Leaving fields - reaching streams

phosphorus emitted from

exclusively agricultural headwaters

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COMLAND & COST 869
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Czech context I.

1. Stock change compared with 1989: (ČSÚ, 2008)

comp. 89	cows	pigs	poultry
10^6 cap.	- 2,079	- 2,253	- 5,166
%	- 60	- 48	- 16

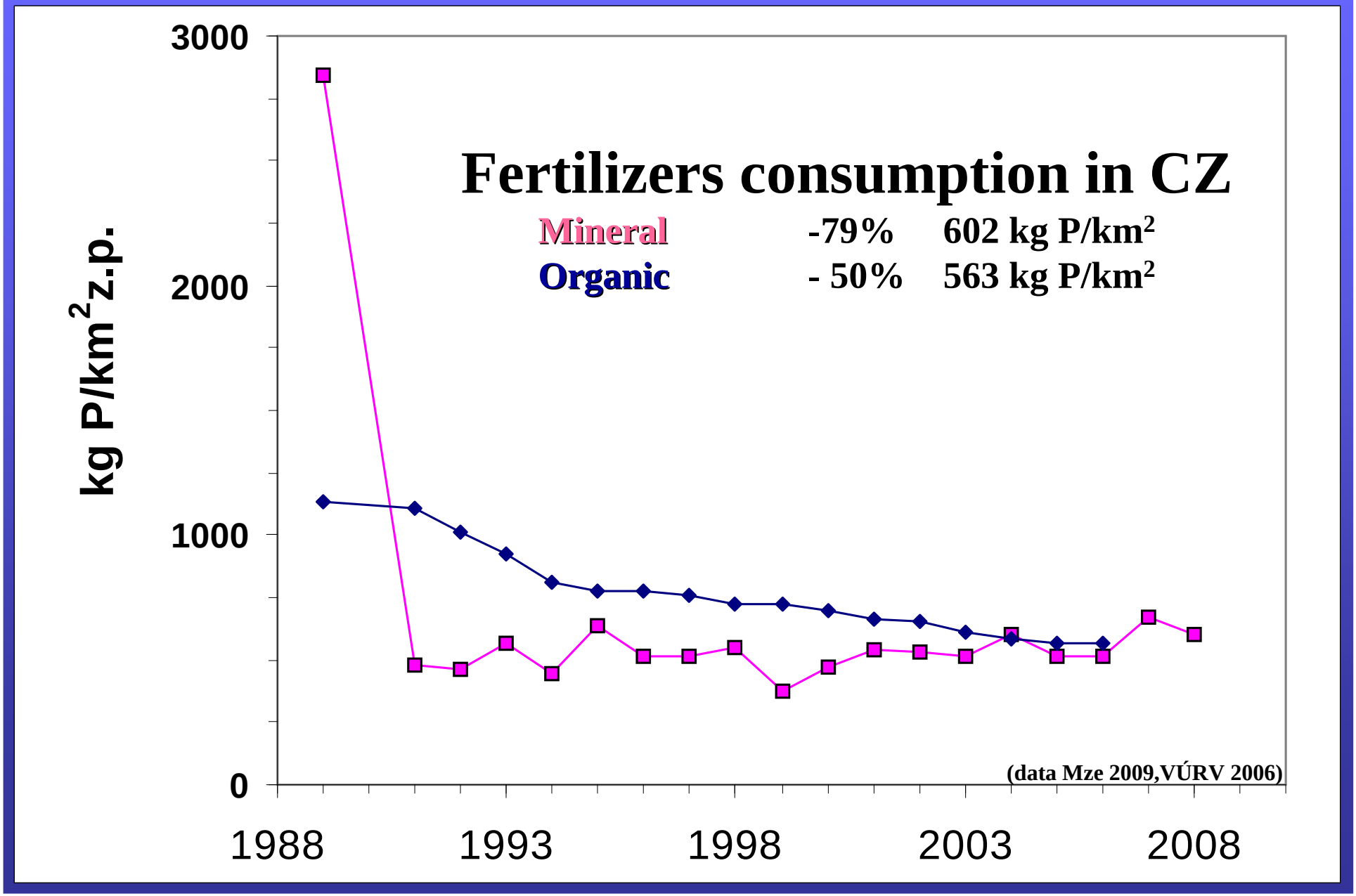
2. Land-use change compared with 1989: (ČSÚ, 2007)

comp. 89	arable	grass	forest	water
km^2	- 2.000	+ 1.500	+ 224	+ 40
%	- 6,2	+ 18	+ 0,9	+ 2,5

3. Sawing area change compared with 1989: (ČSÚ, 2008)

comp. 89	s.beet	potatoes	corn	rape	grain	grass (ar.l.)
10^3 km^2	- 767	- 857	+ 602	+ 2.545	- 2.264	- 6733
%	- 58	- 73	+ 140	+ 240	- 14	- 63

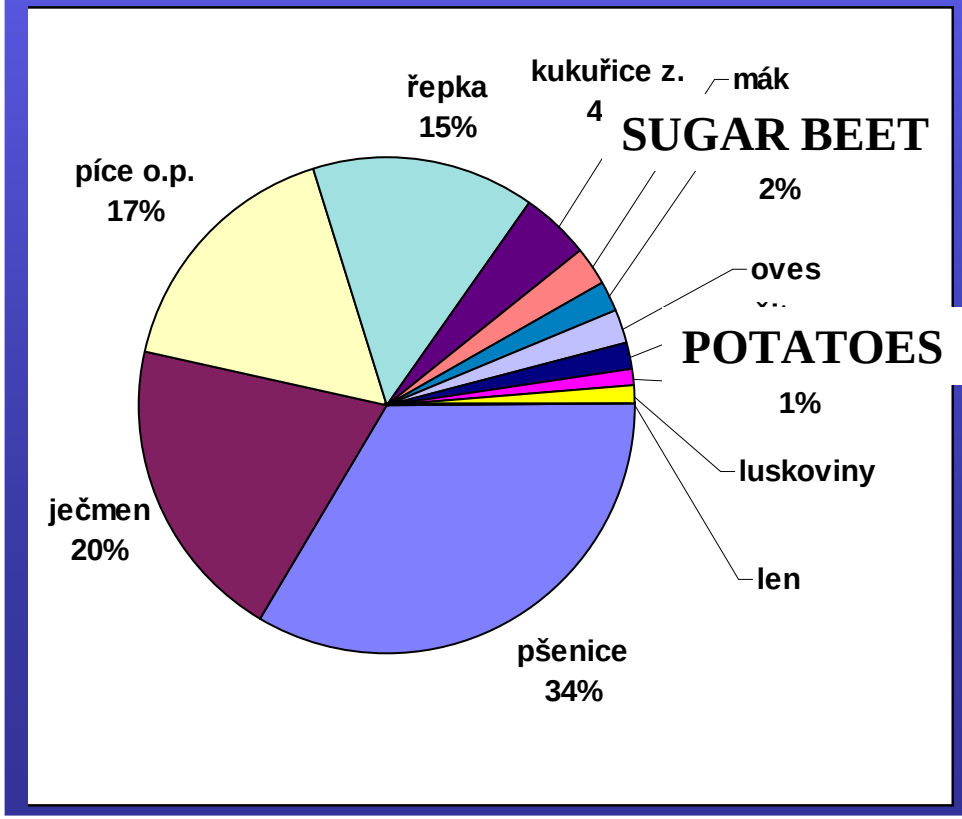
Czech context II.

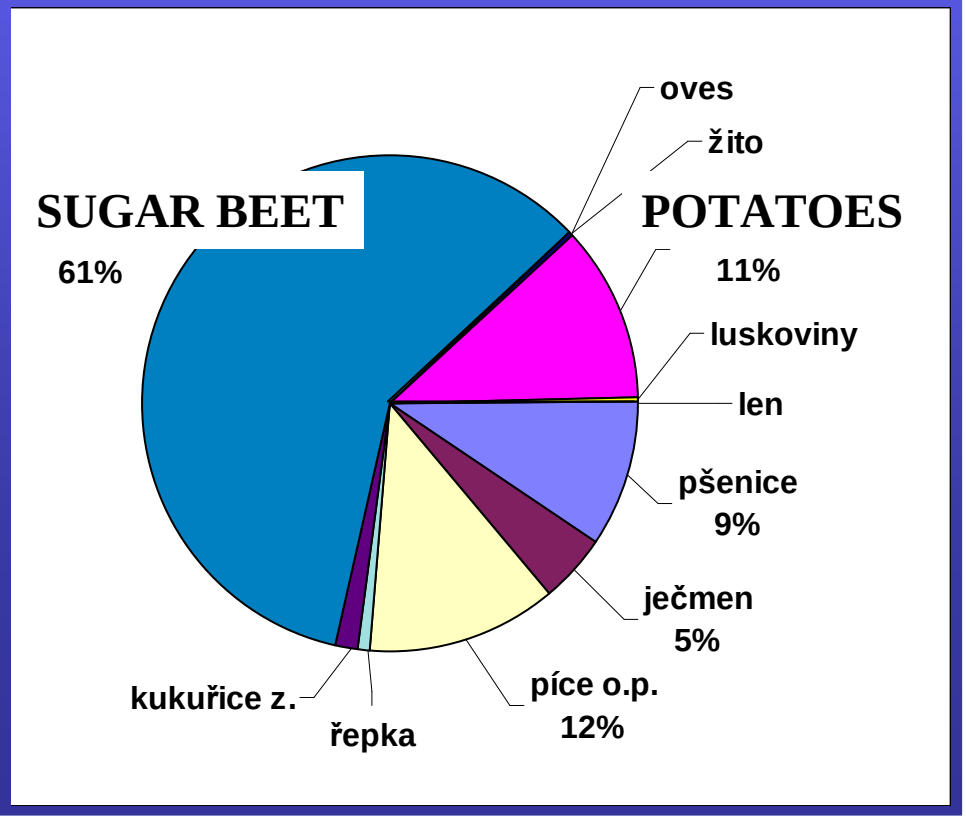


Czech context III.

Sawing area 2008 [km^2]
Data from 80 % a.l. CZ
(ČSÚ, 2008)

Uptake P in yield [kg P/yr]
avg. 2003-7
(MŽP 2008, Vyhl. 274/1998 Sb.)

