

Towards spatially differentiated regulation of nitrogen

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In Denmark, 2/3 of the nitrate leaching from the root zone is removed by natural degradation before it reaches the estuaries but with large spatial variation. For more cost-effective regulation we must be able to separate areas with high and low natural retention and include this information into models utilised for national regulation.

Background

Despite a nearly 50 % reduction in nitrate leaching from the root zone due to enforced regulation of nutrient emission from agriculture since mid 1980s, additional reductions are required in Denmark to meet the objectives of the EU Water Framework Directive.

Achieving such abatements by uniform restrictions for all areas would be very costly and inefficient as studies have shown that reduction varies spatially depending on the local hydrogeological conditions, the presence and dynamics of drains and hydro-biogeochemical conditions in associated riparian lowlands.

More cost-effective regulation may be developed by targeting restriction to areas with low natural nitrogen reduction.

Objectives

to *improve* our understanding and *develop* the scientific foundation, field technologies and modelling concepts for cost-effective quantitative assessments of nitrate transformation at various landscapes required for *spatially differentiated regulation*

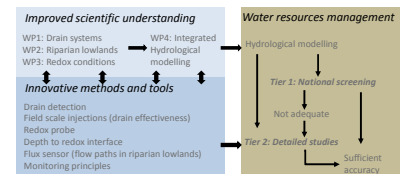
Stakeholder involvement

Local stakeholders will be involved in developing new concepts for emission based regulation allowing local scale data and observations in future national regulations

Supporting regulation

TReNDS supports a two-tiered approach in regulation:

1. National screening based on existing data, but improved modelling concepts integrating knowledge on drain and lowland flow dynamics
2. Local assessments by utilizing new innovative and cost-effective methods and tools.

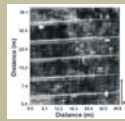


The TReNDS project will elaborate research issues as:

Drains

Improve the detection and understanding of the impact of drainage systems on nitrate transport for different hydrogeological settings

- **Location:** GPR, DualEM, Aerial, Existing GIS data
- **Dynamics:** Tracer test, drain discharge, hydrological modelling



Emission based regulation

Develop new concepts for inclusion of local scale emission data and knowledge in future regulation:

- Observations on nitrogen emissions from individual fields in local management
- New mitigation measures
- Identify low-tech, low-cost instruments for local scale observations
- Collaboration with stakeholders

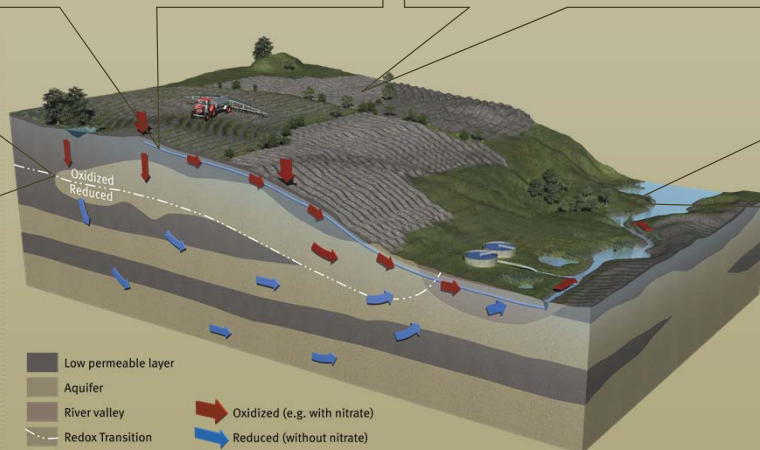
Subsurface redox conditions

Approximately 50 % of nitrate is reduced in the subsurface depending on local redox conditions:

Develop and test a tool for local scale measurements of *redox* conditions



Develop a methodology for establishing a high resolution map of the redox interface



Riparian lowlands

Improve the understanding of the source-sink functioning of riparian lowlands as hydro-bio-geochemical transformation zones:



- Identify major flow paths
- Hydro-biogeochemical nutrient transformation

Two study sites: one sandy and one clayey area

Combining field studies and detailed hydrological modelling

Hydrological modelling

Develop upscale approaches for the utilisation of local scale processes in catchment and national scale hydrological modelling

- Detailed process modelling at field scale
- Catchment scale modelling with upscaling approach
- Advancing concepts for national scale modelling

For more info:

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Municipality of Odder



Danish Nature Agency