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Federal Department of the Environment,
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Federal Office for the Environment FOEN
Water

Biocide Monitoring in Switzerland

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Outline

- Overview on biocide monitoring in Swiss streams

  Organisation: *Who monitors biocides in Switzerland?*

  Method: *Where/How are biocides monitored?*

  Results: *Which biocides at what concentration levels are found?*

  Interpretation: *Characterisation of sites with highest concentration levels*

- Screening (target/suspect) of more than 300 pesticides*

- Conclusions/Outlook

**pesticides = biocides + plant protection products (PPP)*

WHO monitors biocides in Switzerland?

→no national monitoring network for biocide monitoring in surface waters (or monitoring of micropollutants in general)

Data available from:

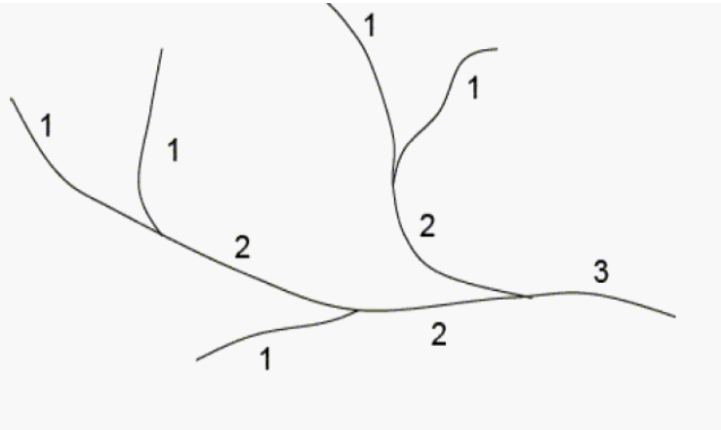
- **Cantonal authorities** → between 2005 and 2012 18 of the 26 cantonal authorities analyzed biocides in surface waters
- **International monitoring station of river Rhine** at Basel→ daily screening of over 300 substances in the river Rhine including biocides
- International comission of the lake Geneva (**CIPEL**)

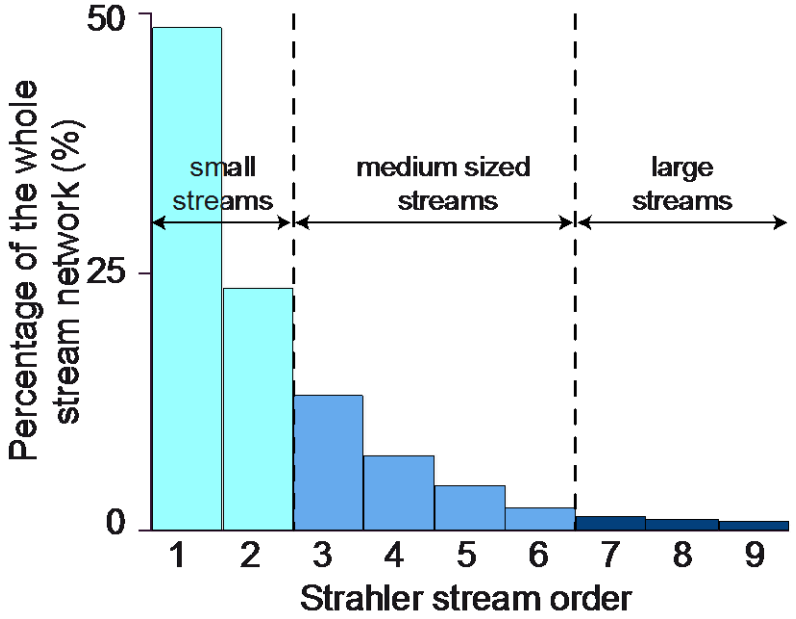
Data collection → nationwide overview of pesticide occurrence in streams (for the period 2005 – 2012)

Major difficulties: differences in *→sampling strategies →analyzed substances*

Surface water network in Switzerland

Strahler stream order:





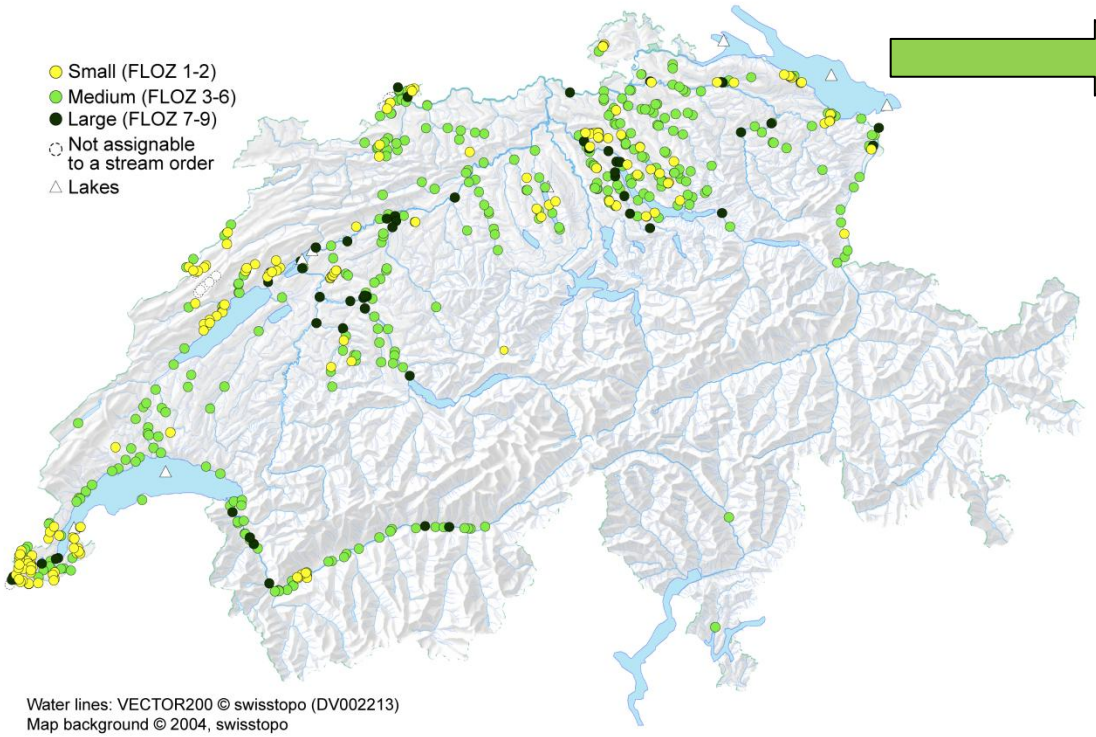
- 50% of all the Swiss streams are headwater streams (stream order 1)
  → 75% are „small“ streams (stream order 1 & 2)

- Only two rivers (Aare & Rhine) with stream order 9

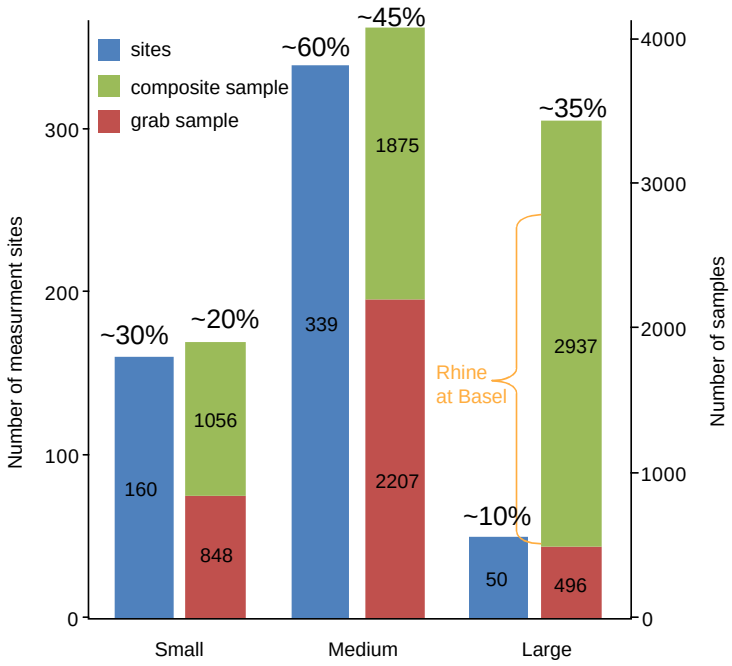
Ref: http://www.bafu.admin.ch/hydrologie/01835/02118/02120/index.html?lang=de

WHERE and HOW are biocides monitored?

