The new Urban Wastewater Treatment Directive from the perspective of the receiving rivers

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Layout

1. New regulations: UWWTD recast & EQS directive
2. Regulations & status regarding WWTP & water courses in Hungary
3. Analysis of current data and situation
4. Outlook

New regulations

New UWWTD (proposal)

New WFD, EQS directive, etc. (proposal)

UWWTD recast

Article 6: Secondary (biological) treatment

- extended to all agglomerations where p.e. > 1000 (previously p.e. > 2000)

Article 7: Tertiary treatment

- Obligatory for all plants with load > 100000 p.e.
- agglomerations 10000 < p.e. < 100 000 p.e. areas sensitive to eutrophication.
- Current list of 'sensitive areas' should be updated

	TN (mg l^{-1})		TP (mg l^{-1})	
	Current	**Future**	**Current**	**Future**
Capacity > 100.000 p.e.	**10**	**<6**	**1**	**<0.5**
Capacity > 10.000 p.e. , if on risky areas	**15**		**2**	

Article 8: Quaternary treatment (NEW!)

- Remove the widest possible spectrum of micropollutants, including pharmaceuticals
- p.e. > 100000
- agglomerations where 10000 < p.e. < 100000 if the concentration or accumulation of micropollutants poses a risk to human health or the environment.

UWWTD recast – Risk assessment & management (Article 18)

Member States must identify risks:

- Water bodies used for human consumption
- Bathing water quality
- Ecological status of water bodies
- Water bodies where aquaculture occurs

Risk Management Measures:

- Establish collecting systems where p.e. < 1000
- Applying secondary treatment where p.e. < 1000
- Applying tertiary treatment where p.e. < 10,000.
- Applying quaternary treatment where p.e. < 10,000.
- Enforcing stricter treatment requirements

Surface water immission requirements for hazardous substances (WFD & daughter directives)

Directive 2013/39/EU amending Directives 2000/60/EC and 2008/105/EC as regards priority substances in the field of water policy

- Directive 2008/105/EC: 33 priority hazardous substances
- Directive 2013/39/EU: extension of the list to 45 compounds
- Environmental quality standards for water, sediment, and biota
- Watch list: +10 substances (pesticides, pharmaceutical residues - diclofenac and 3 antibiotics, bisphenol-A)
- Draft proposal: list extended, 70 substances (compounds) included in the draft, stricter limits
- 9 pharmaceuticals

New EQS' for pharmaceuticals

substance name	AA-EQS (µg/l)	MAC-EQS (µg/l)
17 alpha-ethinylestradiol (EE2)	0.000017	not derived
17 beta-estradiol (E2)	0.00018	not derived
Azithromycin	0.019	0.18
Carbamazepine	2.5	1600
Clarithromycin	0.13	0.13
Diclofenac	0.04	250
Erythromycin	0.5	1
Estrone (E1)	0.00036	not derived
Ibuprofen	0.22	0.022

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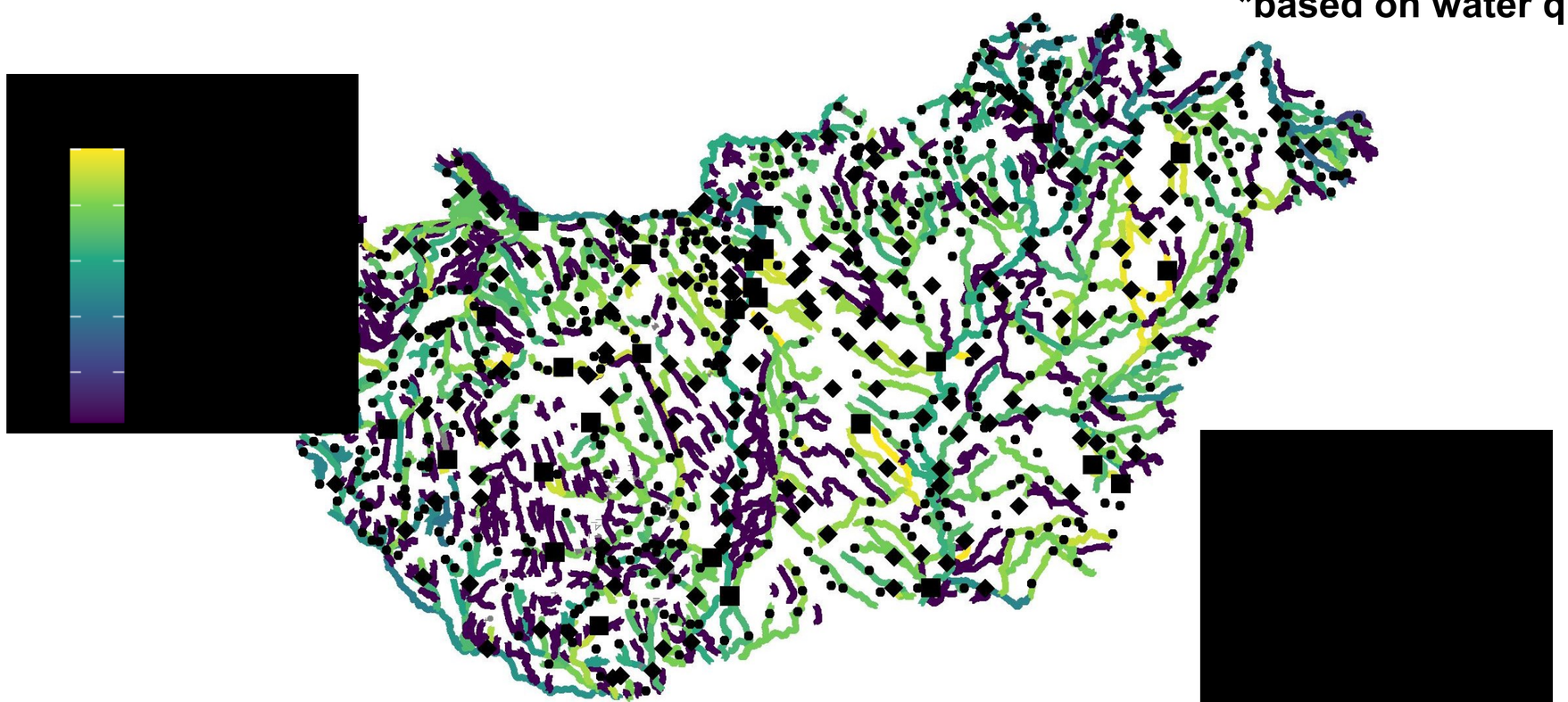
Water bodies & WWTPs in Hungary

