Pollution sources apportionment by dissolved phosphorus emissions:

An appropriate benchmark of their contribution to the reservoirs eutrophication

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European Water Framework Directive: significant pressures and effective measures – need for P–sources apportionment

Hypothesis

- ✓ Not all phosphorus species are equally important for biological production and eutrophication of water.
- ✓ The individual sources of pollution are characterized by different proportion of phosphorus species – their eutrophication significance is different.
- ✓ Traditionally are sources evaluated by total phosphorus only. Therefore, some sources are overestimated and measures taken will be ineffective.
- ✓ Reduction of dissolved phosphorus runoff from sources will lead to improve ecological status of water bodies significantly.

Why only dissolved P reduction is needed?

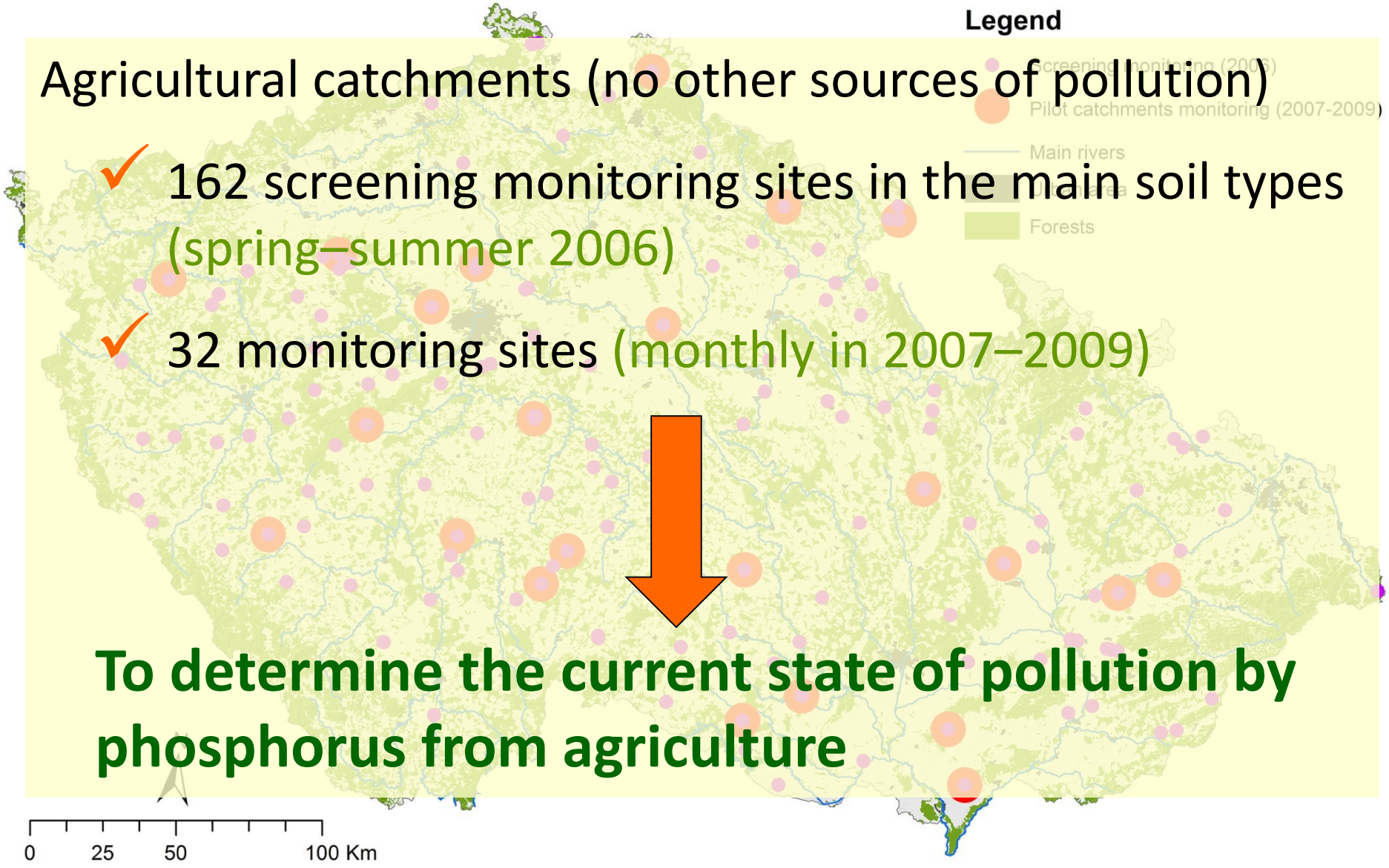
A brief introduction to reservoir eutrophication and role of phosphorus species

- ✓ Phosphorus (P) is key element for lake and reservoirs eutrophication
- ✓ The main phosphorus species for the algae and cyanobacteria growth is **bioavailable P** (mainly dissolved P or SRP) – (Peters, 1981; Reynolds et Davies, 2001).
- ✓ But the bioavailable P is difficult to determine in reservoirs water because its rapid turnover in the phytoplankton community.
- ✓ Therefore, the degree of reservoir eutrophication is traditionally assessed by total P concentration (Vollenweider, 1968; Dillon et Rigler, 1974; OECD, 1982 etc.)

