... and economically feasible?

NITROLIMIT

Nitrogen limitation in freshwaters –
Is nitrogen reduction ecologically meaningful and economically feasible?

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b-tu Brandenburgische Technische Universität Cottbus

KOMPETENZZENTRUM WasserBerlin

TECHNISCHE UNIVERSITÄT DRESDEN

bfg Bundesanstalt für Gewässerkunde

IGB

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Design:

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NITROLIMIT

Nitrogen limitation in freshwaters

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FONA Sustainable Water Management BMBF

Is nitrogen reduction ecologically meaningful ...

Nitrogen limitation in freshwaters

Is nitrogen reduction ecologically meaningful and economically feasible?

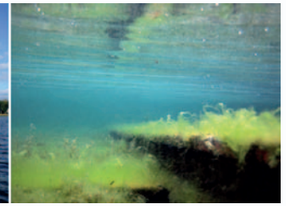
Background

In the summer, we love to dip into cool, clear lake water to relax and regain energy. But just how good is the water quality of our lakes and rivers?

High nutrient concentrations stimulate the growth of algae in many lakes. As a consequence of high algal biomass the water can become murky, oxygen-deficient and malodorous. The affected lakes are rather unappealing to humans and unsuitable as a habitat for many plants and animals.

Phosphorus is widely considered the primary determinant of algal biomass in lakes, i.e., the lower the phosphorus content, the lower the biomass of algae. Control measures have therefore been aimed at the reduction of phosphorus loads. These measures have improved the ecological status of some but by no means all lakes.

Nitrogen has also to be considered as a control factor for algal growth. Consequently, additional requirements are now in place to reduce nitrogen discharges to improve water quality. However, a lack of scientific evidence has made it impossible to analyze the actual efficacy or cost of implementation of this strategy thus far.

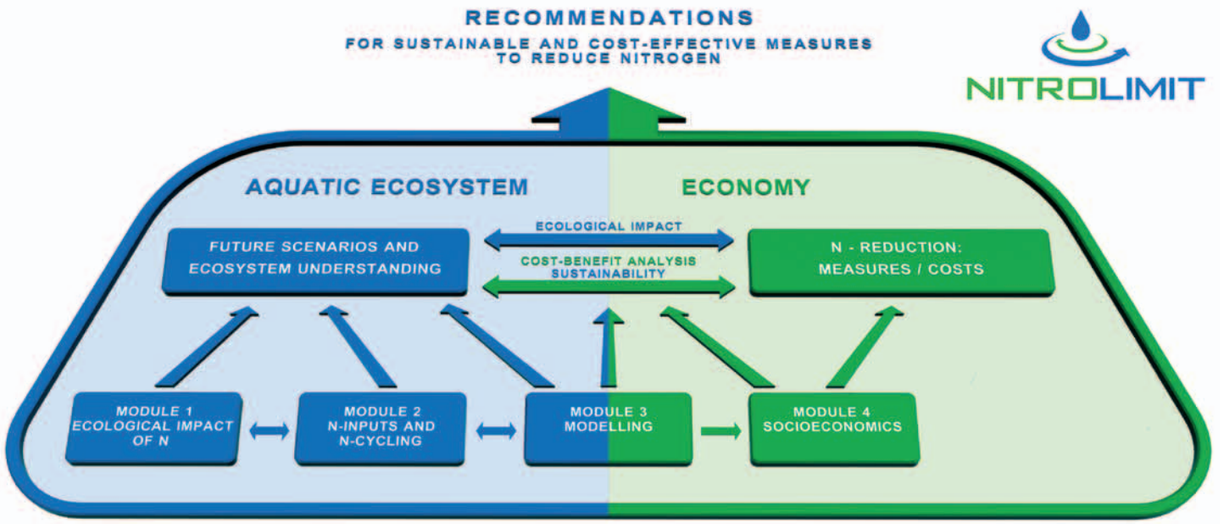


Goals

NITROLIMIT aims to provide a sound scientific basis of information on the origin, fate and effects of nitrogen in freshwaters, and to analyze the costs and benefits of nitrogen reduction measures. Solutions to improve the water quality will be developed and recommendations for sustainable water management will be proposed.

