



Reducing legacy soil phosphorus to tolerable levels for surface waters: A case study from Switzerland

J. Hirte¹, C. von Arb¹, S. Stoll^{1}, E. Frossard², C. Stamm³, V. Prasuhn¹*

¹ Agroscope, Water Protection and Substance Flows, CH

² ETH Zurich, Institute of Agricultural Sciences, CH

³ Eawag, Department of Environmental Chemistry, CH

* Current address: Canton of Basle-Country, Office for Environmental Protection and Energy, CH

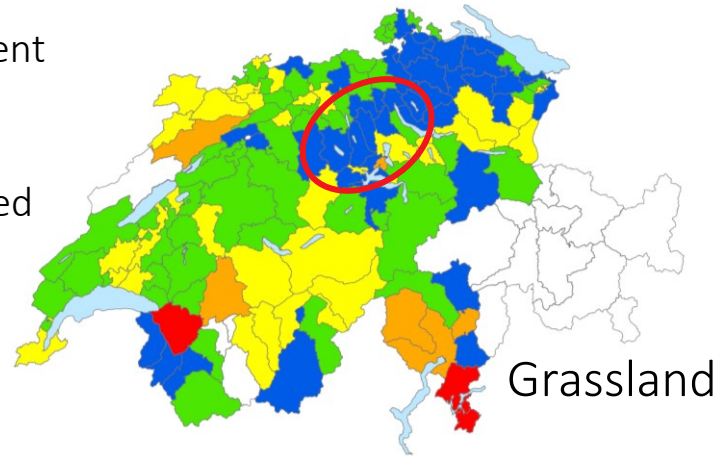
2 February 2022



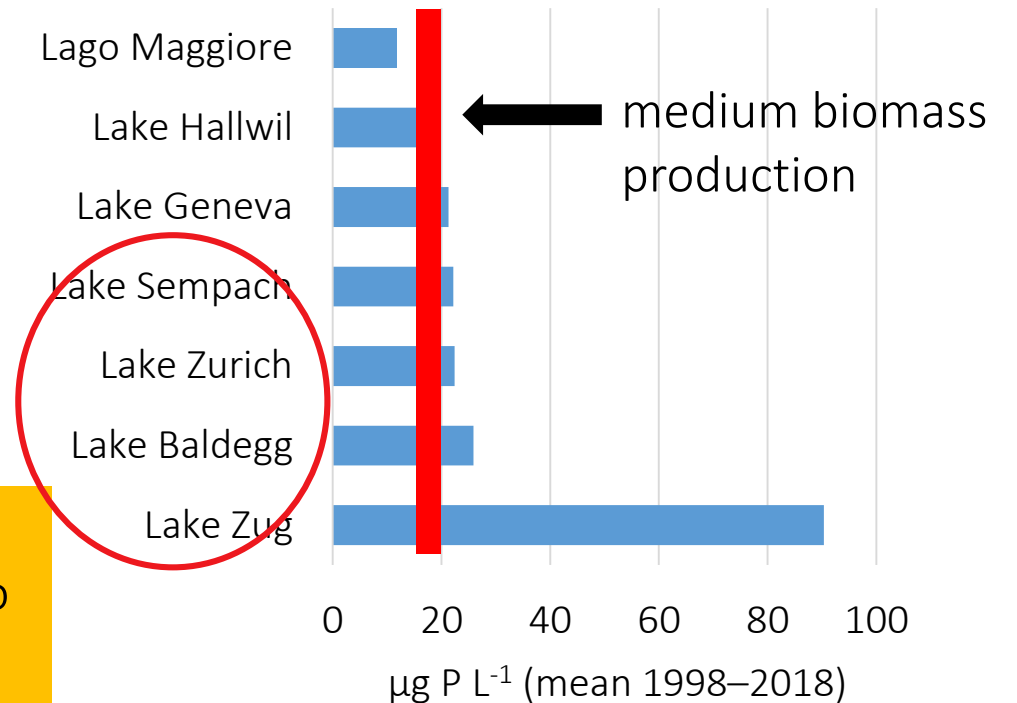
Impact of legacy soil P on surface water quality in CH

P status of agricultural soils

- very often deficient
- often deficient
- balanced
- often oversupplied
- very often oversupplied