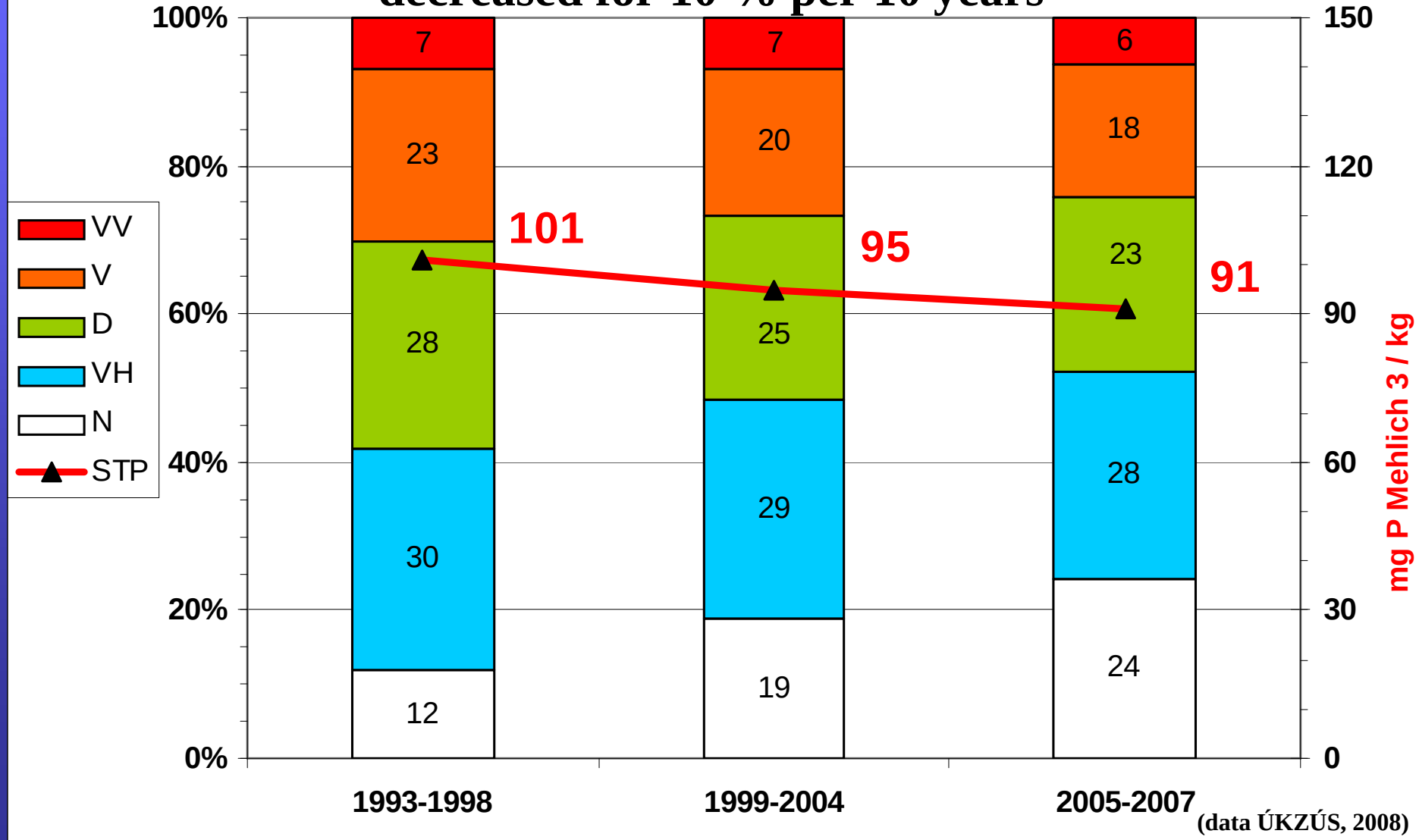




Czech context IV.

Available P in CZ arable land

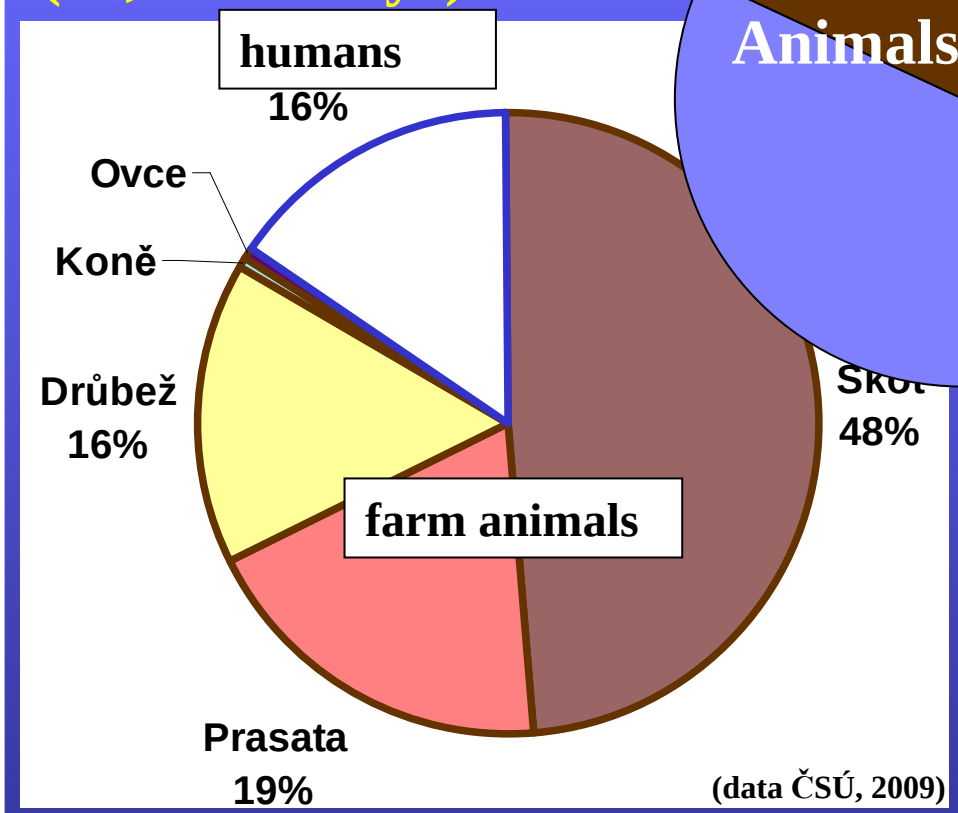
decreased for 10 % per 10 years

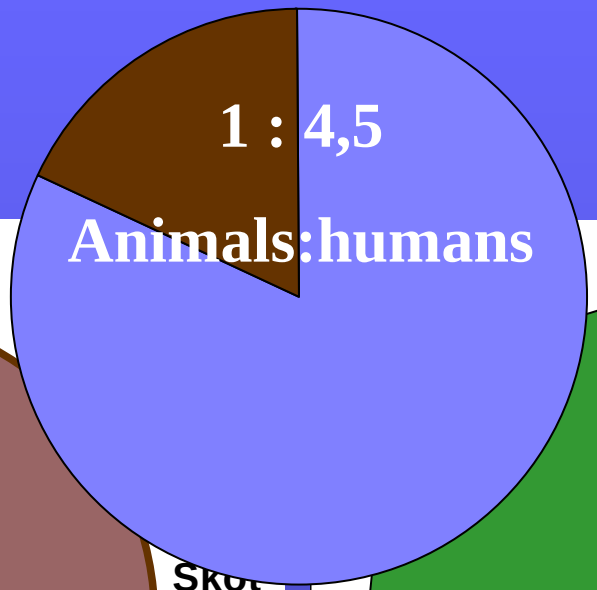


(data ÚKZÚS, 2008)

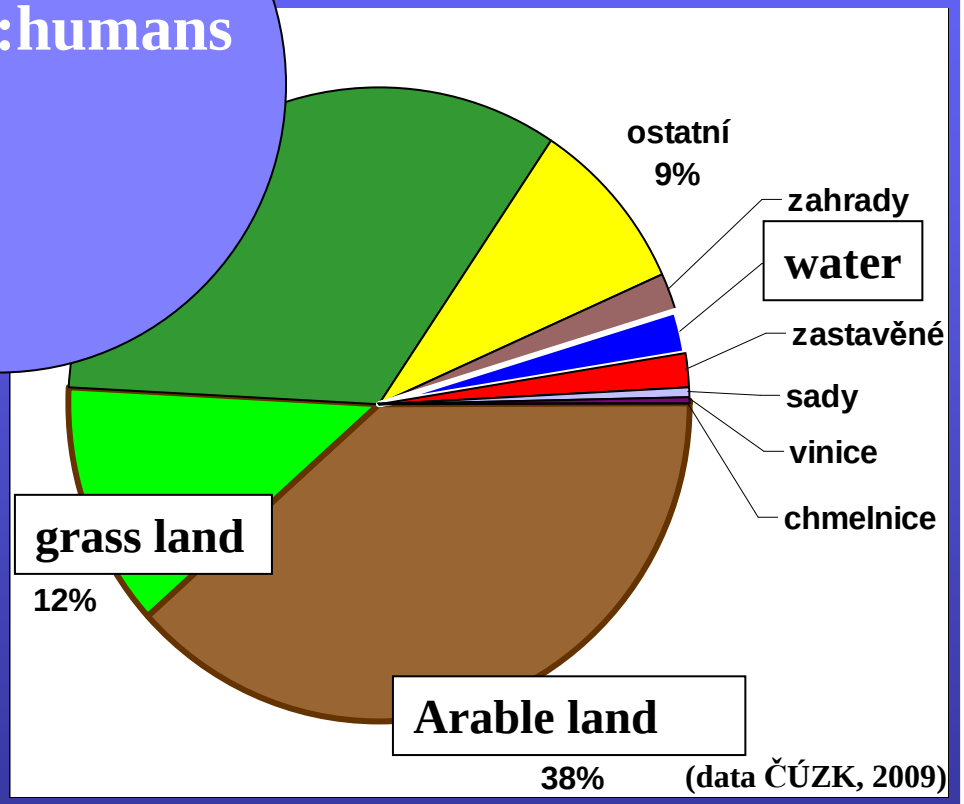
Czech context V.

