



Groundwater under threat: Tackling nitrate pollution from agriculture for a sustainable future – a Slovak and EU perspective

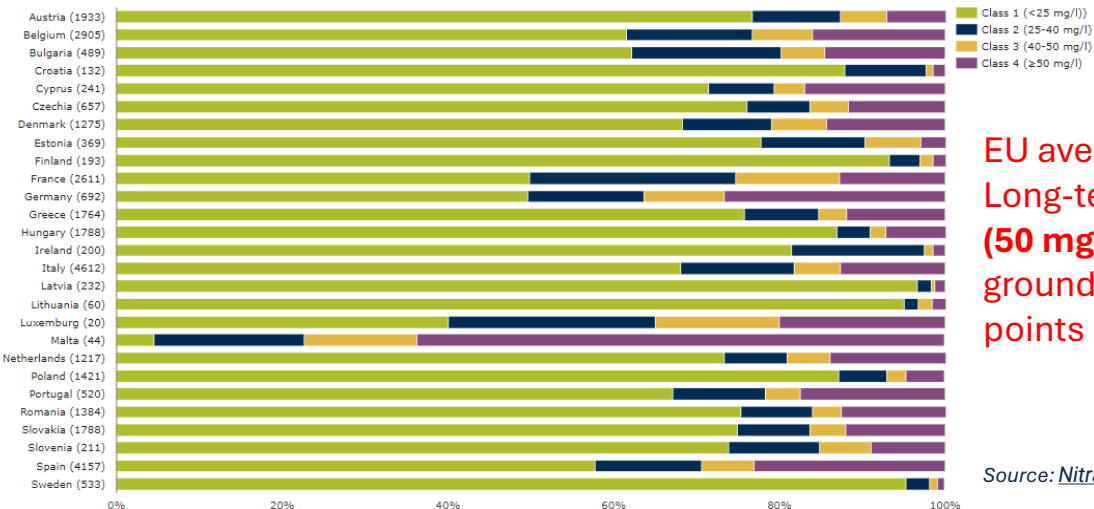
K. B. Pilátová (WRI)

**Webinar, 2nd April 2025
10.00 – 11.00 AM**

Groundwater pollution in EU - Nitrate

- EU countries report a long-term problem with groundwater pollution by nitrates (EEA, 2023);
- 80% of water pollution by nitrates comes from agriculture (EEA, 2023);
- Consequences of increased nitrate concentrations: water eutrophication and impact on human health.

Chart



EU average:
Long-term **exceedances**
(50 mg/l) in 14.1% of all
groundwater monitoring
points

Source: *Nitrates Directive reporting period 7 (2016-2019)*, Joint Research Centre



Agriculture in Slovakia

Quick overview

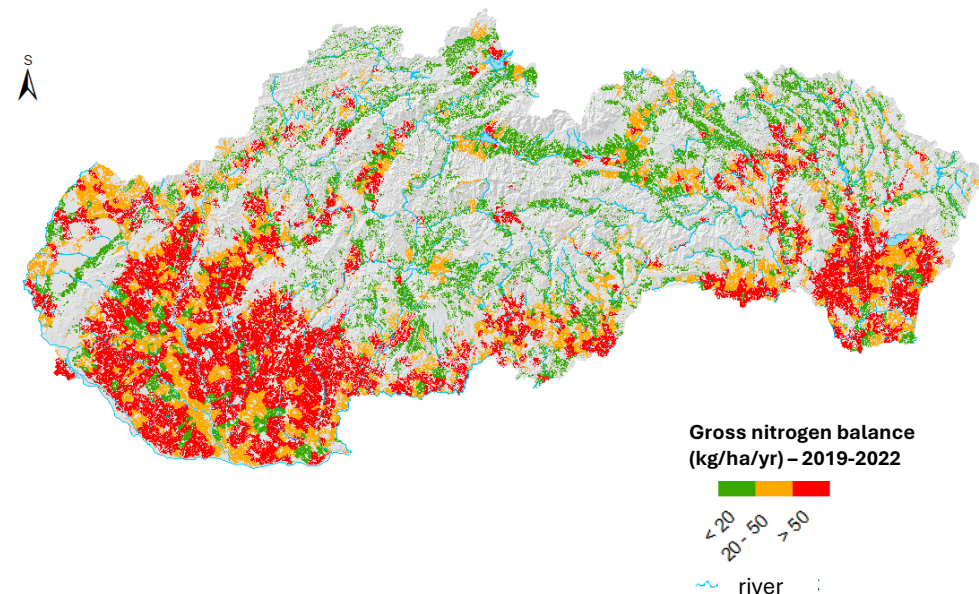
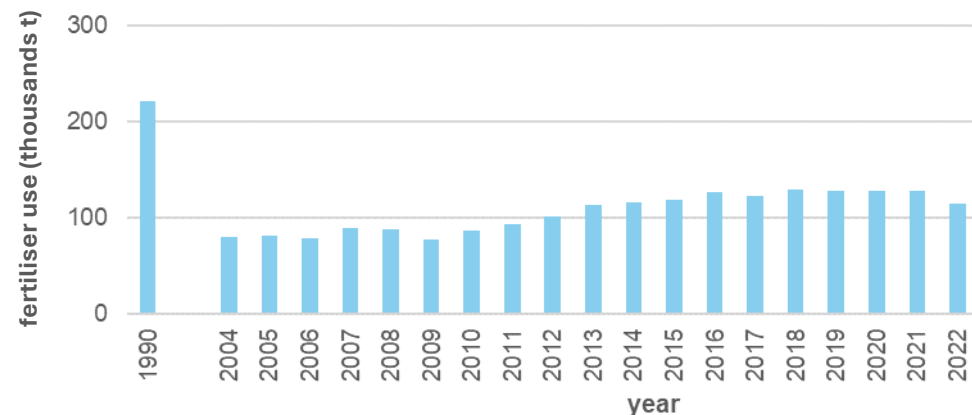
Fertilisers use

