SWAT application in case of small reservoir watershed, Czech Republic

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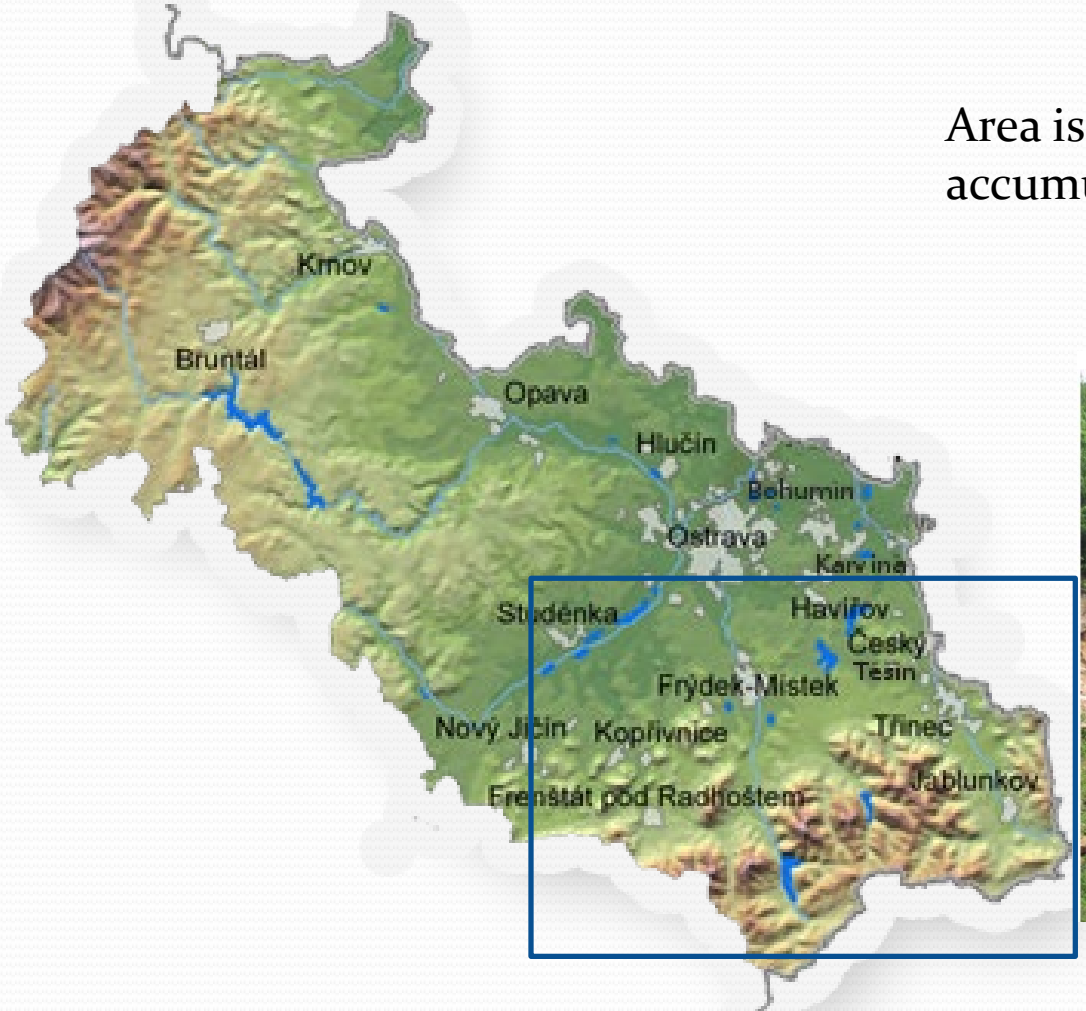
Water resources in carpatian part of Odra basin in Czech Republic



Area is not suitable for large groundwater accumulation

Study objectives

- Assess data avaibility for SWAT model application
- Calibrate and validate SWAT and evaluate performance

Olešná resrvoir

- 33.6 km² watershed area
- Supply water for local industry
- Recreational activities
- …but suffers by high sediments and nutrients inflow

