Influence of agricultural pesticide and urban biocide use on load dynamics in surface waters

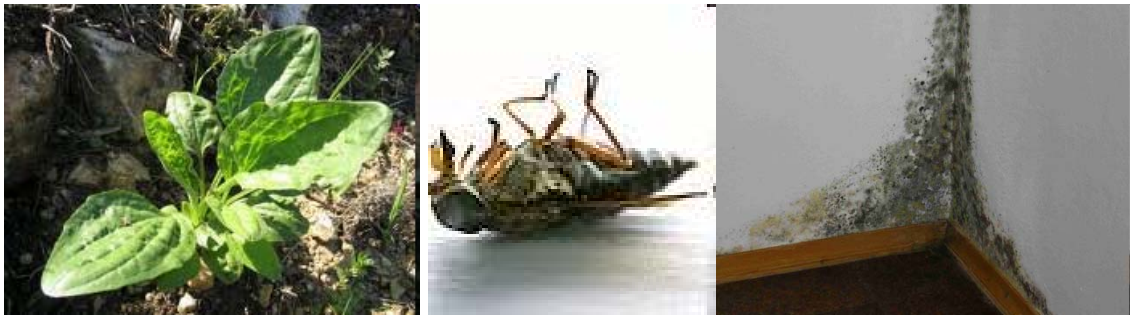
Irene Wittmer, H.-P. Bader, R. Scheidegger, H. Singer, C. Stamm

Overview

- Introduction
- Field study
- Modelling (briefly)
- Conclusions

Introduction

What is a pesticide or a biocide?

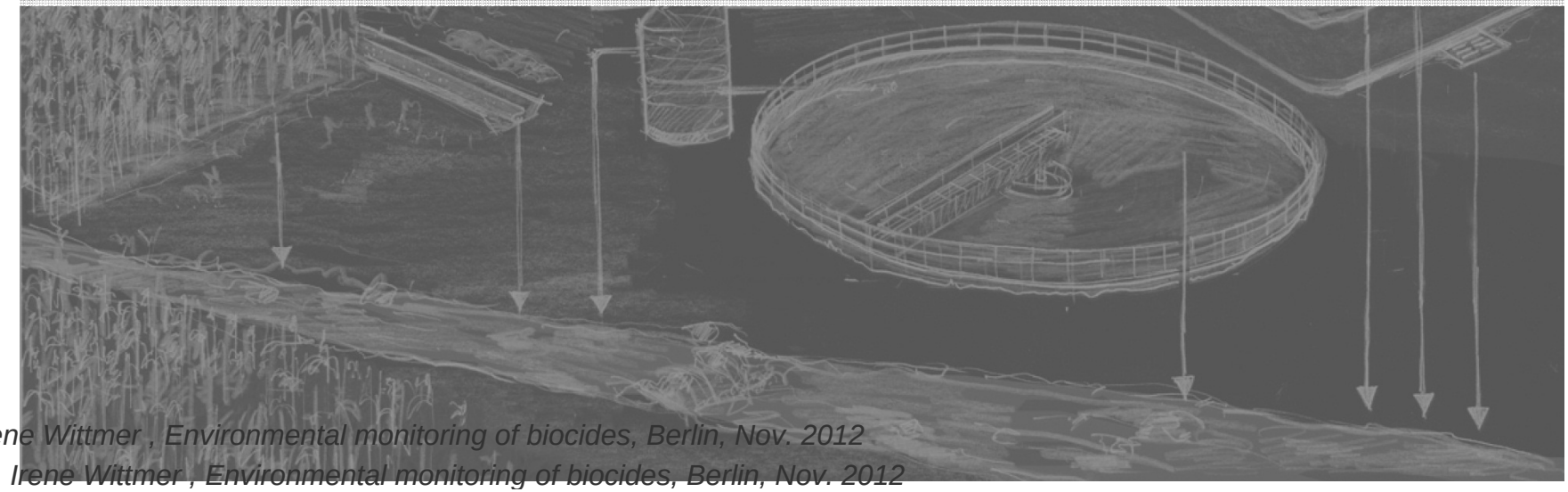


Pesticide
(plant protection)

Biocide
(non-plant protection)