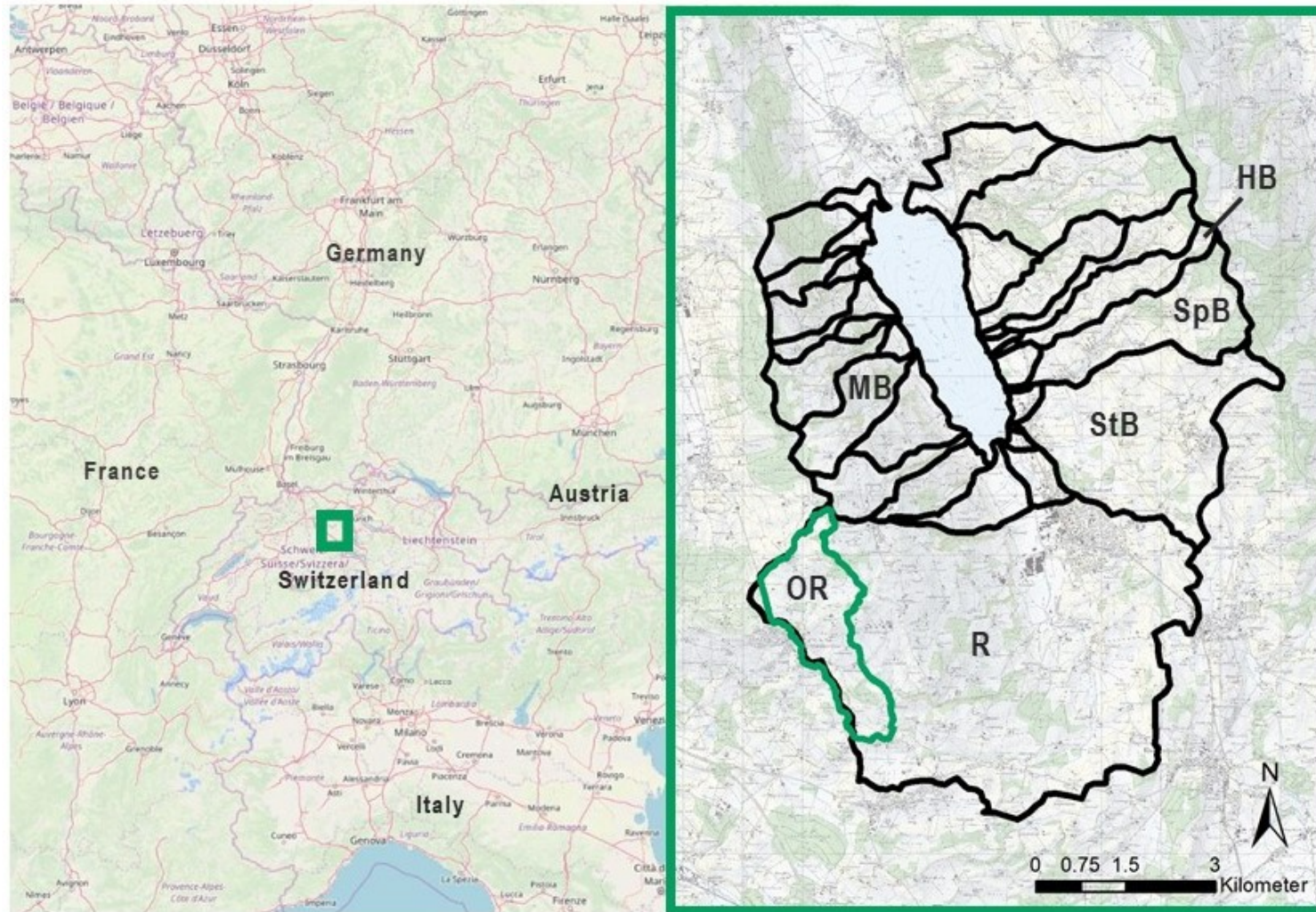
P concentrations of lakes



Goals:

- identify concepts that best predict transfer of soil P to water bodies
- estimate the time it takes to reduce legacy soil P to tolerable levels for surface waters