- Decrease of fertilisers use since 1990's
- From 2009 to 2018 slow increase

Gross nitrogen balance

- Gross nitrogen balance (34,6 kg/ha) below EU average (~ 50 kg/ha)
- Areas with higher nitrogen surplus also with higher NO₃ gw concentrations

N balance
34,6 kg/ha/yr



Groundwater quality - SK

Key facts

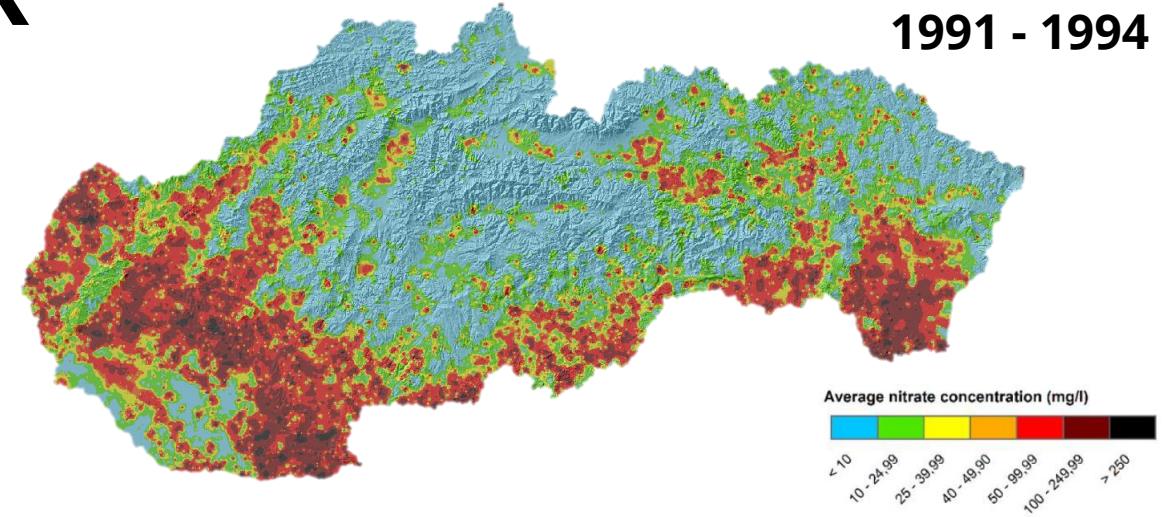
- GW quality **improvement** since 1990's
- over past decade little improvement
- **cca.12 %** of all monitoring boreholes - NO₃ **above 50 mg/l** -long term
- the worst situation in the Podunajská pahorkatina hills, where nitrate concentrations have remained elevated or even increased

Denser monitoring network (2008, 2019-2023)

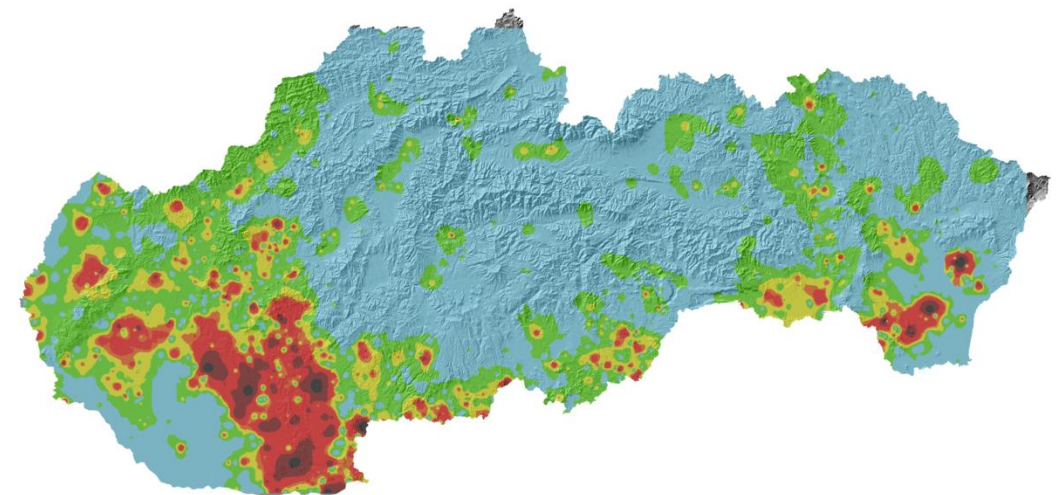
- more accurate delineation of pollution hotspots
- the need to tackle extremely polluted areas (in black)

average nitrate concentrations in gw

1991 - 1994



2008 - 2011



Implementation of Council Directive 91/676/EEC (Nitrates Directive)

Accession of
the SR to the EU



Implementation
91/676/EEC

The aim of this Directive is to:

- reduce water pollution caused or induced by nitrates from agricultural sources;
- prevent further pollution of this kind;
- harmonise MS and increases comparability of results/measures.

