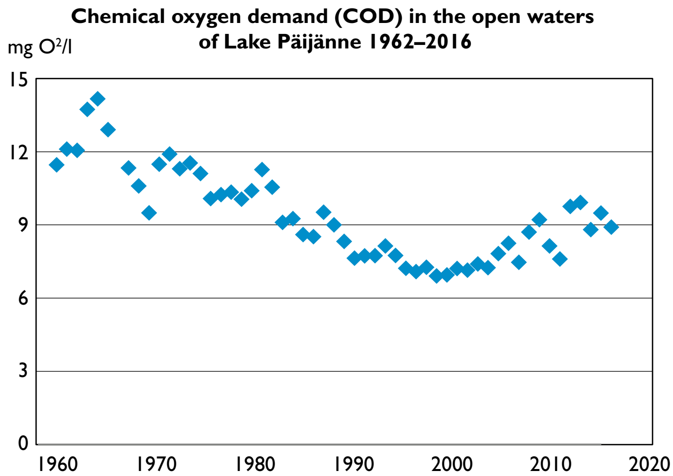
Climate change additionally impacts agriculture by prolonging the growing season, while also increasing the frequency of extreme weather events like droughts and floods. Crop yields may vary more than previously, and even be reduced in fields with poor drainage or soil conditions, or where the cultivated crop varieties are no longer well-suited to the changed climatic conditions. Most of the nutrients added to such fields in fertilisers will be washed into water courses. During dry seasons more water may be needed for irrigation than is locally available.

The prices of agricultural products and inputs are driven by the growing demand for food due to world population increases, changes in eating habits, and the impacts of climate change in major food producing regions. These prices also influence the decisions made on Finnish farms, such as what crops are profitable to grow, how much farms should invest in technology to improve yeilds, and what practices should be adopted to reduce nutrient loads. Subsidies provided to encourage agri-environmental measures also determine what is profitable from a farmer's perspective.

The intensified use of forests will also inevitably impact our waters, especially if insufficient attention is paid to land use planning. The new practice of harvesting entire trees, including branches and stumps, is particularly increasing the nutrient loads entering water courses.

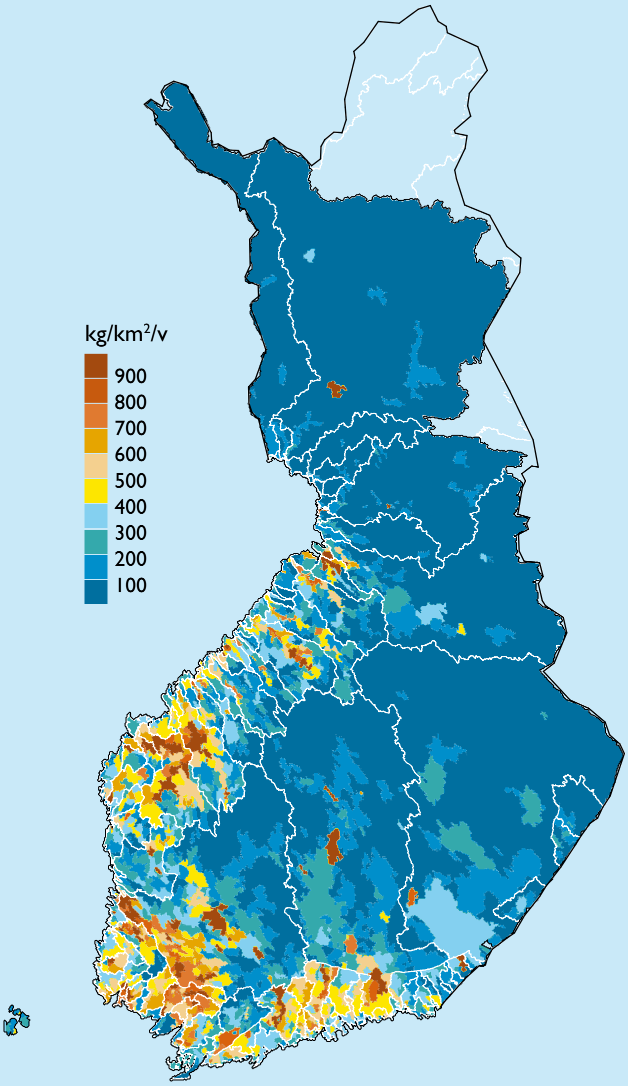
In recent years, issues related to water management in mining and the contamination of water bodies with chemicals and plastics have also arisen. Very little is yet known about the combined effects of higher concentrations of pharmaceuticals and other chemicals on aquatic life.