Input data - soils

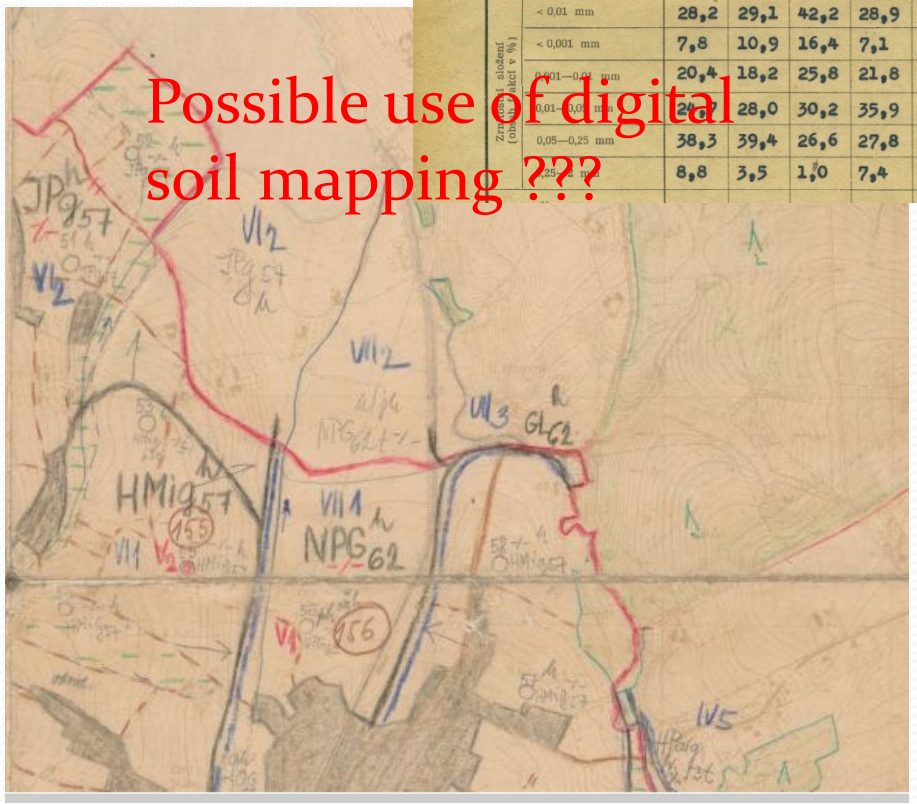
High resolution soil survey in 1969

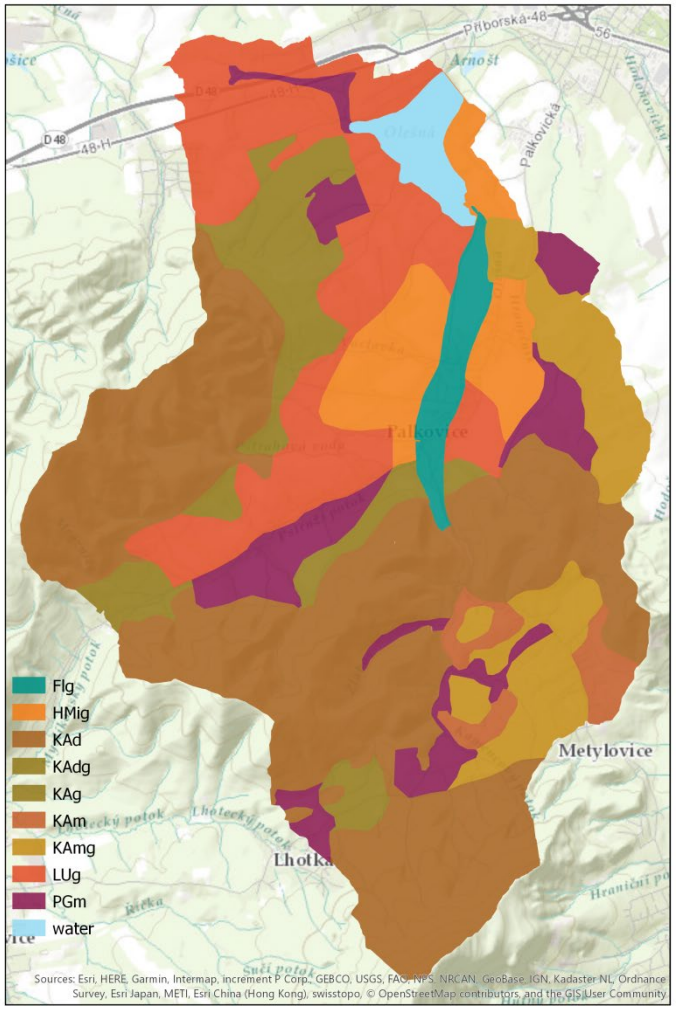
JZD Palkovice

ANALYTICKÁ CHARAKTERISTIKA PROFILU č. 239 Okres

Horizonty (označení indexy)	"V" 1	NPG 62		
	1	2	3	4
Vzorek z hlubiny v cm	5–15	40–50	70–80	100–110
< 0,01 mm	28,2	29,1	42,2	28,9
< 0,001 mm	7,8	10,9	16,4	7,1
0,001—0,01 mm	20,4	18,2	25,8	21,8
0,01—0,05 mm	24,7	28,0	30,2	35,9
0,05—0,25 mm	38,3	39,4	26,6	27,8
0,25—2 mm	8,8	3,5	1,0	7,4

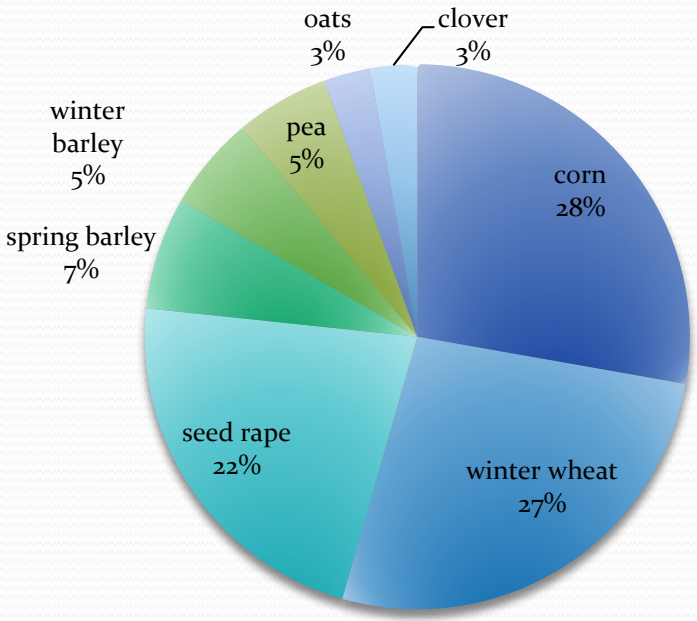
Possible use of digital soil mapping ???