Water bodies

	Nitrogen treshold	Phosphorus treshold
597 hilly WBs *557 mostly in HU*	TN < 3…5 mg l^{-1} *(34% fail*)*	TP < 0.20 mg l^{-1} *(69% fail*)*
535 lowland WBs *495 mostly in HU*	TN < 3…5 mg l^{-1} *(27% fail*)*	TP < 0.15…0.30 mg l^{-1} *(53% fail*)*

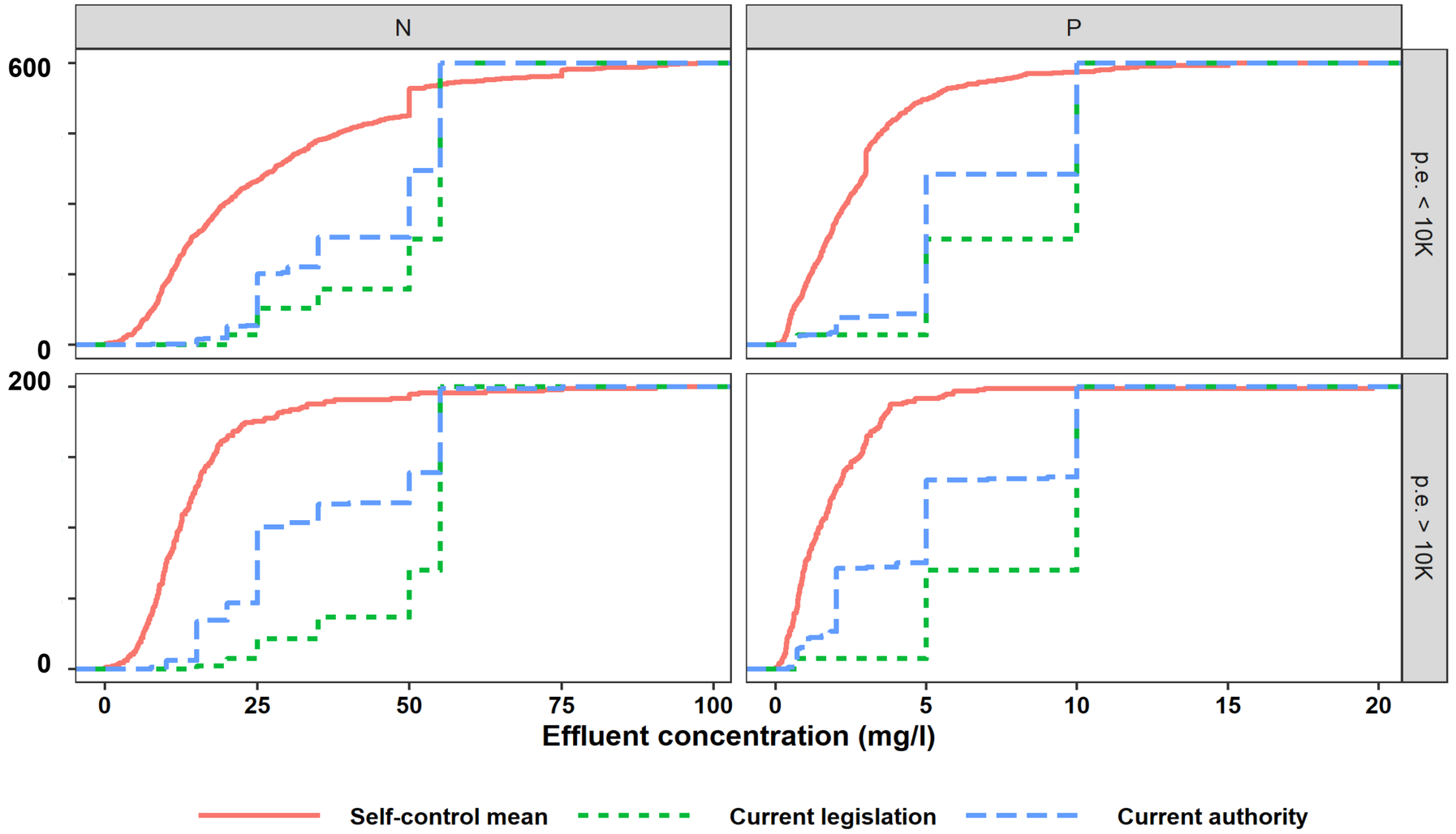
*based on water quality monitoring data



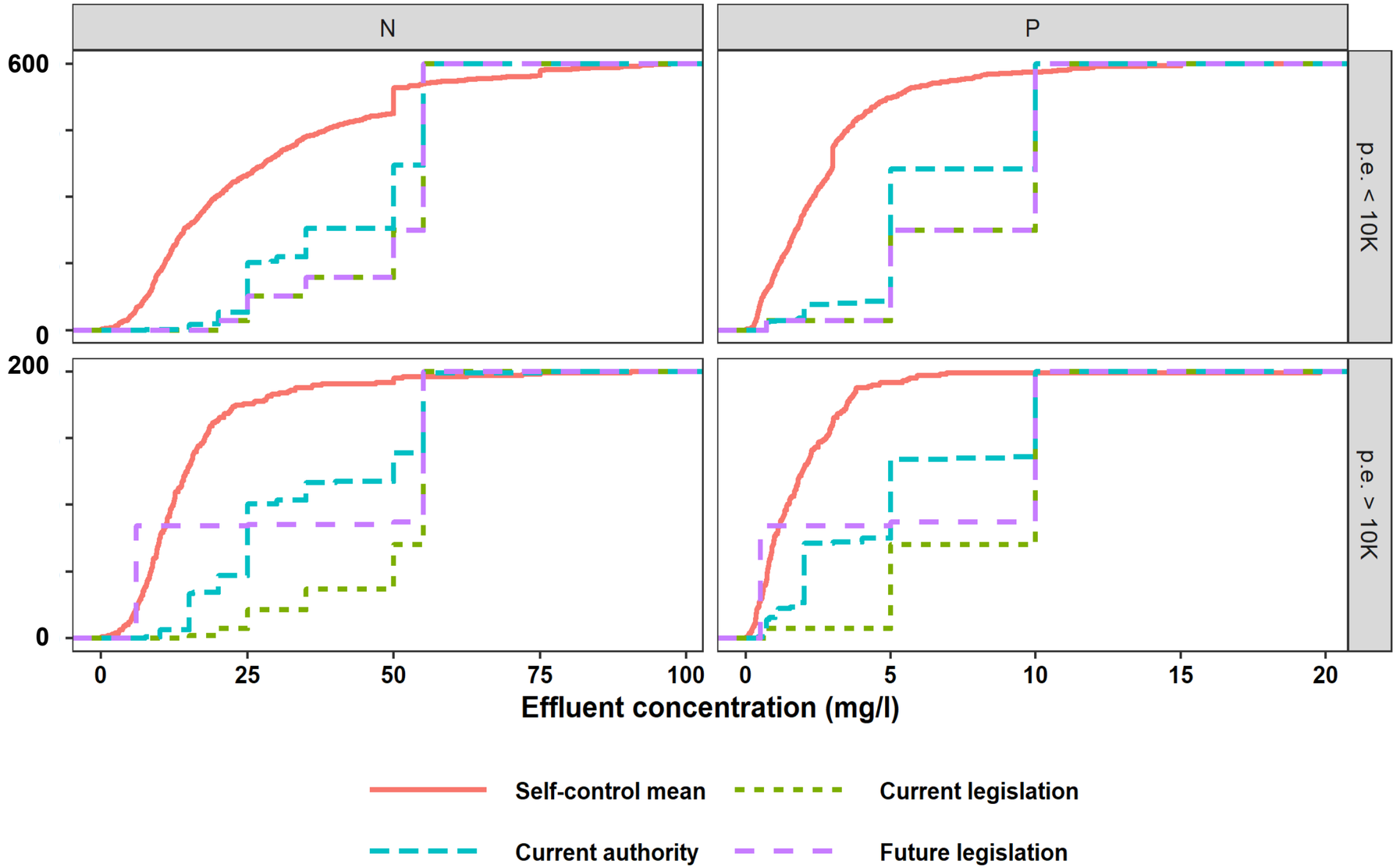
WWTP – receiving river relations HU

		capacity category (p.e.)			
		p.e. > 100K	10K < p.e. < 100K	p.e. < 10K	
river flow (m^3/s)	$Q_{riv} < 0.1$	3	53	257	**313**
	$0.1 < Q_{riv} < 1$	13	43	190	**246**
	$1 < Q_{riv} < 10$	4	26	86	**116**
	$10 < Q_{riv} < 100$	2	13	24	**39**
	$Q_{riv} > 100$	7	26	40	**73**
		29	**161**	**597**	**787**

WWTP effluent concentrations (N&P)



WWTP effluent concentrations (N&P)



