

Science for Environment Policy

Good water quality improvements in the River Seine – but more needs to be done to reduce nitrate pollution

Water policies at European and French national levels have led to a clear improvement in the water quality of the River Seine, a new study has found. A significant reduction in phosphate and ammonium pollution and increasing oxygen concentrations are evident. However, nitrate concentrations are still higher than the recommended level for good freshwater status, despite substantial reductions of surplus nitrogen in agricultural soils over the past few decades. The researchers recommend strengthening current agri-environmental management measures to help the river to return to a fully healthy status.

The River Seine is one of France's most important rivers. It drains a 76 260 km² catchment basin, containing heavily populated cities, such as Paris, and supports extensive industrial and commercial activities as well as intensively farmed [agricultural](#) lands. The river and its estuary have been profoundly modified over the last century by dykes, locks, dredging navigation canals for shipping, sediment removal in the estuary harbours and construction of flood defences.

Changes in the structure of the river together with high levels of pollution from human activities have severely affected the quality of the Seine's water — a story repeated for many other European rivers.

In response, European policies to reduce water pollution and improve freshwater quality have been put in place. These policies include the [Nitrates Directive](#)¹ (reducing nitrate pollution from agricultural sources) and the [Urban Waste Water Treatment Directive](#)² (protecting the environment from industrial and domestic sewage pollution), both of which came into force in 1991, the [Integrated pollution prevention and control Directive](#)³ of 1996 (updated in 2008, further controlling pollution from a wide range of industrial plants), and the [Water Framework Directive](#) (WFD)⁴ of 2000, which aims to ensure surface freshwater and groundwater bodies reach 'good ecological status' by 2015.

Comprehensive records from monitoring stations along the Seine are available from the 1970s. These records offer a unique view of how European and French national water quality policies have influenced the Seine's water quality.

Based on records from 45 stations (22 in the estuary and 23 upstream from the estuary to Paris) and river-flow data from national authorities, researchers have investigated seasonal and long-term trends of phosphate, ammonium and nitrate nutrients, as well as oxygen and chlorophyll levels (as a measure of algae biomass) in the River Seine from 1970 to 2014. They established a picture of the river's health using [European Environmental Quality Standard](#) (EQS) concentration ranges and related WFD surface-water status categories (bad, poor, moderate, good and high) for each of the investigated elements.

Remarkable improvements in water quality have been seen, driven mainly by reduced phosphate and ammonium loads reaching the river. This has been reflected in higher oxygen and lower chlorophyll levels and an almost total absence of summer algal blooms in the estuary.

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Contact:
estela.romero@upmc.fr

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1. The Nitrates Directive (91/676/EEC) <http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:31991L0676>

2. Urban Waste Water Treatment Directive (91/271/EEC) <http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:31991L0271>

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3. Integrated Pollution Prevention and Control Directive (96/61/EEC) <http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A32008L0001>

4. The Water Framework Directive <http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32000L0060>

Phosphate and ammonium levels were classified throughout the year as 'good' or 'high' more than 85% of the time after 2010, compared with just 9% of the time for phosphates and 20% for ammonium in the 1970s. This, say the researchers, shows the positive impact of measures to reduce point sources of pollution from wastewater treatment plants (ammonium mostly comes from urban sources) and a ban on phosphates in detergents.

In contrast, nitrate levels, which mostly come from diffuse agricultural sources, have increased by 150% since the 1980s. This is despite over 20 years of regulations aimed at reducing nitrate pollution from diffuse agricultural sources, which have effectively lowered surplus nitrogen levels in the soil from 65 kg of nitrogen per hectare in 1990 to around 45 kg per hectare in 2012. Only recently have there been signs of improvement. In 2011, half the nitrate levels were classified as 'moderate' and half as 'poor', but by 2014, almost 70% of levels were classified as 'moderate' and 30% as 'poor'.

The researchers say that either current regulations have failed to curtail diffuse nitrate pollution, or that the ability of groundwater to retain nutrients for decades before they are released into the river might be slowing down progress in tackling nitrate pollution.

This study also revealed that although freshwater policies have substantially improved the river water quality, extensive alterations have damaged the estuary's capacity to retain nutrients and reduced nutrient contamination of coastal waters.

Overall, this study shows that good progress has been made in improving the condition of the river. Nevertheless, excessive nitrate levels are preventing the river from achieving 'good ecological status' in terms of its nutrient levels, as required by the WFD. To ensure the river is restored to good health, the researchers call for stronger measures to manage nitrate pollution, including: less intensive agricultural practices; the expansion of organic farming; planting more diverse crop rotations; improved manure management; and restoring ponds that will retain nutrients.