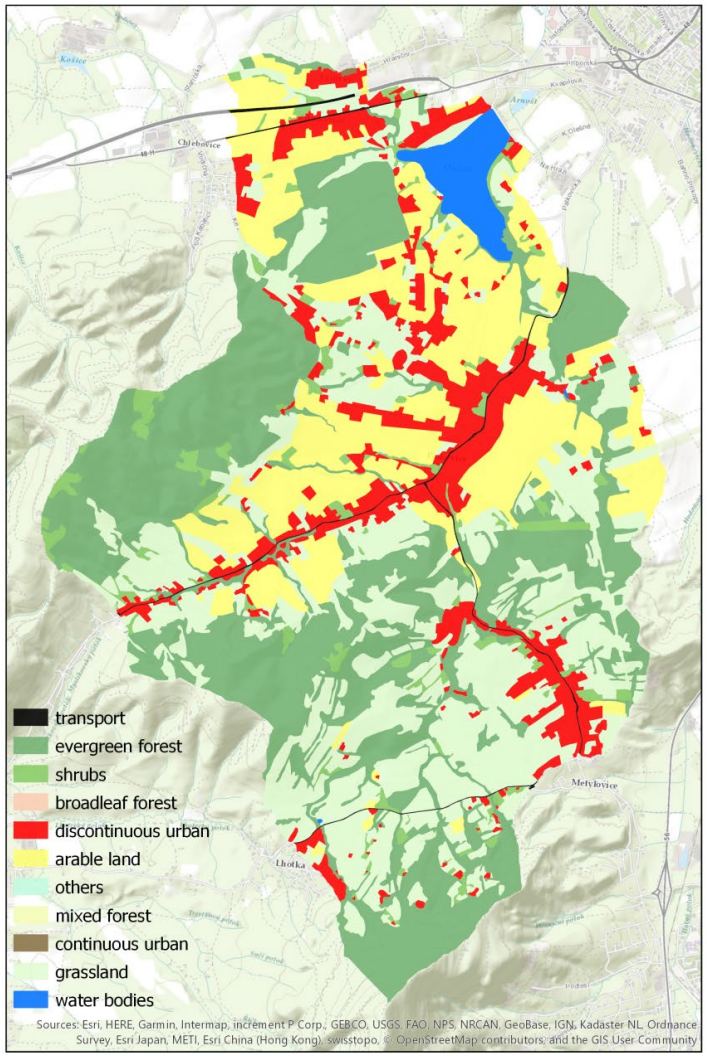




Input data – land use

- the need for consultation with local farmer
- fields aggregation, 7 year rotation



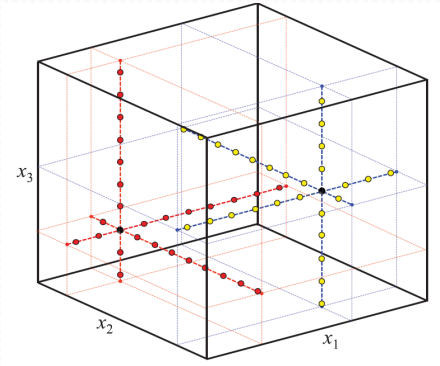


Calibration and validation process

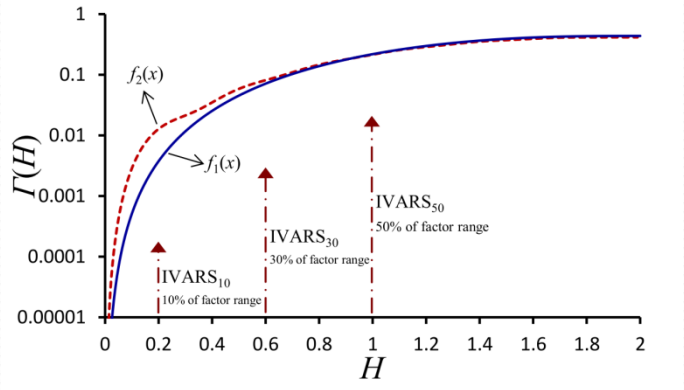
- Usage of 2007-2011 period for calibration and 2012-2015 for validation
- Automatic calibration againts point measurment of discharge, suspended solids and nutrients
- Performance assessed according to NSE and PBIAS

Hydrological balance calibration

- Two discharge time-series avaible
- Reduction of parameters by sensitivity analysis according to Razavi and Gupta (2016) - VARS