Excretion P CZ 2008
(38,9 10^3 t P/yr)





Land-use 2008
(78,8 10^3 km^2)



Czech context summary

1. Atmospheric deposition: **5 – 50** kg **TP**/km^2.yr (EEA, 2007)
   - **26** kg **SRP**/km^2.yr (Škoda, 1994)
2. Fertilizers: **1.100** kg **P**/km^2.yr ag.l. (Mze 2009,VÚRV 2006)
3. Uptake P in yield:
   - **335** kg **P**/km^2.yr (area and yield weighted avg.)
     - **88** grain, **140** corn, but **2.661** potatoes and **7.249** řepa (kg **P**/km^2.r)
     - (avg. 2003-08, count from ¾ arable land CZ)
4. Storage in soil: **91** mg **P Mehlich 3**/kg (ÚKZÚS, 2008)
   - (arable land CZ 2005-7)
5. Outflow: **17 – 1** kg **TP**/km^2.yr
6. Erosion: **10^0 – 10^3** kg **P**/km^2.yr (potencial)
7. Drainage: ¼ agricultural land (VÚMOP, 2007)

Why to measure non-point sources of P?

point sources:

registered (mostly)
improved by detergent ban **(Reg. 78/2006)** (less effective)
and „solved“ from 2010 UWWT **(91/271/EC)**

> 10.000 PE **(popul. equiv.)** ask tertiary treatment
> 2.000 PE ask secondary treatment

non-point s.:

generally decreasing in load (mineral fertilizers, abandonment of arable land, animal stock density), but not in importance.

source apportionment: appropriate management tool for reaching 1st WFD environmental objective but „persistent blooms during summer months“ = MODERATE status.

REDUCE EUTROPHICATION

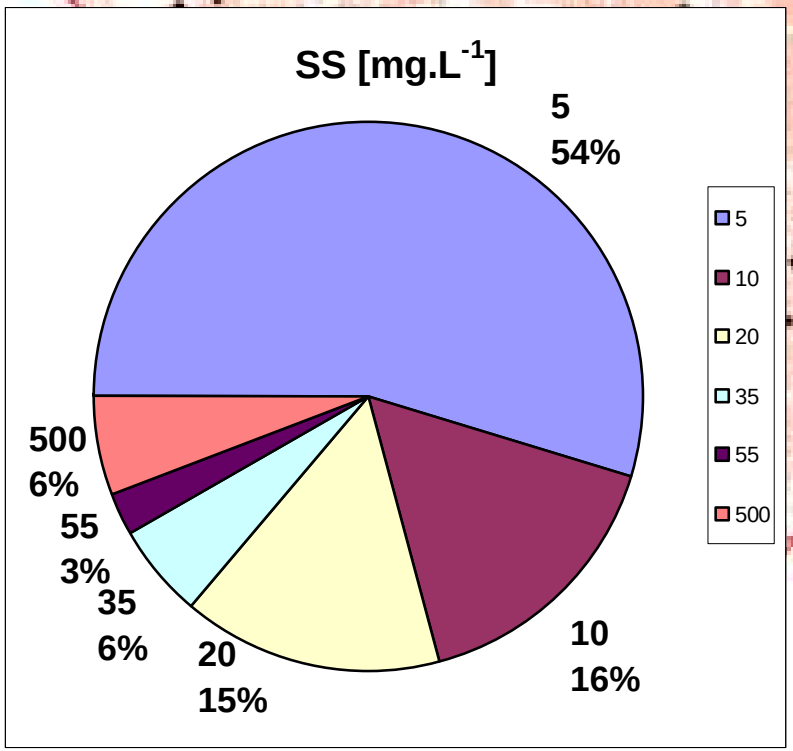
Aims of project:

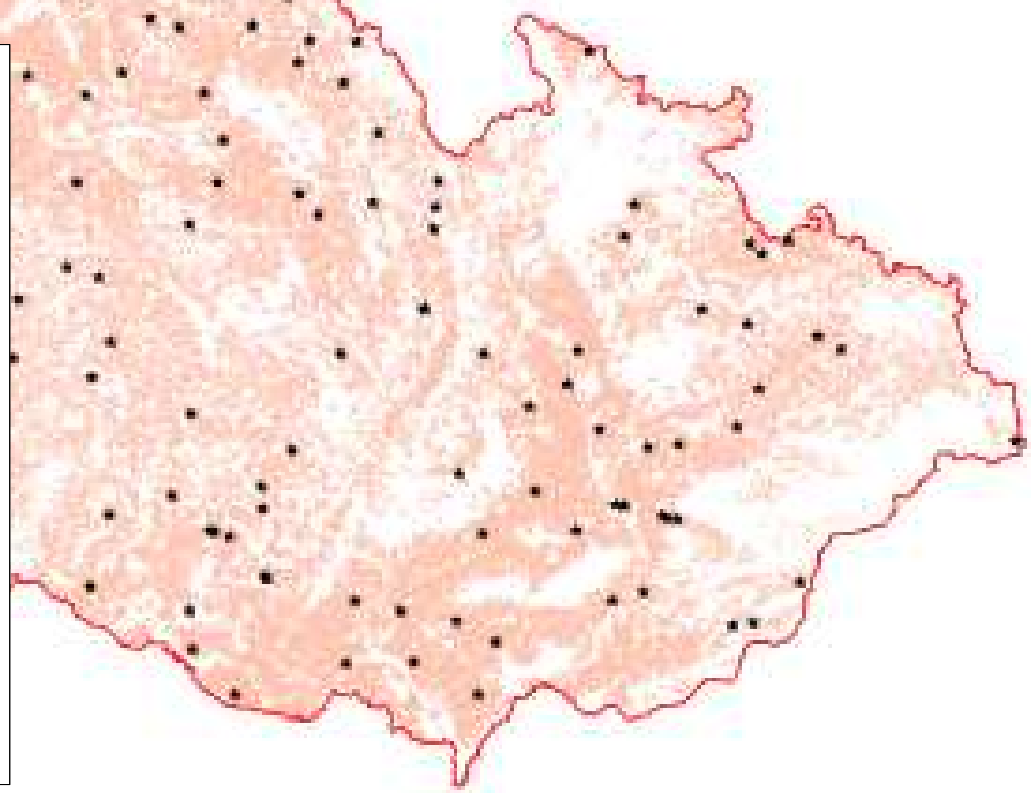
1. To measure real immisions (CZ 2000´)
2. To improve source apportionment (compare to used export coef., enhance model´s inputs)
3. Compare erosional and extraerosional portion
4. Evaluate impact of P-form on eutrofication
   - SRP, TP, BAP, DIP, DOP, PP, CP

(Reservoir Orlík, VII. 2008)

Methods & results I.a

2006: screening on 234 profiles,
162 one-shoot samples from 11 main soil types,
which represent 80% arable land of CZ
May – August, base-flow condition