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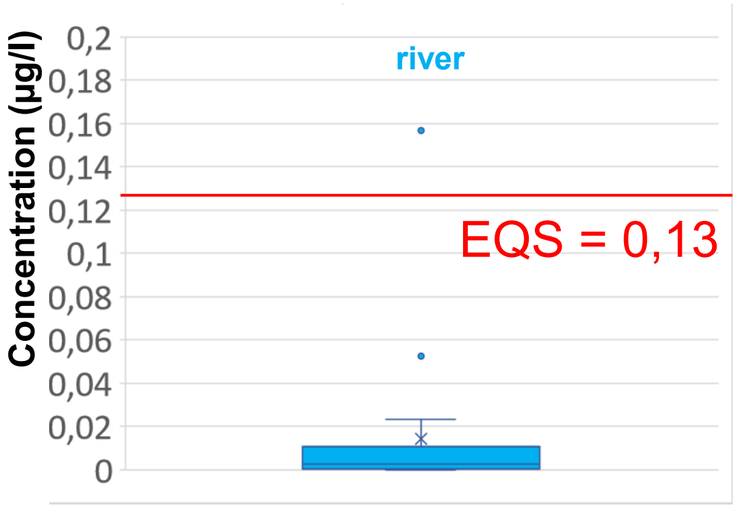
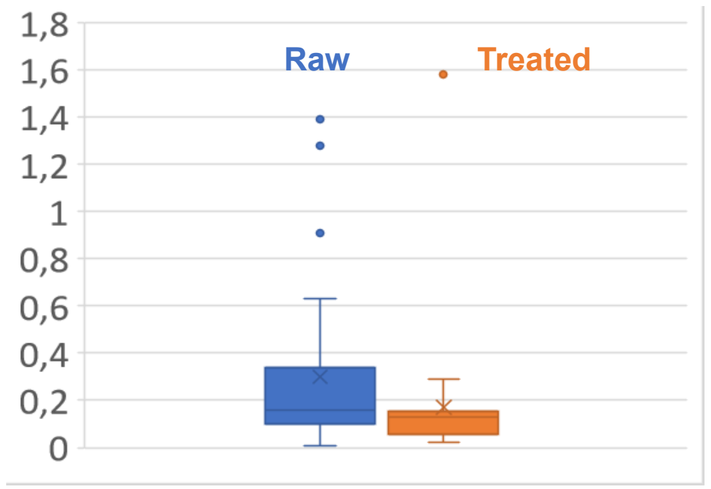
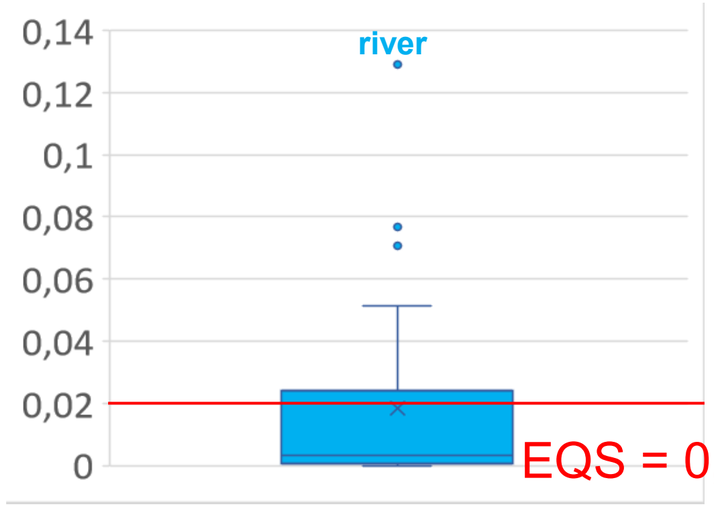
Clarithromycin