Introduction

Usage of pesticide and biocide

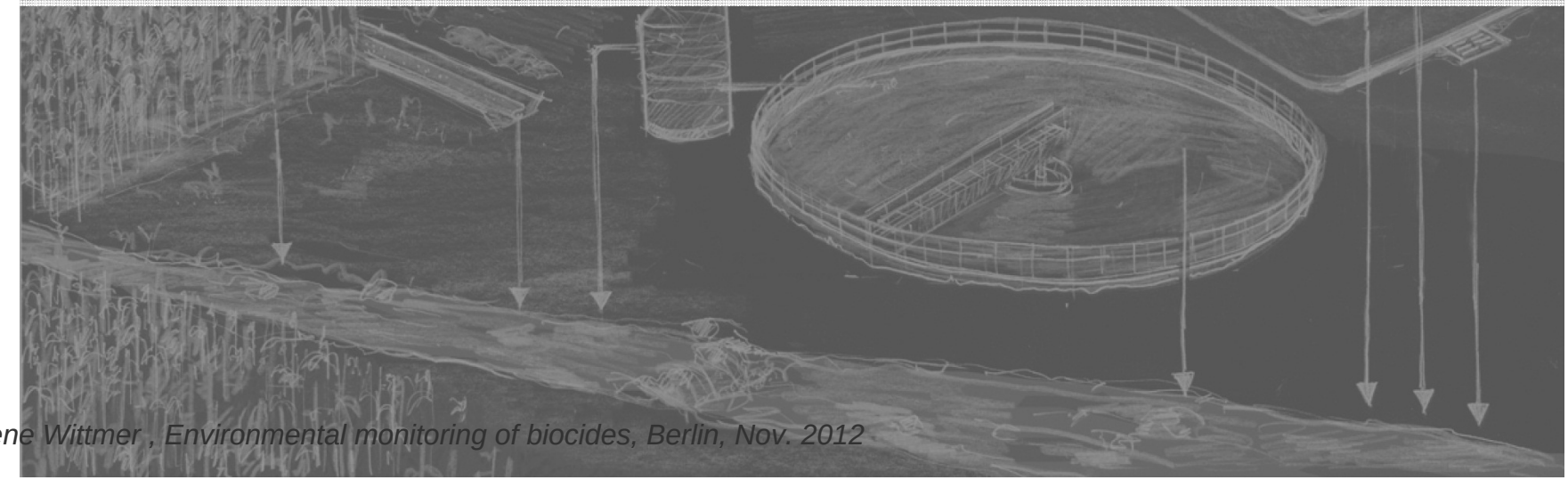


Irene Wittmer , Environmental monitoring of