Main requirements resulting from the implementation of the NiD:

Designation of nitrates
vulnerable areas and
their revision

National Action
Programme

Code of Good
Agricultural Practice

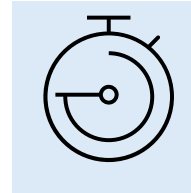
Groundwater and
surface water quality
monitoring to monitor
the effectiveness of the
implemented measures

Reporting on the status
of implementation of
Council Directive
91/676/EEC for
4-year periods

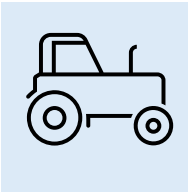
Council Directive 91/676/EEC - limitations



**Varying implementation
between MS**



Time lag in the unsaturated zone



**Pressure from farmers to maintain
crop yield**



Monitoring : complexity and high cost

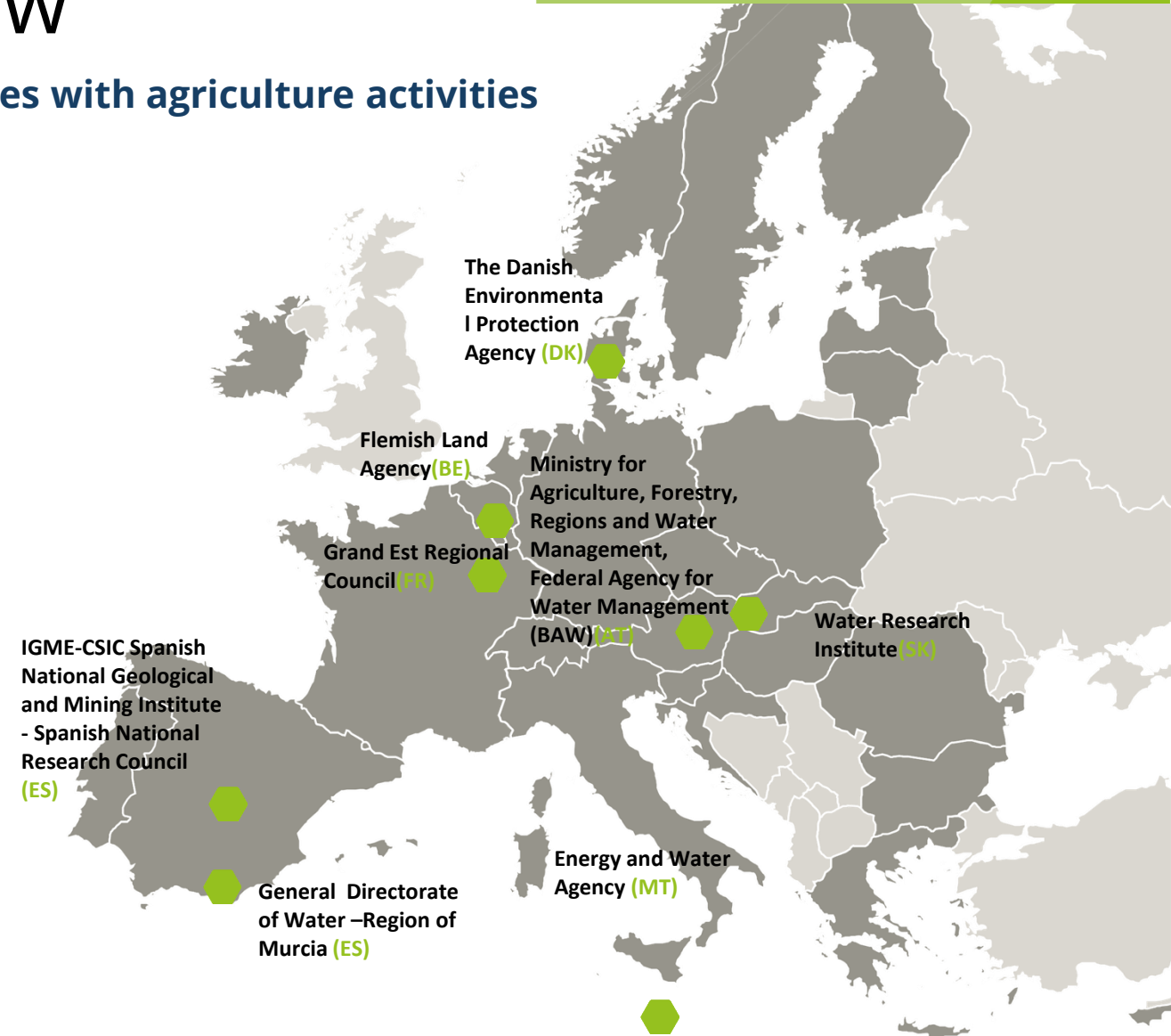


Out of date - does not yet reflect the technical innovations and research

GEMS overview

Groundwater management in nitrate vulnerable zones with agriculture activities

- 8 partners/ 7 countries
- 2024 - 2028
- Different climate, natural conditions
different approaches to tackle high nitrate
concentrations in groundwater