(2005-2012)

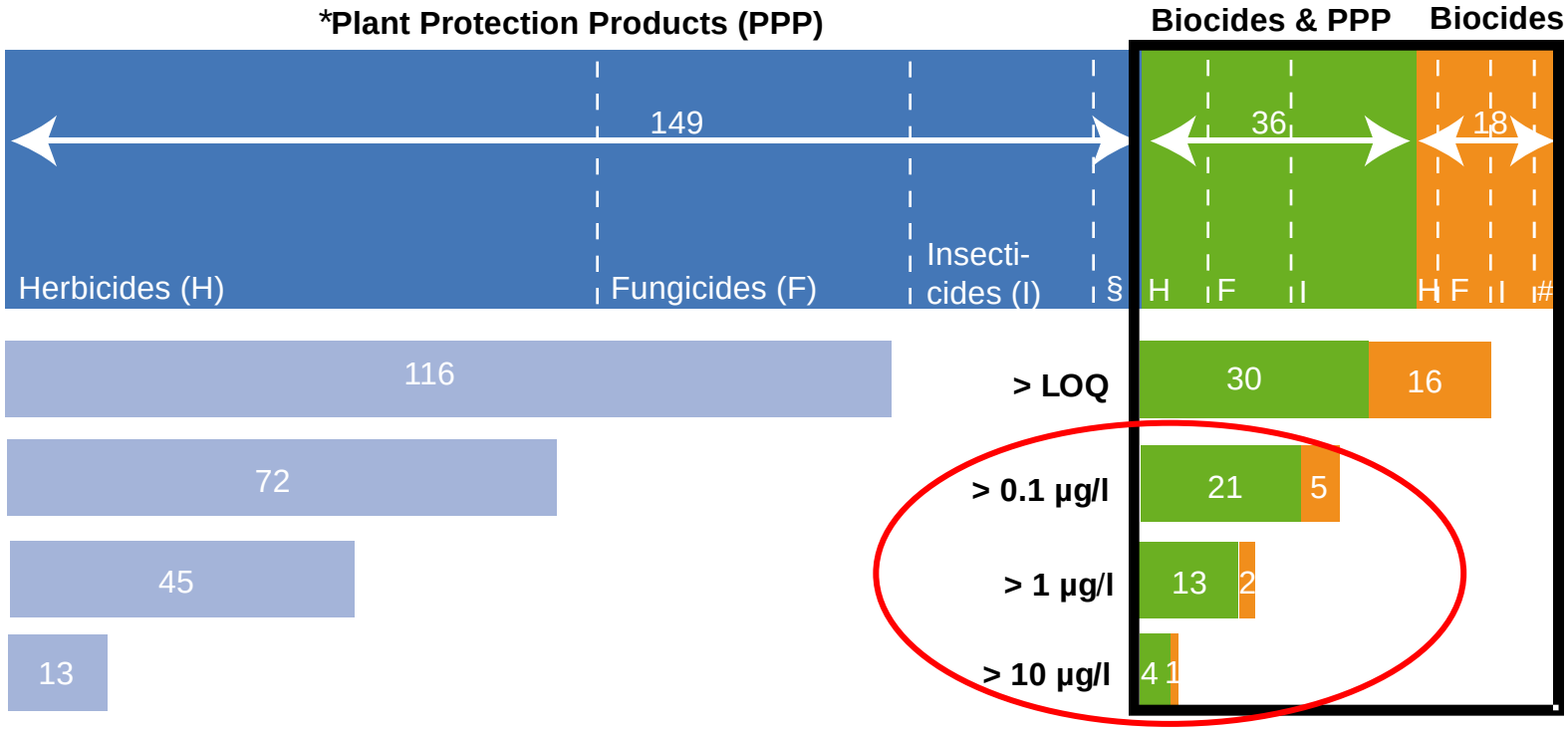


563 sampling sites in streams
~10‘000 samples



HOW MANY biocides are monitored? (2005-2012)

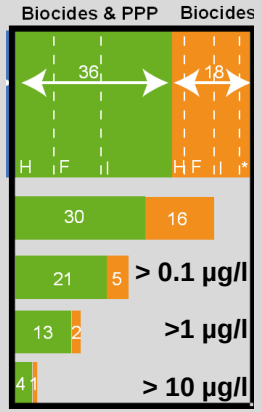
Number of pesticides analysed in rivers between 2005 and 2012:



→ **26 biocides with concentrations >0.1 µg/l**

** pesticide = plant protection product (PPP) + biocide*
§ Acaricides, molluscicide, plant growth regulator
 # Repellents

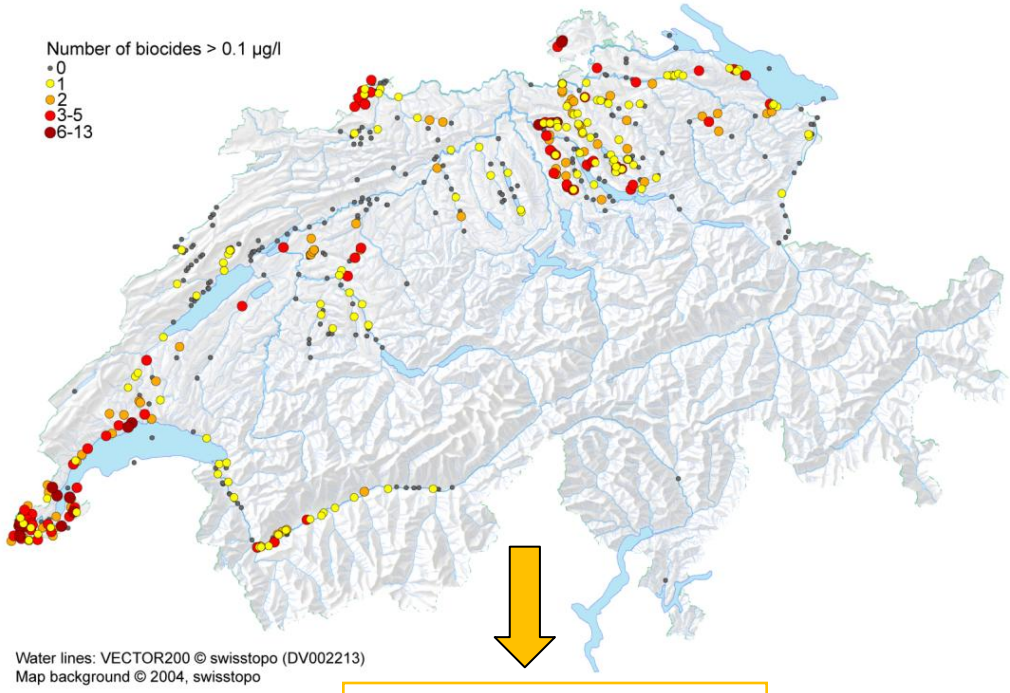
Biocides > 0.1 µg/l (2005-2012)



	Active Substance	CAS No.	Maximum Concentration [µg/l]	95% Percentile Concentration [µg/l]	Values >LOQ/Total (Total)	Authorisation (status May 2012) * = *banned*
> 10 µg/l	***Carbendazim***	10605-21-7	27	0.04	30% (2700)	Biocide & PPP
	Chlorotoluron	15545-48-9	81	0.02	8% (4800)	Biocide* & PPP
	DEET	134-62-3	301	0.13	67% (7500)	Biocide
	Diuron	330-54-1	18	0.09	29% (6200)	Biocide & PPP
	Isoproturon	34123-59-6	11.6	0.08	25% (6200)	Biocide & PPP
> 1 µg/l	**Chlorpyrifos**	2921-88-2	7.4	<*LOQ*	1% (5300)	Biocide* & PPP
	Cyproconazol	94361-06-5	1.6	0.02	14% (1300)	Biocide & PPP
	Diazinon	333-41-5	2.6	0.033	28% (7900)	Biocide* & PPP*
	Diflubenzuron	35367-38-5	5.0	0.046	11% (750)	Biocide & PPP
	Fenoxycarb	79127-80-3	2.1	0.015	6% (750)	Biocide & PPP
	Propoxur	114-26-1	1.6	<*LOQ*	3% (1300)	Biocide*
	Tebuconazole	107534-96-3	1.7	0.031	19% (3800)	Biocide & PPP
	Terbuthylazin	5915-41-3	5.6	0.05	23% (8500)	Biocide* & PPP
	Terbutryn	886-50-0	2.4	0.01	14% (8000)	Biocide & PPP*
	Thiabendazole	148-79-8	1.9	<*LOQ*	3% (940)	Biocide & PPP
> 0.1 µg/l	1,4-Dichlorbenzol	106-46-7	0.10	<*LOQ*	1% (2900)	Biocide*
	Chlorpyrifos-Methyl	5598-13-0	0.17	<*LOQ*	0.4% (3000)	Biocide* & PPP
	Dichlofluanid	1085-98-9	0.18	<*LOQ*	5% (680)	Biocide & PPP*
	Fenpropimorph	67306-03-0	0.27	<*LOQ*	1% (5900)	Biocide & PPP
	Imidacloprid	138261-41-3	0.17	<*LOQ*	3% (590)	Biocide & PPP
	Irgarol	28159-98-0	0.10	<*LOQ*	4% (5500)	Biocide
	Monolinuron	1746-81-2	0.67	<*LOQ*	3% (3700)	Biocide & PPP*
	Permethrin	52645-53-1	0.10	<*LOQ*	0.4% (2600)	Biocide & PPP*
	Propiconazole	60207-90-1	0.56	0.02	10% (3700)	Biocide & PPP
	Thiamethoxam	153719-23-4	0.12	0.037	20% (140)	Biocide & PPP
	Triclosan	3380-34-5	0.13	0.031	24% (620)	Biocide