Study area: Lake Baldegg catchment, central CH



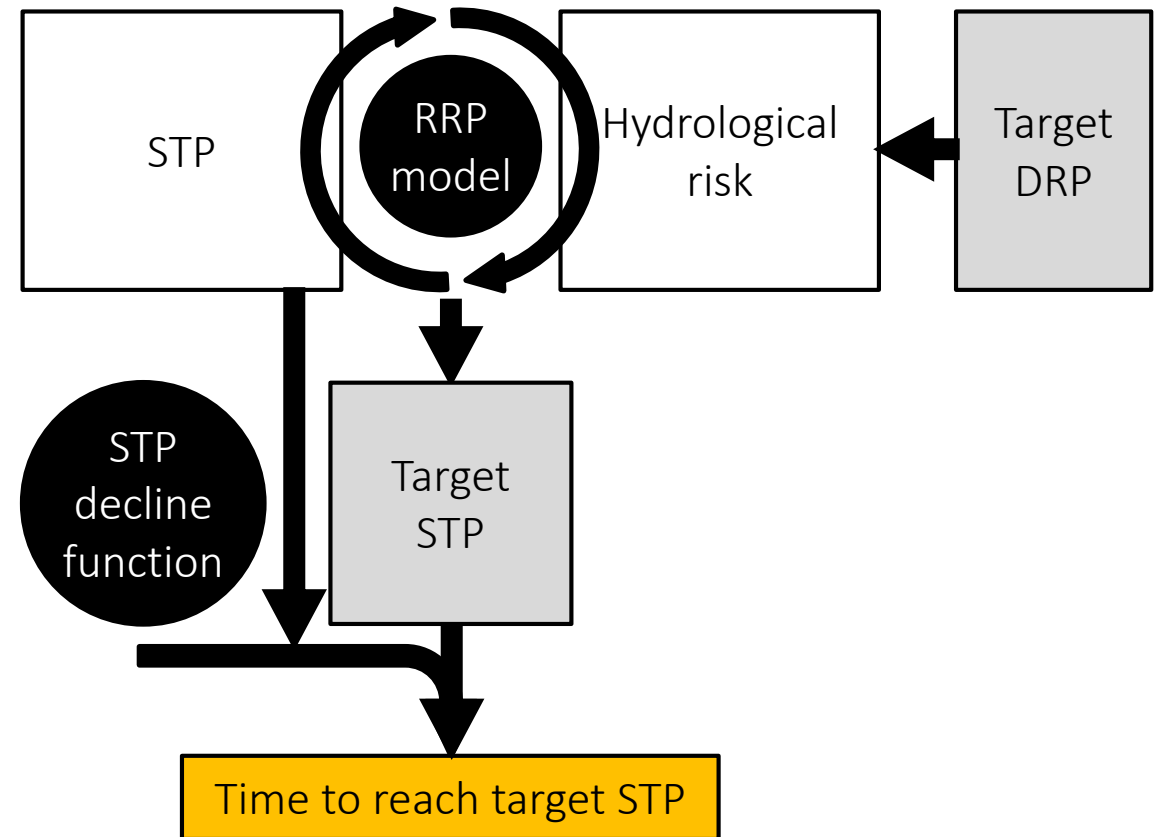
Transfer of soil P to water bodies – concept

- soil test P (STP; measured CO₂-saturated water-extractable P)
- hydrological risk (rainfall-runoff-P (RRP) model) Lazzarotto et al. 2006; Hahn et al. 2013