biocides, Berlin, Nov. 2012

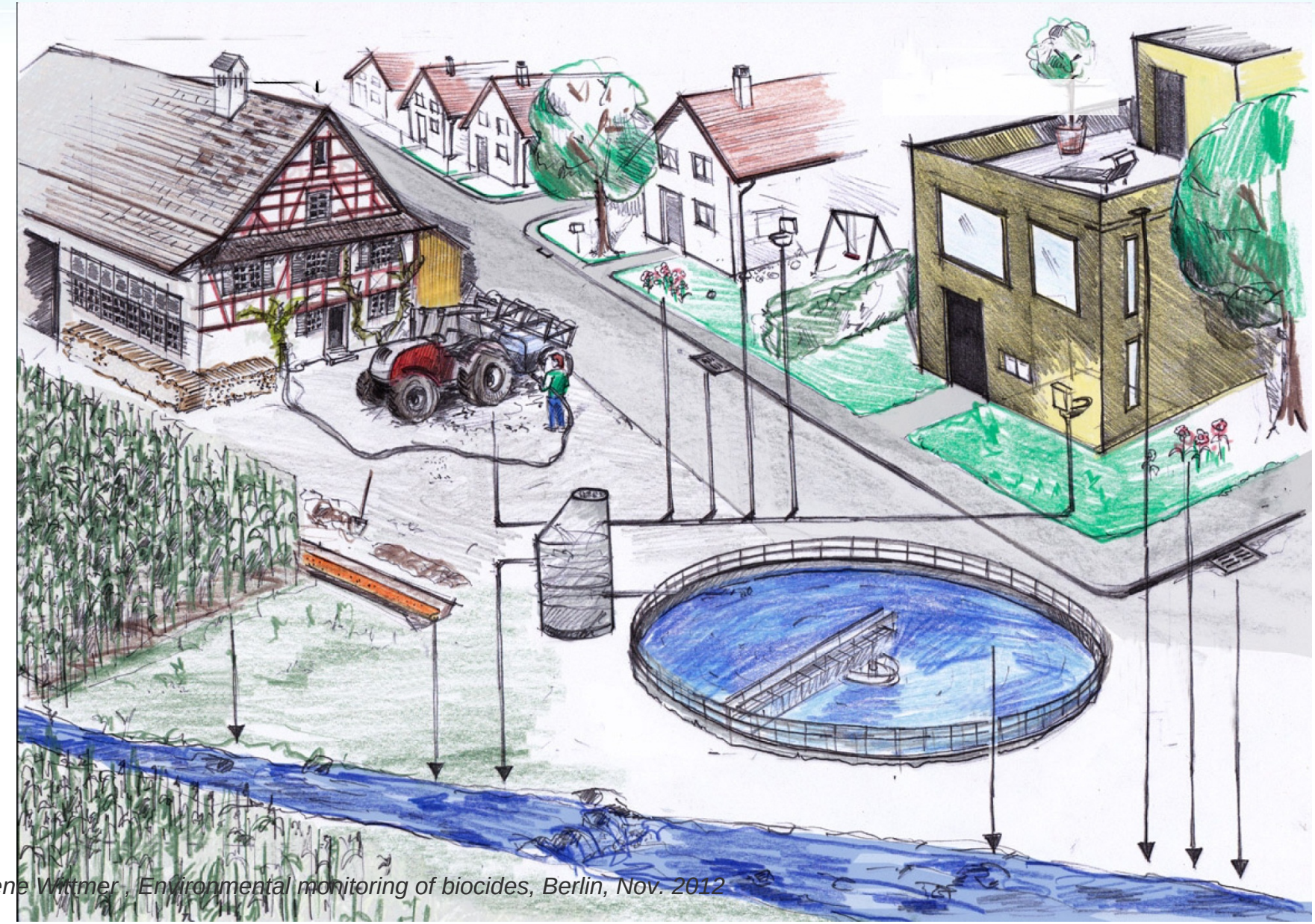
Introduction

Introduction

Input pathways to surface waters



Introduction



