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GEMS

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.

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

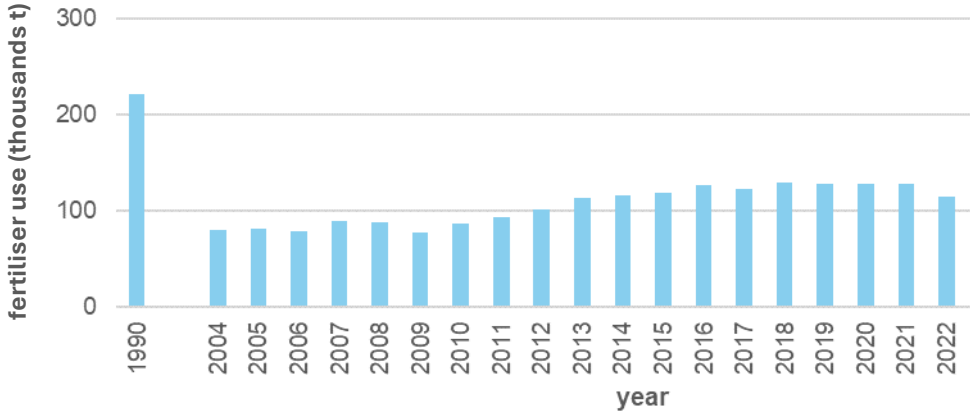
Quick overview

Fertilisers use

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

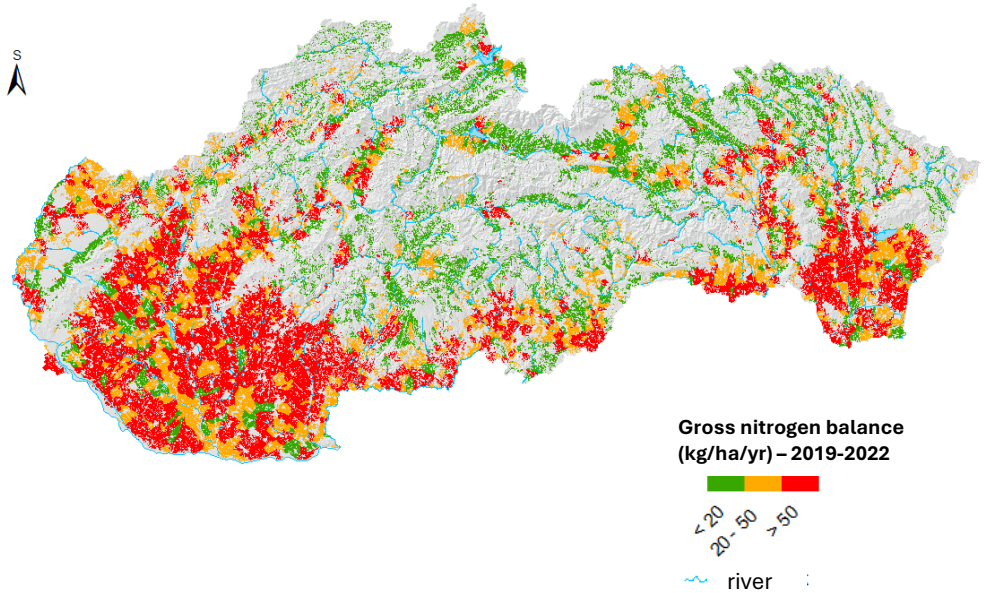
Gross nitrogen balance

- 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

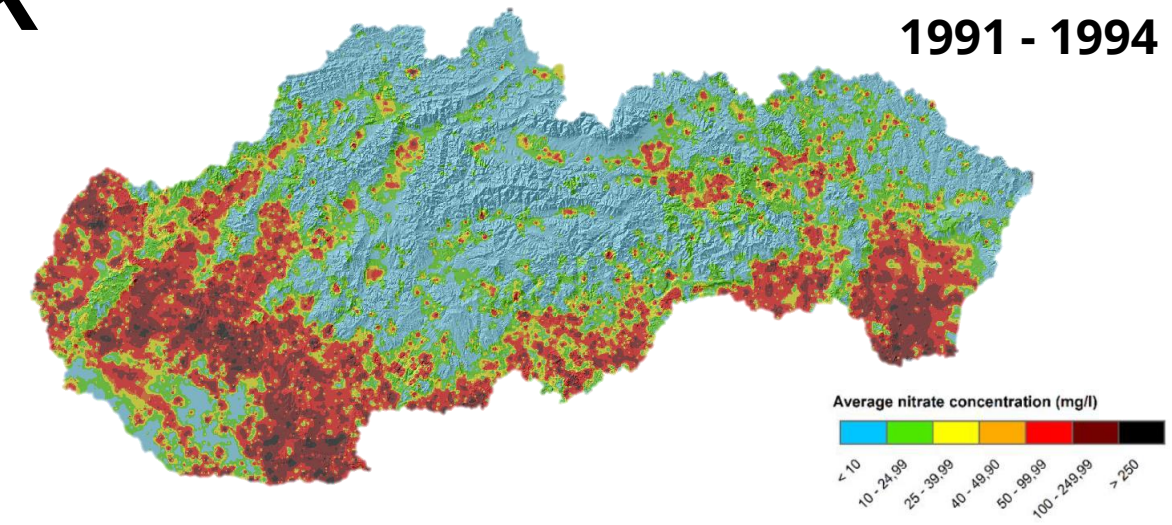
- GW quality **improvement** since 1990´s
- over past decade little improvement
- **cca.12 %** of all monitoring boreholes - NO_3 **above 50 mg/l** –long term
- the worst situation in the Podunajská pahorkatina hills, where nitrate concentrations have remained elevated or even increased