Project structure

NITROLIMIT is launched as the first comprehensive research endeavor of a multidisciplinary team of scientists from seven research institutions to answer the question: Is nitrogen reduction ecologically meaningful and economically feasible?



Modul 1 – Nitrogen as a control variable of phytoplankton

- Development and statistical analysis of a nationwide database of nutrient concentrations and phytoplankton biomass
- Field studies on seasonal regulation of phytoplankton in five model lakes and rivers
- Experiments of phytoplankton growth limitation by nitrogen (N) and phosphorus (P)
- Nutrient competition between phytoplankton and aquatic plants
- Reduction of phytoplankton by zooplankton and shellfish

Modul 2 – Quantification of nitrogen inputs and cycling

Inputs

- Nitrogen input from the atmosphere
- Fixation of molecular N2 by cyanobacteria
- Release of ammonium (NH4) from the sediment

Internal cycling processes in water bodies

- Nitrification (oxidation of ammonia to nitrate)
- Denitrification (conversion of nitrate)
- Anammox (anaerobic oxidation of ammonium to N2)
- Release of N2O (laughing gas)

Coupling of N and P cycles

- Effects of nitrate on phosphorus release from sediments

Nitrogen balance

Modul 3 – Ecosystem modelling

Integration of Module 1 and 2 results in existing models depicting the status of the surface waters

- Nutrient inputs from catchment areas (MONERIS)
- Ecological model for lakes (SALMO)
- Ecological model for rivers (QSim)

Model simulations

- Accounting of sources and paths of nutrient inputs
- Identification of key processes and control variables
- Simulation of measures to improve water quality

Modul 4 – Socio-economic analysis

- Catalog of measures and costs for nitrogen reduction
- Analysis of the social benefits of improved water quality
- Comparison of costs and benefits of combinations of different measures
- Scenario analysis (MONERIS)
- Life cycle assessment (ecobalance)
- Population surveys (recreational use of surface waters; choice experiments)
- Cost-benefit analysis

Model lakes and rivers

This research is being conducted at five lakes and rivers representative of the common surface water types in Germany

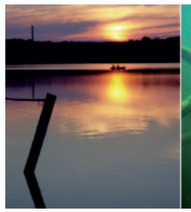
- Stably stratified deep lake (Scharmützelsee)
- Periodically stratified lake of average depth (Müggelsee)
- Very shallow mixed lake (Langer See)
- Riverine lake (Havel)
- Large river (Elbe)

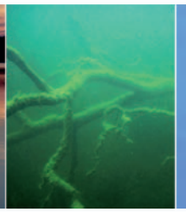
Other surface water types will be included in our analysis of the nationwide database.

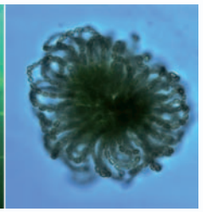
Partners

The project will be conducted by a multidisciplinary team from seven research institutions

- Brandenburg University of Technology, Department of Freshwater Conservation, Bad Saarow and Department of Water Treatment Biotechnology, Cottbus
- Federal Institute of Hydrology (BfG), Koblenz
- Kompetenzzentrum Wasser Berlin gGmbH (KWB)
- Leibniz Institute of Freshwater Ecology and Inland Fisheries (IGB), Berlin and Neuglobsow
- Technische Universität Berlin, Institute for Landscape Architecture and Environmental Planning
- Technische Universität Dresden, Institute for Hydrobiology







Collaboration

NITROLIMIT is carried out in close collaboration with a range of associated partners. The Berlin Senate and Berliner Wasserbetriebe support the applied research in this project to a significant extent. Members of the federal and state water task force (LAWA) contribute to the development of the nationwide database.

Stakeholders from the German states, municipalities and water industry will be informed about the contents and results of the project in stakeholder workshops where nitrogen reduction measures will be discussed.

For further information:
www.nitrolimit.de