Star sampling



Integrated variograms for every parameter

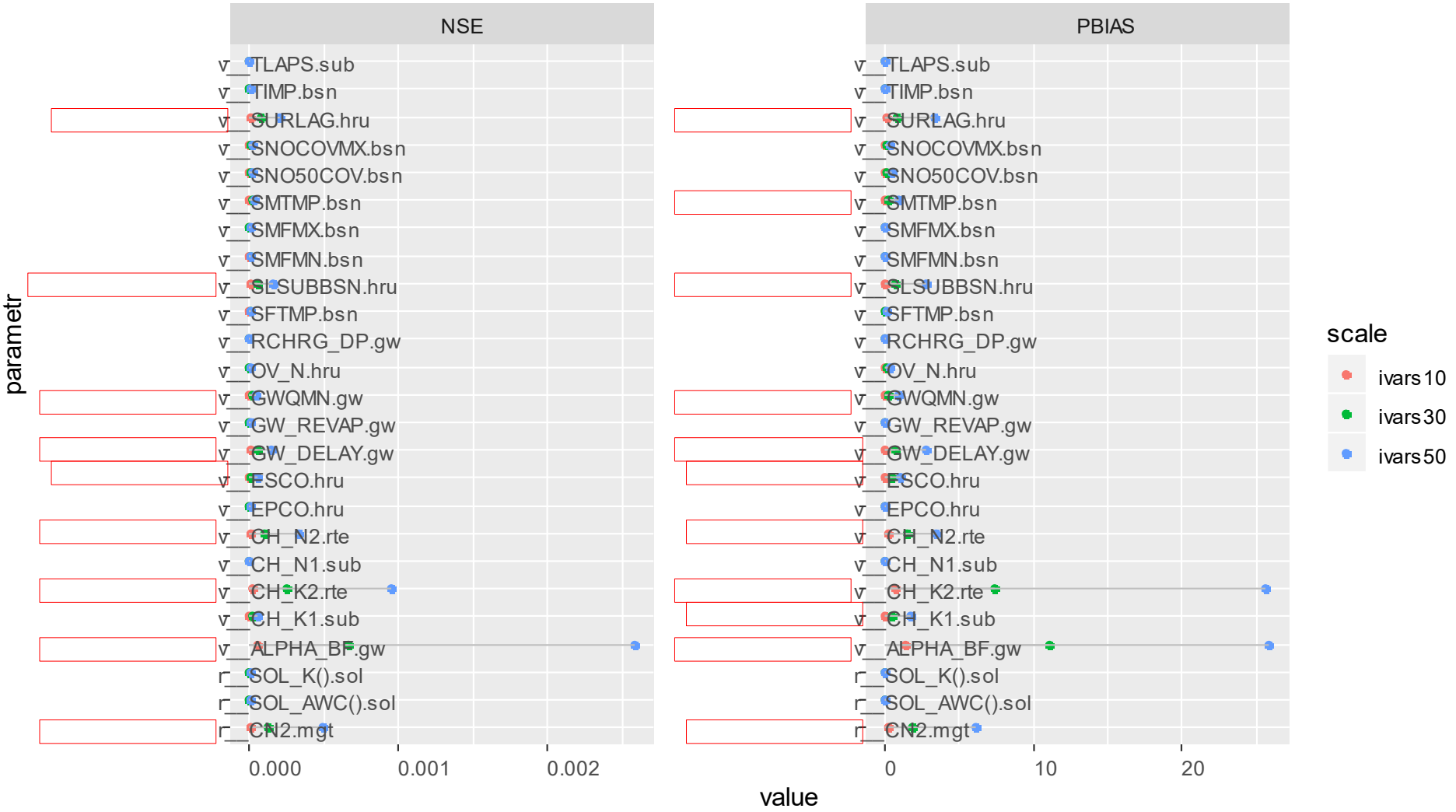
SWATpasteR

Sediments and nutrients balance calibration

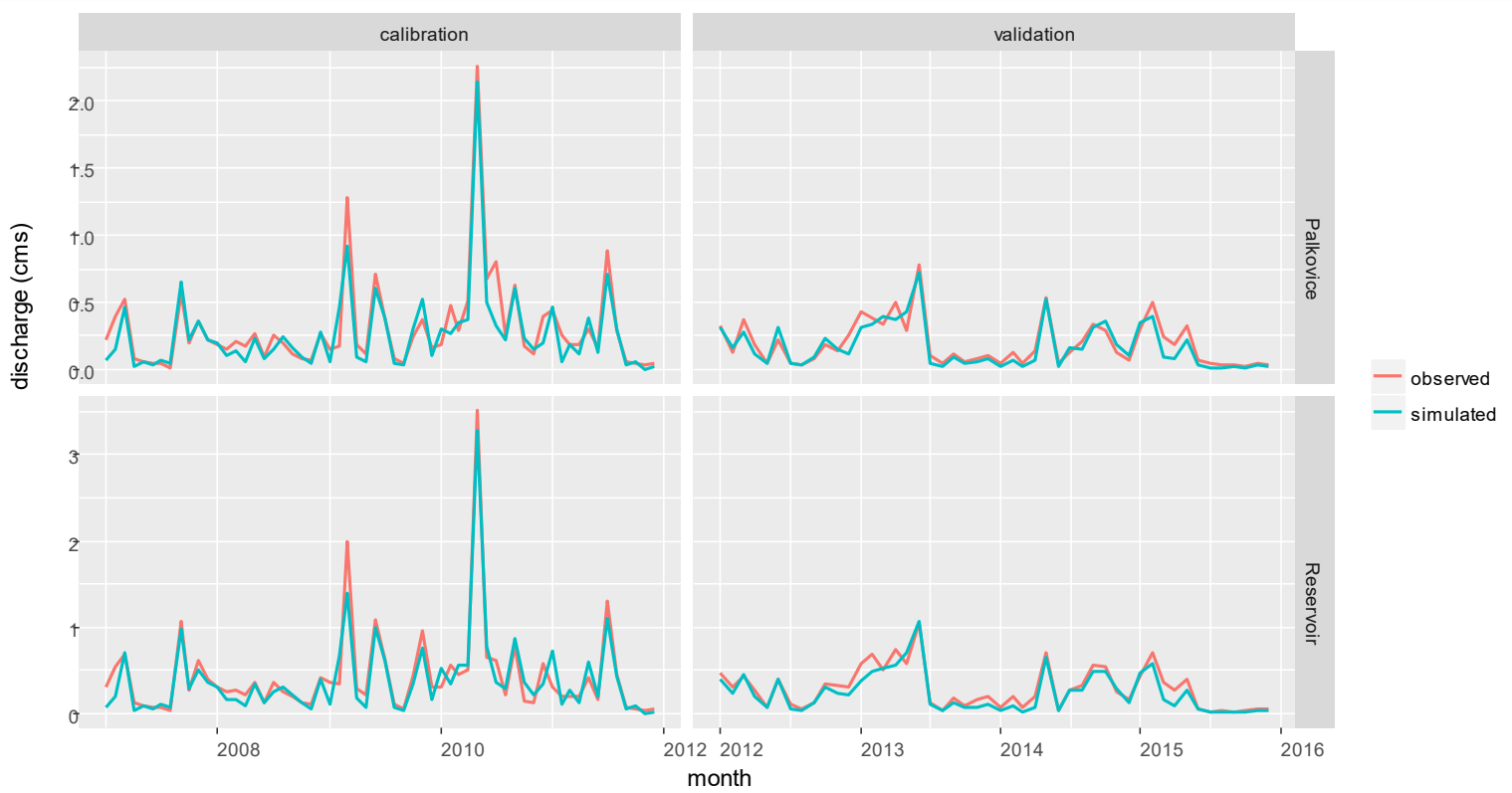
- Monthly loads estimated from reggresion model (LOADEST) using discharge data, monthly samples and seasonality
- Used common parameters
- Random hypercube sampling

Nitrate	Total phosphorus	Sediments
v__HLIFE_NGW.gw	v__PHOSKD.bsn	v__CH_COV1.rte
v__SOL_NO3().chm	v__ERORGP.hru	v__CH_COV2.rte
v__ANION_EXCL.sol	v__PPERCO.bsn	v__PRF_BSN.bsn
v__NPERCO.bsn	v__CMN.bsn	v__SPCON.bsn
v__ERORGN.hru	v__PSP.bsn	v__SPEXP.bsn
v__AI1.wwq		