Denser monitoring network (2008, 2019-2023)

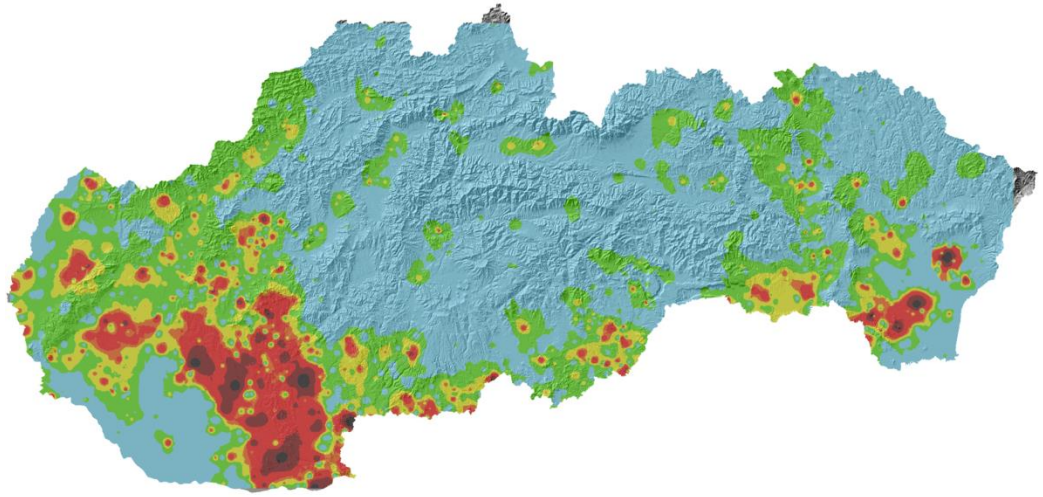
- more accurate delineation of pollution hotspots
- the need to tackle extremely polluted areas (in black)

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

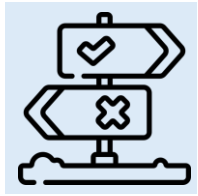
The aim of this Directive is to:

- 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.

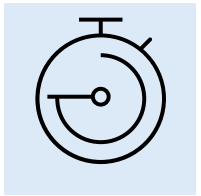
Main requirements resulting from the implementation of the NiD:

- 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

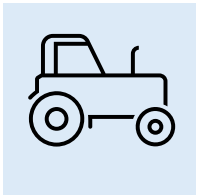
Council Directive 91/676/EEC - limitations