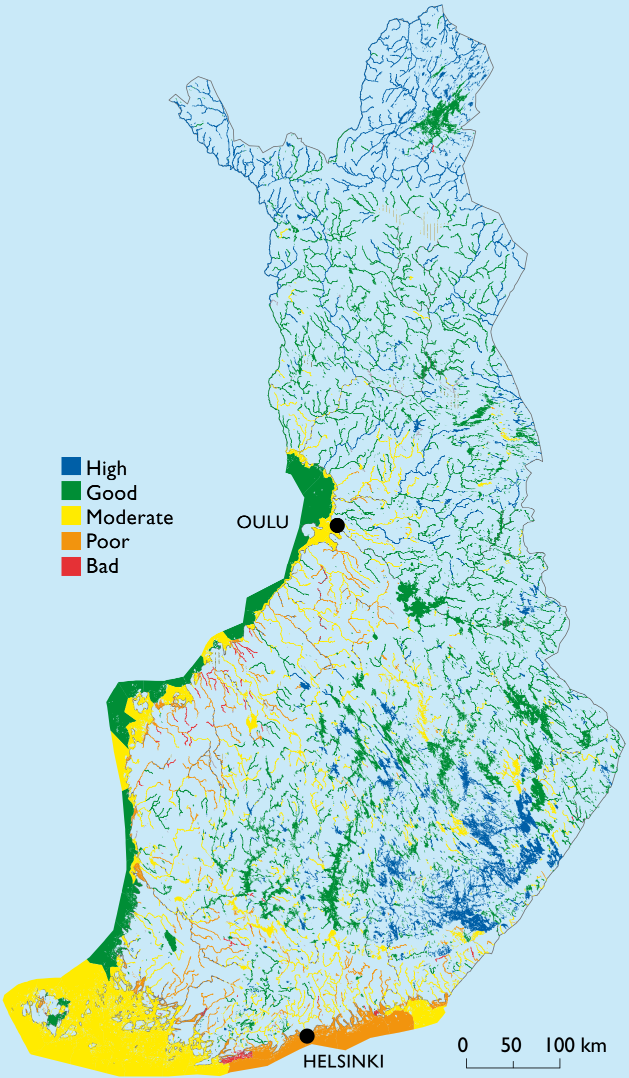
Trends in eutrophication and the concentrations of organic substances in the open waters of Lake Päijänne, as reflected in figures for water transparency and chemical oxygen demand, illustrate how conditions in Finland's inland waters have been changing. Reductions in wastewater loads led to gradual improvements in water quality until the early 2000s, when changing climatic conditions started to increase concentrations of organic substances, also reducing the productive water layer in open waters. Source: Finnish Environment Institute SYKE. 2017.

Anthropogenic nitrogen loads entering the Baltic Sea



Anthropogenic nitrogen loads entering the Baltic Sea, kg/km^2 per year (average specific load 2000–2013). Source: VEMALA model. Finnish Environment Institute SYKE. 2017.

Finland's surface waters by ecological status 2015



Most of Finland's surface waters are classified as having high or good ecological status. Waters with status lower than good include 35% of total river length, 15% of total lake area, and 75% of coastal waters by area. Source: The Assessment of the ecological status of Finland's surface waters 2015. SYKE, ELY Centers and Finnish Game and Fisheries Research Institute. Map: National Land Survey of Finland, permit number 7/MML/12.

Everyone in Finland wants our lakes, rivers and the sea to be in a good ecological state. This means we must limit the amounts of nutrients and chemicals entering aquatic environments due to human activities.

In practice, it also means that we must carefully consider the location and intensity of human activities also from the perspective of water protection. To facilitate this, the Finnish Environment Institute and the Natural Resources Institute are collaborating to develop tools that will help us to examine how climate change, measures in agriculture and forestry, the production of bioenergy and other human activities are affecting the ecological state and quality of our inland and marine waters. One such tool is a new river basin and coastal modelling system devised at the Finnish Environment Institute for use in evaluating the impacts of climate change and individual agricultural practices on aquatic environments.

Clean water as a precious natural resource is becoming scarce on a global scale. This problem increasingly lies behind many conflicts. Finland's world-class expertise on water monitoring, water resource management, water modelling and water protection is a highly exportable asset.

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