Area of interest: Czech Republic

Type of pollution: Agricultural non erosion, point (urban wastewater), erosion

Agricultural non erosion run-off



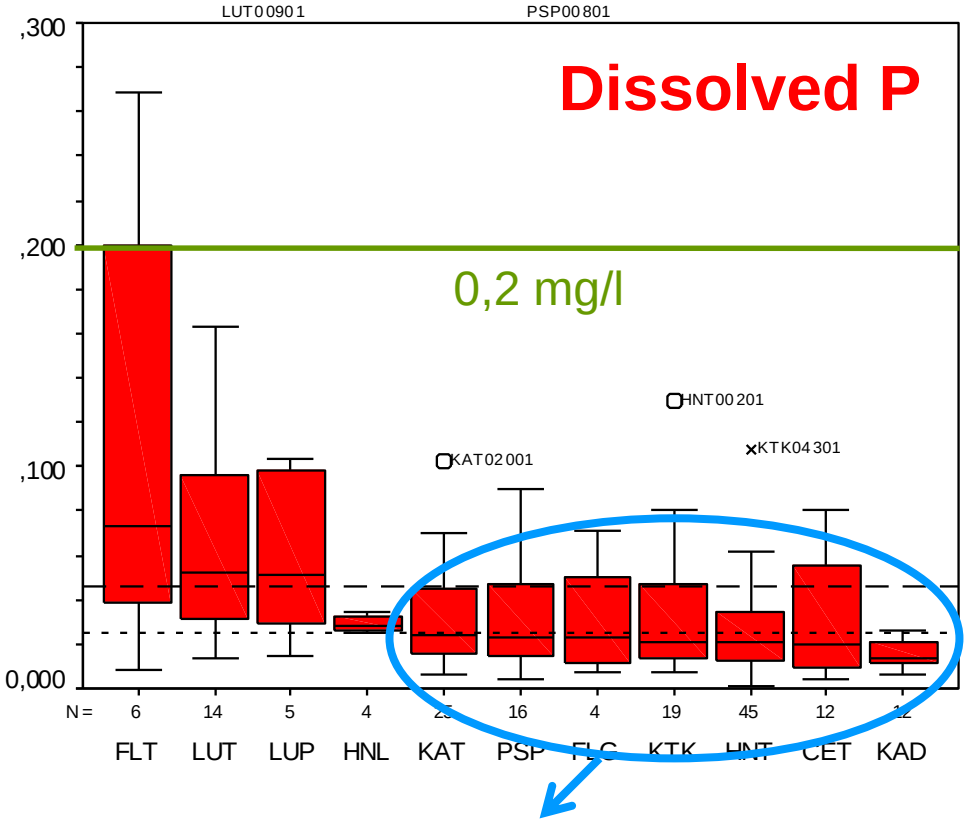
Agricultural catchments (no other sources of pollution)