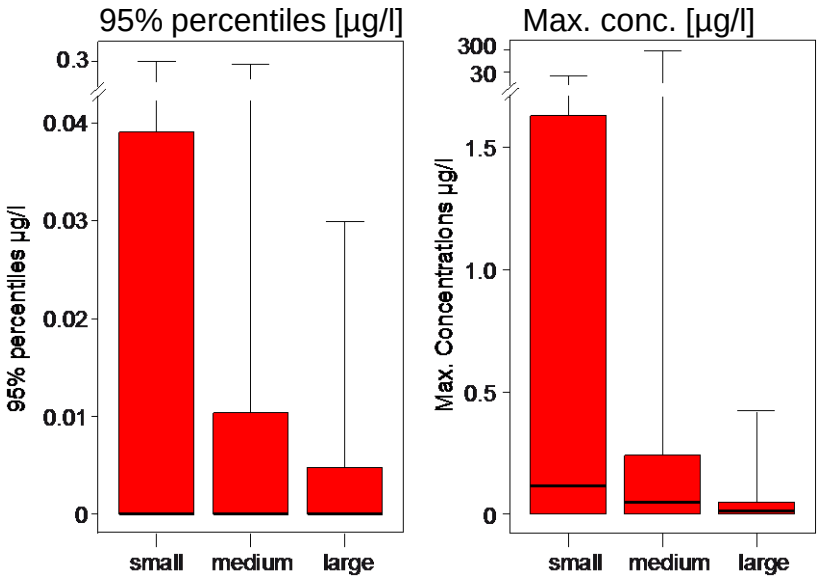
CONCENTRATION levels of biocides in Swiss streams (2005-2012)

Sampling sites in streams with at least one measured value >0.1 µg/l:



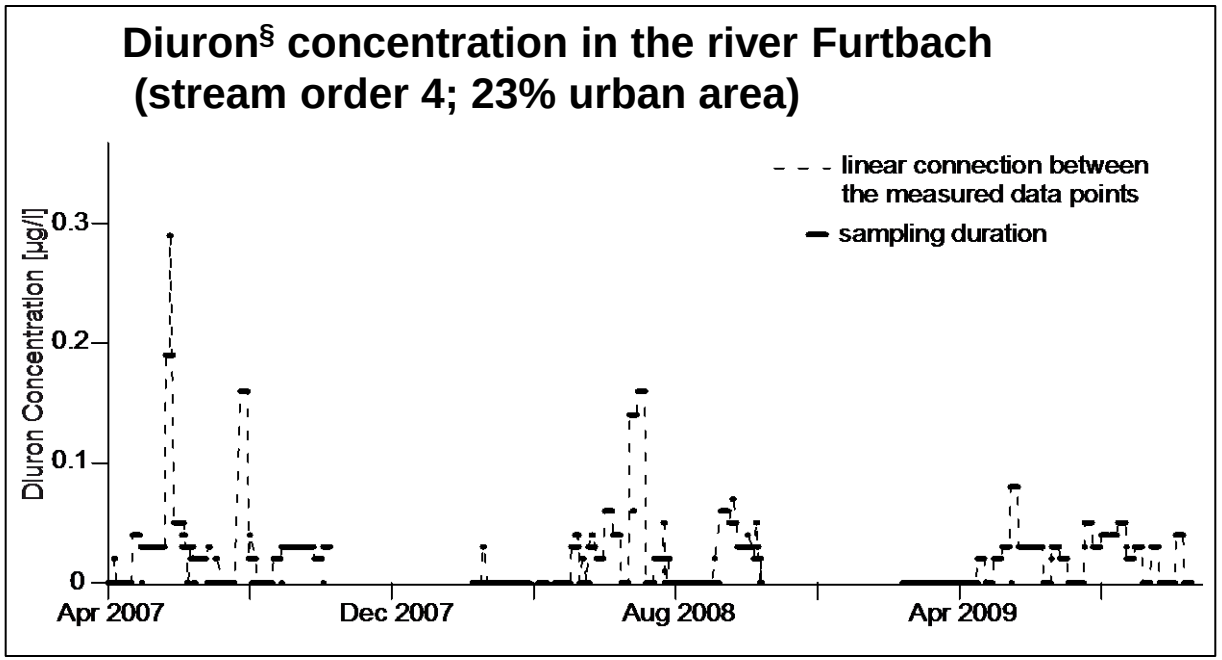
Total:	287 (52%)
Small:	92 (58%)
Medium:	185 (55%)
Large:	10 (20%)

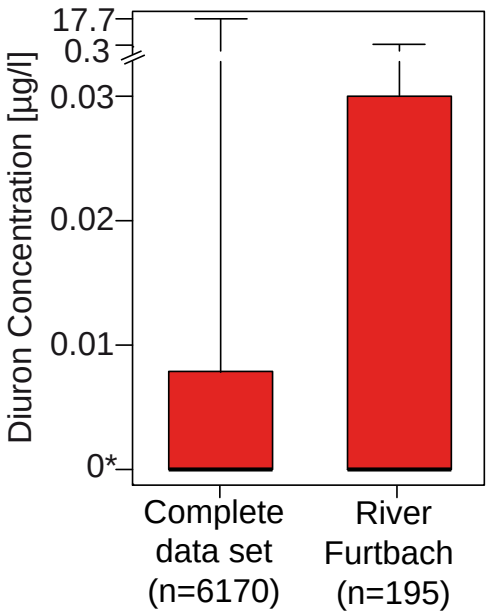
Concentration levels in different stream sizes:



→ in small streams clearly higher concentrations found than in medium and large rivers

Sampling frequency & land use





(Values <LOQ were considered as 0)*

§In Switzerland Diuron approved as biocide (esp. PT 7, 9, 10→ i.e. façades); also approved as PPP (esp. vineyards)

High Resolution Mass Screening with liquid chromatography mass spectrometry (LC-MS/MS)

Total: 345 pesticides considered (only synthetic organic substances)
→ of which 143 biocides

~30 % analyzed by target screening
~60 % analyzed by suspect screening

(~10 % not analyzable by LC-MS/MS)

} *Analytics performed by Eawag*

→ Applied to samples from 5 selected catchments (40-150 km^2) with different biocide and PPP sources

Joint project between the Cantonal Authorities (Aargau, Solothurn, Thurgau, Vaud, Zürich), Eawag & FOEN

Overview / Conclusions

- Biocides until now not the focus in Swiss surface water monitorings
  → BUT, now several projects which consider them

- Eventhough highest concentrations found in small & medium streams, less sampling activities in small streams

- Data indicate, that more PPP are found in Swiss surface waters than biocides

- New analytical method allows screening of an enormous number of micropollutants

Outlook

- FOEN Project on micropollutants from diffuse sources (incl. biocides) → final report mid-2013

- Harmonised sampling strategy for micropollutants from diffuse sources

  → sampling & evaluation concept: project on-going (Eawag & Swiss centre for applied ecotoxicology→ I. Wittmer)

- Land use analysis

  → source identification

  → hot-spot identification

THANK YOU FOR YOUR ATTENTION!