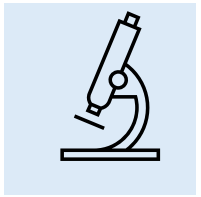
Varying implementation between MS



Time lag in the unsaturated zone



Pressure from farmers to maintain crop yield



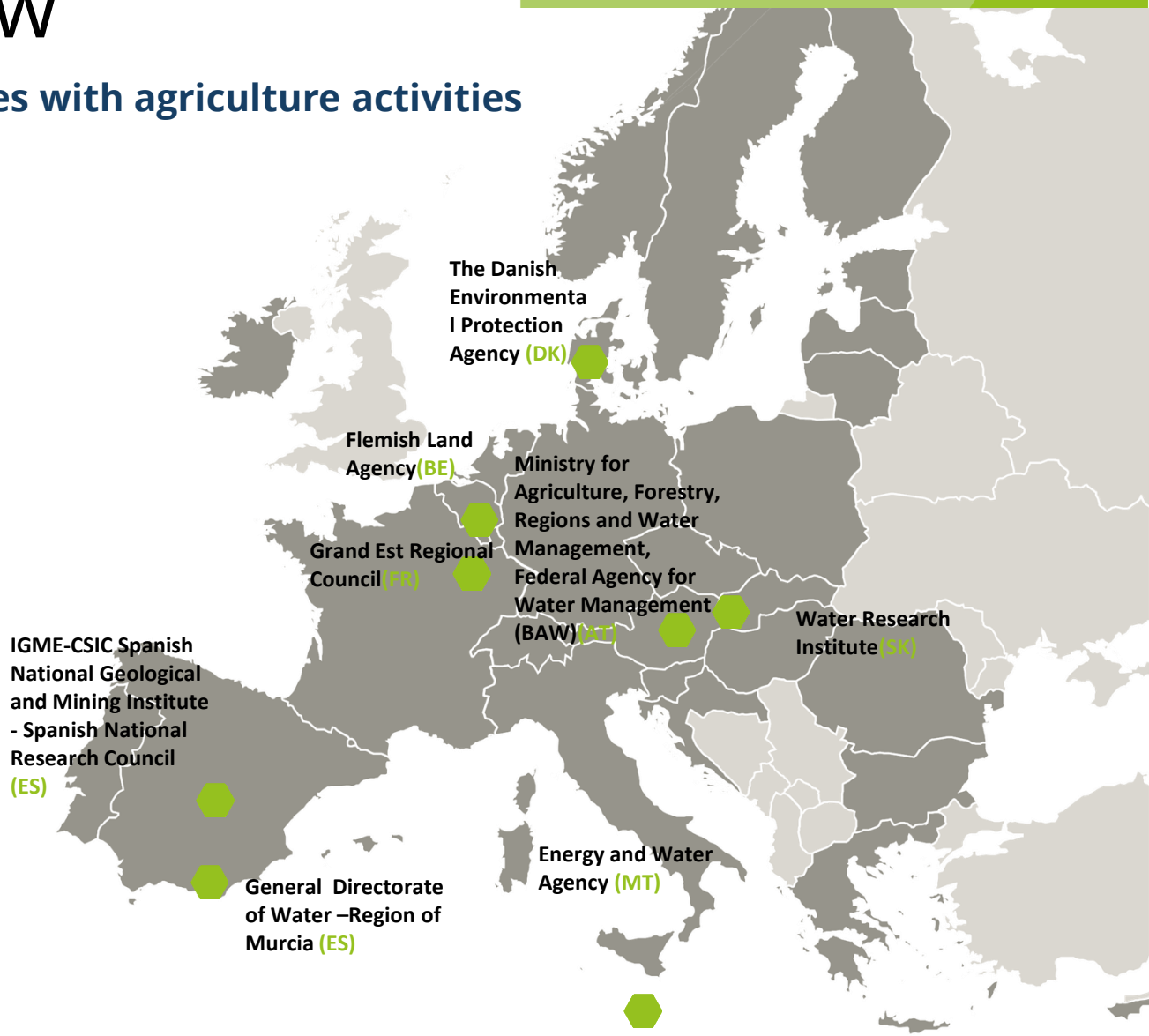
Monitoring : complexity and high cost

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



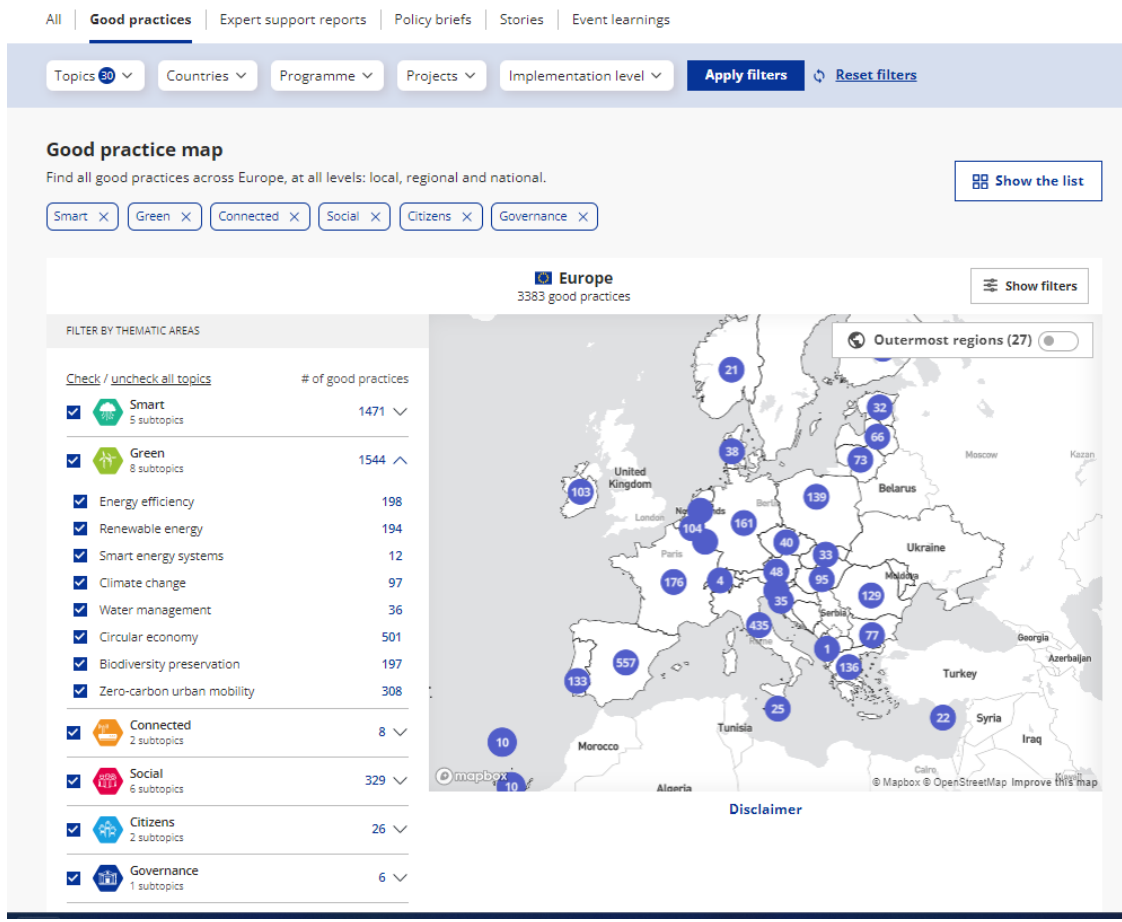