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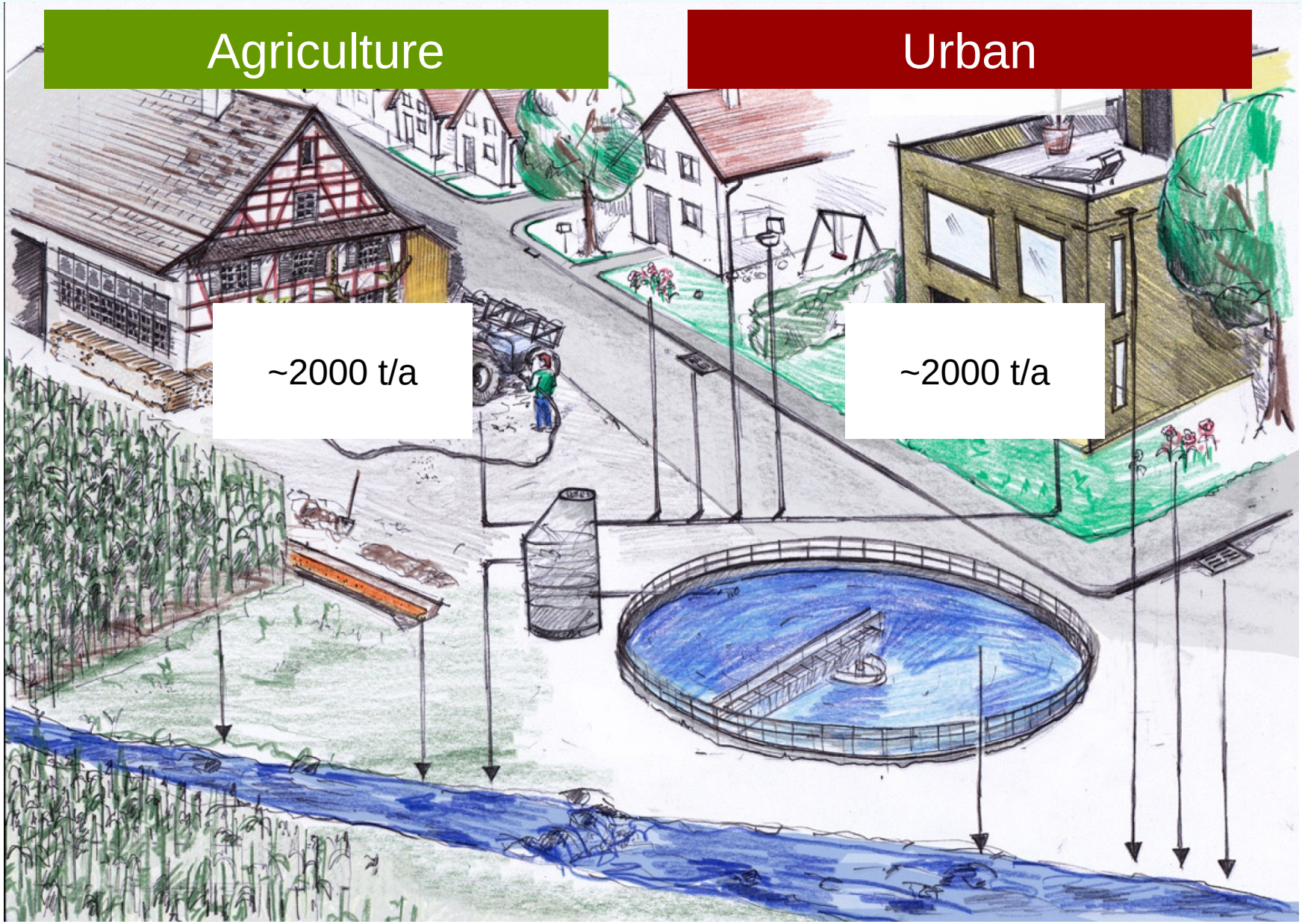
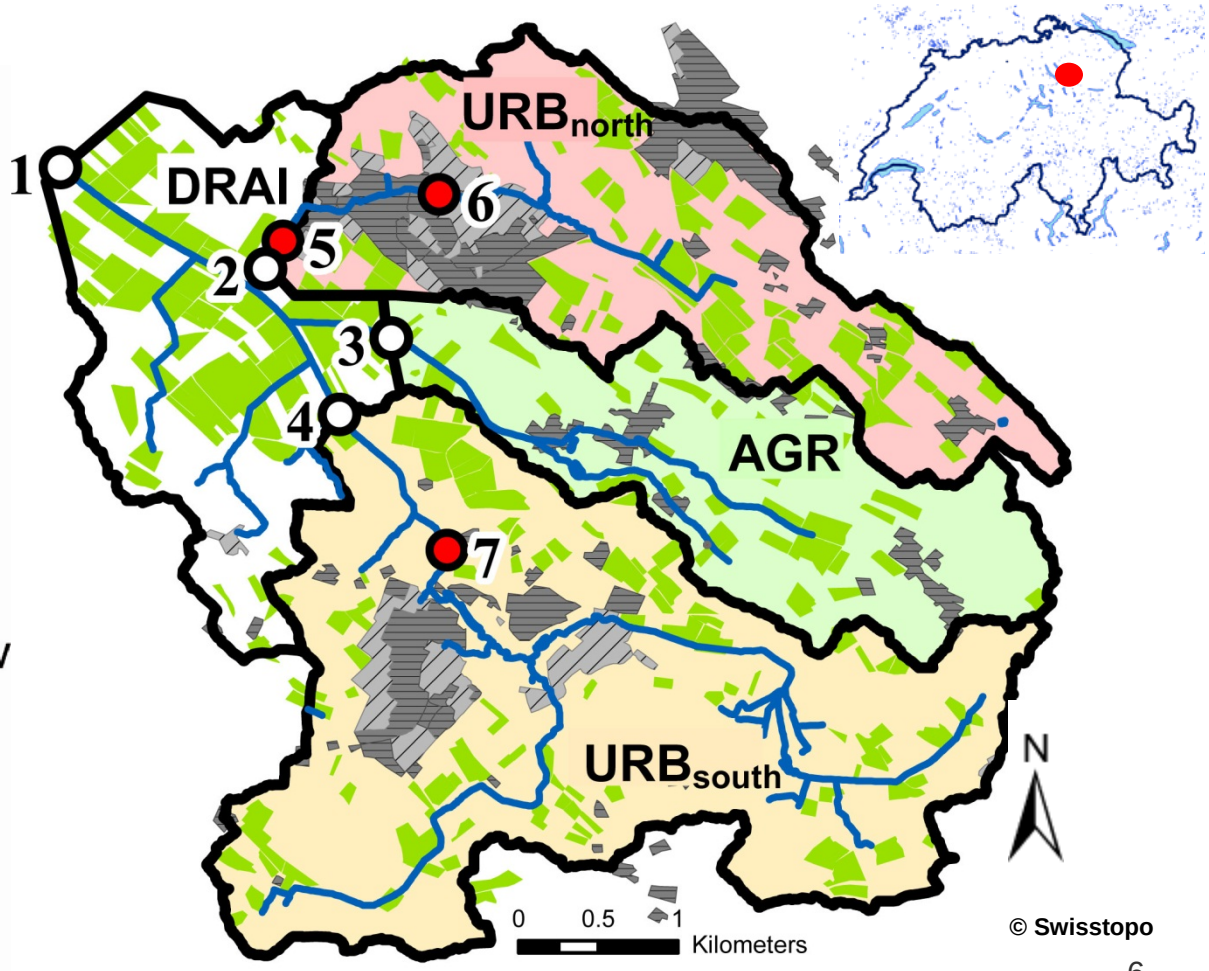