GEMS – the main objectives

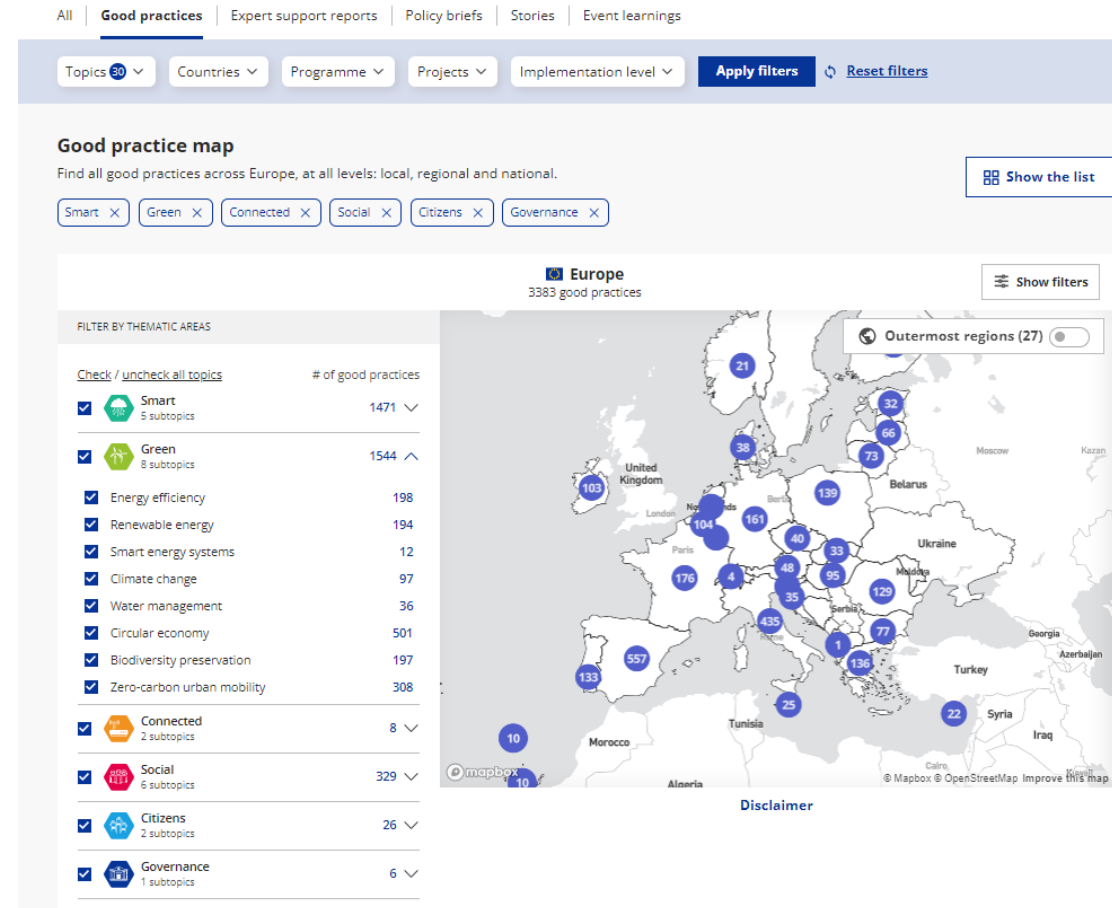
- Improve regional public policies to support groundwater quality improvement and sustainable groundwater management in the NVZ i.e. **more effective implementation of the Nitrates Directive**;
- **Improve knowledge** and capacity building of reg. **public authorities** through stakeholders' group;
- Identify and adopt **technical innovations** and **successful examples of best practices** in the regions to improve policy instruments.



GEMS – outcomes

- Policy improvements (SK –NAP)
- Good Practices (share and transfer)
 - (i) Data and monitoring**
 - (ii) Groundwater quality and pollution**
 - (iii) Policy Governance and stakeholders' engagement
 - (iv) Integrated water management and adaptation to climate change

**Total of
28
examples
GP**



EXAMPLE of GP 1 by WRI

Objectives

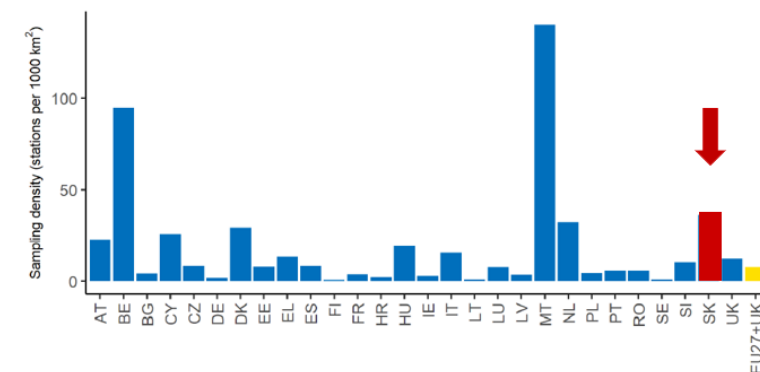
- To improve an understanding of **spatial variation of nitrate pollution** in groundwater caused by agricultural activities – drilling No. **1146 monitoring BHs** to target pollution from agriculture.
- To **identify** the nitrate concentration **hotspots**
- To execute more **precise delineation of Nitrate Vulnerable Zones (NVZ)**



Implementation

- **WRI map portal** development
<https://imon.vuvh.sk/>
- „**Early warning system**“ established 2021
- **NVZ were revised** in 2016 and 2020, already decreased of total NVZ area by 15%

