Sources and input pathways of glyphosate into surface waters

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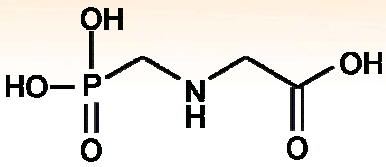
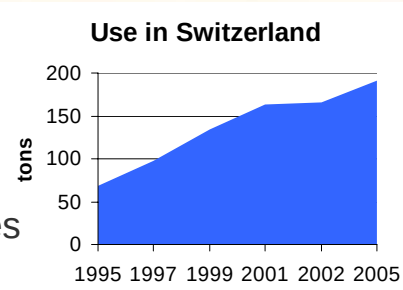
Glyphosate





Goals

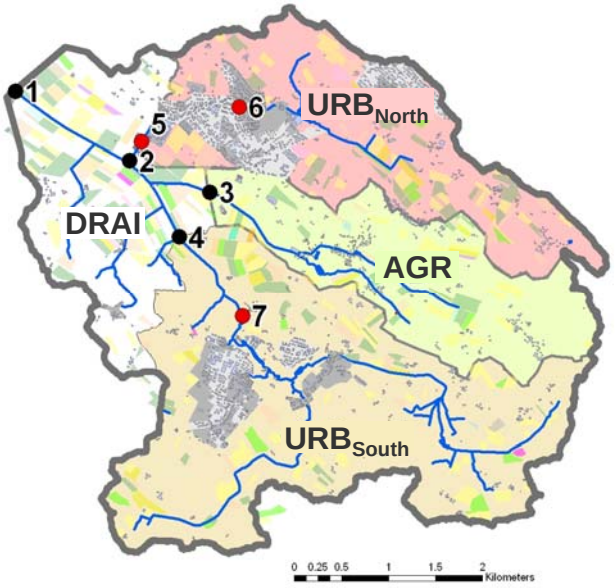
→ Field study in a catchment with different sources to investigate occurrence in surface waters

- non-specific herbicide
- used for various applications
- genetically modified crops
- dissipates due to degradation and sorption
- high concentrations in surface waters

- Analyzing seasonal patterns
- Understanding loss dynamics during rain events
- Identifying the role of the urban drainage system

Study catchment

total area of 25 km^2
12 000 inhabitants



- Water samples
- Discharge data
- Precipitation data
- Agricultural application
- Data of other pesticides, biocides and wastewater tracers

Method

Sampling strategy (March to Nov 2007)

