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Effective reducing of water pollution by nutrients from agricultural land - a primary matter of available spatial information

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Introduction

- **Diffuse water pollution from agriculture remains significant pressure to water bodies**, which confirms also the Danube River Basin District Management Plan – Update 2015. This sector is responsible for 42% of total nitrogen emissions and 28% of the total emissions of phosphorus to surface waters, respectively.
- **According to the official statement of the European Commission** (COM (2015) 120 final), **despite some progress in reducing the consumption of mineral fertilisers there are still many deficiencies in basic measures introduced by the Member States in order to reduce pressure from agriculture.**
- In the EU countries, water pollution by nutrients from agriculture is mainly regulated by (basic) measures in Action programmes in designated vulnerable zones under Nitrates Directive.
- Because phosphorus significantly contributes to surface water eutrophication, measures for the regulation of P losses to water should be integral part of measures which are implemented under Nitrates Directive.

Inputs regulation and timing – the standard source oriented agricultural practice

- **The regulation of nutrient inputs for crops** (including the decreasing of fertilization intensity) **is the immediate area where attention is usually focused at decreasing their loses to water environment.**

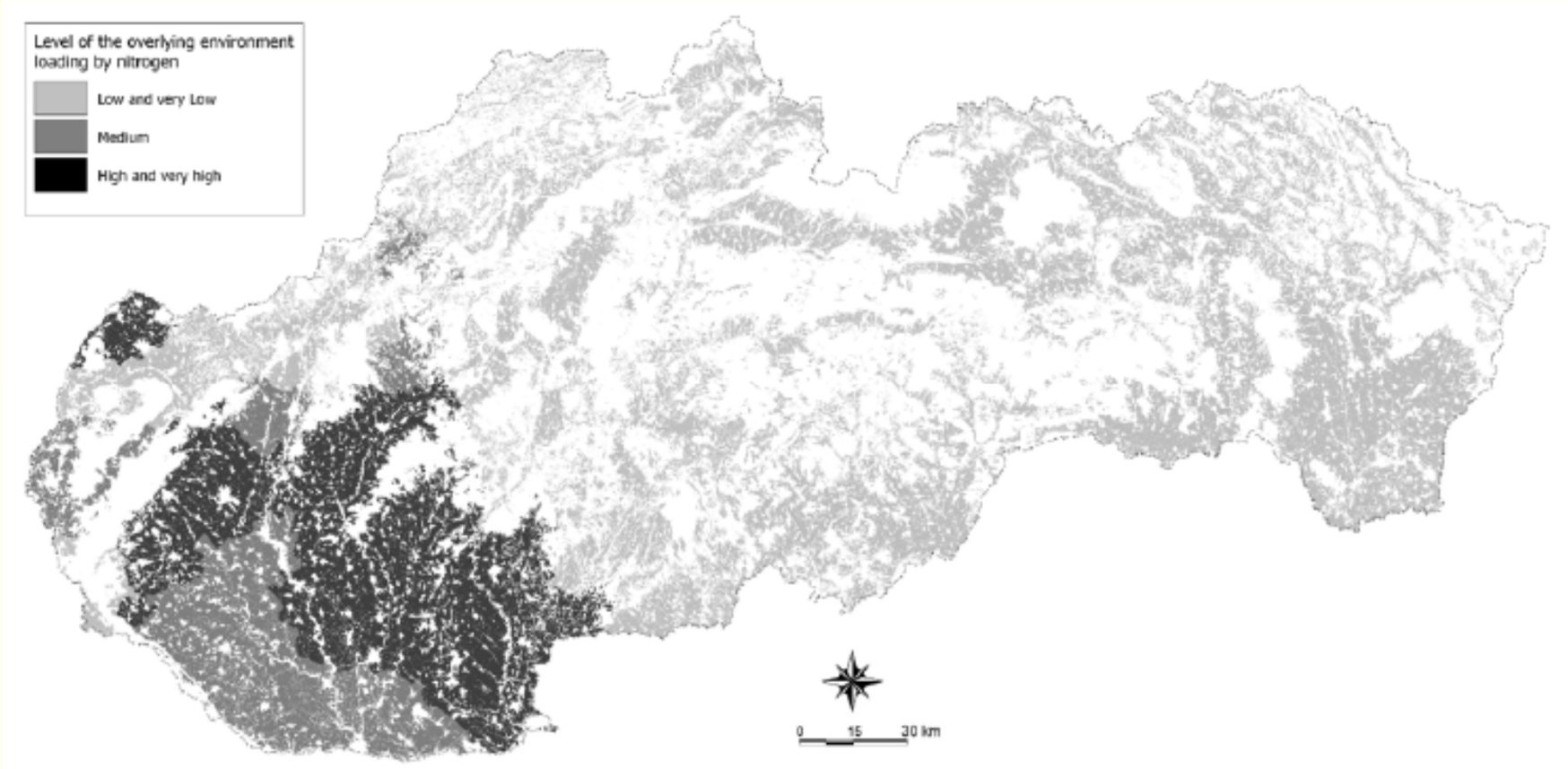
- **It lies in matching the supply of nutrients to crop needs and increasing the nutrient use efficiency** (NUE) which corresponds with the application of 4R approach: - **Right source** of nutrient,
  - **Right amount** of nutrient,
  - **Right time** of fertilizer/manure application and
  - **Right place** of fertilizer/manure application.