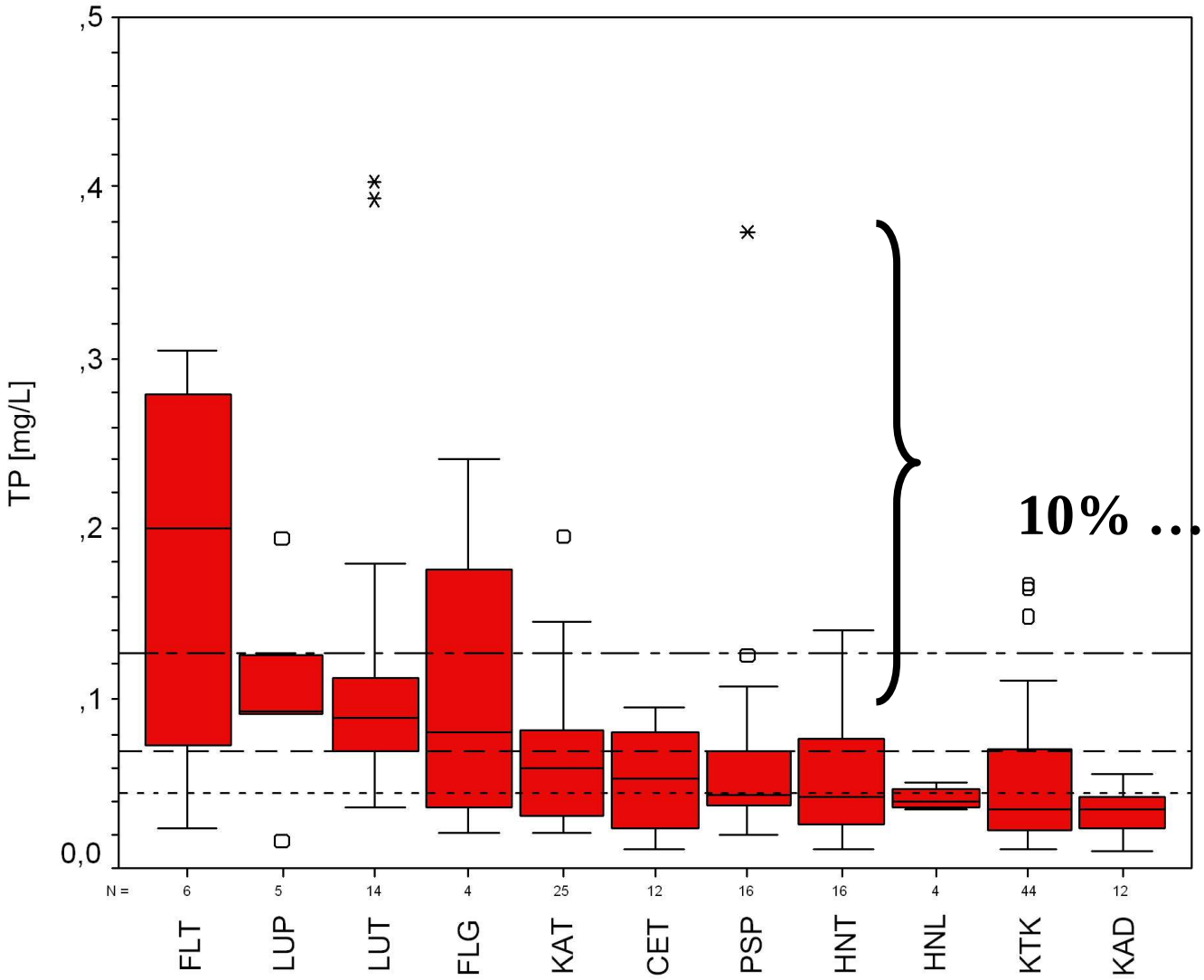




Methods & results I.b

median TP = 0,046 mg/L
mean TP= 0,069 mg/L

SRP/TP = 55%

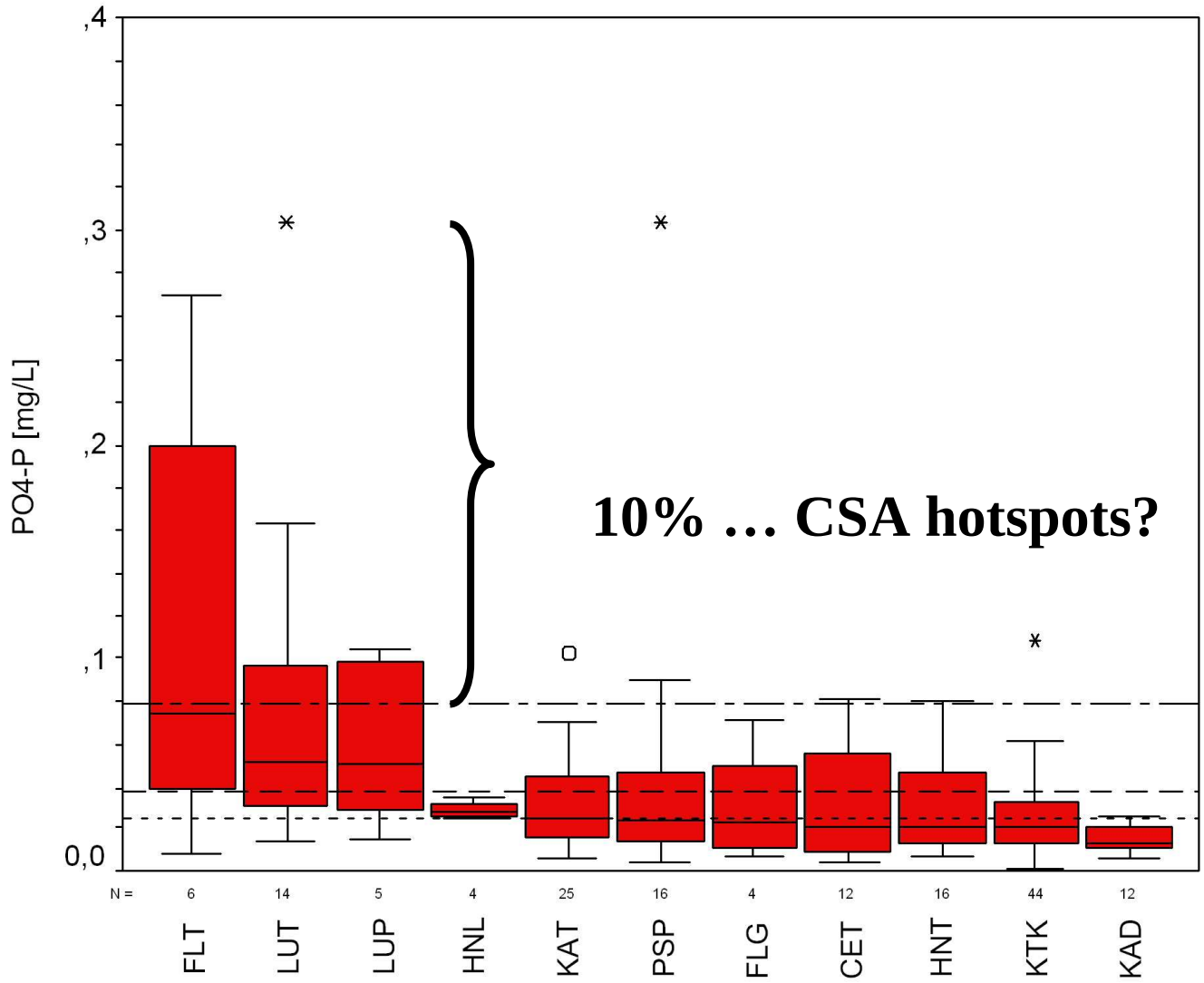


10% … CSA hotspots?

Methods & results I.b

SRP/TP = 55%

median SRP = 0,024 mg/L
mean SRP = 0,038 mg/L

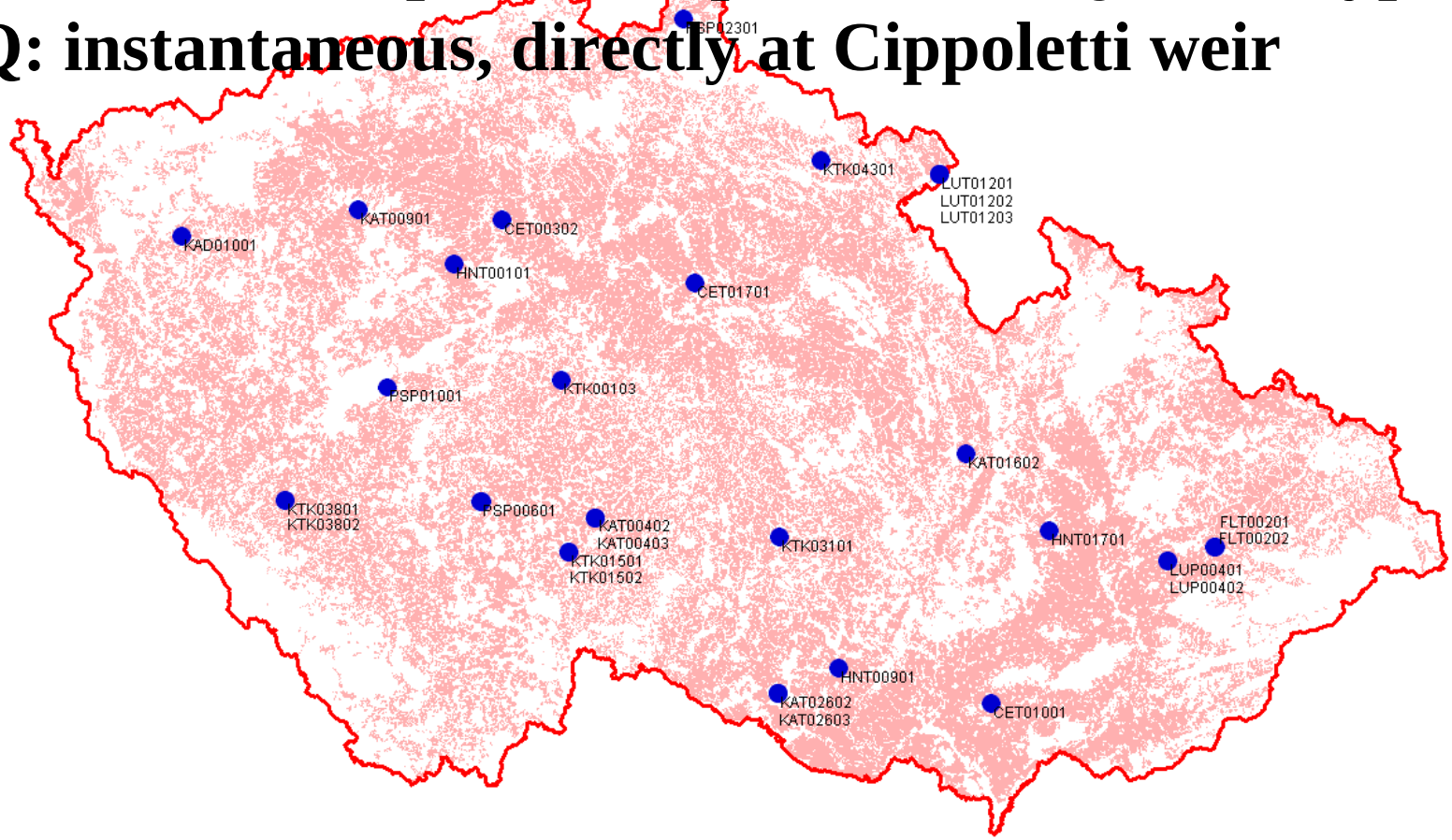


Methods & results II.a

2007-9: Seasonal dynamic in 14 watersheds

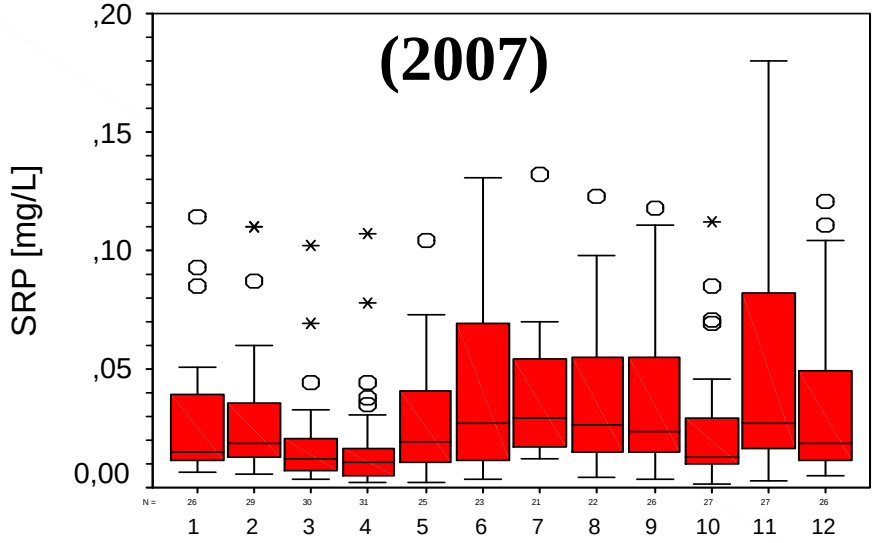
≈ cca 30 profiles represent 9 major soil types