Mon.
network
4,2M. €
2017 - 2023

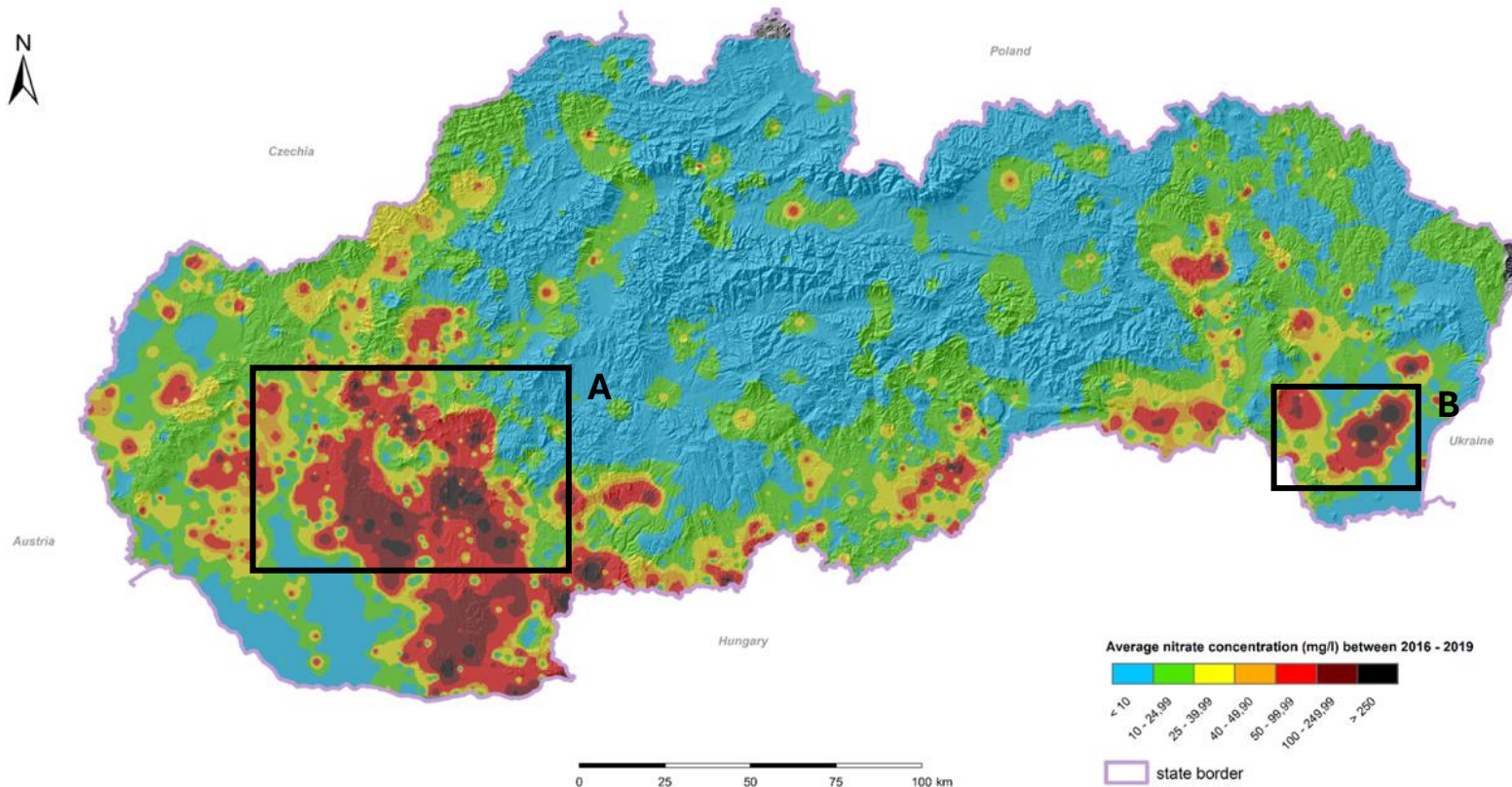


Improved understanding of spatial distribution of pollution from agriculture

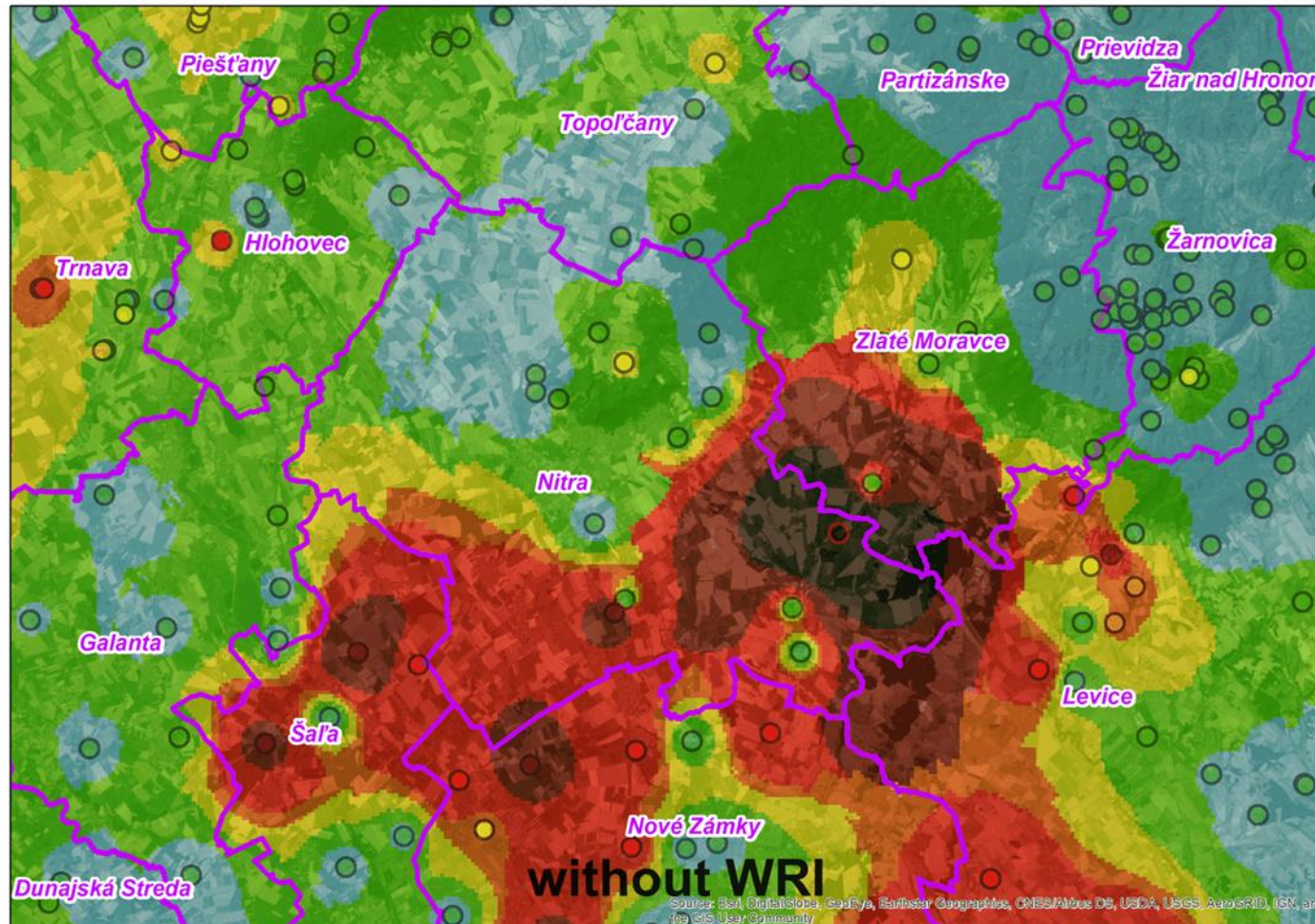
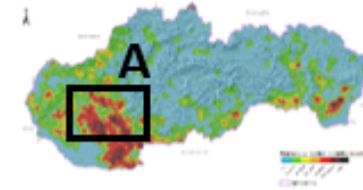
IDW model: Nitrate concentration in groundwater

