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The effective reducing of diffuse water pollution by nutrients from agricultural land - the primary issue of available information

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Introduction

- **Diffuse water pollution from agriculture (agricultural land) remains significant pressure to water bodies**.

  As follows from Danube River Basin District Management Plan – Update 2015, in terms of nutrient emissions into surface waters, this sector is responsible for 42% of total nitrogen emissions and 28% of the total emissions of phosphorus, respectively.

- Improvement of water state/quality presupposes the design and implementation of environmentally efficient and cost-effective measures.

- Concerning measures, **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.**

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

Inputs regulation and timing – the standard source oriented agricultural practice

- In general, **reducing of unproductive nutrient losses on field/farm level lies in matching the supply of nutrients to crop needs and increasing the nutrient use efficiency** (NUE).

  Principally, it embraces:
  - determining the total effective rates of given nutrient, respecting real crop productivity in specific soil-climatic conditions, and
  - (at least) the optimum way and time of fertilizer or animal/organic manure application.

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

- **In the EU countries, water pollution by nutrients from agriculture is mainly regulated by the Nitrates Directive.** Measures in Action programmes in designated vulnerable zones are core of basic measures defined in Article 11.3 of Water Framework 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.

Recent evolution of nutrient consumption – the example of Slovakia

- In the Slovak Republic, from environmental view, nitrogen and phosphorus consumption in fertilizers can be assessed as favourable.

- Despite of some increase of **fertiliser N consumption** in recent years, its average consumption in period 2012-2014 was well below the consumption in 1990 (**50% of the level of consumption in 1990**).

- In the case of phosphorus, the situation is even more pronounced: average **consumption of P in fertilizers** in the period 2012-2014 was **12% of the consumption of this nutrient in 1990**.

Year/period	N -fertilizers (thousands t of N)	P - fertilizers (thousands t of P)
1990	222.3 t	73.2
Average for period 2004-2007	82.2	4.8
Average for period 2008-2011	86.2	6.7
Average for period 2012-2014	110.1	9.0
Ratio of average for period 2012-2014 to 1990	**-50%**	**-88%**

- **Similarly at livestock stocks, in comparison to 1990 was observed significant, and even undesirable, decline**:

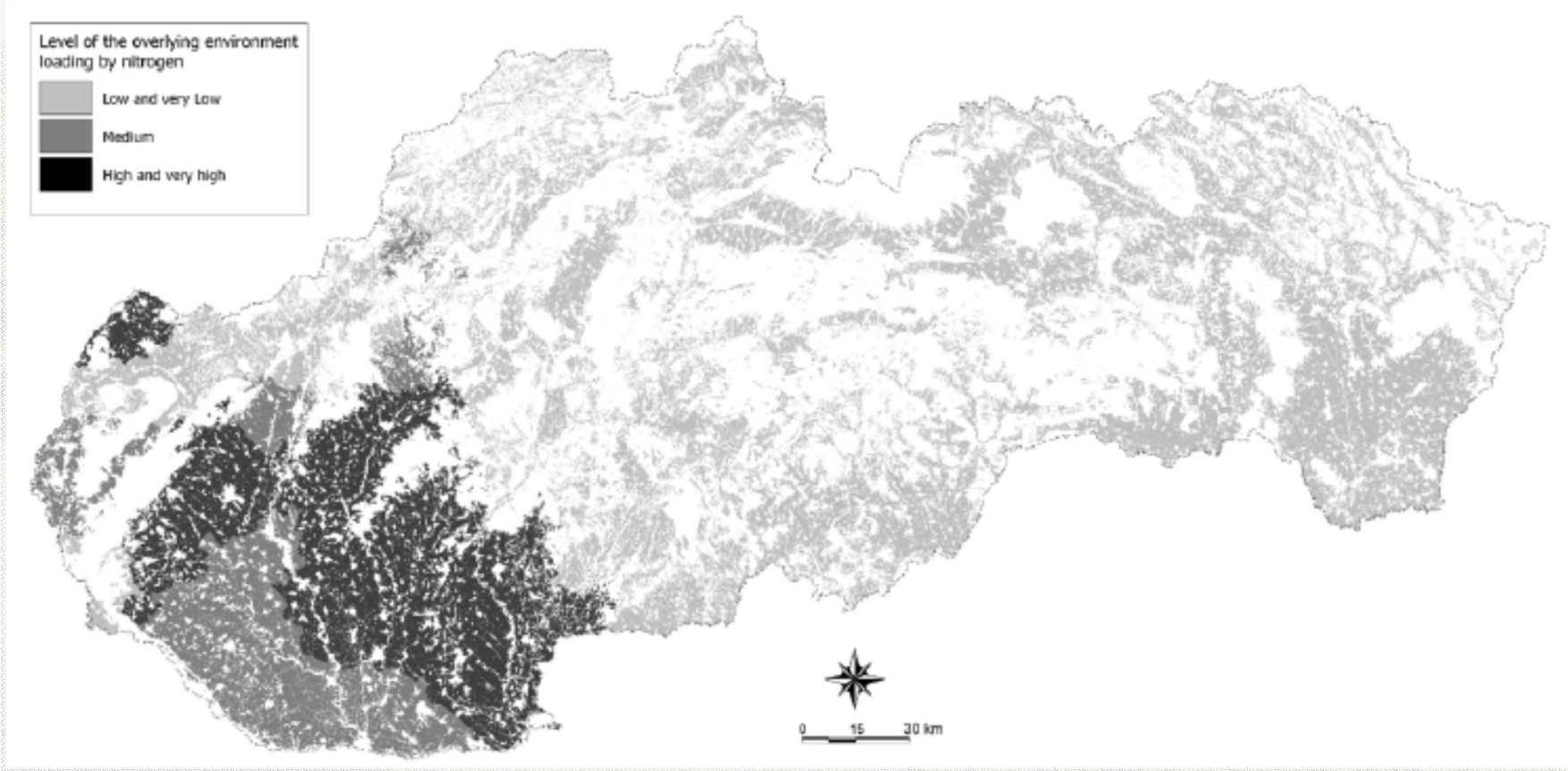
Year/period	Livestock species			
	Cattle	Pigs	Poultry	Sheeps & goats
1990	1563.1	2520.5	16477.8	610.7
Average for period 2004-2007	519.4	1078.6	13428.9	369.1
Average for period 2008-2011	472.8	689.3	12294.7	417.2
Average for period 2012-2014	467.8	636.8	11770.9	435.4
Ratio of average for period 2012-2014 to 1990	**-70%**	**-75%**	**-29%**	**-29%**