GEMS – the main objectives

- 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

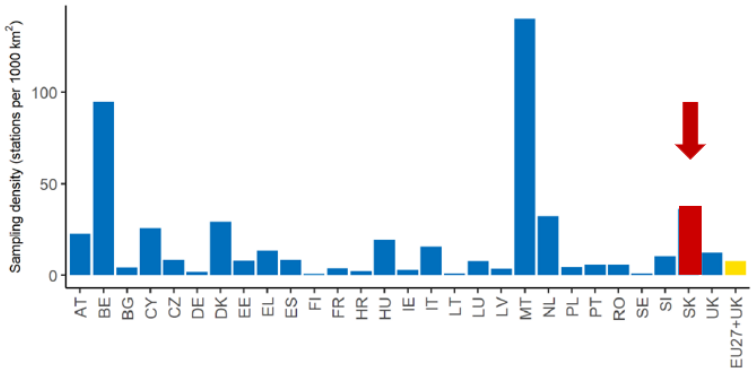
Objectives

- **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

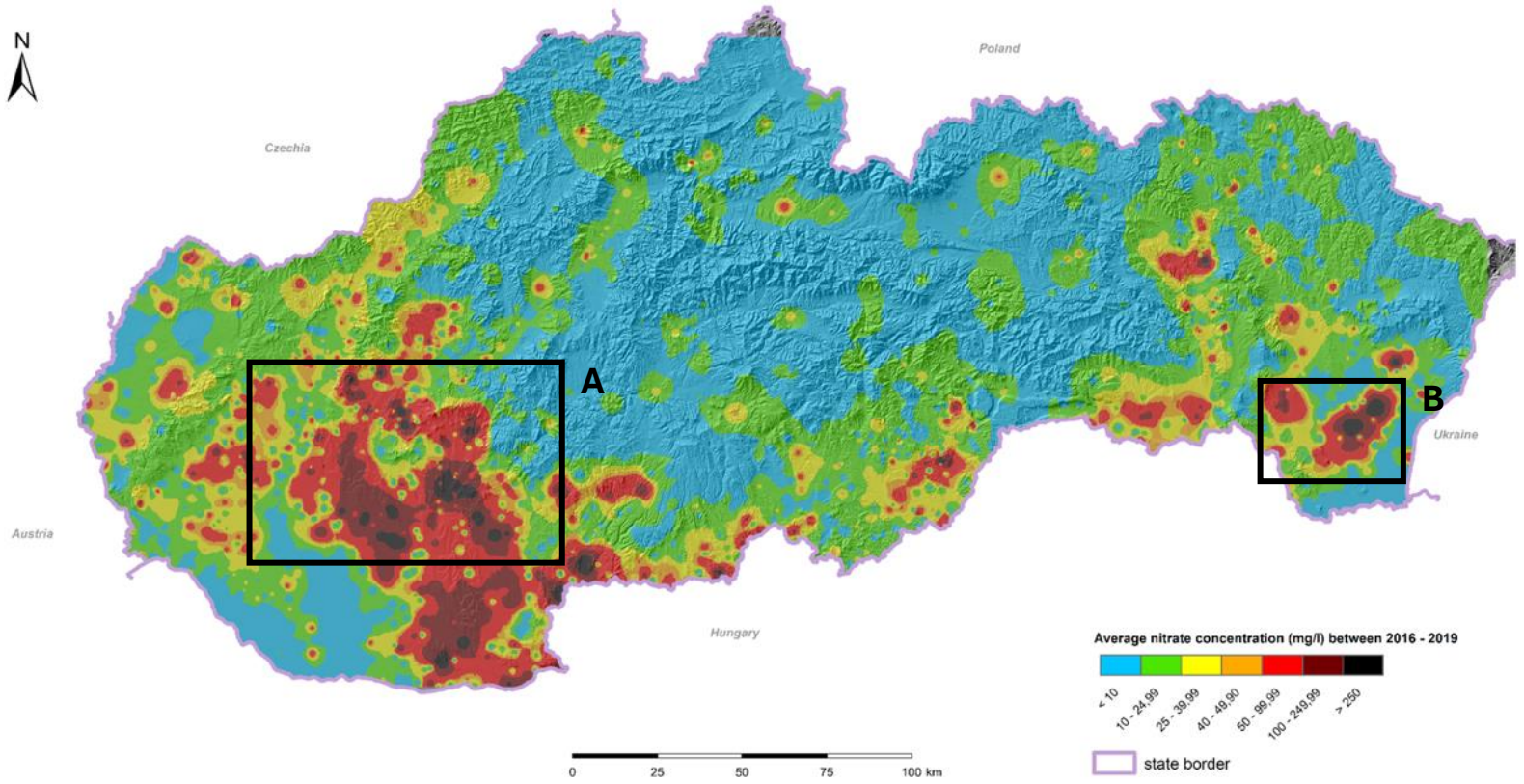
Mon. network 4,2M. € 2017 - 2023