WRI monitoring helps:

- A. Find new polluted locations
- B. Refine existing polluted locations



Finding new polluted locations



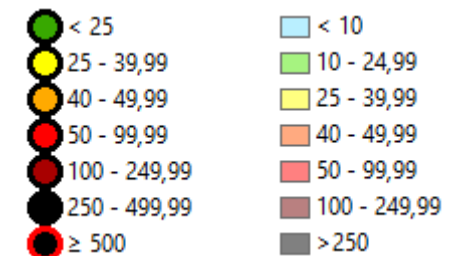
IDW model without WRI wells

- Previously districts: Topoľčany, Hlohovec and Galanta without high concentration of nitrate.

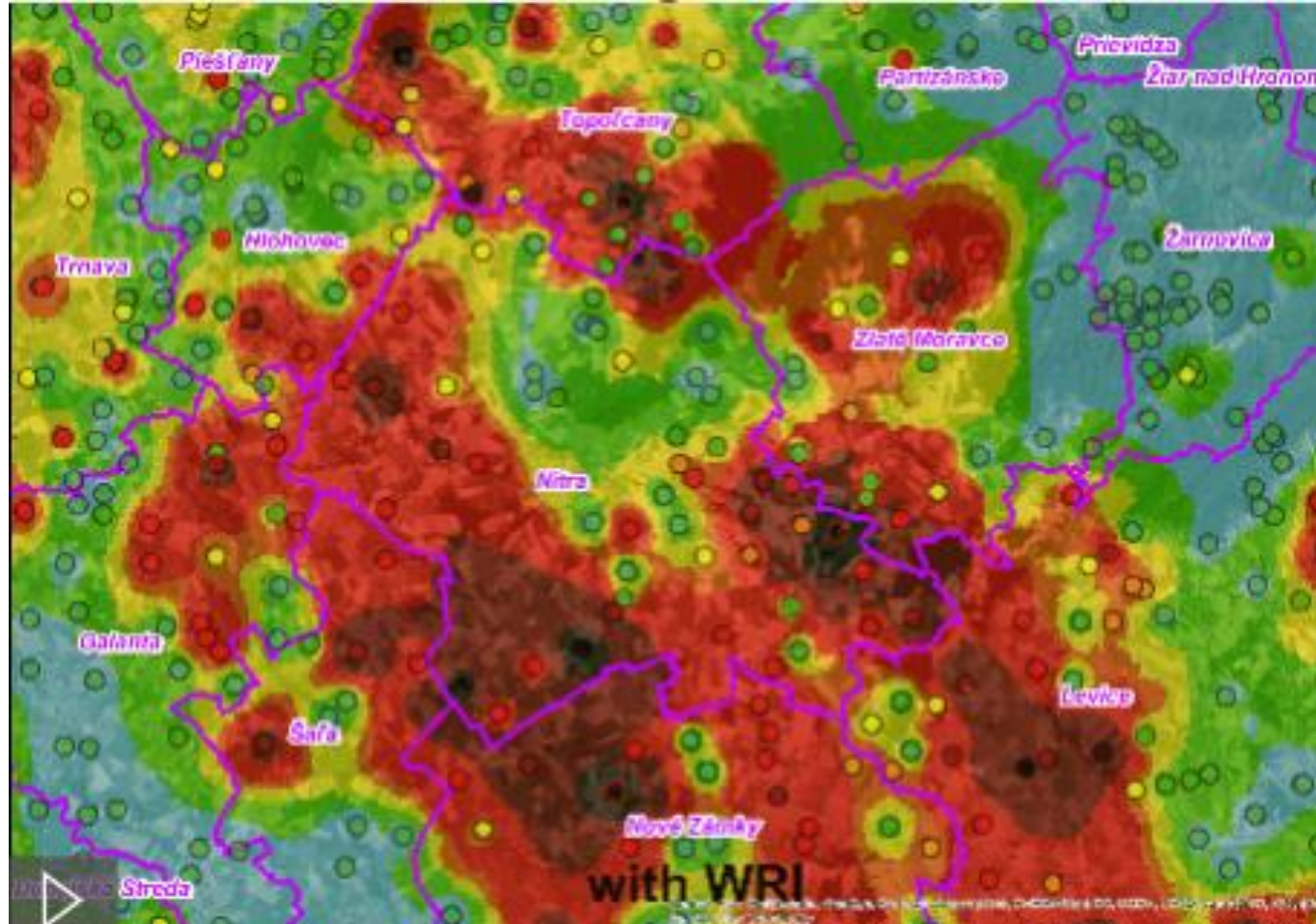
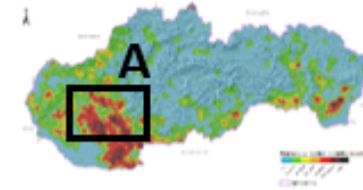
IDW model with WRI wells

- Refinement of pollution in the districts of Nitra and Zlaté Moravce
- "Finding" pollution in the districts of Topoľčany, Hlohovec and Galanta.