Results - sensitivity

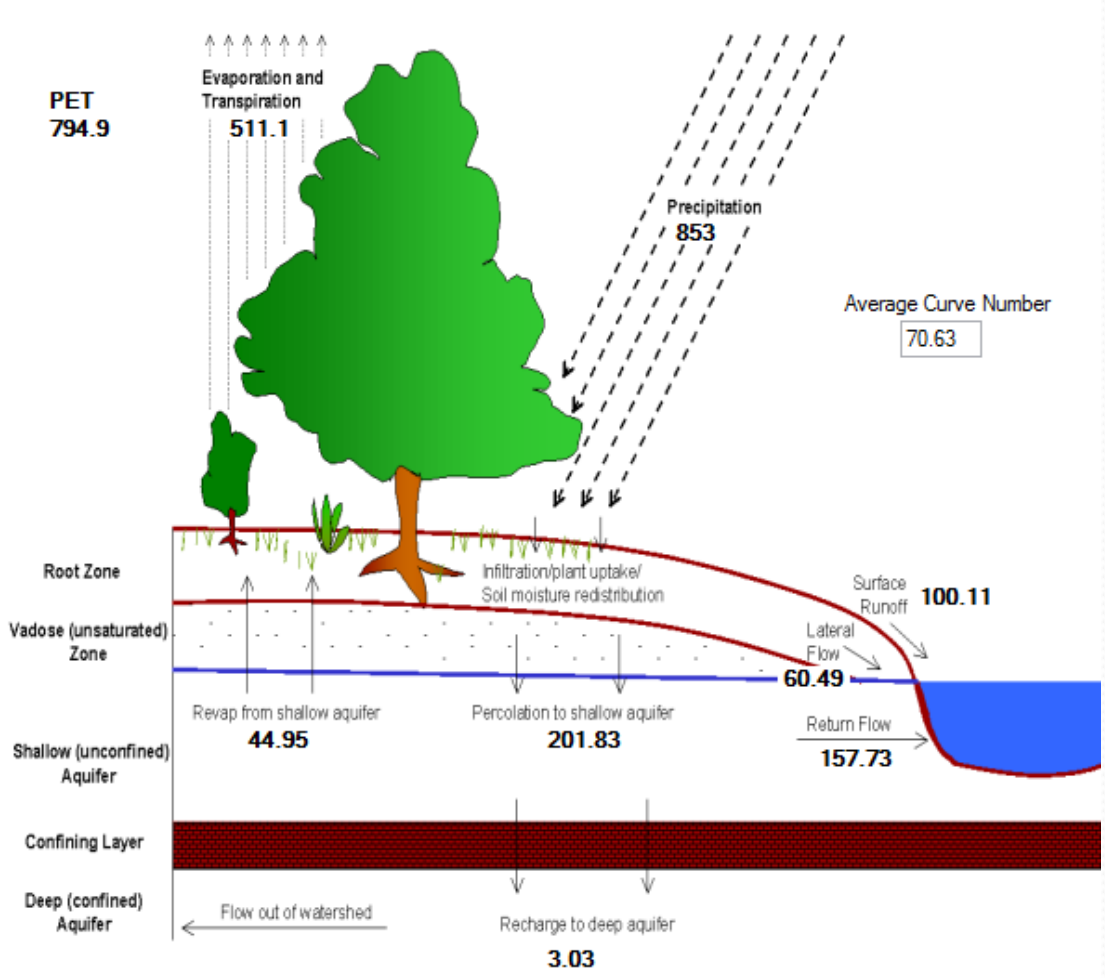


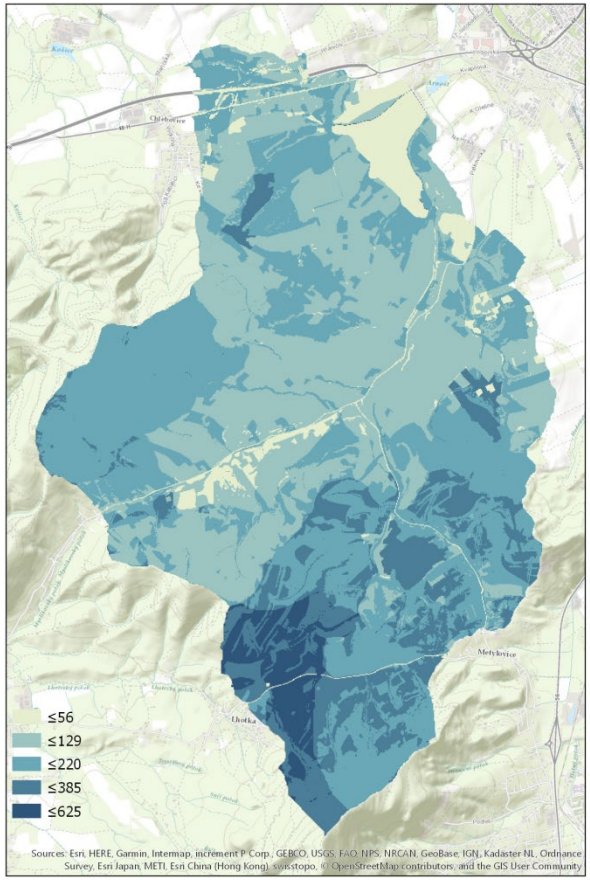
Results – best performance for hydrology