→ target level of dissolved reactive P (DRP)
→ target level of STP

- STP decline function (based on P-mining experiment) Frossard et al. 2014

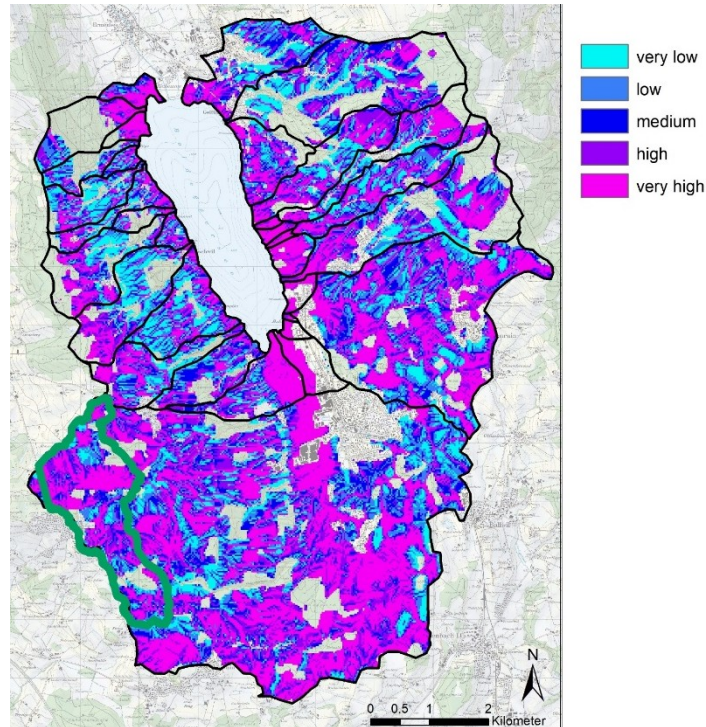
➔ Time to reach target STP



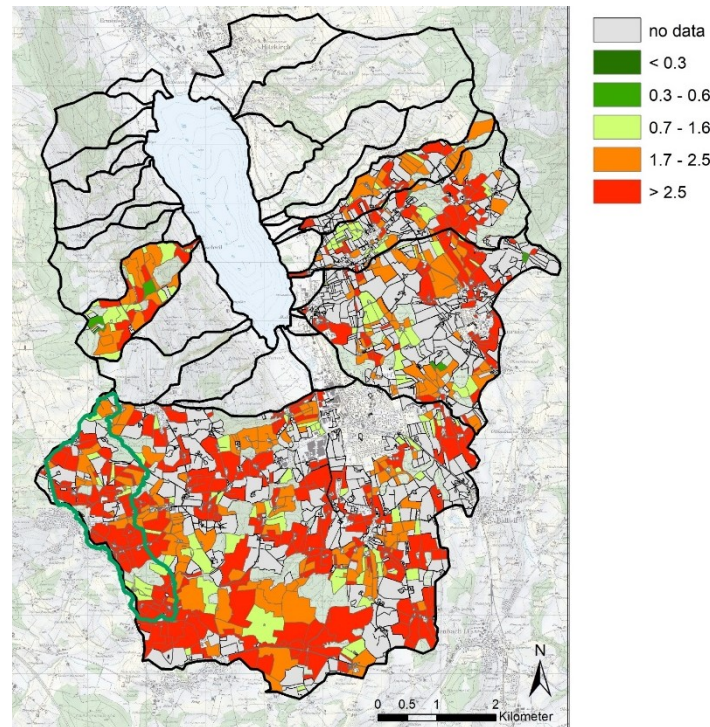


Transfer of soil P to water bodies – input data

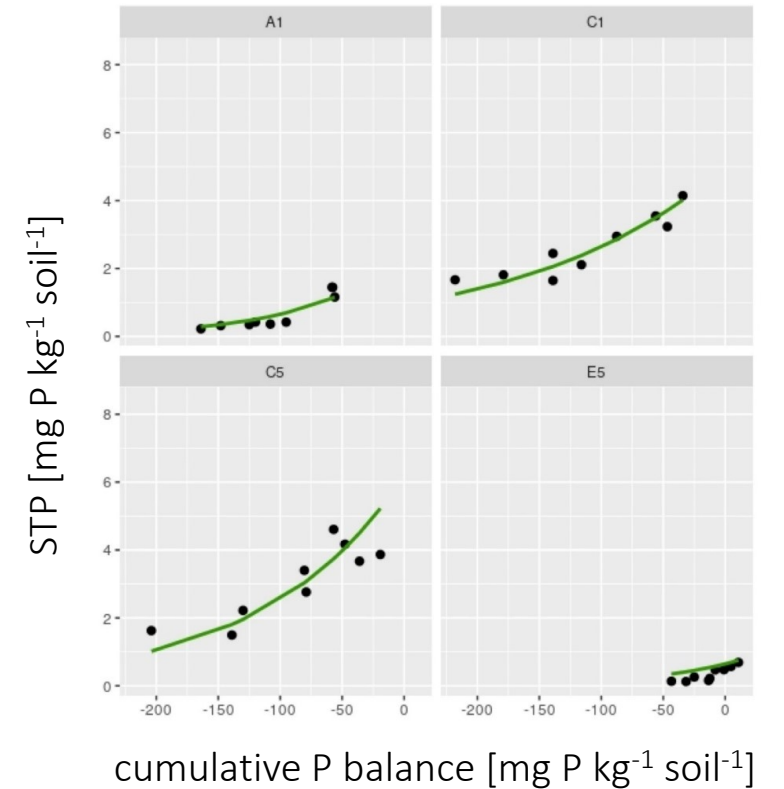
Hydrological risk for a medium rainfall event of 35 mm day⁻¹



Measured STP [mg P kg⁻¹ soil⁻¹]