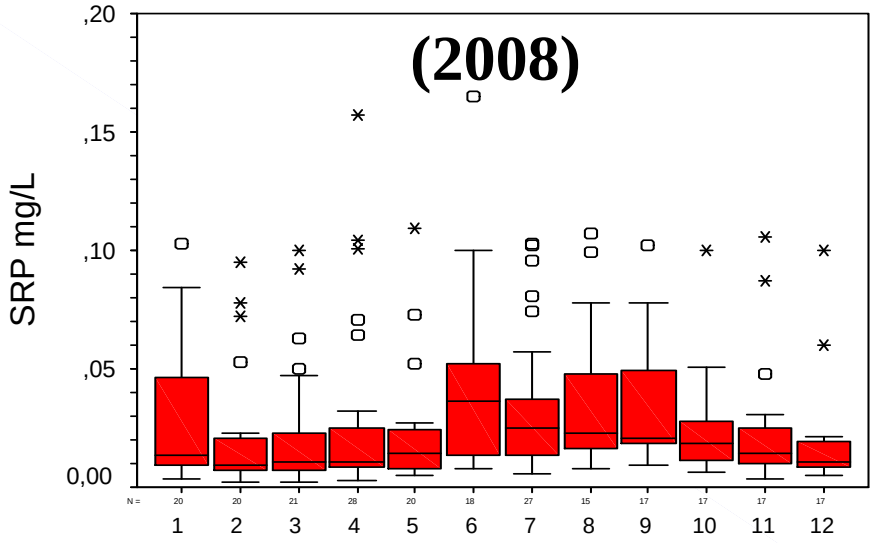
Q: instantaneous, directly at Cippoletti weir