Field study 2007 – in the Greifensee catchment

Catchment area: 25 km^2
Inhabitants: 12‘000

Sampling stations
- Surface water
  - 1 Total
  - 2 URB$_{north}$
  - 3 AGR
  - 4 URB$_{south}$
- Urban drainage system
  - 5 WWTP
  - 6 Storm Sewer
  - 7 Combined sewer overflow

Land use
- Arable crops
- Combined sewer system
- Separate sewer system
- Surface waters

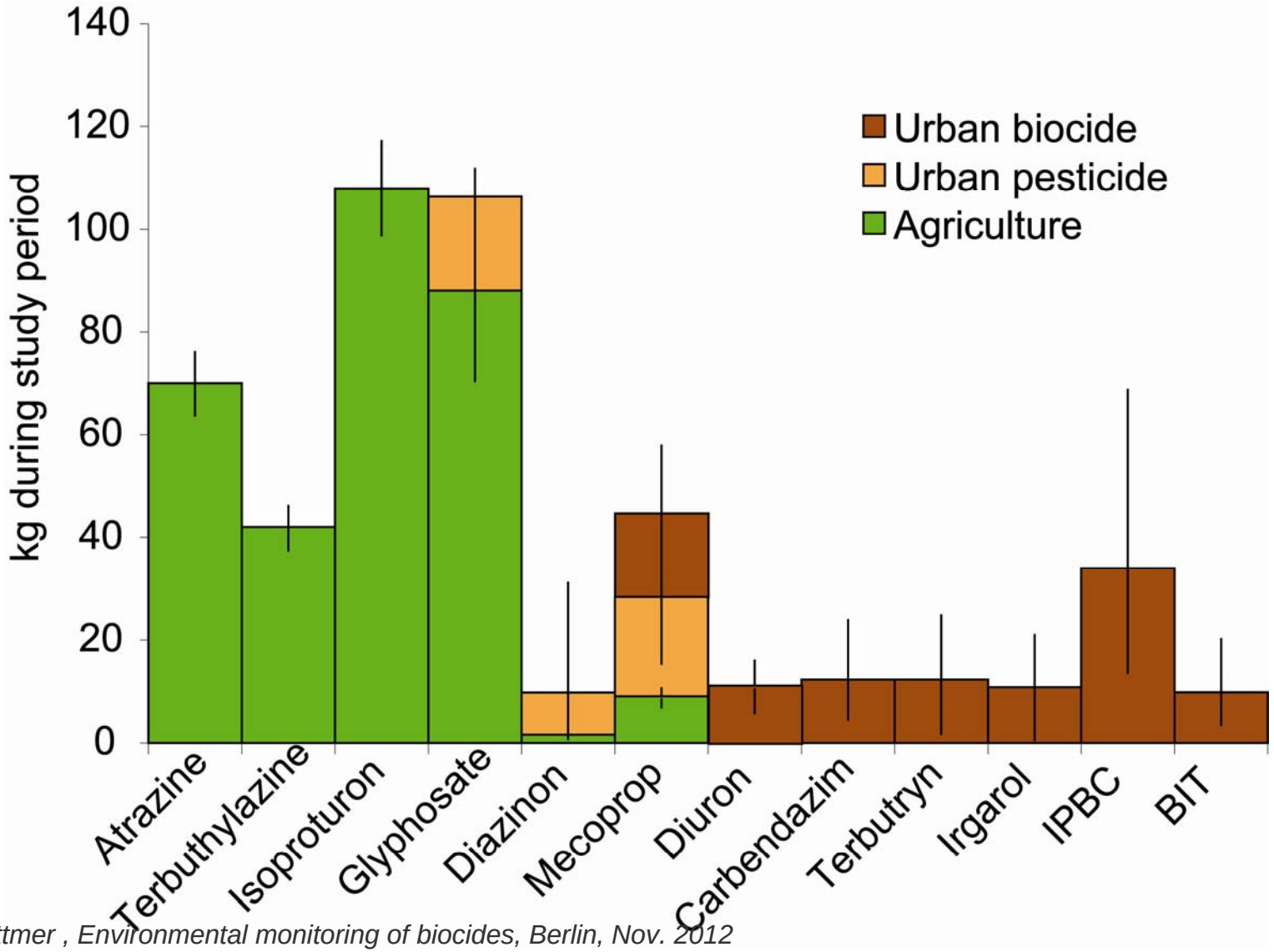