- Sufficient storage capacities for animal manure and crop/intercrop selection are inseparable part of nutrient input optimisation.

- In many countries the consumption of nutrients in fertilizers and animal manure, as well as nutrient balance seems favourable from environmental view. The Slovak Republic can serve as an example:
  - **fertiliser N consumption in period 2012-2015 represented 52% of the level in 1990**,
  - **consumption of P in fertilizers in the period 2012-2015 was 13% of the level in 1990**,
  - **at livestock was observed significant, and even undesirable, decline** (cattle -70%, pigs -75%, poultry -27%, sheeps -27% and goats -29%),
  - except of three years, **nitrogen balance on state level in period 1993-2015 didn´t exceed the value 50 kg N/ha and P balance was mostly negative**.

- **Above mentioned information gives evidence on decrease of nutrient load on state level but on regional and local level the situation is (can be) different.**

- **Estimation of nitrogen load** (*first draft*), based on evaluation of gross nitrogen balance on districts level (LAU-1 regions) in 2012 and effect of crop cover in autumn – spring period, gives some provisional spatial information.



Adapted from: Bujnovský, R. et al. 2016. Ekológia (Bratislava) 35, No. 1, p. 66-77

- According to this daft, 25% of agricultural land falls into the category high and very high load and 15% to medium load category.

- Estimation of the load of agricultural land by phosphorus (P source), based on P index approach (*under preparation*) will embrace:

  - information on available P supply in the soil from results of the last cycle of agrochemical soil testing (by different types of agricultural land on districts level – LAU-1 regions), and

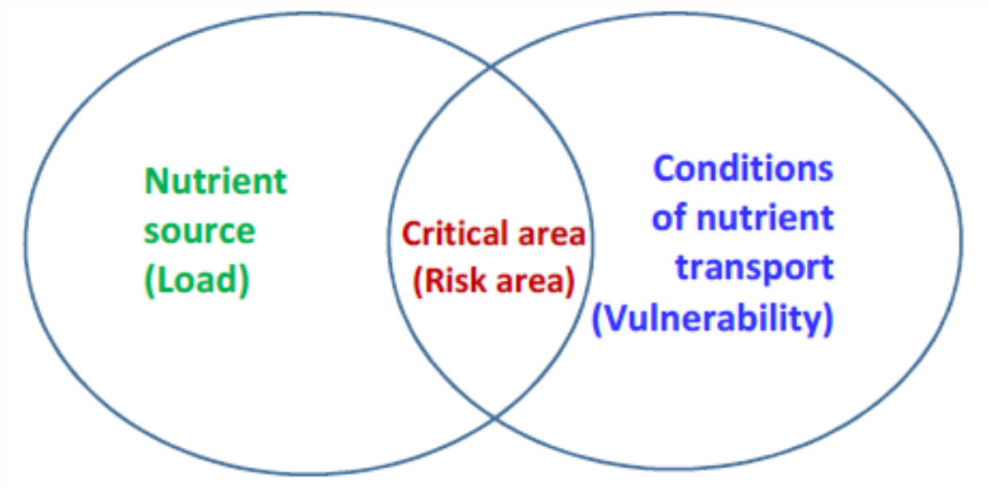
  - consumption of phosphorus in fertilizers and animal manure (by different types of agricultural land on districts level – LAU-1 regions).