- Average load of agricultural land by nitrogen from animal manure in last years was around 20 kg N/ha.

- **Except of two years, nitrogen balance on state level since 1993 didn´t exceed the value 50 kg N/ha.**
  P balance was mostly negative what is reflected in gradual decline of available soil P what is documented in results of regular Agrochemical Soil Testing.

- 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).

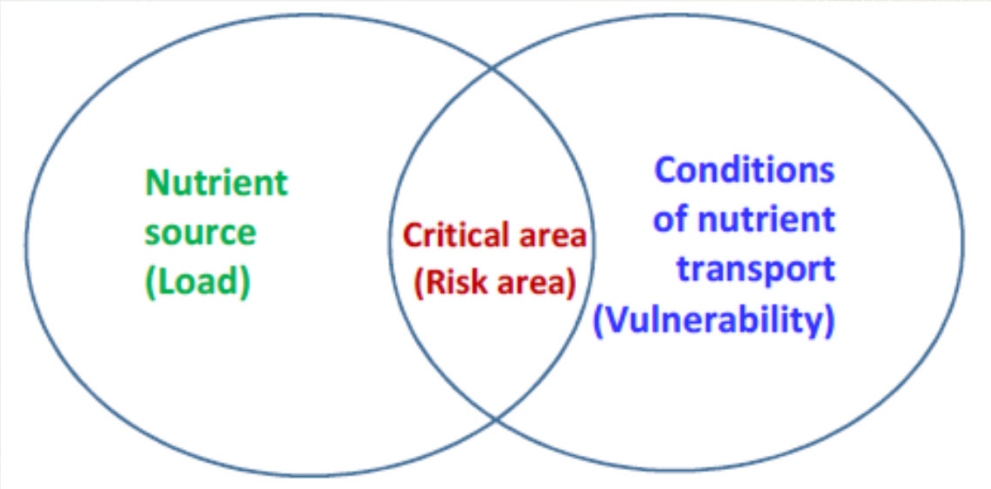
  Practically, according to previously introduced information on phosphorus consumption in fertilizers and P balance, the high and very high category of P load is not relevant.