Rain events
- Automatic
- Time proportional

Dry periods
- grab samples

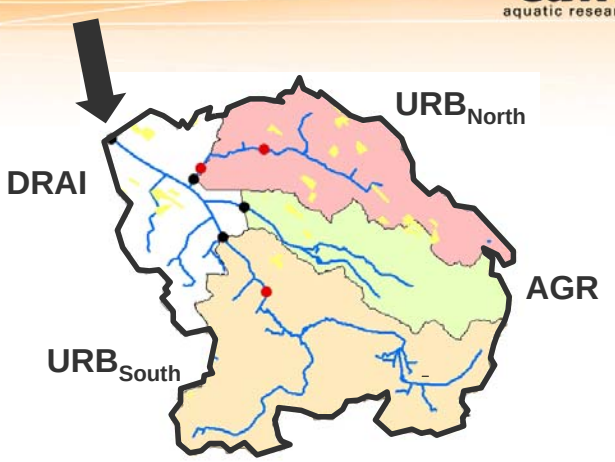
Analytical method

- derivatization with FMOC-Cl
- enrichment with SPE
- detection with LC-MS/MS

LOQ of 20 ng/L

Agricultural application

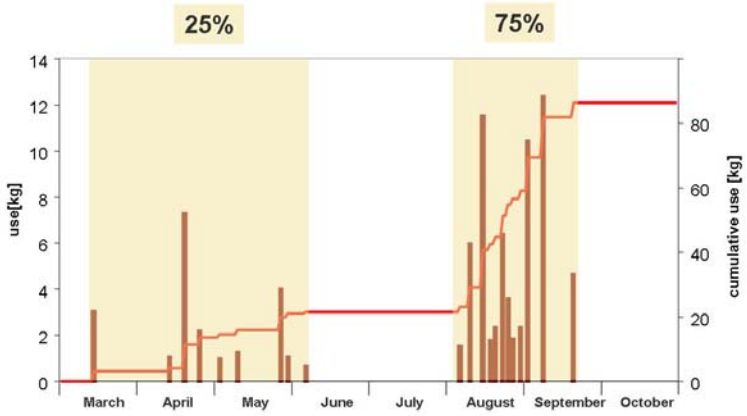
in 2007



Area
- 32 fields
- 53 ha

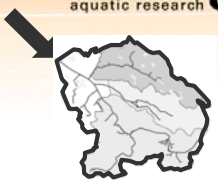
Applied amount

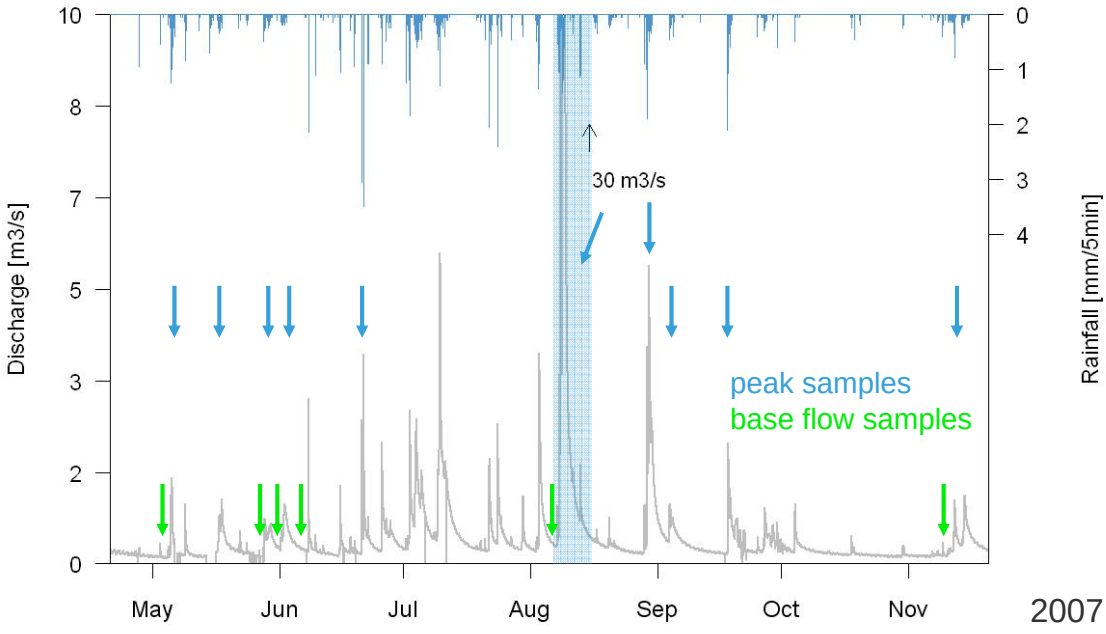
1. isoproturon 107 kg
2. glyphosate 88 kg
3. atrazine 74 kg