Studied compounds

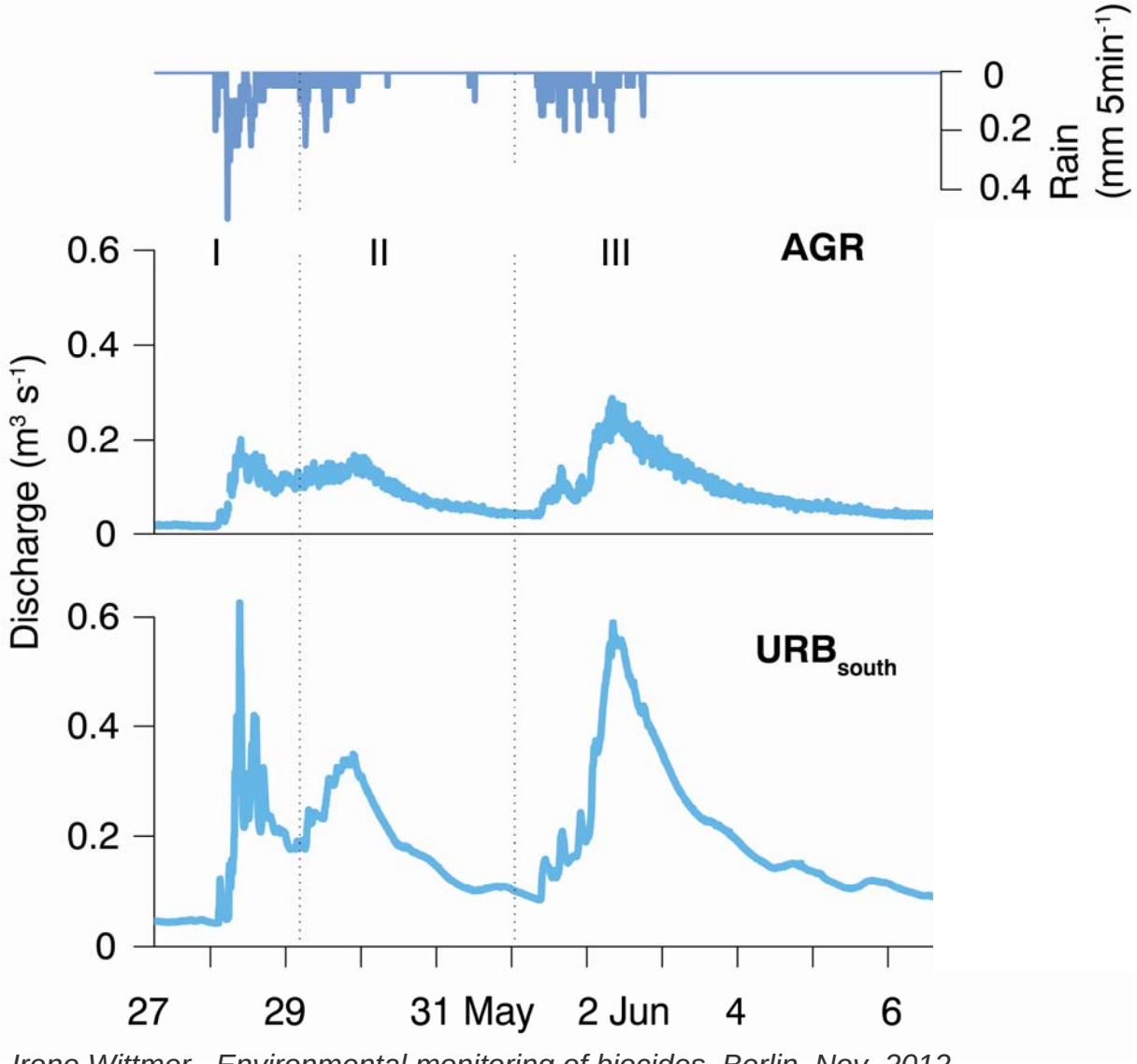
Pesticides (agriculture)	Biocides (urban)
Carbendazim	**Carbendazim**
Diazinon	**Diazinon**
Terbuthylazine	**Terbuthylazine**
Isoproturon *	**Isoproturon ***
Mecoprop	**Mecoprop**
Atrazine *	**Isothiazolinones**
Sulcotrion	**IPBC**
Mesotrion	**Irgarol ***
	Diuron *
Selected samples of:	**Terbutryn ***
Glyphosate *	**Glyphosate ***