P mining pot experiment

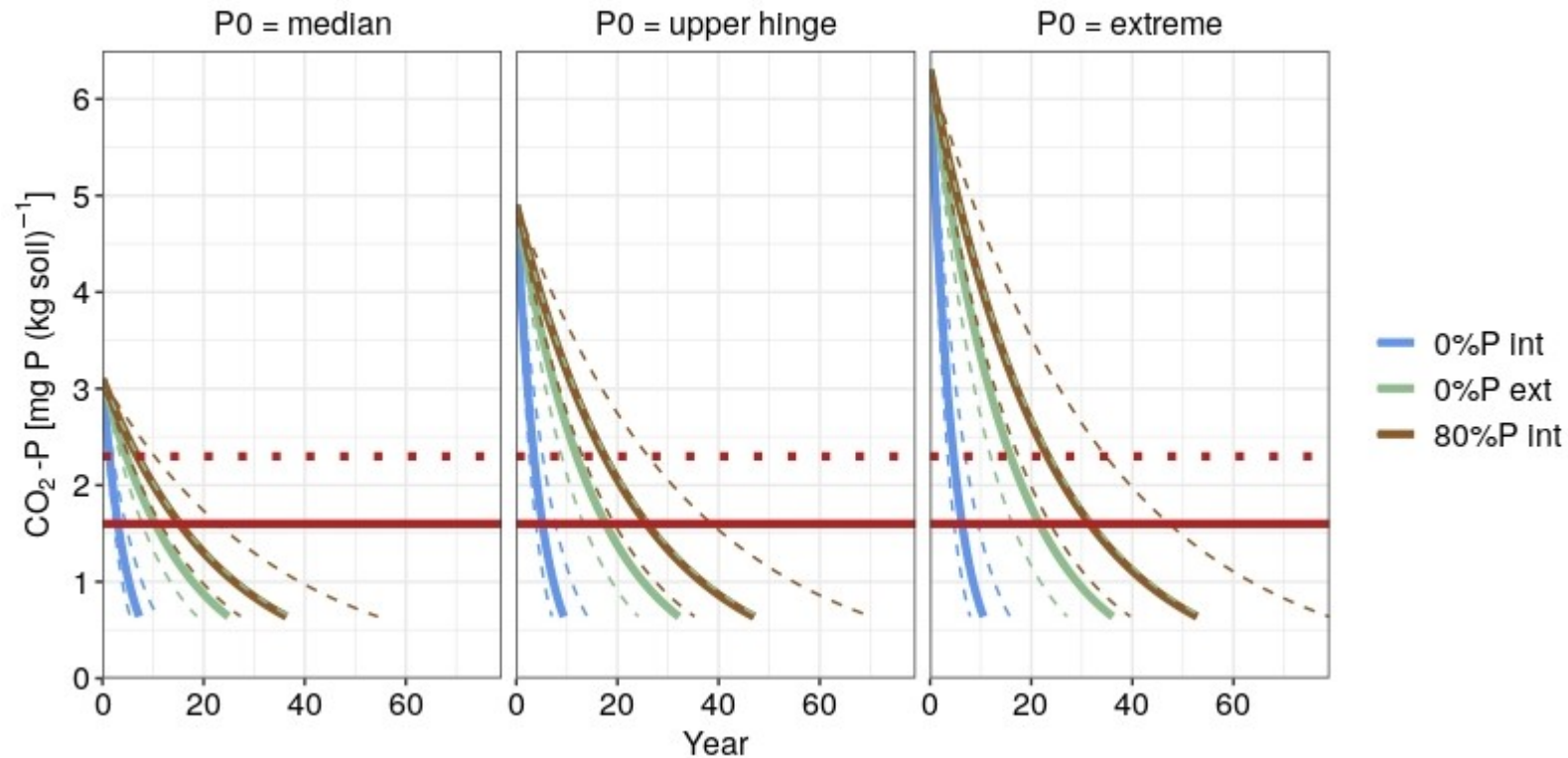


different scenarios of DRP loads depending on STP values

P decline function



Time to reach target STP



- 0% P, 100% NK fertilization: 2–9 years
- 0% NPK fertilization: 8–32 years
- 80% P, 100% NK fertilization: 11–47 years

Read more:

von Arb C., S. Stoll, E. Frossard, C. Stamm, V. Prasuhn. 2021.

The time it takes to reduce soil legacy phosphorus to a tolerable level for surface waters: What we learn from a case study in the catchment of Lake Baldegg, Switzerland. *Geoderma* 403, 115257.

doi.org/10.1016/j.geoderma.2021.115257