Average nitrate concentrations in gw
(mg/l) for the period 2016 - 2019



Finding new polluted locations



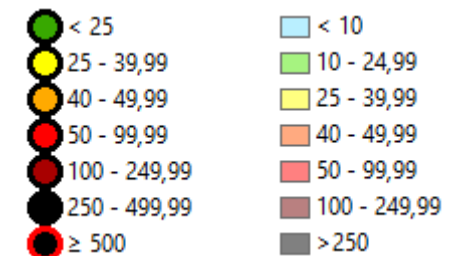
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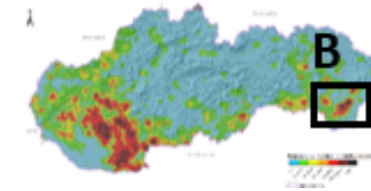
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Refinement of existing polluted locations



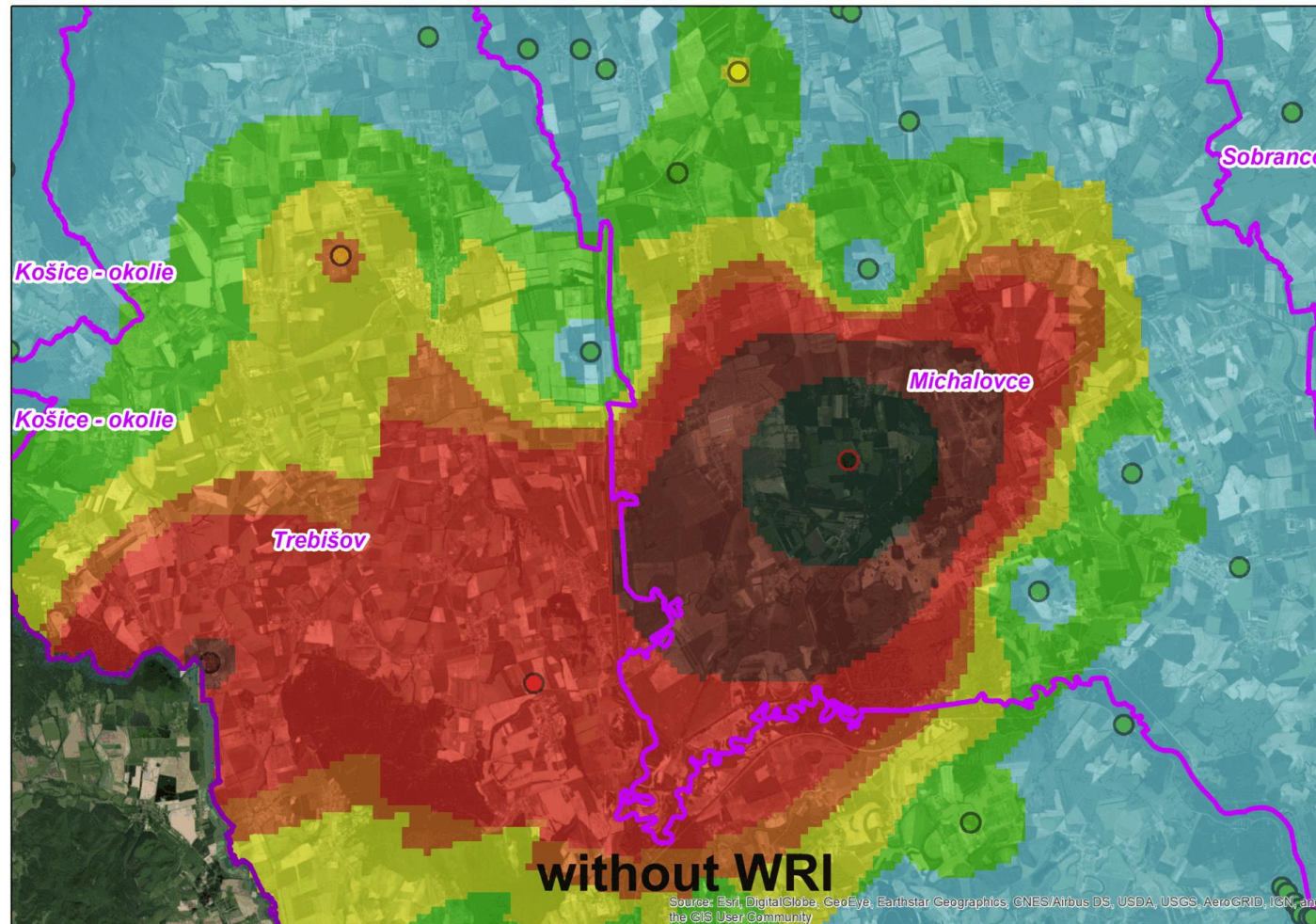
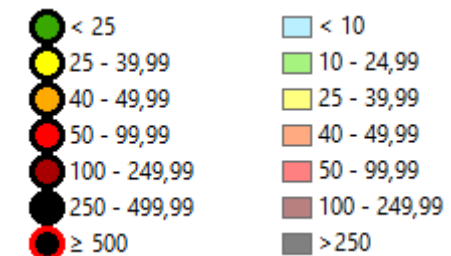
IDW model without WRI wells

- Significant water pollution in the Trebišov district
- Partial pollution in the Michalovce district

