Variability of phosphorus load from agricultural land in Czech Republic

Part I: baseflow conditions

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Introduction

Should we reduce primarily point or non-point sources of phosphorus pollution? Crucial question is always answered in context of existing data. As well in Czech Republic in 2010, where apparent decrease of TP concentration during last 20 years is recorded in rivers. But many water bodies stay in risk not to meet good ecological status in 2015 (WFD) because of eutrophication. Gathering knowledge of amounts, impacts and desirable threshold of P load from point and non-point sources revealed agricultural land as a most uncertain P source. Moreover its relative amount is suspected to prevail in future.

Aim of the project is thus to describe unbiased P load from Czech agricultural land and evaluate its share on present stage of eutrophication. Load is described in terms of P quantity and bioavailability comprehensively summarized. Finally, it will help to find appropriate measures in water bodies across the country.

Assessment of P from erosion will follow with emphasis on conditions surrounding different delivery of size fractions and their saturation/equilibrium concentration with regard to surrounding water incl. discharged wastewaters) and leaching prevails.

Results

- TP and SRP concentration in major soil groups were lower than mean of 0.069 and 0.038 mg.L⁻¹, respectively.
- Eutric Fluvisols, albic and albo-gleic Luvisols frequently far exceeded global median of cSRP of 0.024 mg.L⁻¹.
- Instantaneous specific yields are higher from tile-drainage than brook during winter and spring.
- Summer cTP and cSRP within one watersheds were 0.038 ± 0.012 and 0.021 ± 0.019 mg.L⁻¹.

Methods

Whole monitoring is done at agricultural headwaters (any settlement was strictly excluded) with avg. area 2 km².

Spatial variability of P load during baseflow conditions is characterized by macro-scale for 11 dominant soil groups (based on 158 one-shot summer samples in 2008).

Micro-scale variability is described by one example of eutric Cambisols, most extant soil group in Czech Republic. Ten profiles diverge only in land-parcel structures and crop within that watershed: At five headwaters pairs of brook and adjacent tile-drainage were sampled monthly.

Temporal variability is described at three scales.

Interannual variability of specific yields (15 headwaters in 2007-2009)

- Seasonality of instantaneous load (monthly sampling of cca 30 profiles and direct measurement of discharge) and oscillations of concentrations during freeze-thaw cycle and spring uptake maximum.

Conclusion

With respect to threshold for eutrophic water, 0.035 mg.L⁻¹ BAP, summer load from agricultural land during baseflow do not affect large capacity for downstream wastewater dilution, but alone cannot hold up persistent blooms. Although minor soil types cover < 10% of Czech arable land they could be important source of bioavailable P. Phosphorus load during baseflow conditions is comprehensively summarized. Finally, it will help to find appropriate measures in water bodies across the country. Assessment of P from erosion will follow with emphasis on conditions surrounding soil particles during in-stream transport (i.e. different delivery of size fractions and their saturation/equilibrium concentration with regard to surrounding water incl. discharged wastewaters) and conditionally delayed P release from riverine or lake sediment.