Azithromycin





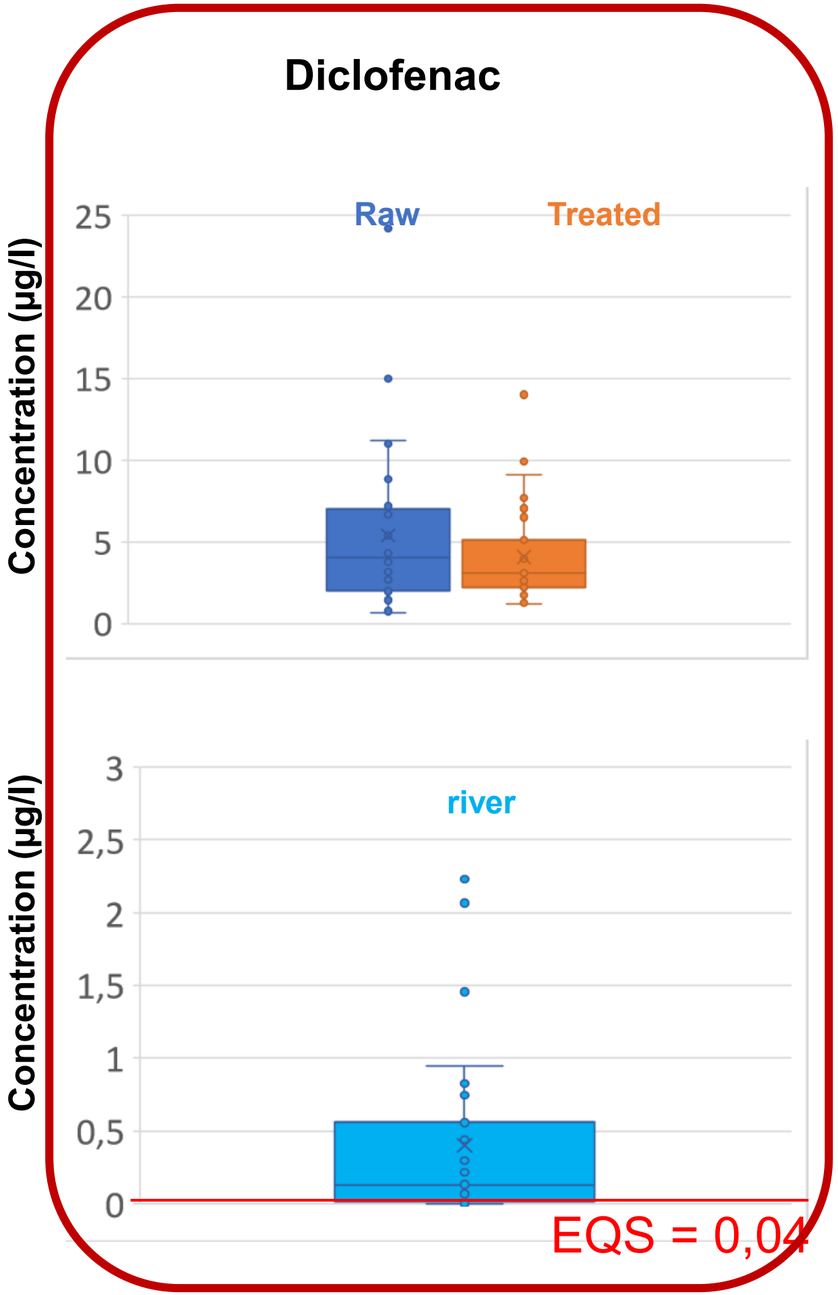
HU WWTP

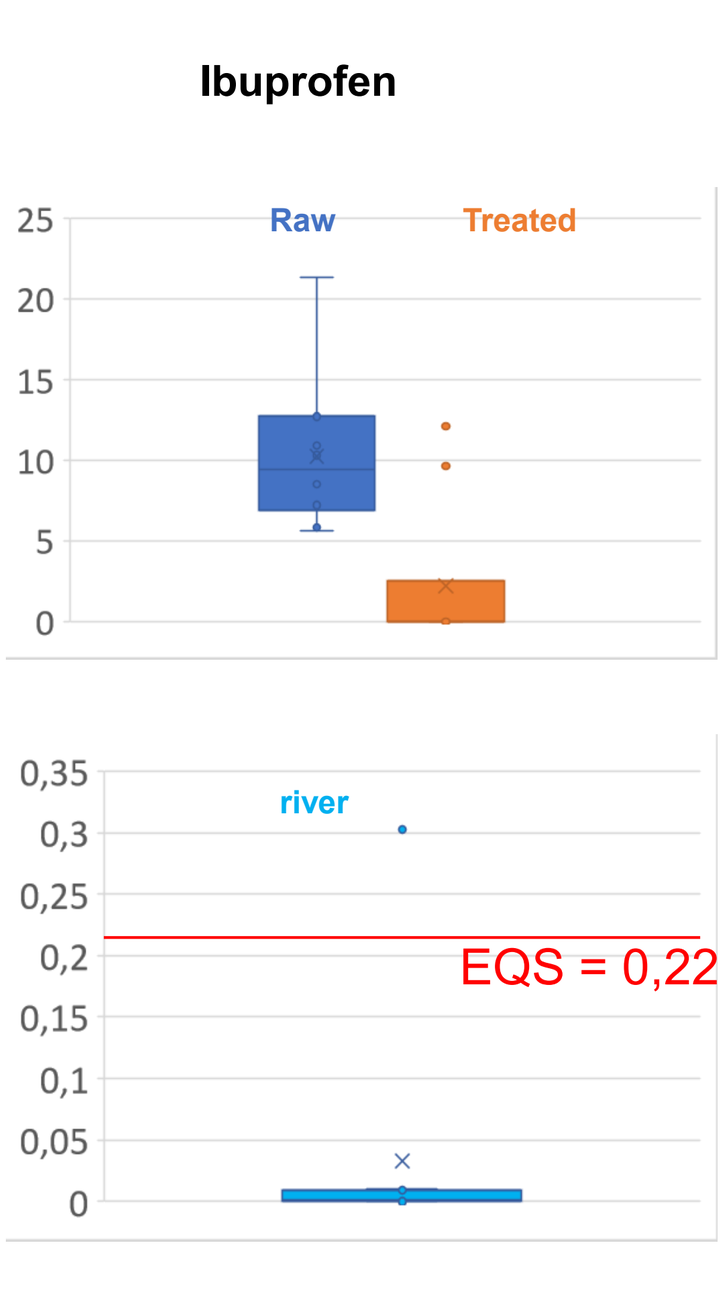
raw and treated concentrations (2018-2019)