Seasonal concentration dynamics

at the outlet of the catchment

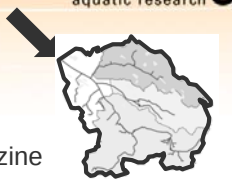


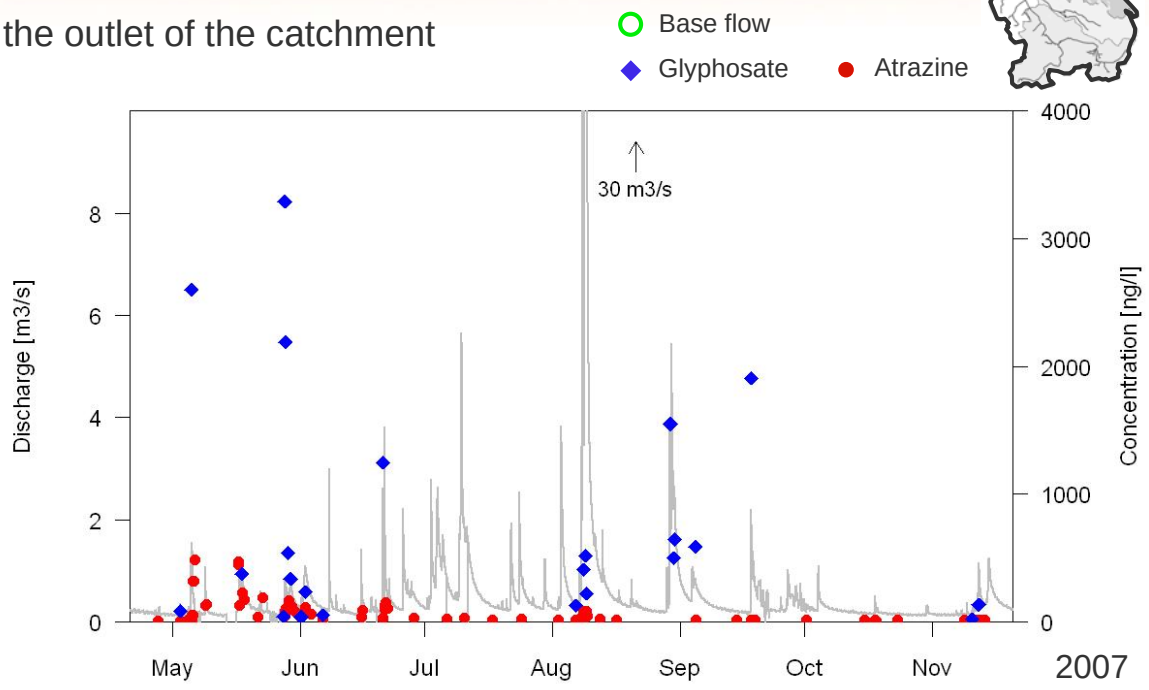


mean annual precipitation (1997 – 2008) 1210 mm
precipitation in 2007 1110 mm

Seasonal concentration dynamics

at the outlet of the catchment



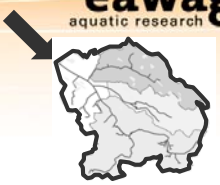


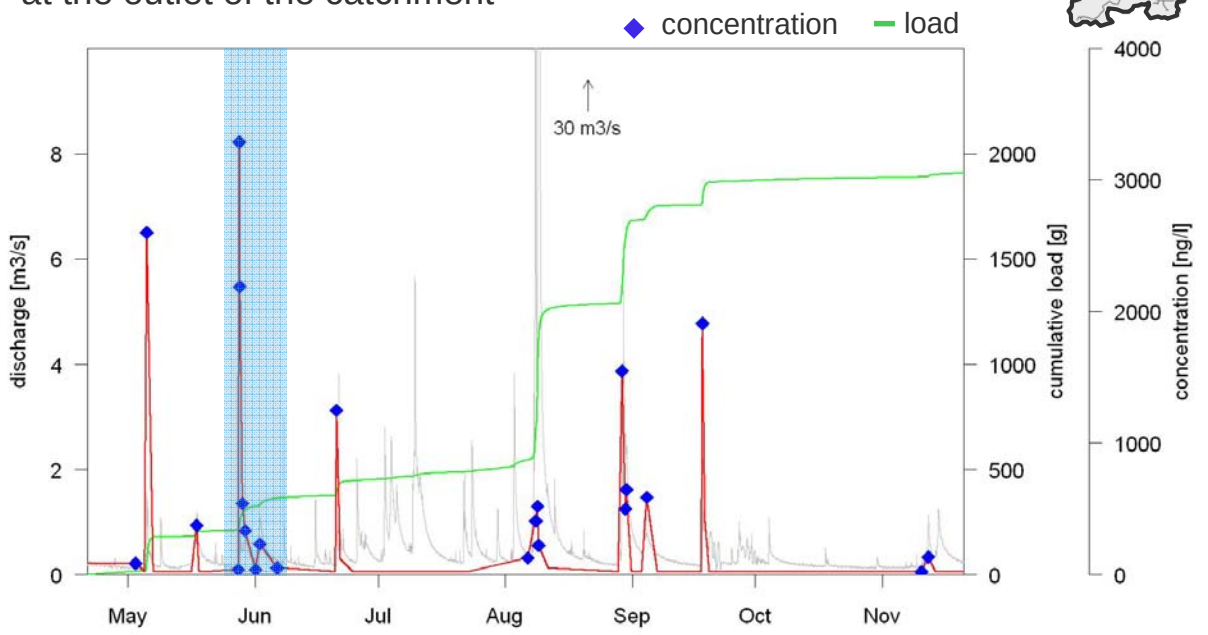
concentration dynamics depending on discharge

- high concentrations during rain events
- low concentrations at base flow

Seasonal load – minimum value

at the outlet of the catchment





Total minimum load of 1.9 kg and applied amount of 88 kg (agriculture)