- **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%



Improved understanding of spatial distribution of pollution from agriculture

IDW model: Nitrate concentration in groundwater

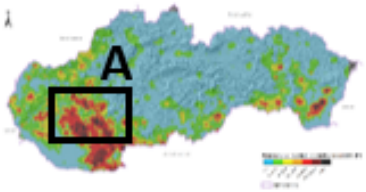


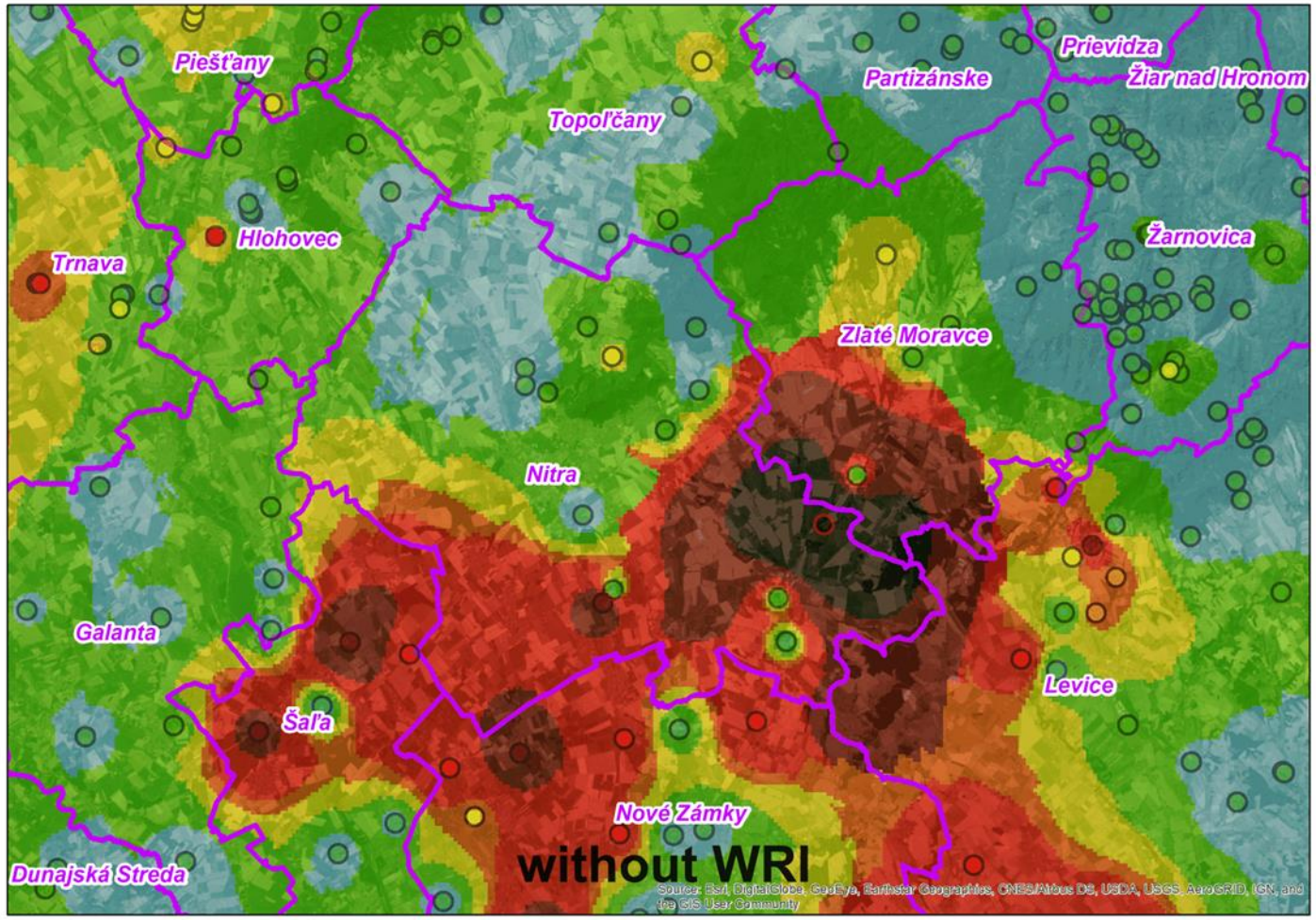
WRI monitoring helps:

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.