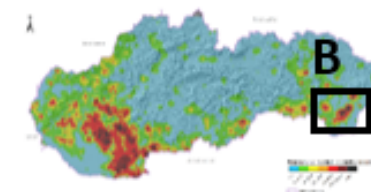
IDW model with WRI wells

- Refinement of pollution in the districts of Trebišov and Michalovce

Average nitrate concentrations (mg/l)
for the period 2016 - 2019



Refinement of existing polluted locations



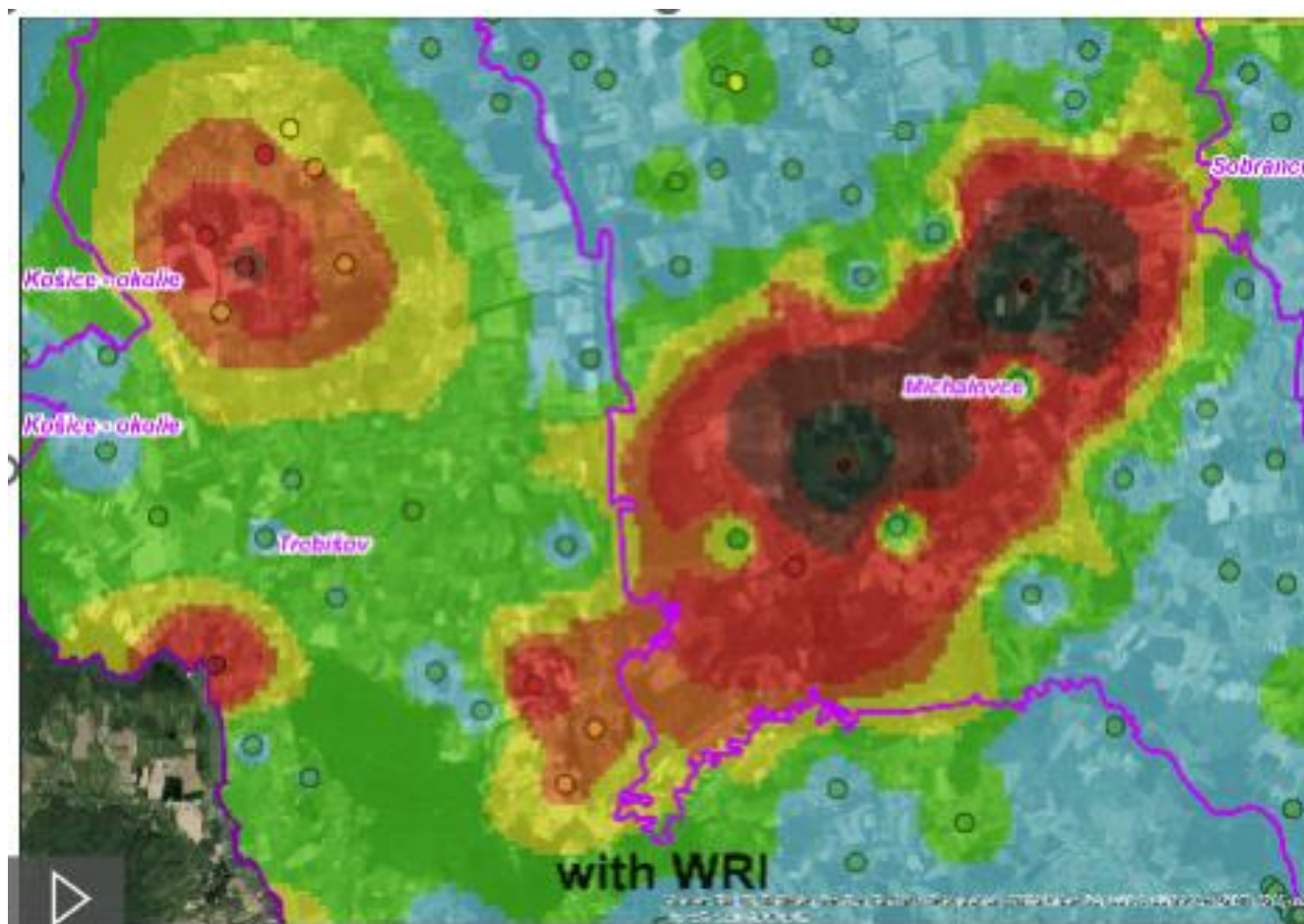
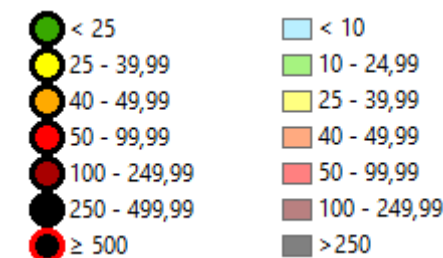
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IDW model with WRI wells

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Average nitrate concentrations (mg/l)
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Social networks and project info.



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GEMS

**GEMS - Groundwater management
in nitrate vulnerable zones with
agriculture activities**

🌱 GREEN Water management

Project summary

A few numbers

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Project summary

GEMS aims at enhancing regional public policies in Europe regarding sustainable groundwater management polluted by high level of nitrates from agricultural sources. The European Environment Agency (EEA) estimates that Europe exceeds the nitrogen leakage limit by 3.3 times and phosphorus leakage limit by 2 times.

Several EU countries report poor water quality in their territory and a systemic problem in managing nutrient pollution from agriculture and others have critical points where pollution is not adequately addressed. A high level of nitrate makes water unsuitable as drinking water. In rivers, lakes and marine waters, nitrogen and other nutrients stimulate the growth of algae. As a result, there is an urgent need to adopt additional measures to achieve the Nitrate Directive objectives and to improve public policies to support these efforts. GEMS will work and explore the best practices in EU regions on the following topics: Data and monitoring, groundwater quality and pollution, policy, governance and stakeholders' engagement and integrated water management.

GEMS partnership is composed by 8 public authorities with vast experience and knowledge about groundwater management and problems related with high level of nitrates:

- LP1 - Region of Murcia (DG Water) (ES)
- AP2 - Spanish Geological and Mining Institute (as advisory partner) (ES)
- PP3 - Energy and Water Agency (MT)
- PP4 - the Danish Environmental Protection Agency (DK)
- PP5 - Water Research Institute (SK)

Thank you

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