  Practically, according to previously introduced information on phosphorus consumption in fertilizers and P balance, the high and very high category of P load is practically not relevant.

- **Usually, measures only based on nutrient load (N, P) are not sufficient for effective reduction of their loses to water.**

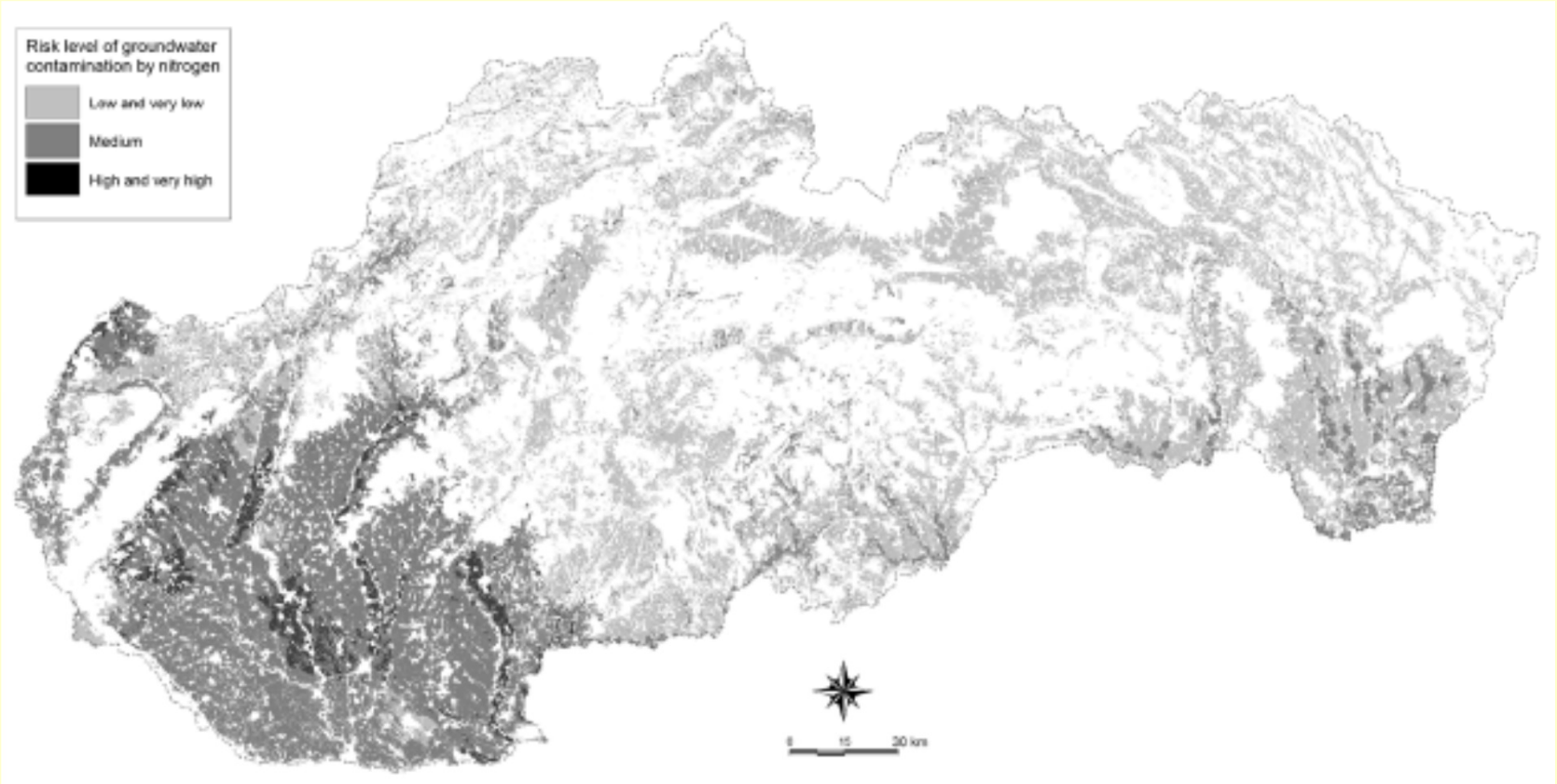
Integration of areas of nutrient source and transport to make measures more effective