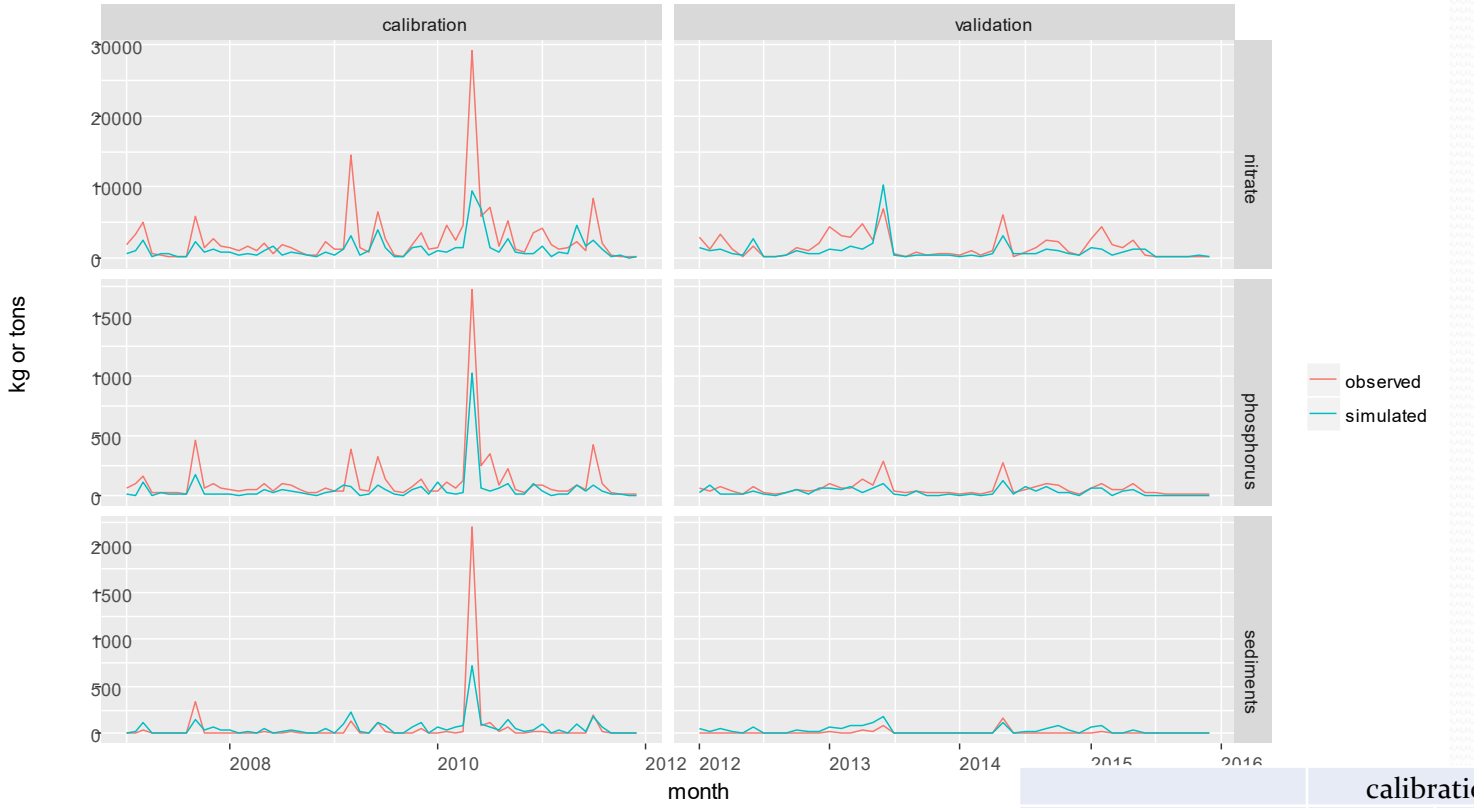
	Calibration				Validation			
	NSE		PBIAS		NSE		PBIAS	
	Daily	Monthly	Daily	Monthly	Daily	Monthly	Daily	Monthly
Palkovice gauge	0.63	0.88	-5.6	-5.6	0.53	0.85	-11.8	-11.9
Reservoir inflow	0.46	0.91	-8.9	-9	0.35	0.87	-17.8	-18

Results – best performance for hydrology





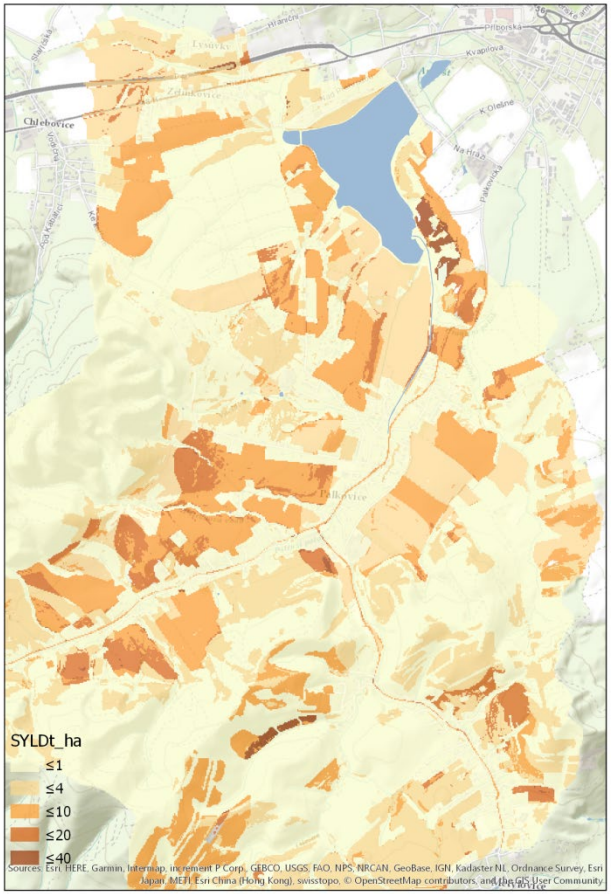
Results – best performance for sediments and nutrients



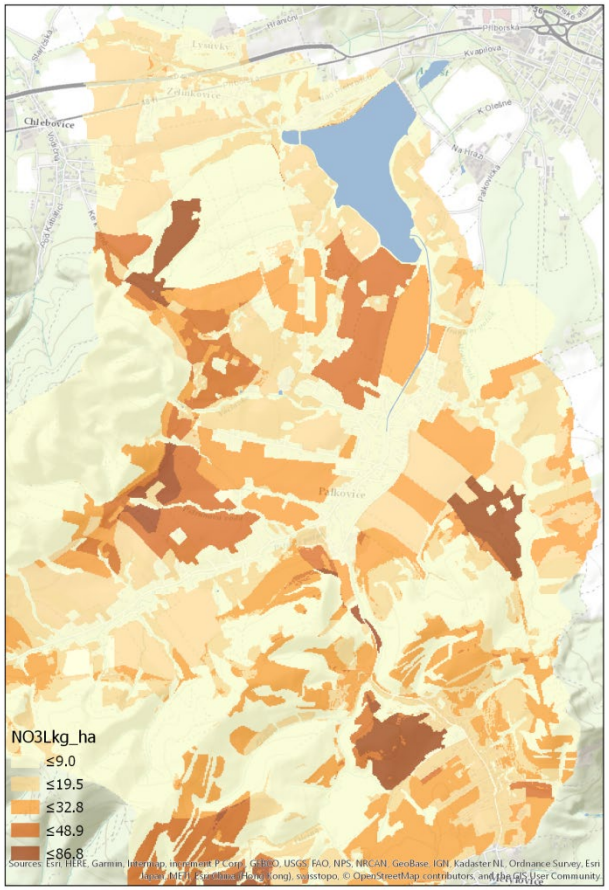
	calibration		validation	
	NSE	PBIAS	NSE	PBIAS
Sediments	0.52	-4.7	0.36	-42.1
Nitrates	0.36	-54.2	0.38	-38.2
Total phosphorus	0.66	-57.2	0.33	-46.1