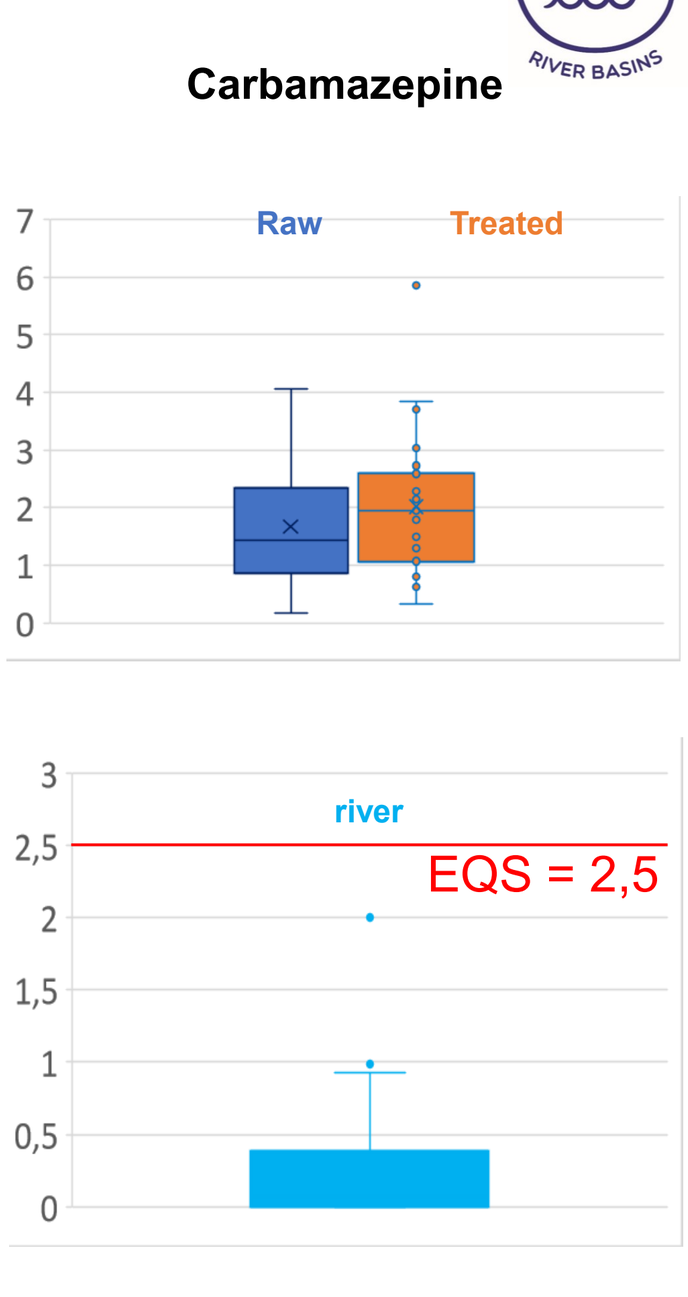
KEHOP project

***Estimated* river concentrations after mixing (MFQ)**

No upstream effects


Diclofenac
Concentration (µg/l)
Raw
Treated
25
20
15
10
5
0
Concentration (µg/l)
river
3
2,5
2
1,5
1
0,5
0
EQS = 0,04


Ibuprofen
Raw
Treated
25
20
15
10
5
0
river
0,35
0,3
0,25
0,2
0,15
0,1
0,05
0
EQS = 0,22


Carbamazepine
Raw
Treated
7
6
5
4
3
2
1
0
river
3
2,5
2
1,5
1
0,5
0
EQS = 2,5

Calculations & results

Calculation methodology

Summation along the hydrological „tree” (network)

- immediate total mixing of plant discharges in the river
- no loads from abroad
- no diffuse loads
- no retention / self-cleaning / decay in the streams (any substance)

River flow: long-term most frequent flow („Q66%”)

Dilution factor:

$$d_{tot,j} = \frac{Q_{r,j}}{\sum Q_w}$$

Calculation variants

Plant effluent N & P values (4 variants):

- according to current legislation
- according to authority permit (current)
- according to self-check reports
- according to future legislation

Plant effluent DCF values (2 variants):

- Uniform concentration 3.5 mg / m³
- Uniform spec. emission of 0.7 mg/cap/day

Accuracy check

Fraction of water bodies failing to achieve the standards for physico-chemical parameters

Variant	Compound	Hilly WBs	Lowland WBs	Total
Current legislation	Total N	23%	38%	29%
Current permit	Total N	20%	36%	26%
Current self-control	Total N	15%	27%	19%
RBMP monitoring	***Total N***	***38%***	***30%***	***31%***
Current legislation	Total P	39%	46%	42%
Current permit	Total P	37%	44%	39%
Current self-control	Total P	25%	31%	26%
RBMP monitoring	***Total P***	***70%***	***56%***	***61%***