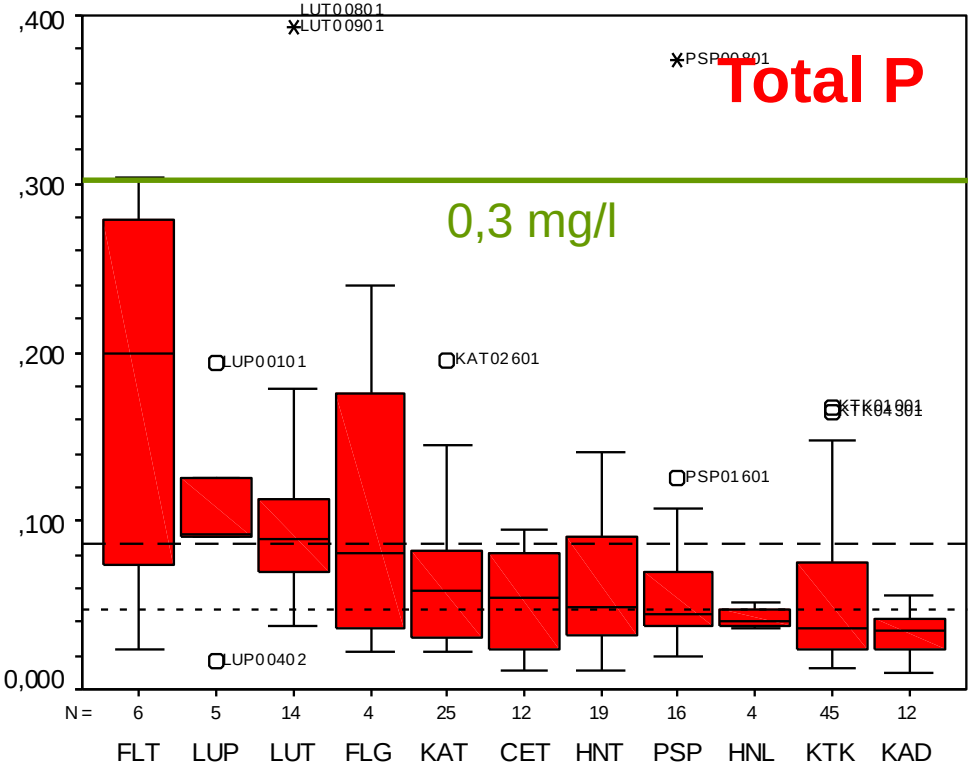
- ✓ 162 screening monitoring sites in the main soil types (spring–summer 2006)
- ✓ 32 monitoring sites (monthly in 2007–2009)

To determine the current state of pollution by phosphorus from agriculture

Agricultural non erosion run-off (results)