- The **critical area concept** (based on risk assessment of diffuse water pollution by nitrogen or phosphorus), basically combines the two spatial information namely
  - the level of load of agricultural land by nutrient, and
  - conditions of nutrient transport to the specific water body.



- Usually, **critical or hot-spot areas for nitrogen and phosphorus are different – what is determined by mechanism of nutrient transport**.

- **The risk of diffuse pollution of groundwater by nitrogen substances from agricultural land** is perceived as a result of the interaction of groundwater vulnerability (respecting effective rainfall in winter half, soil capacity to accumulate water, depth of groundwater table level under land surface and permeability of the rock environment – hydraulic conductivity) and load of agricultural land by nitrogen.



Adapted from: Bujnovský, R. et al. 2016. Ekológia (Bratislava) 35, No. 1, p. 66-77

- According to this daft, around 5% of agricultural land falls into the category high and very high risk and 42% to medium risk category.

- Targeting management activities to “critical areas”, where the highest nutrient emissions to water come from, contributes to increase the environmental efficiency and cost-effectiveness of measures which can be more acceptable and viable for farmers.

- Since diffuse water pollution by nutrients from agriculture exceeds the boundaries of the field and farm, **efficient water protection assumes proper allocation of effective measures within given river basin**.

  This requirement is very actual especially for allocation of supplementary measures (e.g. agri-environmental measures under 2nd pillar of CAP).

Effect of time delay

- **Because current trends of nitrates decrease in EU waters are considered as too slow to reach the required level of water quality in 2027, it may give the impression that additional measures are needed to reduce diffuse pollution.**

  It means mainly the respective extension of Nitrate Directive vulnerable zones (when whole country approach is not applied) and updating the relevant Actions Programmes.

- The improvement of water quality is gradual process. Thus, **little or no change in water quality does not necessarily imply that the adopted measures are ineffective, because agricultural measures does not have the remediation nature.**

- Any information on responding time of water body to adopted measures helps to have more objective view on their effectiveness.

Concluding remarks...

1. The need to improve the state of waters, what results from EU water legislation, creates the pressure/responsibility also to farmers.

2. The setting or revision of basic measures – if relevant – often consists in:
   - decrease of nutrient surplus often accompanied by reduction of their inputs (mainly nitrogen),
   - and/or in extra costs linked with manure and crop management.

   Usually this affects the farm revenues and thus their competitiveness and future development what is/can be sensitive area at dialogue with farmers.

3. At evaluation of the sufficiency of adopted measures it is essential to check their allocation with regard to areas which most contribute to nutrient emissions to water.

4. From view of change the nutrient and land management, farmers need to be in picture and understand the sources of water pollution and transport paths.

5. Relevant supporting spatial information is the fundamental requirement for achieving of success – good water status and the sustainable agriculture.


Thank you for attention!