Accuracy check

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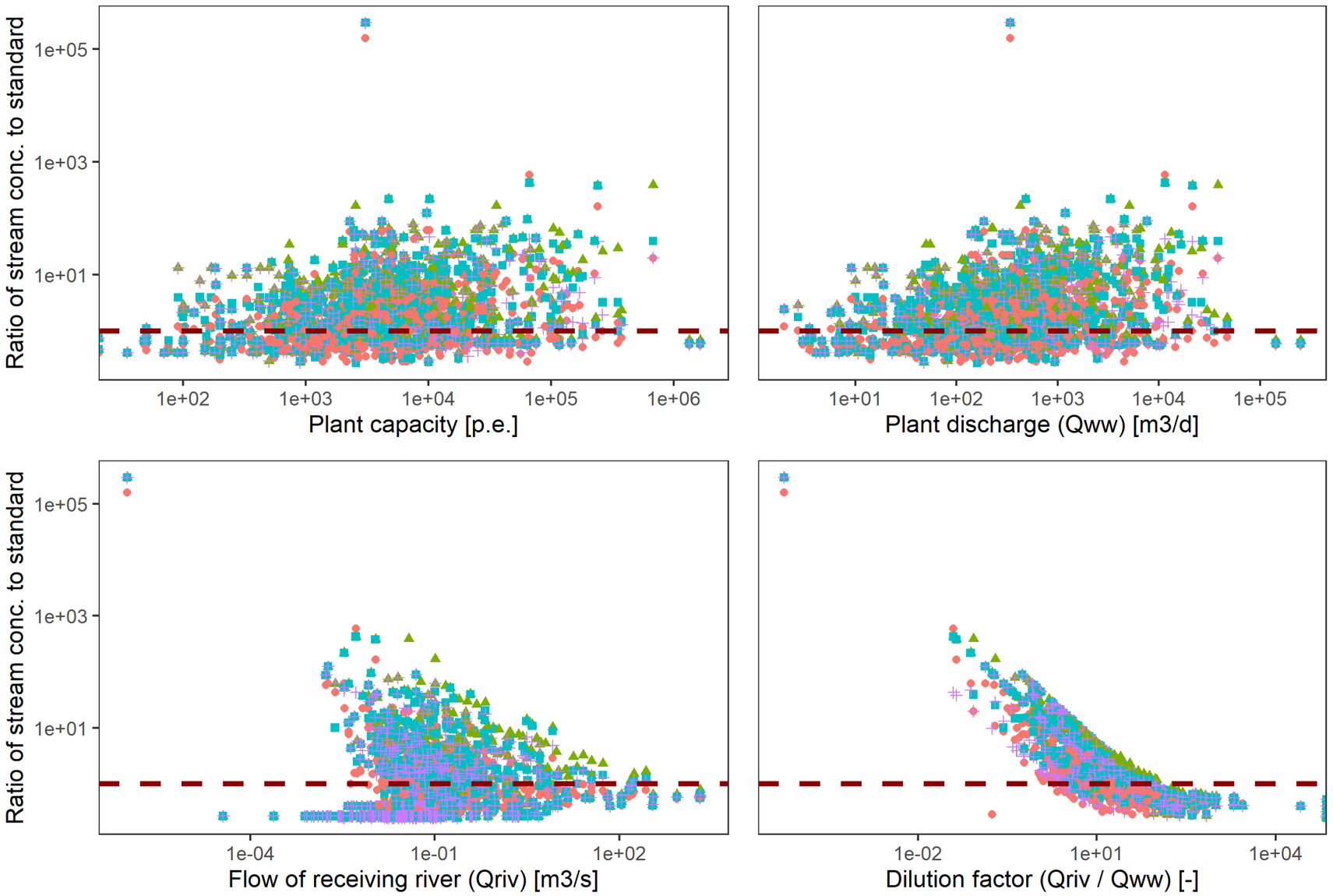
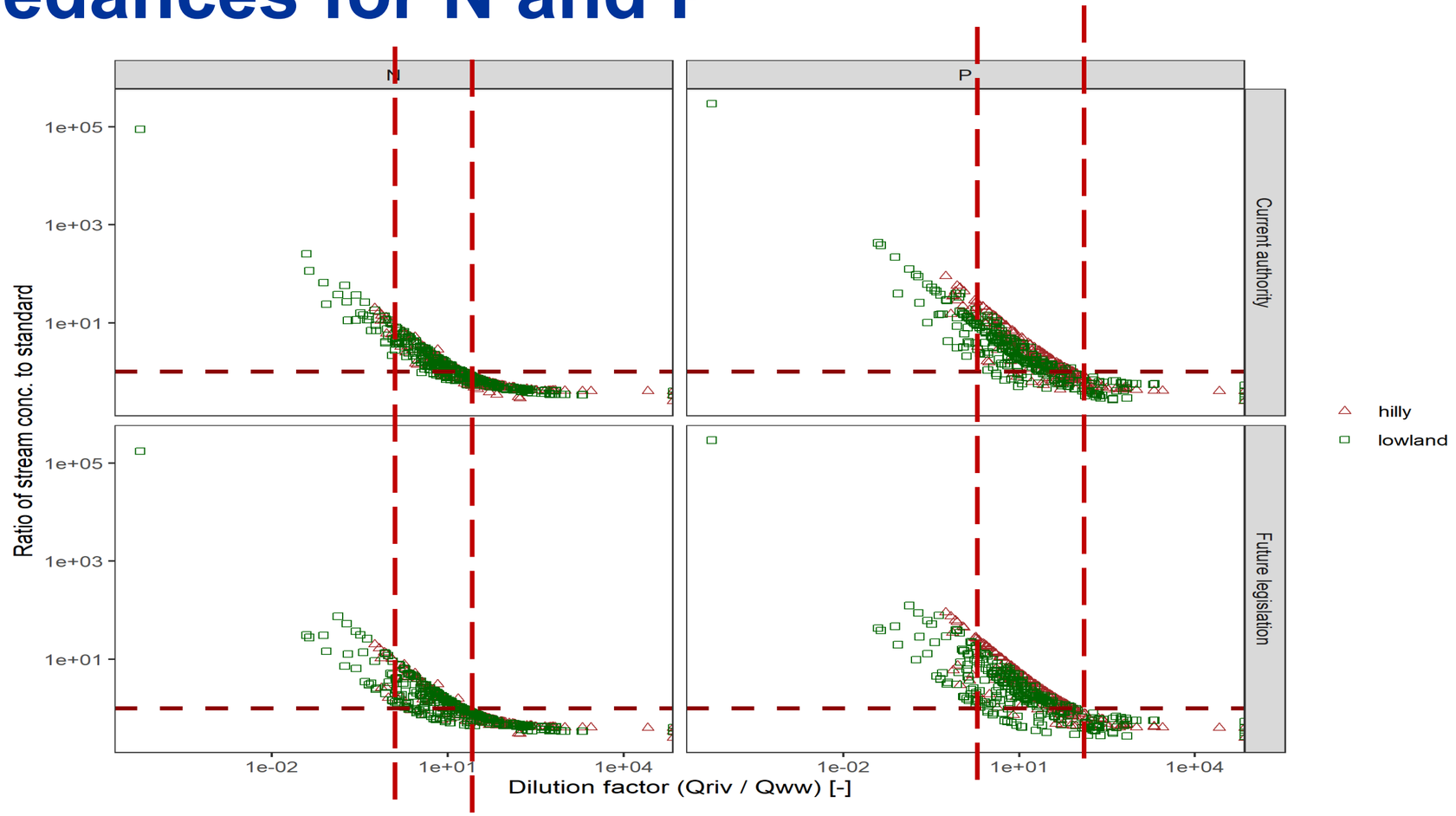
„Future”	Total N	22%	34%	25%
Current legislation	Total P	39%	46%	42%
Current permit	Total P	37%	44%	39%
Current self-control	Total P	25%	31%	26%
RBMP monitoring	***Total P***	***70%***	***56%***	***61%***
„Future”	Total P	38%	43%	40%