162 screening monitoring sites



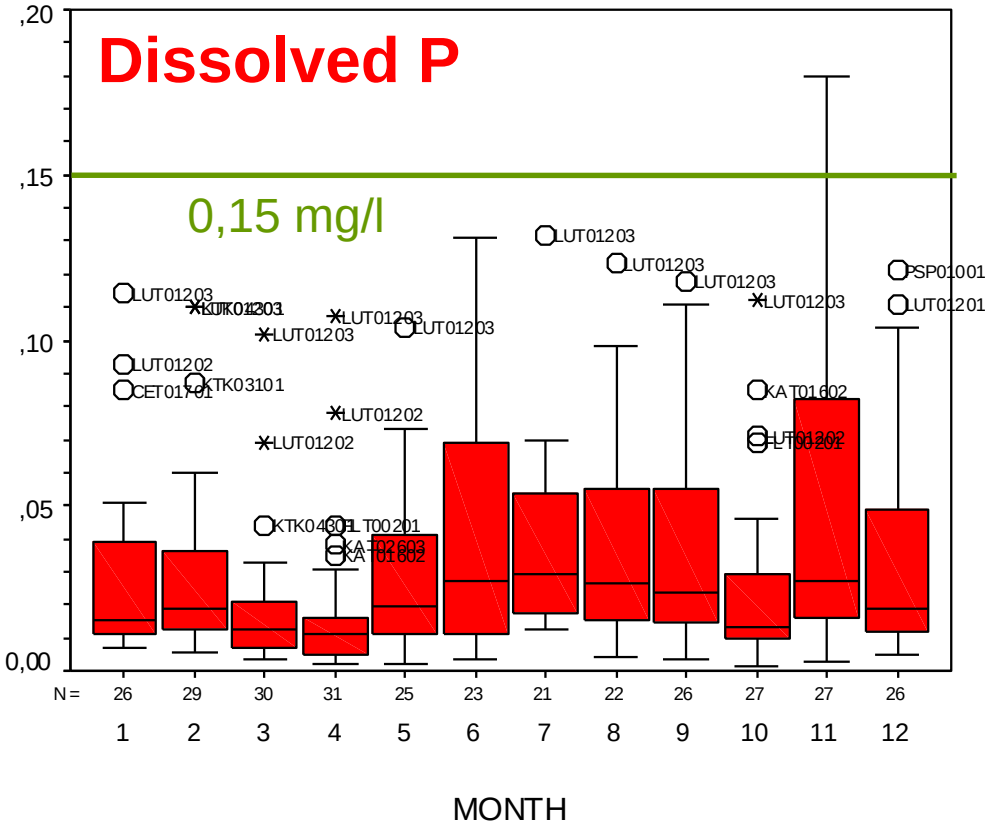


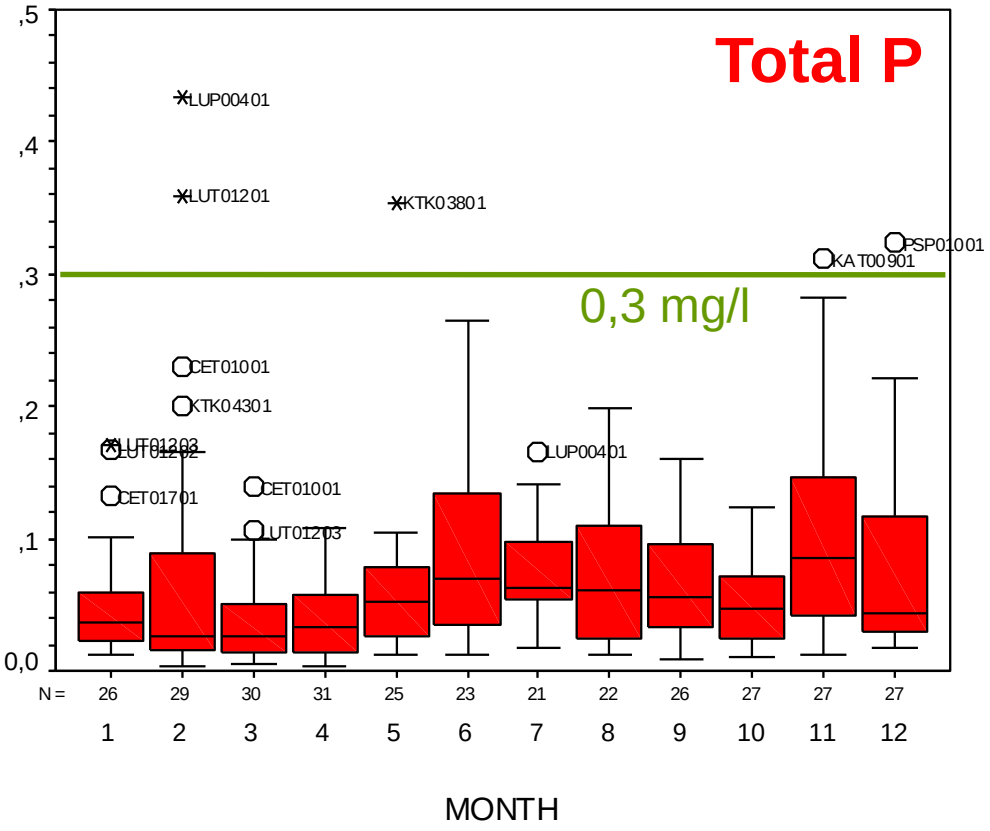
Represents 73% of agricultural land in the Czech Republic

Biologicaly active P represents 30-60 % of total P in run-off

Agricultural non erosion run-off (results)

32 monitoring sites





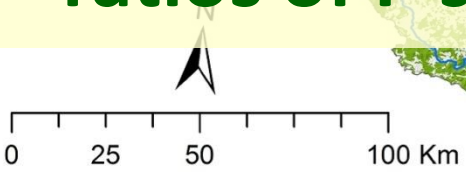
Non erosion run-off has very little effect on water eutrophication

P run-off from point sources (urban wastewater)

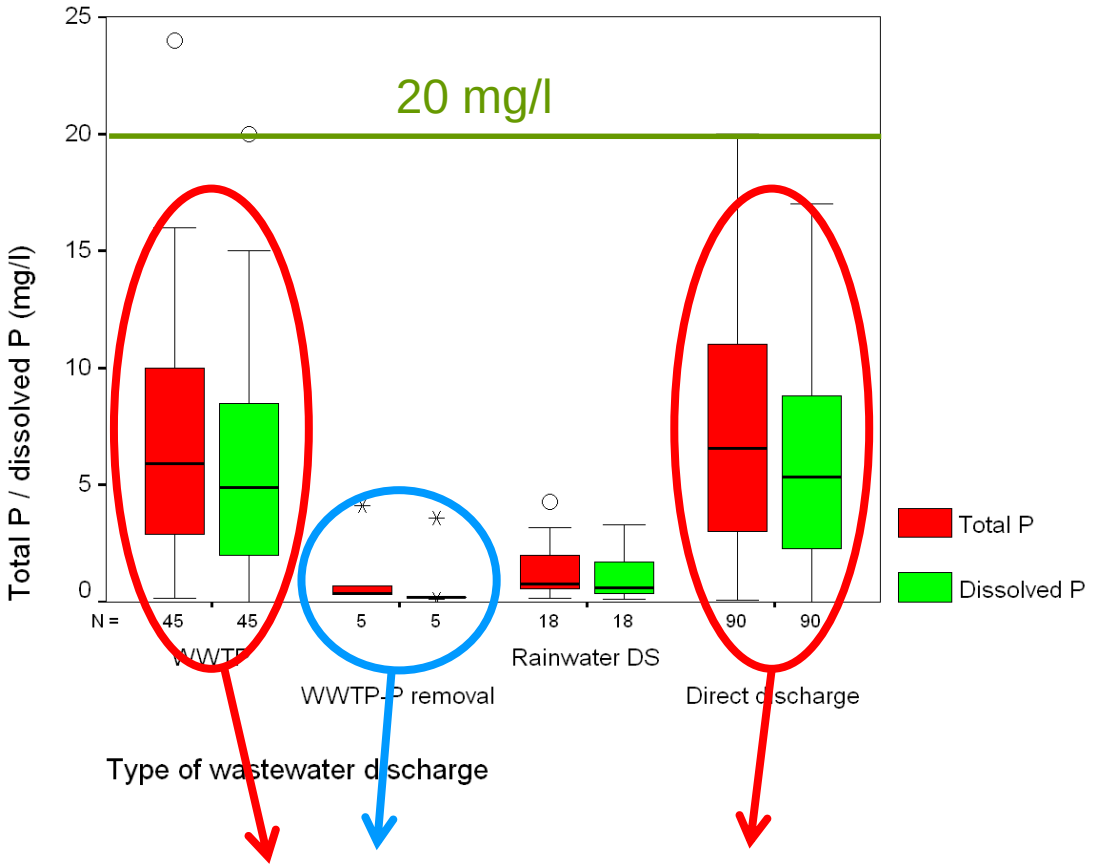
2 catchments with small towns and villages (1-6.217 inhab.)