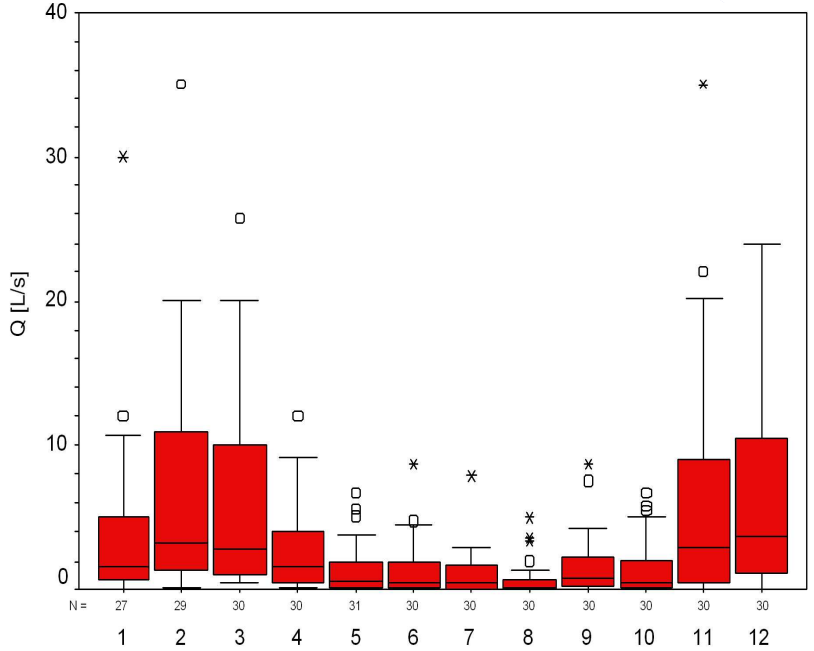


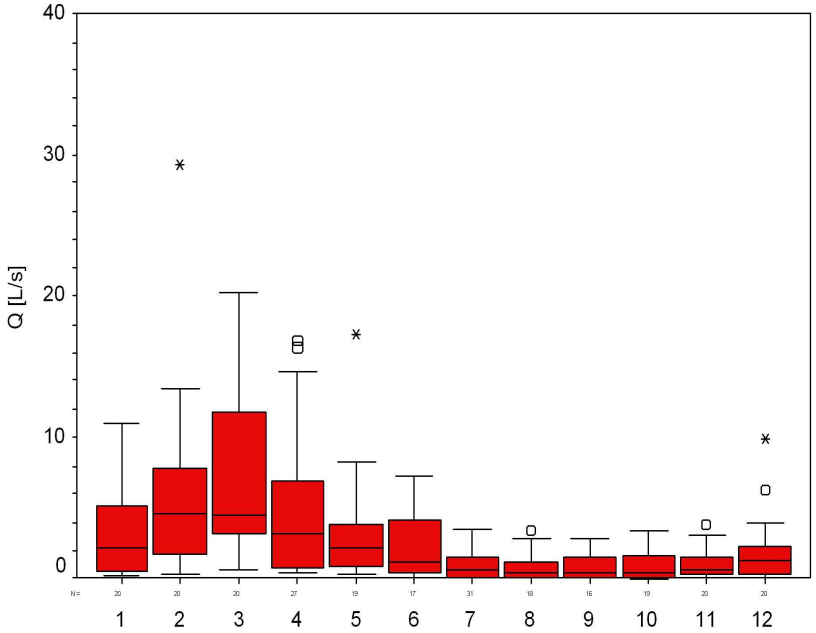
median SRP/TP = 50 %

Methods & results II.b







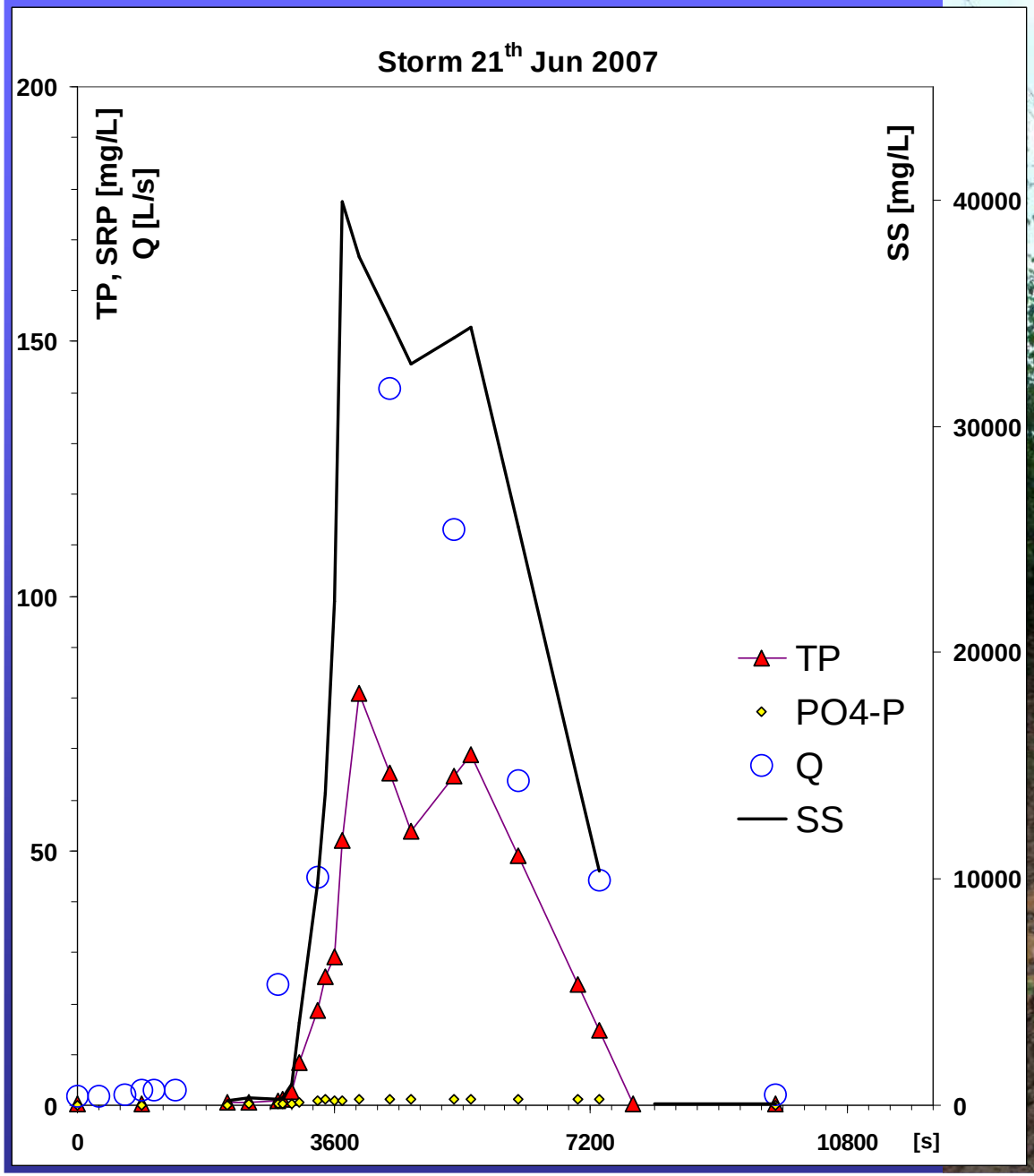


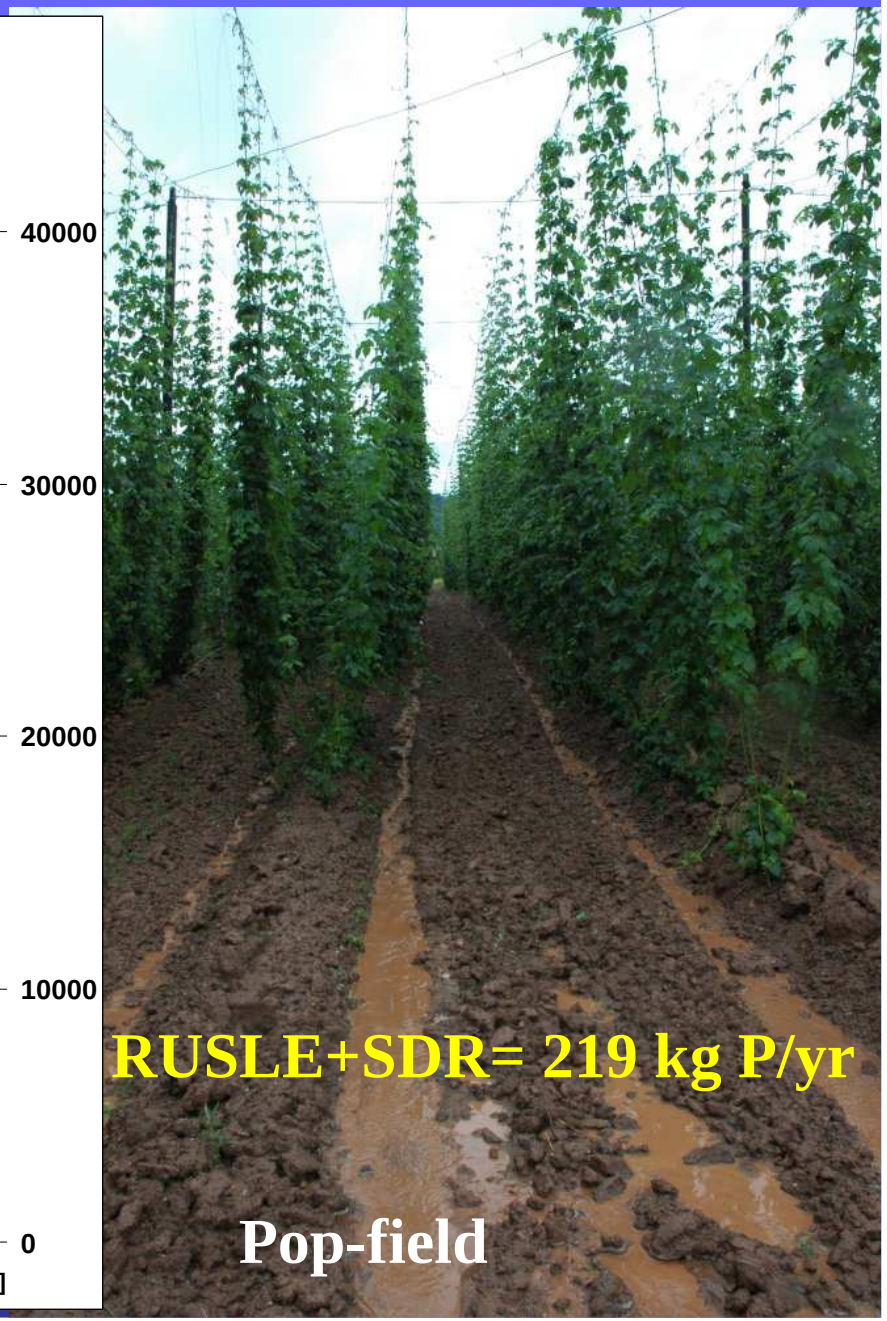
1st aproximation of spec. yield: 17 – 1 kg TP/km^2

Methods & results III.

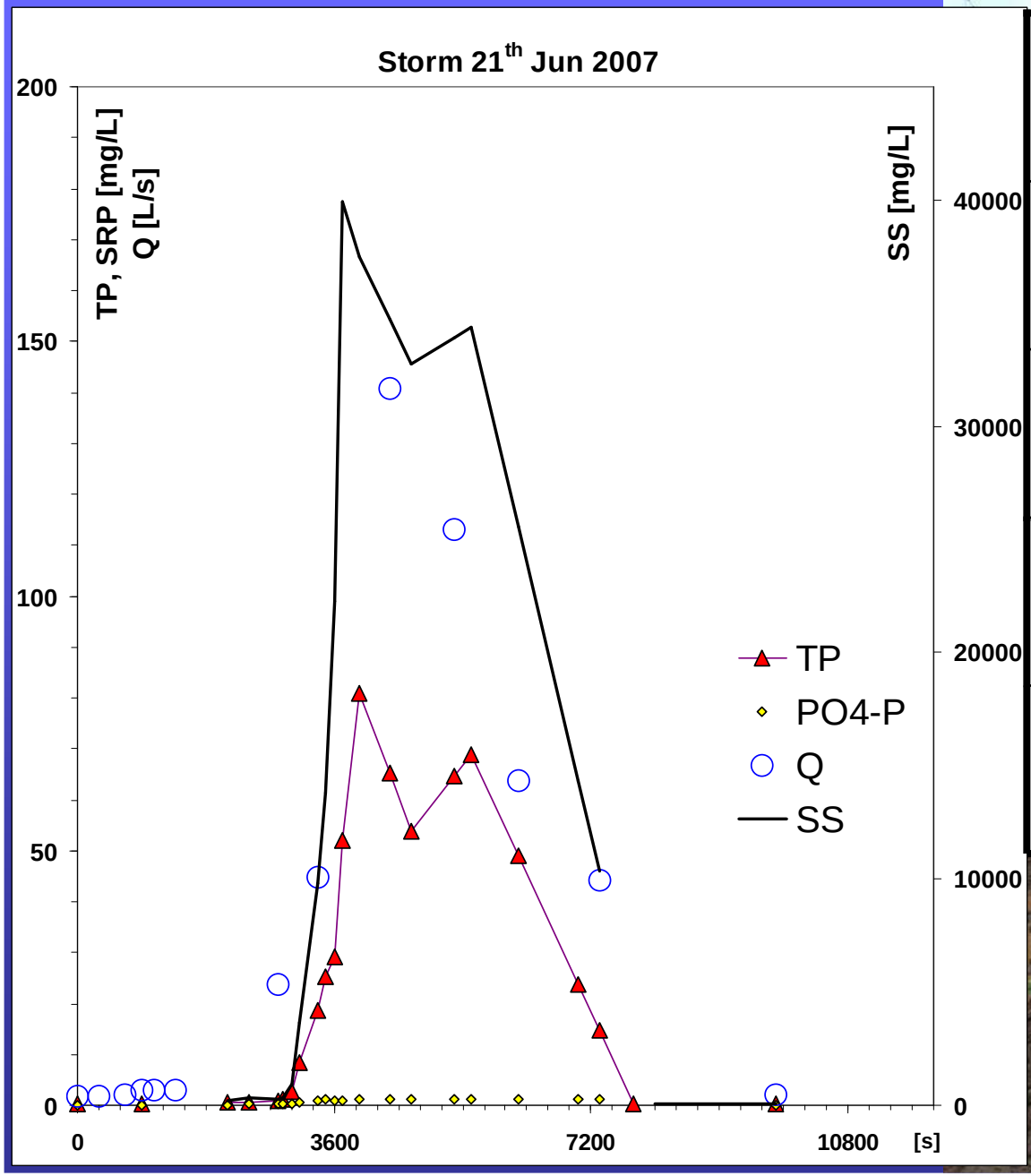
storm-flow vs. base-flow

Methods & results III.