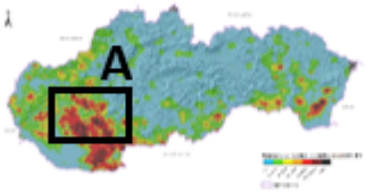
IDW model with WRI wells

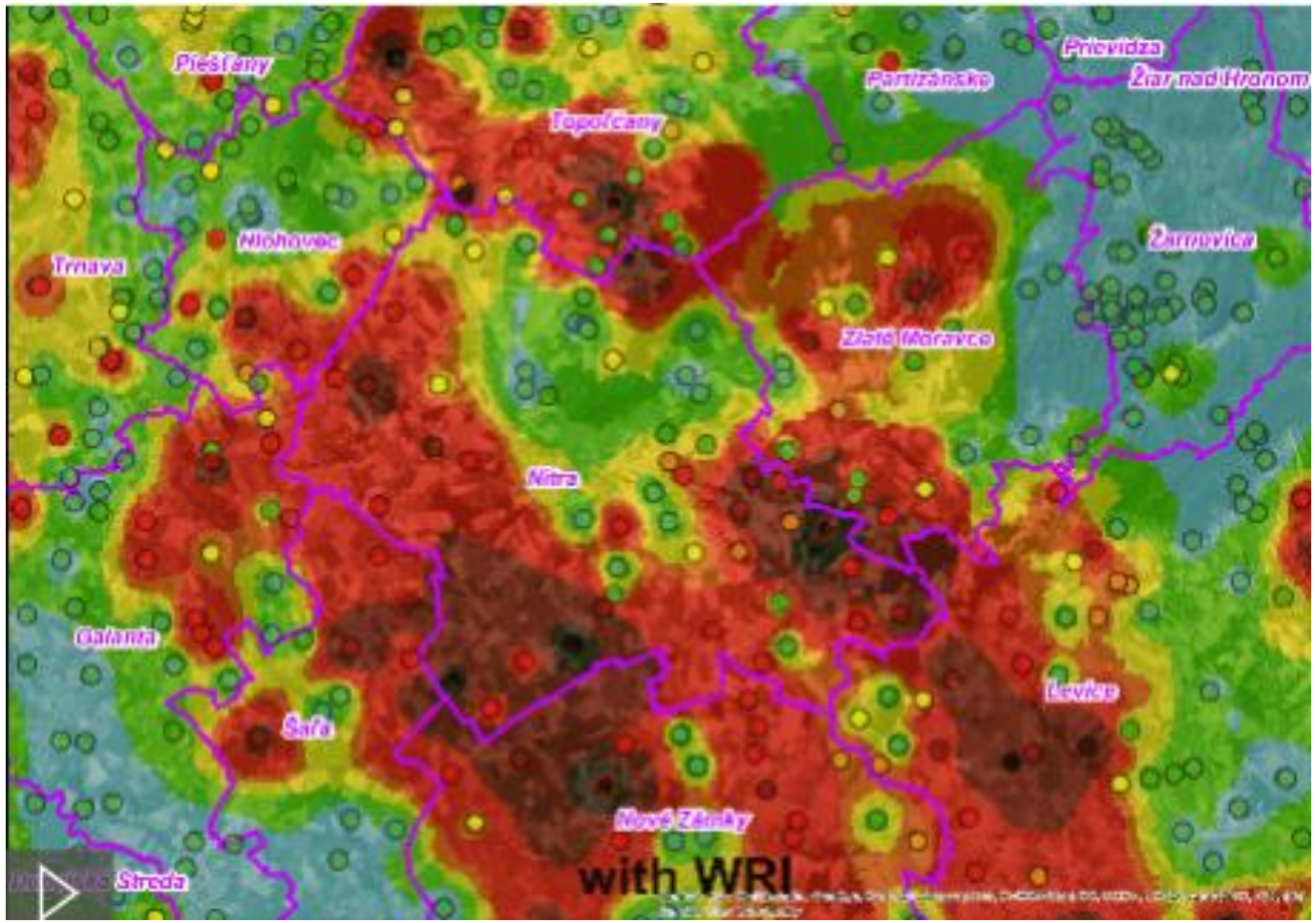
- Refinement of pollution in the districts of Nitra and Zlaté Moravce
- "Finding" pollution in the districts of Topoľčany, Hlohovec and Galanta.

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

< 25	< 10
25 - 39,99	10 - 24,99
40 - 49,99	25 - 39,99
50 - 99,99	40 - 49,99
100 - 249,99	50 - 99,99
250 - 499,99	100 - 249,99
≥ 500	>250