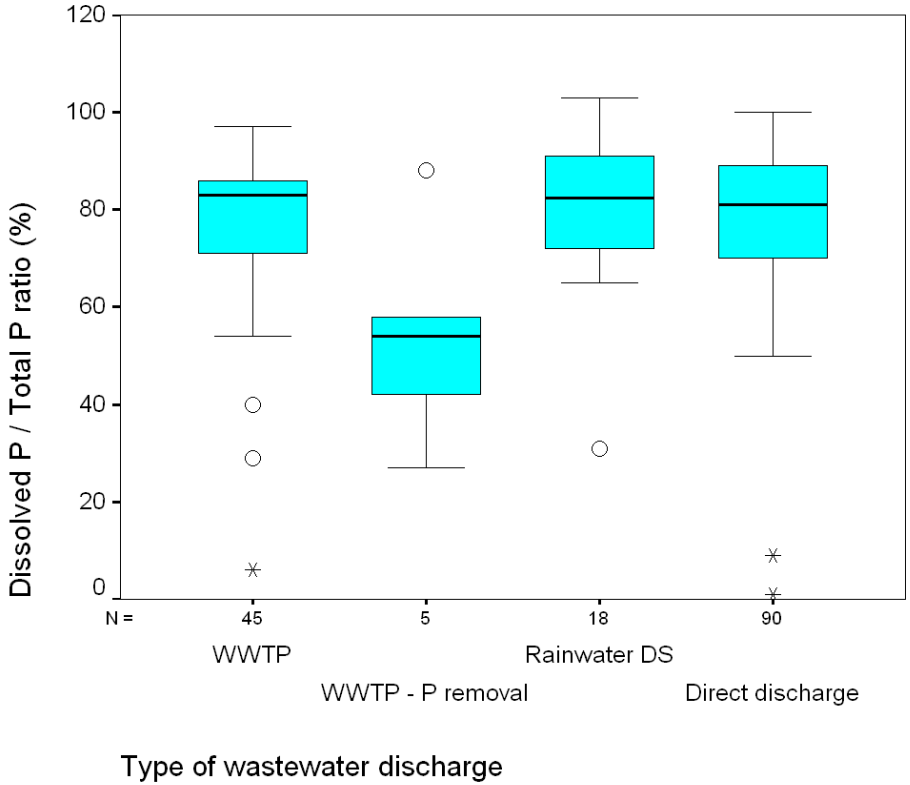
- ✓ Monitoring of different type of wastewater discharge (WWTP, WWTP with P removal, direct discharge, rainwater discharge system).
- ✓ Total P and dissolved P determination .