** plus metabolites*

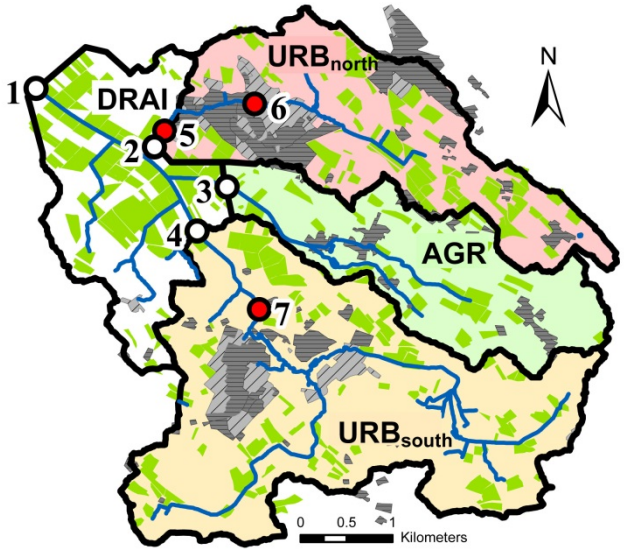
Consumption
in the study catchment during the measurement period



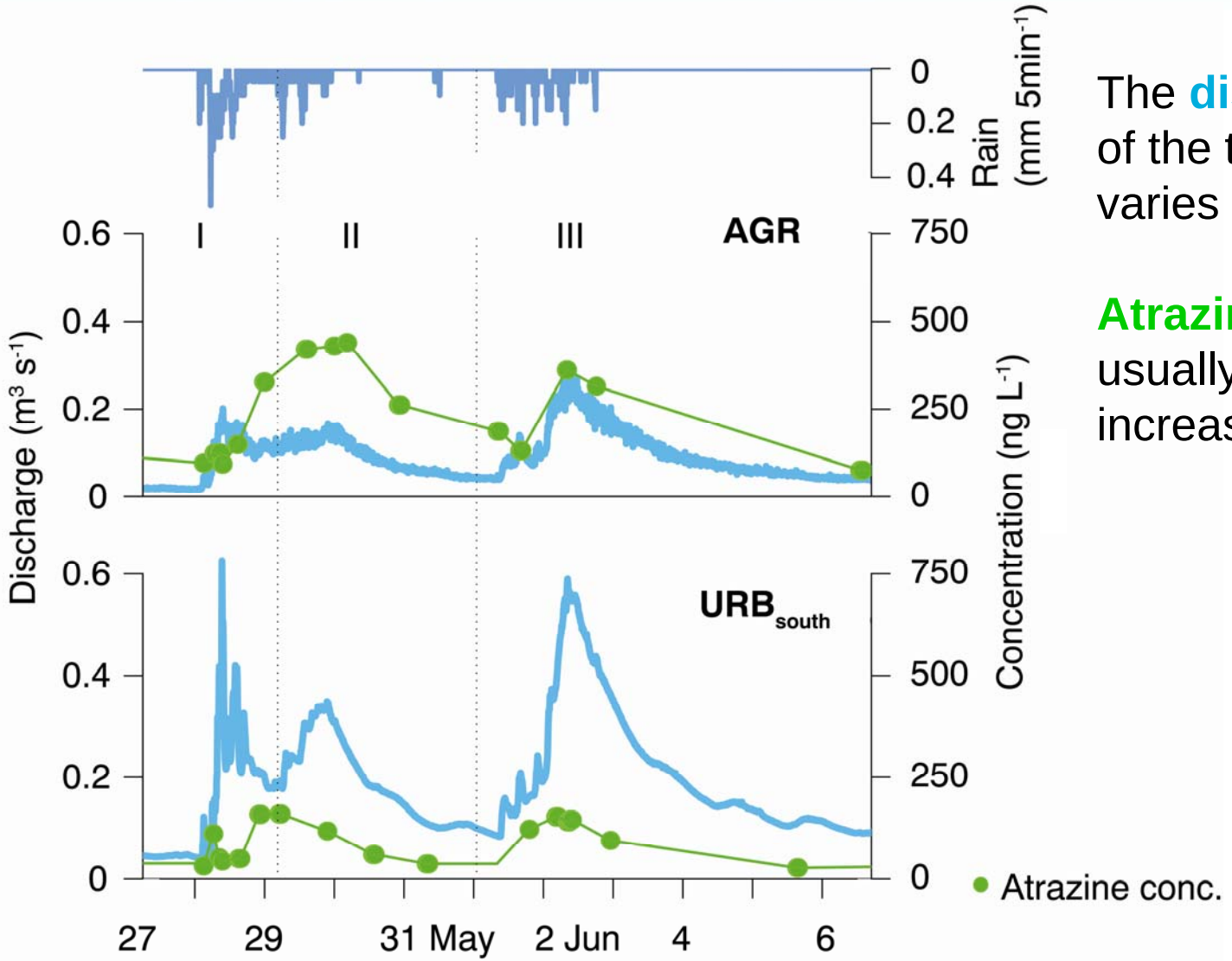
Concentration dynamics



The **discharge dynamic** of the two catchments varies