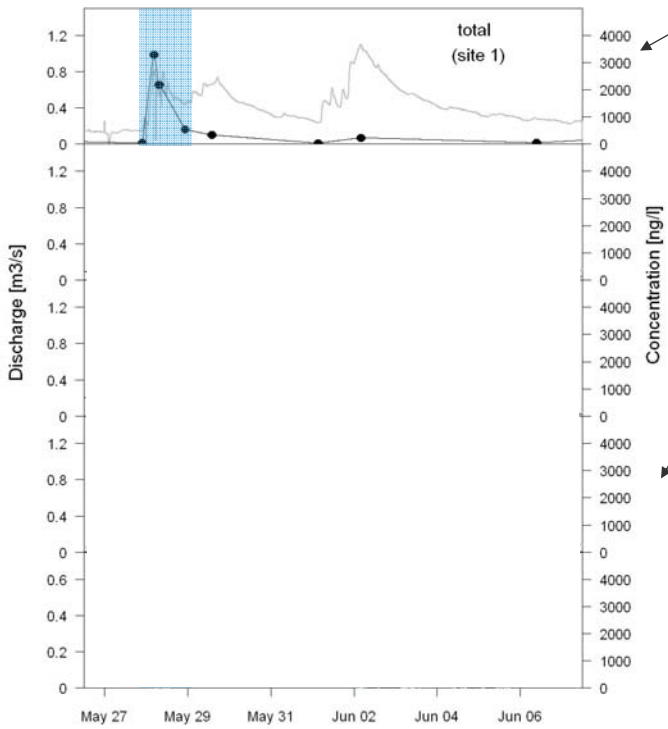
→ loss of 2.2%

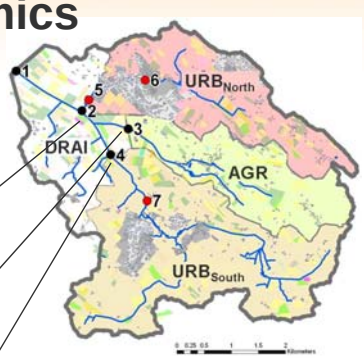
Atrazine: 0.8%

→ agriculture not only source

Sub-catchments: concentration dynamics

event based

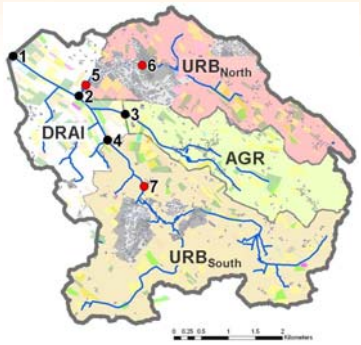


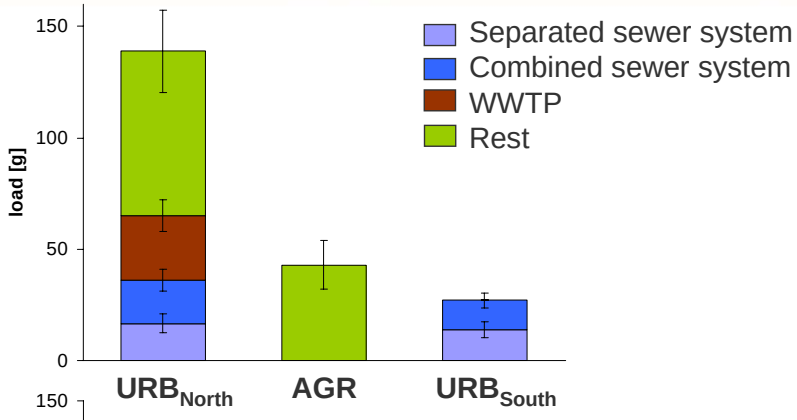


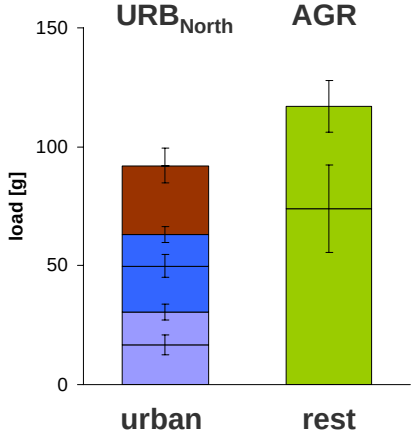
First discharge
- high concentrations
- fast flow
- combined sewer overflow

→ Urban input important

load (event based)







→ 44% of the load during this rain event from the urban drainage system

Conclusions

- High peak concentrations > other pesticides
- Losses from urban areas are important for the occurrence of glyphosate in surface waters
- Urban losses through WWTP, separated sewer system and overflow of combined sewer system

→ Combined modelling of the glyphosate losses from urban and agricultural areas

Thank you for your attention!