To determine characteristic P concentrations and ratios of P species in urban wastewater



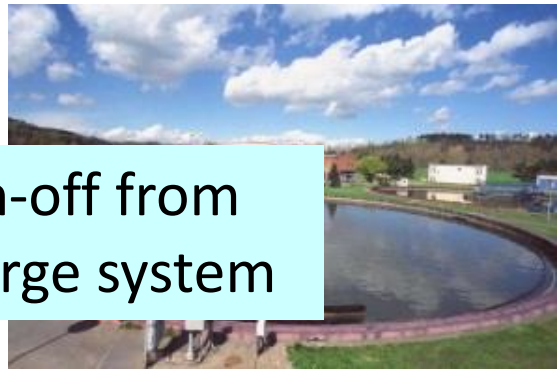
P run-off from point sources (results)





High concentrations from common WWTP and direct discharge

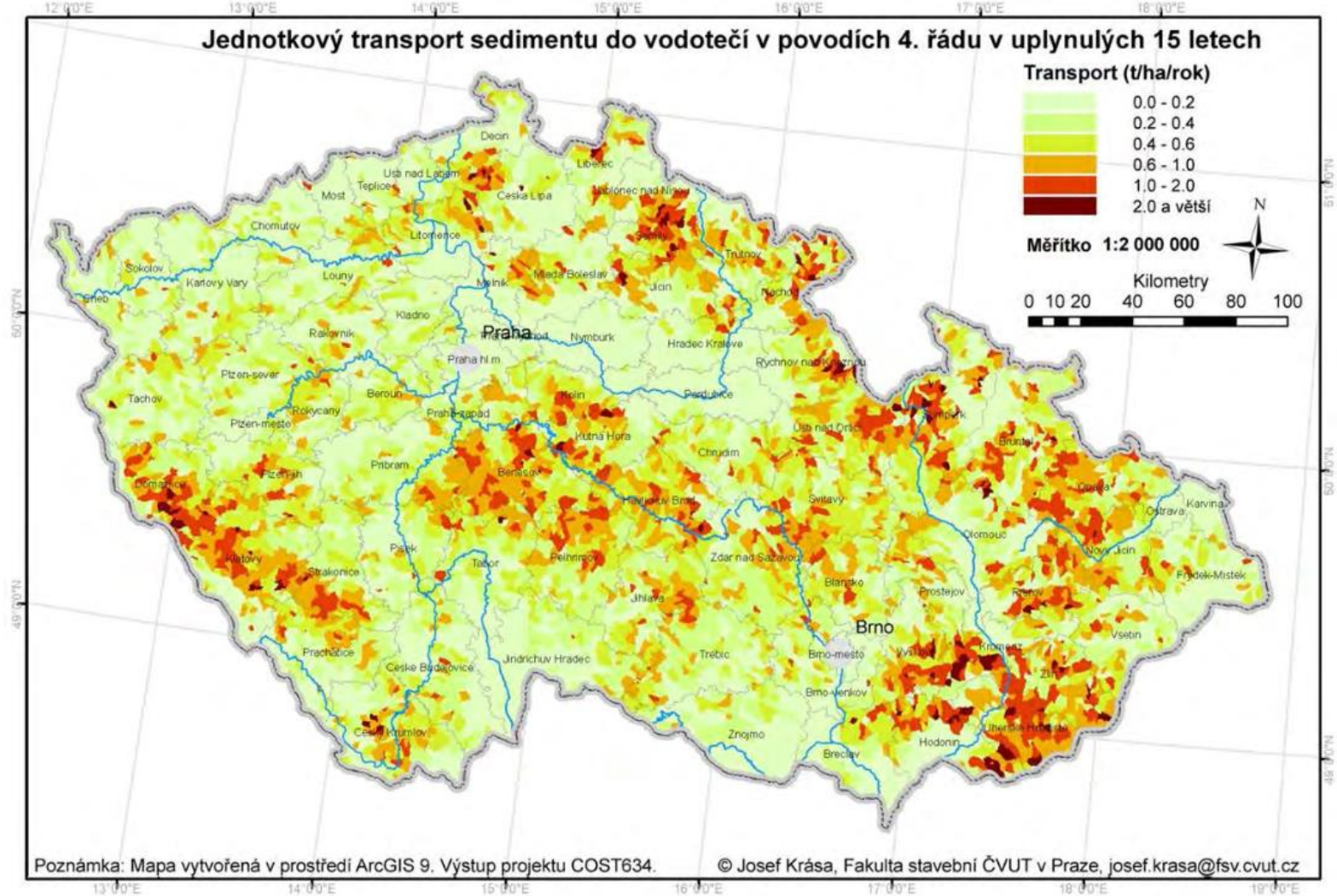
Very low concentrations in WWTP with P removal



Biologicaly active P represents 70–90 % of total P in run-off from common WWTP, direct discharge and rainwater discharge system