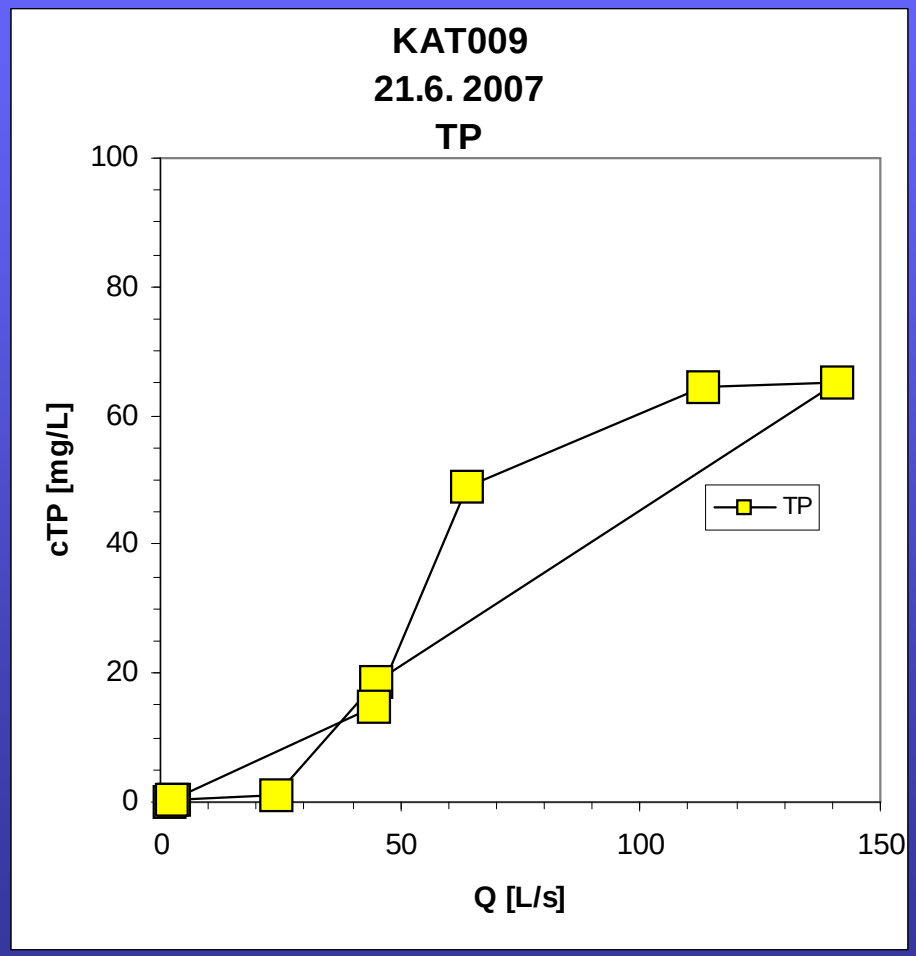


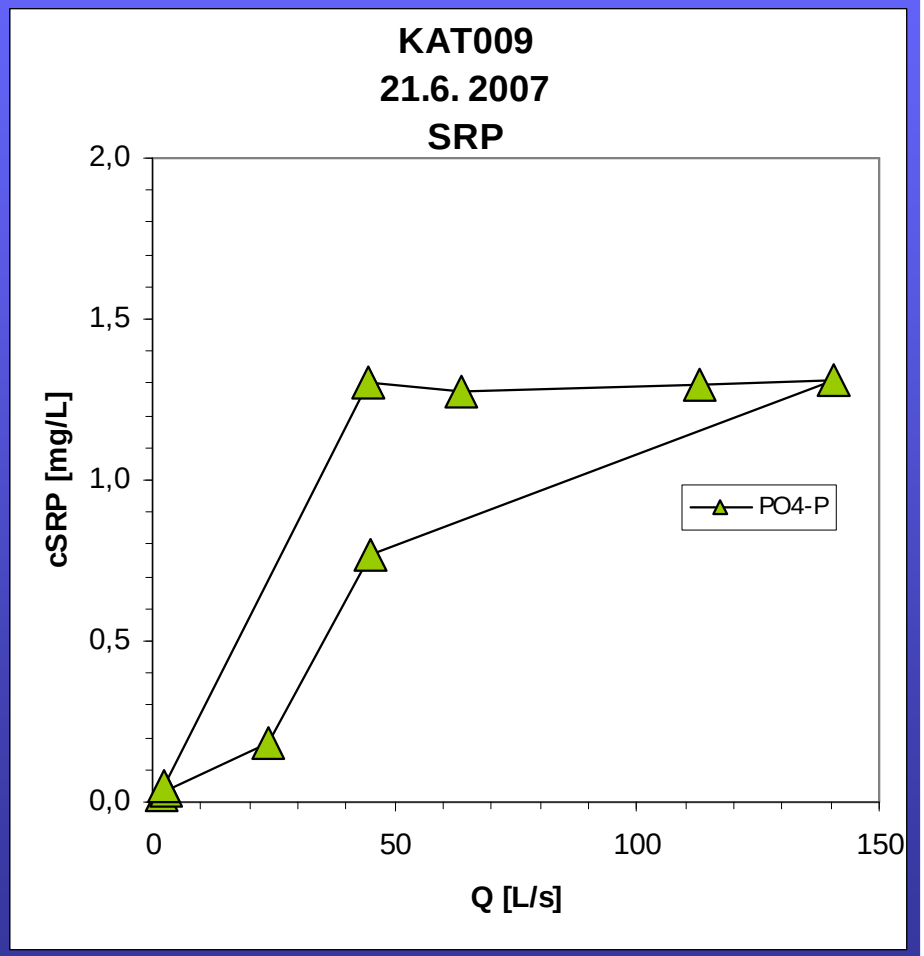
Methods & results III.



Peak 2:46 21st Jun, 2007	of 2007 bsfl
Q_{max}=141 L/s sum = 449 m^3	0,8 %
SS_{max}=40 g/L sum = 11 t	1563%
TP_{max}= 81mg/L sum=20,4 kg	330 %
SRP_{max}= 1,3mg/L sum=0,53 kg	35 %

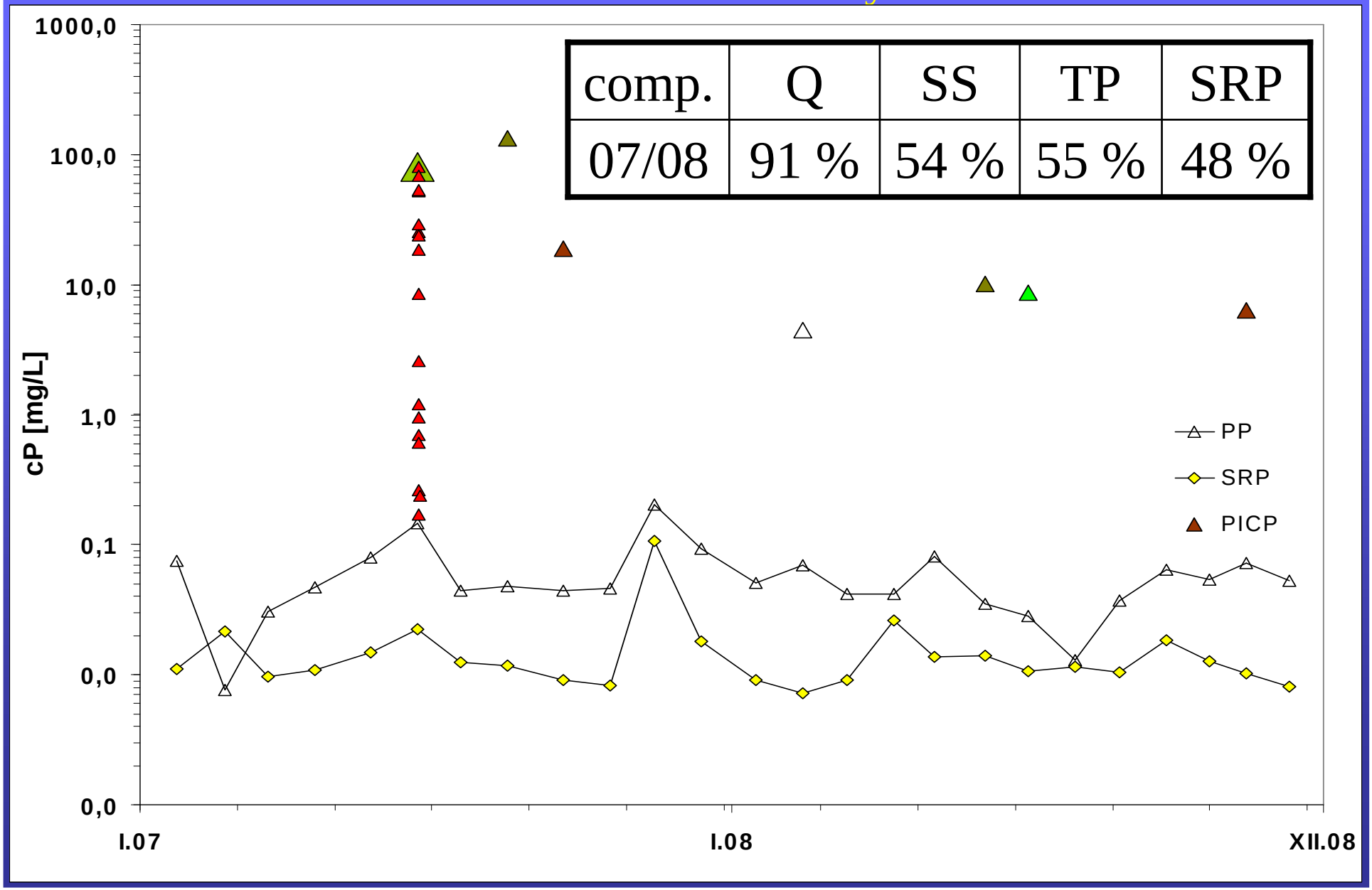
Methods & results III.





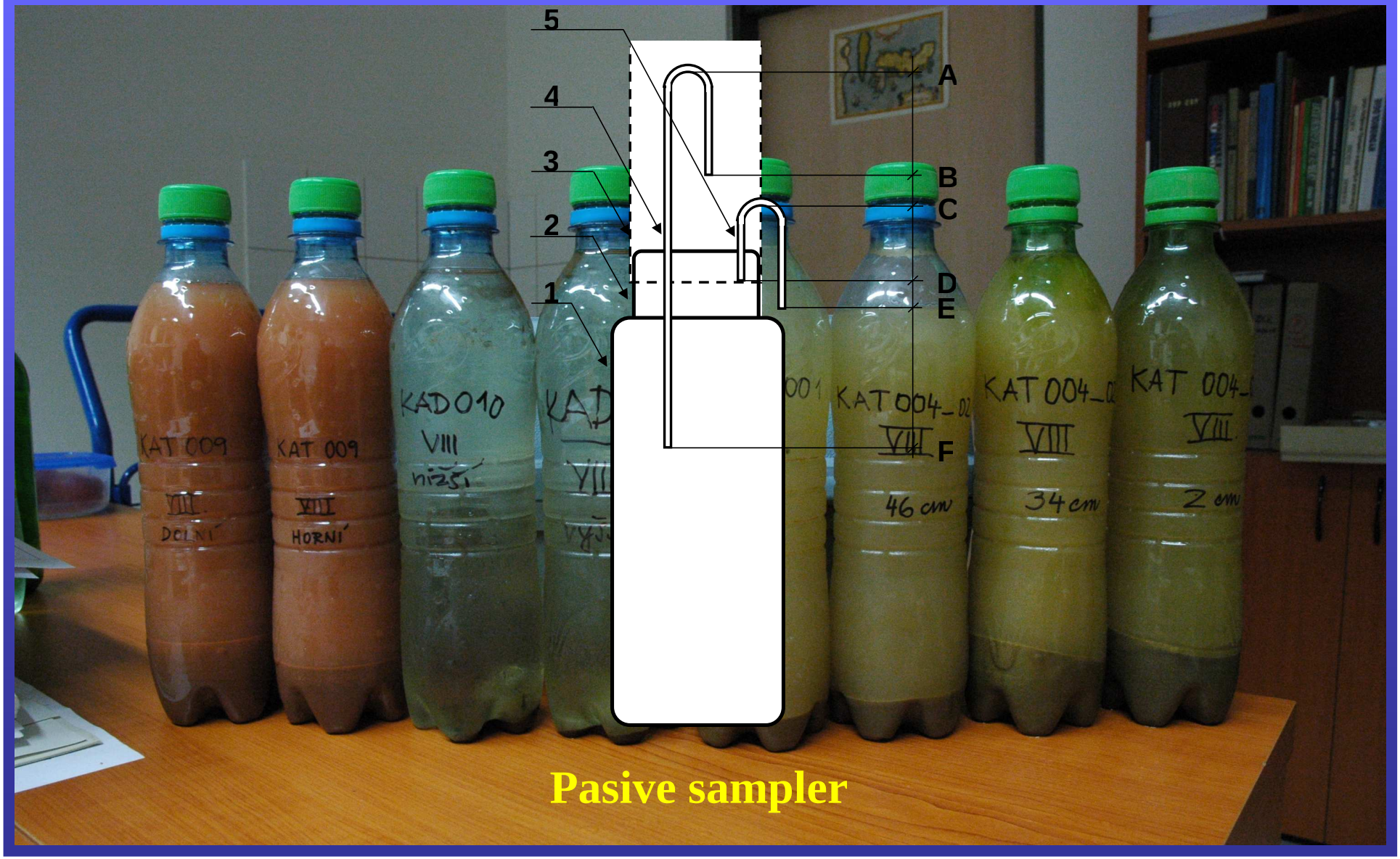
Methods & results IV.