- **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

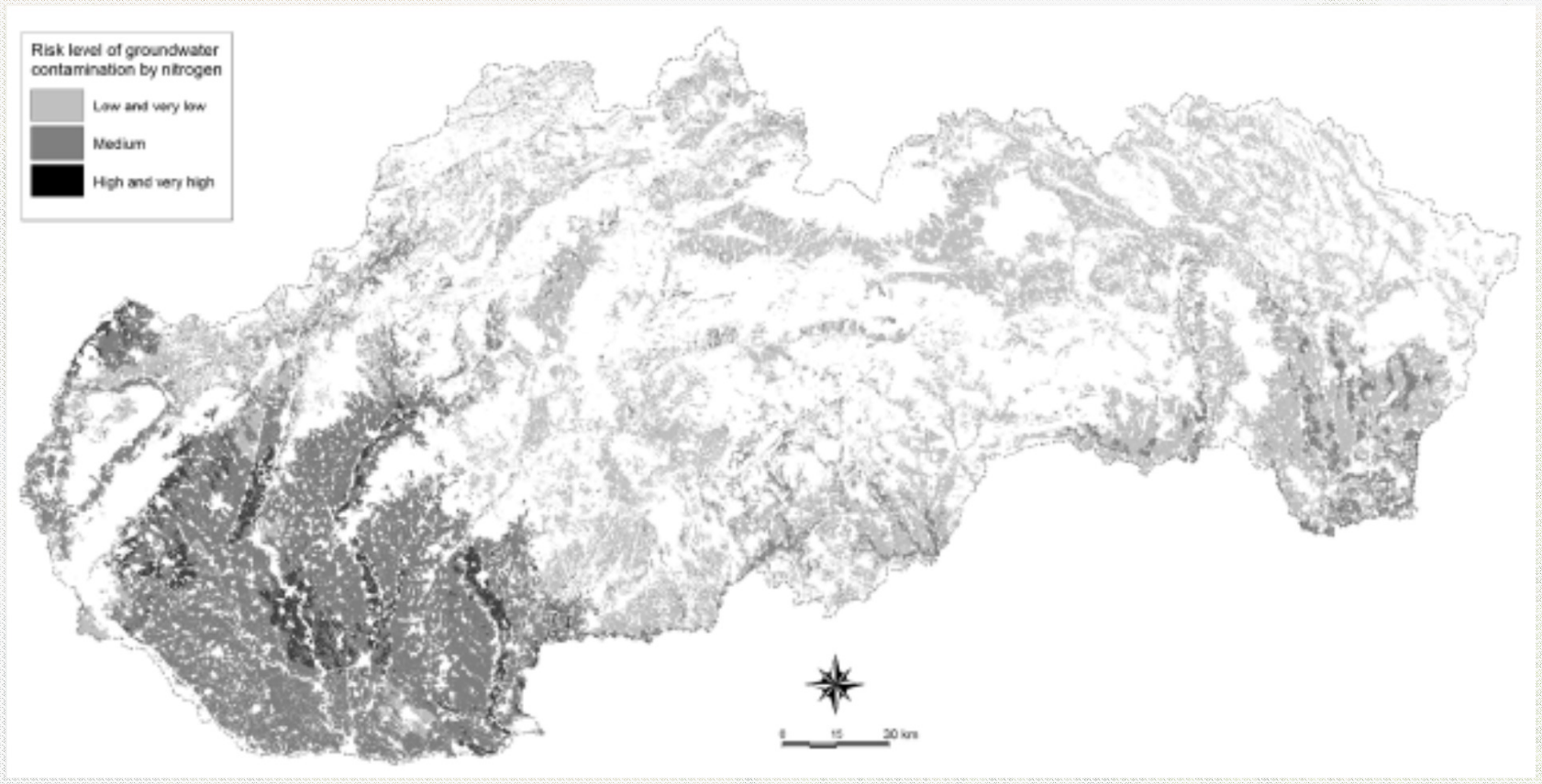
- The **critical area concept**, which basically falls into Best Agricultural Practice, combines the nutrient source and transport conditions in agricultural land.

  This concept, which essentially is based on **risk assessment** of diffuse water pollution (by nitrogen and phosphorus), practically represents the intersection of 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 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 at river basin level**.

  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 and updating the relevant Actions Programmes.

- The improvement of water quality is gradual process which is result of adopted measures at right places as well as time of responding of water bodies to measures. 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.**

- In the lowland areas of Slovakia residence time of rainwater in the soil, affecting the flow of nitrogen to groundwater due to leaching from the soil, may exceed a period of five years, which affects the reaction time of the water bodies adopted measures.

Concluding remarks...

- The need to improve the state of waters, what results from EU water legislation, creates the pressure to policy makers and main groups of stakeholders, including farmers.

- The setting or re-assessment 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.

- Nevertheless, at evaluation of the sufficiency of adopted measures and prospective introduction of additional or more stringent measures in agriculture it is essential to check the allocation of measures with regard to areas which most contribute to nutrient emissions to water.

  Any information on responding time of water body to adopted measures helps to have more objective view on their effectiveness – which is not common.

- **Relevant spatial information is the fundamental requirement for achieving of success - the sustainable agriculture and good water status.**


Thank you for
attention!