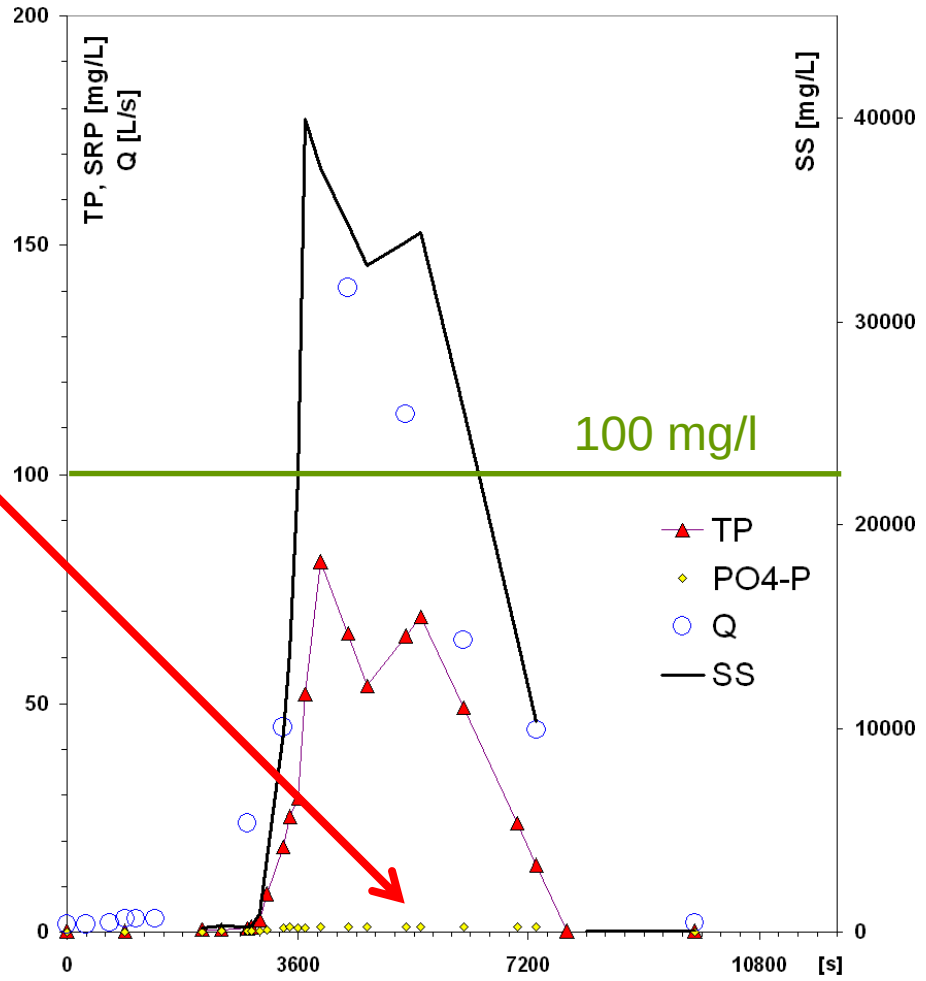
Agricultural erosion run-off

Transport of erosion sediment to surface water in small catchments



Storm rainfall – erosion run-off (results)

- ✓ Huge amount of phosphorus transported in particles.
- ✓ Dissolved P represents only 1–5% of total P in run-off.



Pilot river basin of water supply reservoir Stanovice

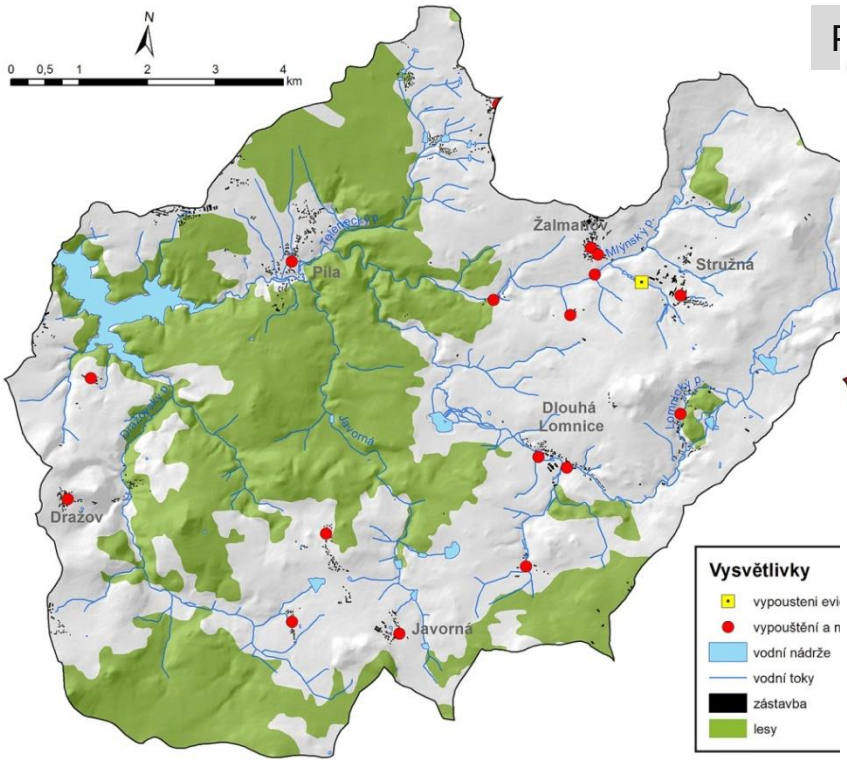
Modelling of the eutrophication potential according:

- ✓ Emissions of dissolved P
- ✓ Distance of source from reservoir dam (along the river)
- ✓ Retention of P in rivers and fish ponds

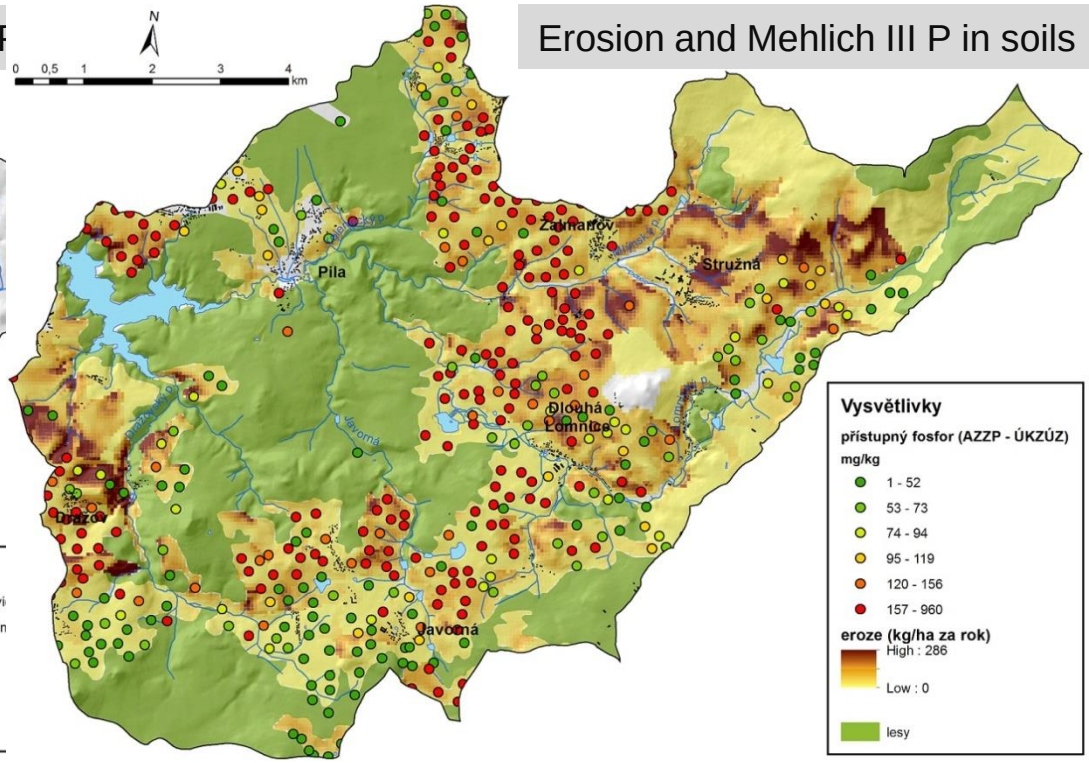
The resulting list of different P-sources ordered by decreasing importance for Stanovice reservoir eutrophication

Pilot river basin of water supply reservoir Stanovice (results)

- ✓ At the top of the list are mainly point sources
- ✓ Several plots are significantly threatened by erosion and contributes to the reservoir eutrophication



Erosion and Mehlich III P in soils



Conclusions (valid for the czech situation only)

- ✓ Agricultural non erosion phosphorus run-off is typical by low P-species concentration and its impact on eutrophication of surface water bodies is small.
- ✓ Discharge of wastewater (especially from small towns and villages) is key source of dissolved P and there is no difference between common WWTP and direct sewage water discharge.
- ✓ Application of P-removal in WWTP reduced dissolved P run-off effectively.
- ✓ Contribution of erosion run-off to eutrophication of water is little bit complicated. Content of dissolved P in run-off is very low, but transport of soil particles into water with low P concentration may result in P release and eutrophication.

Thank you for your attention

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