Looking for critical source areas

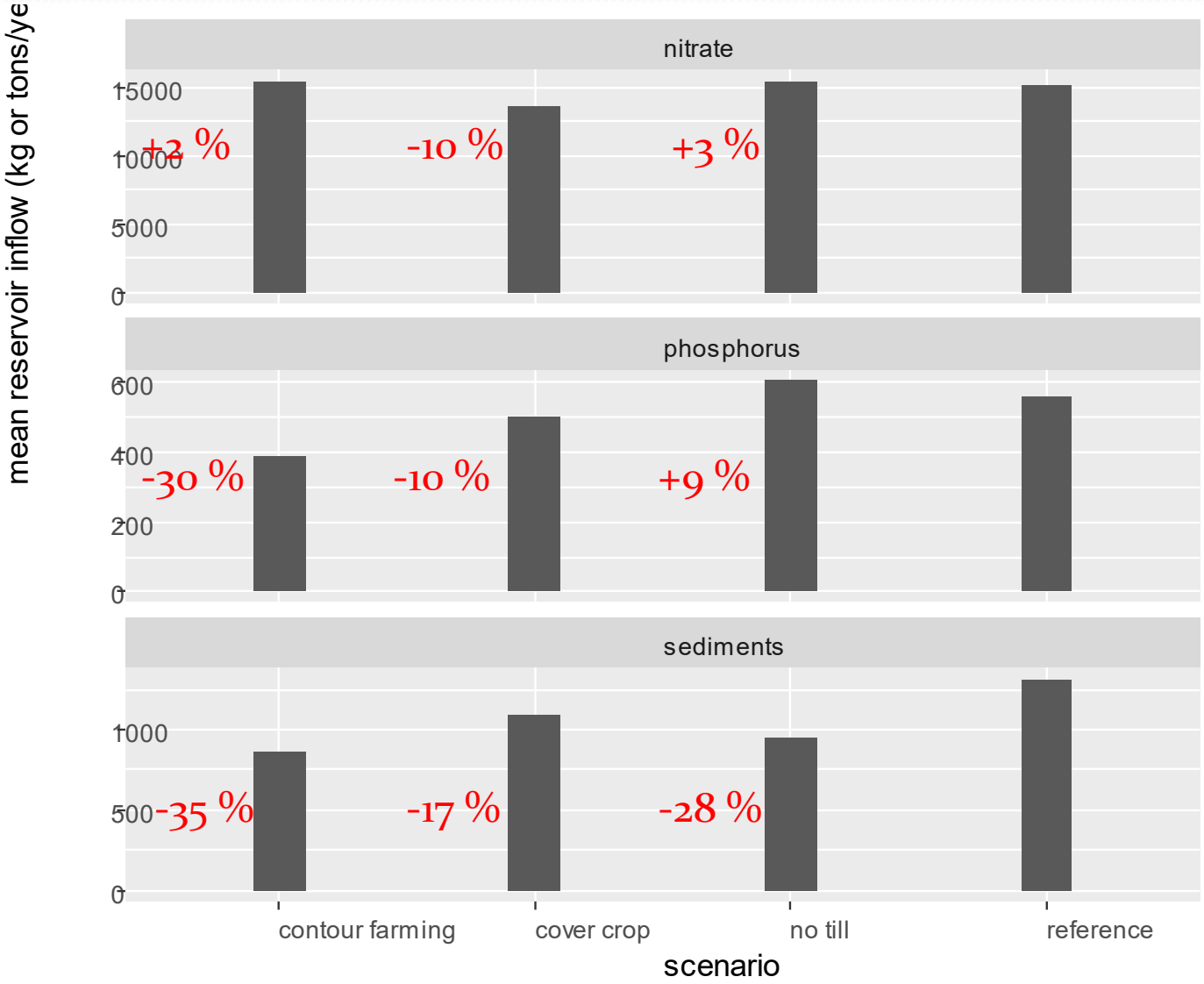
Sediments loading



Nitrate leaching



Estimating BMPs effectivity



Conclusions

- Soil data could be readily avaible in apropriate resolution
- Management data have to be obtained via consultation with farmers
- SWAT provides reasoneble prediction of reservoir water inflow
- sediments and nutrients are probably underestimated

Next steps…

- improve calibration of sediments and nutrients load
  - including soft data
- make prognosis of climate change impact
- estimate efficiency of conservation practices under climate scenarios