Phosphorus

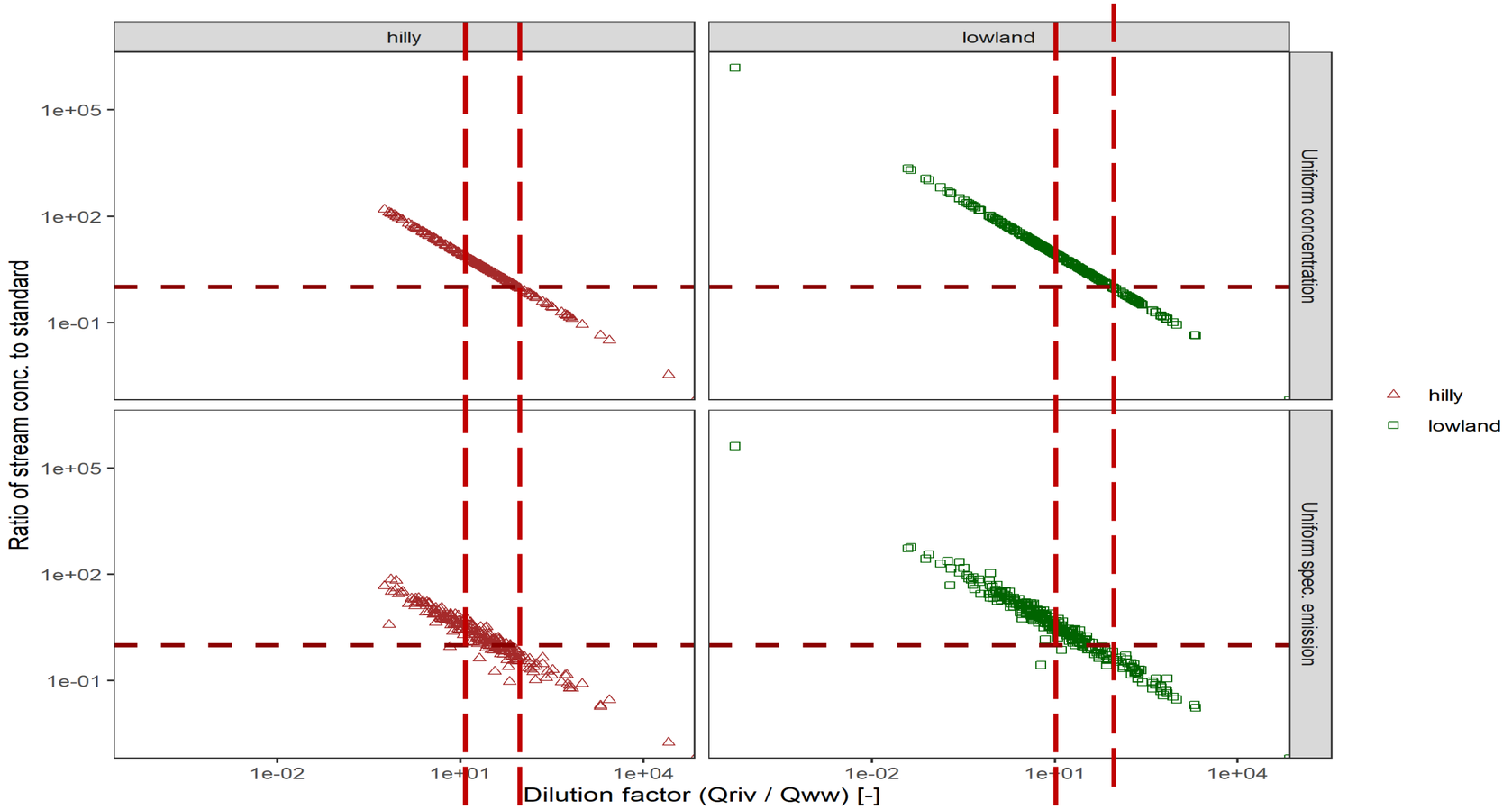

Ratio of stream conc. to standard
1e+05
1e+03
1e+01
1e+02
1e+03
1e+04
1e+05
1e+06
Plant capacity [p.e.]
1e+01
1e+02
1e+03
1e+04
1e+05
Plant discharge (Qww) [m3/d]
1e-04
1e-01
1e+02
Flow of receiving river (Qriv) [m3/s]
1e-02
1e+01
1e+04
Dilution factor (Qriv / Qww) [-]
Current self-control
Current legislation
Current authority
Future legislation

Exceedances for N and P



d	start of exceedances	exceedances ubiquituous
Nitrogen	100	1
Phosphorus	100	1

Exceedances for diclofenac



d	start of exceedances	exceedances ubiquituous
Diclofenac	100	10

Summary & conclusions

Summary & conclusions

- Need for reliable emission data in Central and Eastern European countries
- Effect of new UWWTD marginal when compared to data uncertainties
- New UWWTD causes very slight improvement in WB status regarding N & P
- New EQS directive will induce a heavy deterioration in WB status
- Suggestion for a „tier1” designation of risky areas (based on diclofenac): d<100

Outlook

- Further accuracy check
- Further trace substances to be investigated
- …

Thank you for the attention!

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