Finding new polluted locations





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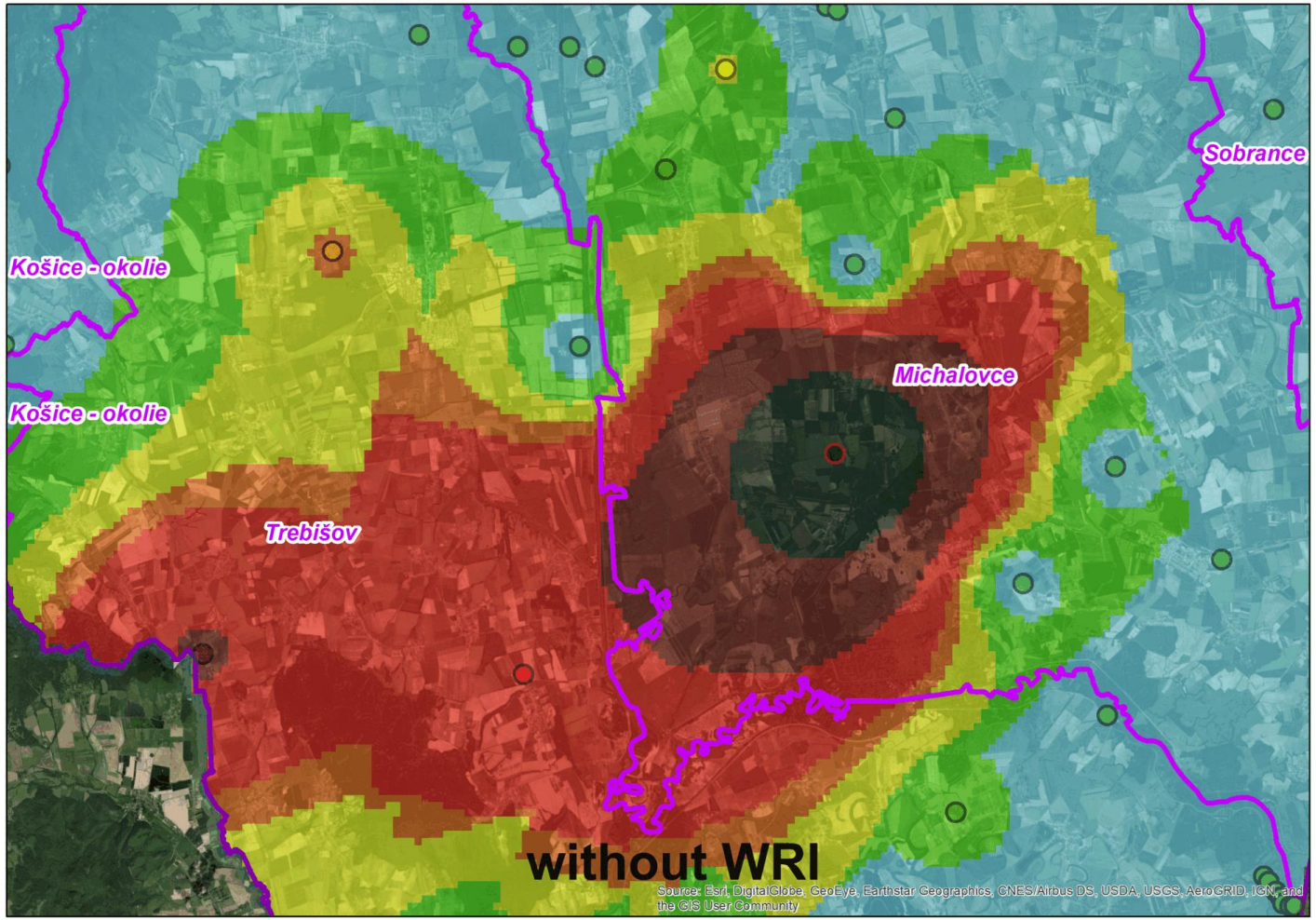
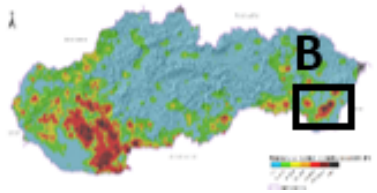
Refinement of existing polluted locations





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

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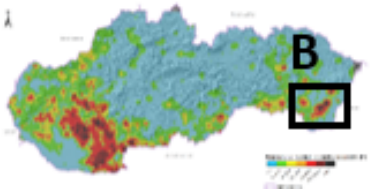