interannual variability



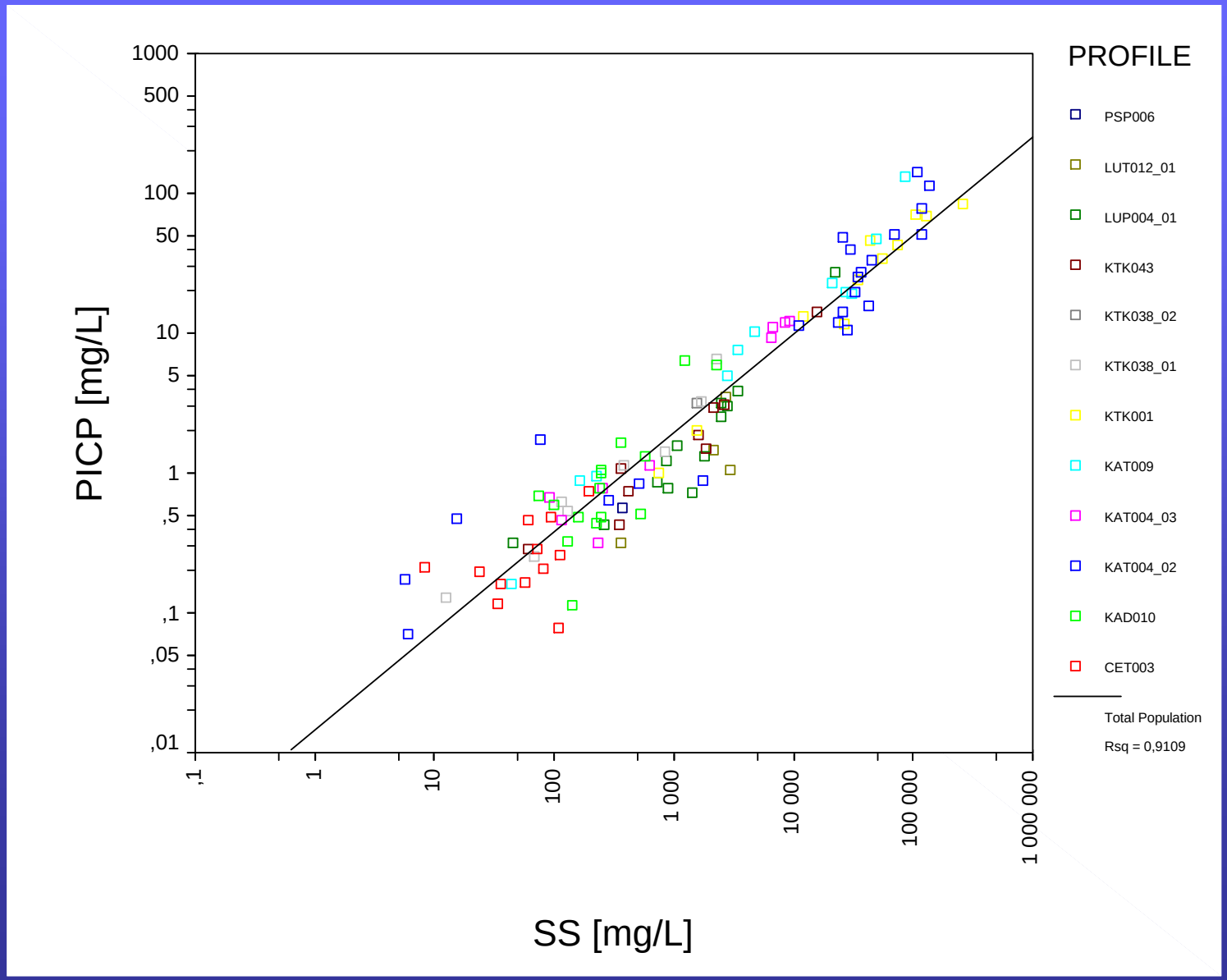
comp.	Q	SS	TP	SRP
07/08	91 %	54 %	55 %	48 %

Methods & results IV.

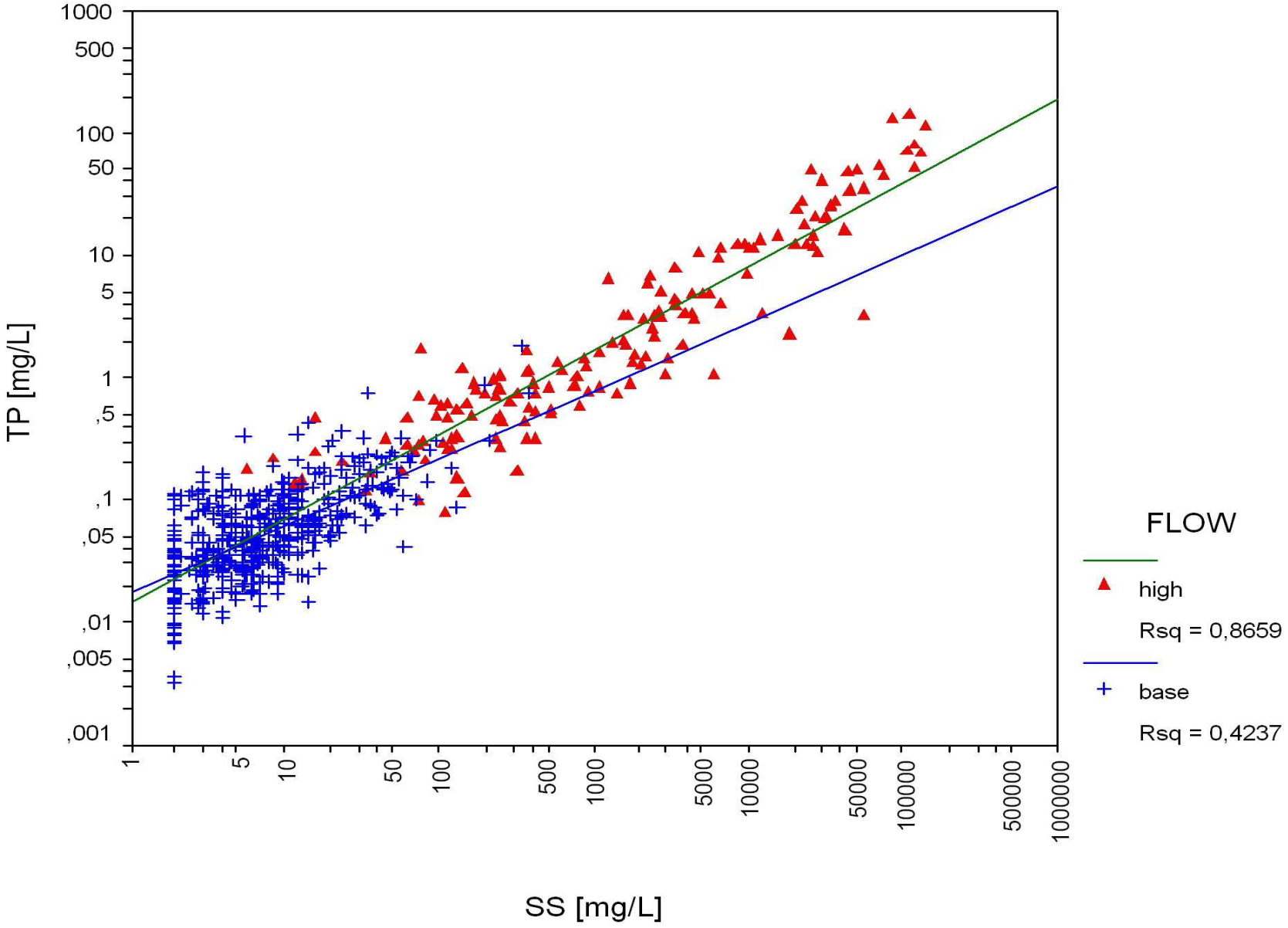


Pasive sampler

Methods & results IV.

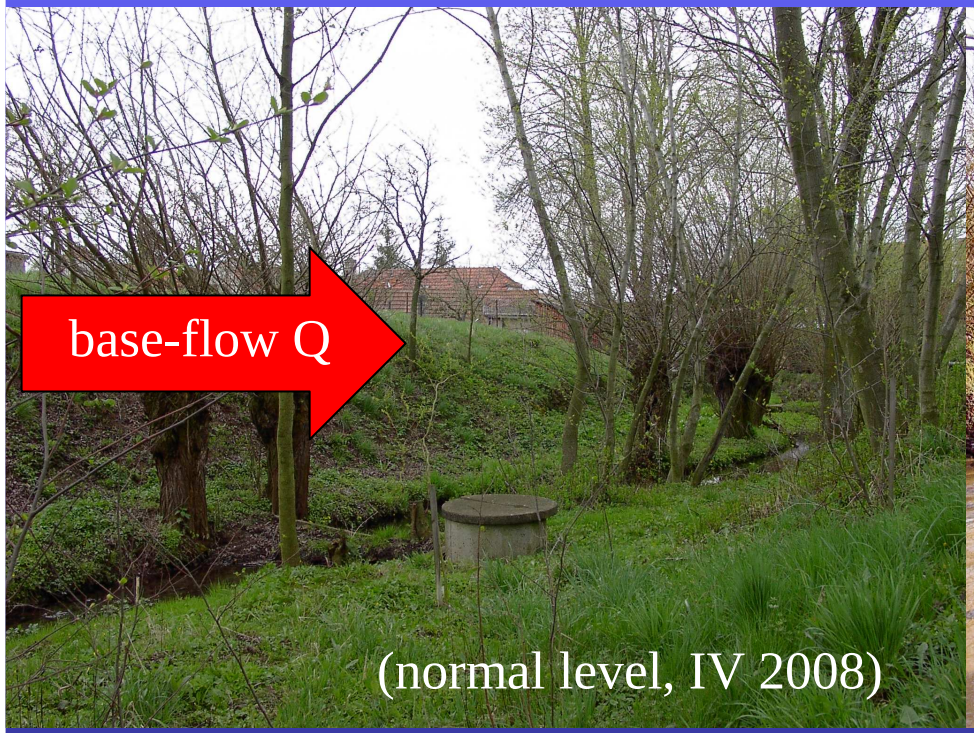


Methods & results IV.



Discusion

3. Compare erosional and extraerosional portion
4. Evaluate impact of P-form on eutrofication



Erosion or snowmelt: SRP/TP = up 10% but kg TP/hod.
… how yearly budgeting talks to algae?

erosion Q ?

… differently than disturbances!

base-flow Q ?

Other sources of uncertainty …

Thank you for attention …

25.1.2009, 10 cm snow, 50 m from creek.

Watershed of Švihov reservoir, drinking water source for capital = 1.200.000 inhabitant …