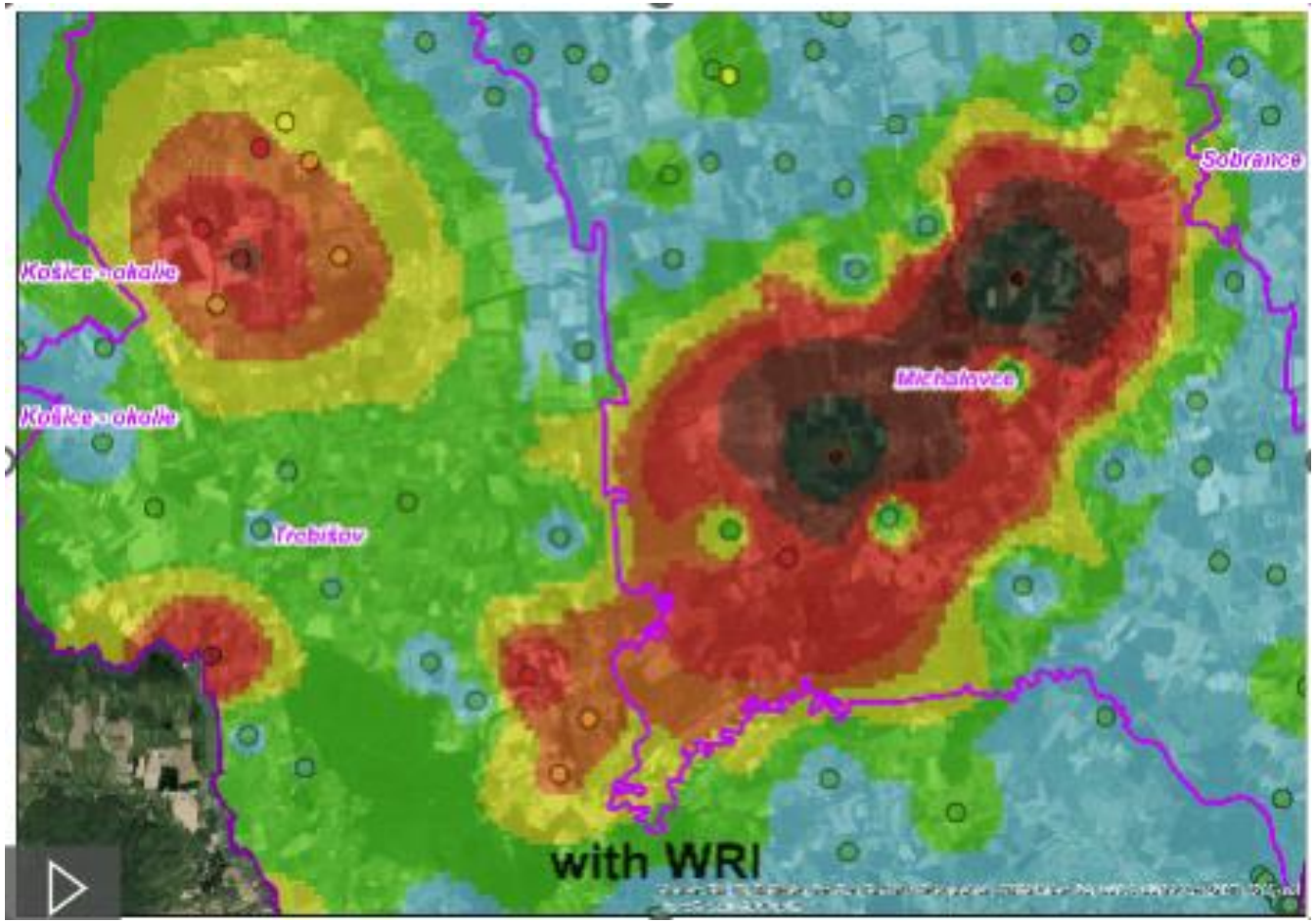

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Social networks and project info.

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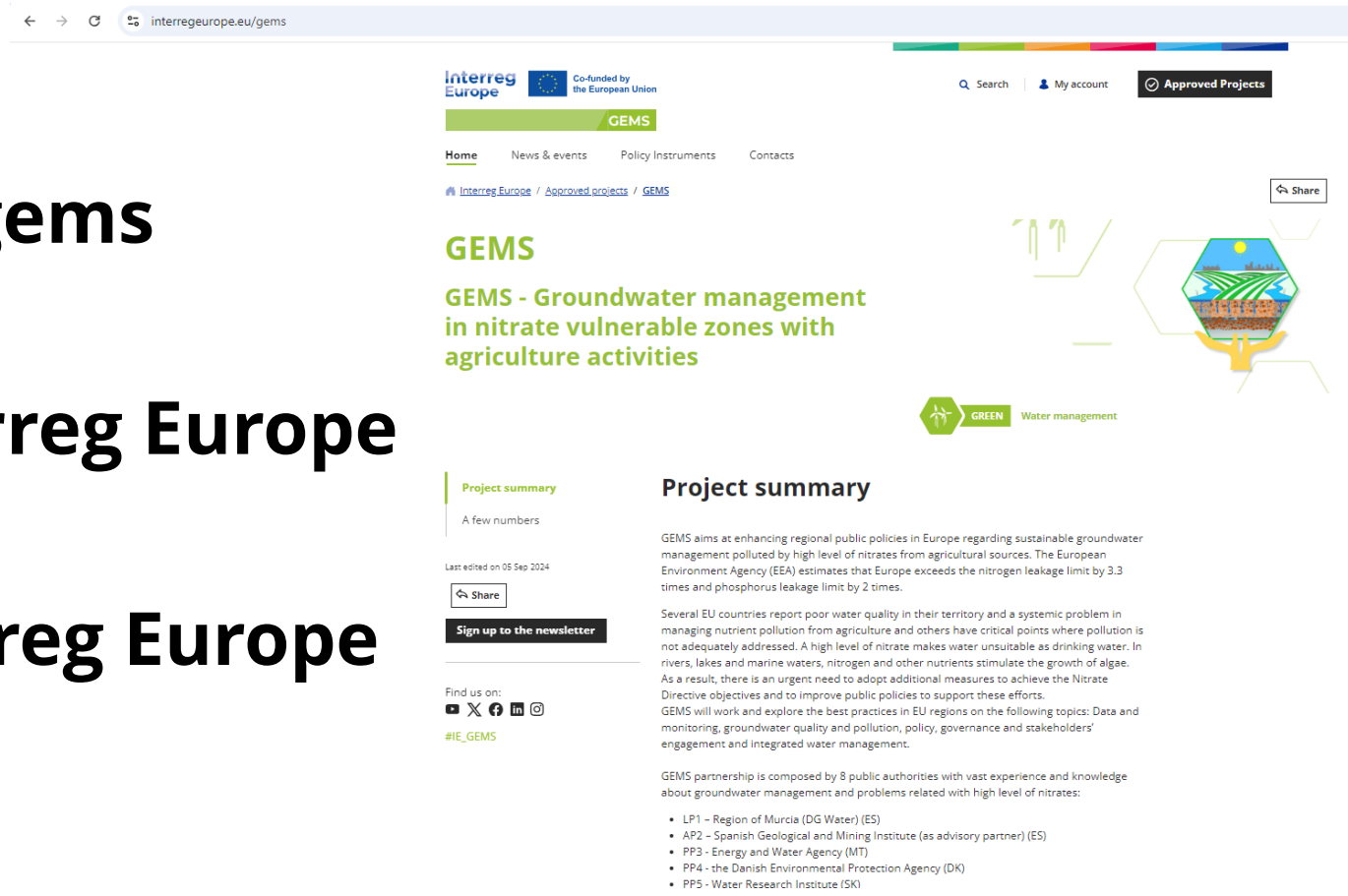

Thank you

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