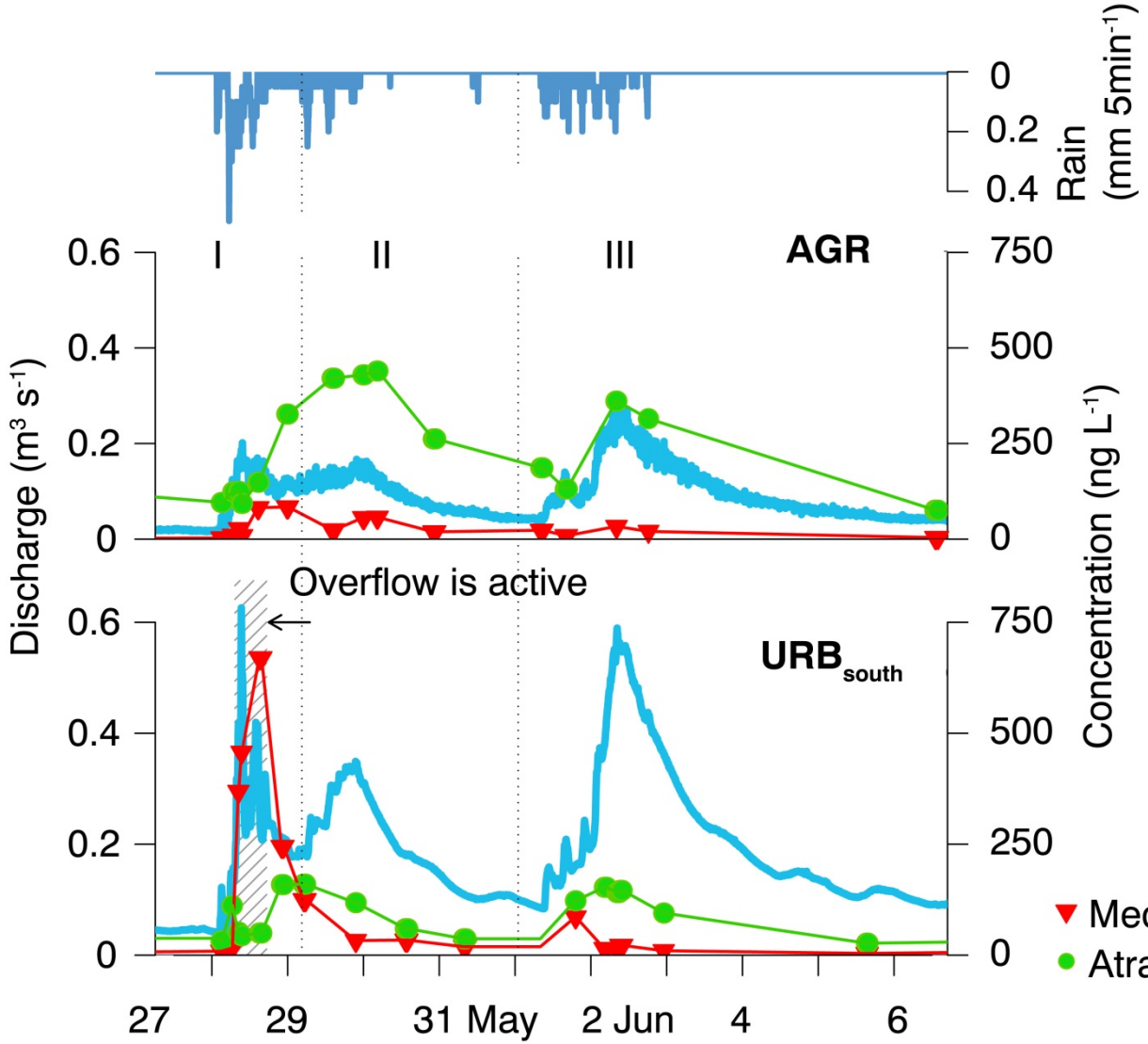
Concentration dynamics



The **discharge dynamic** of the two catchments varies

Atrazine- concentrations usually increase with increasing discharge

Concentration dynamics

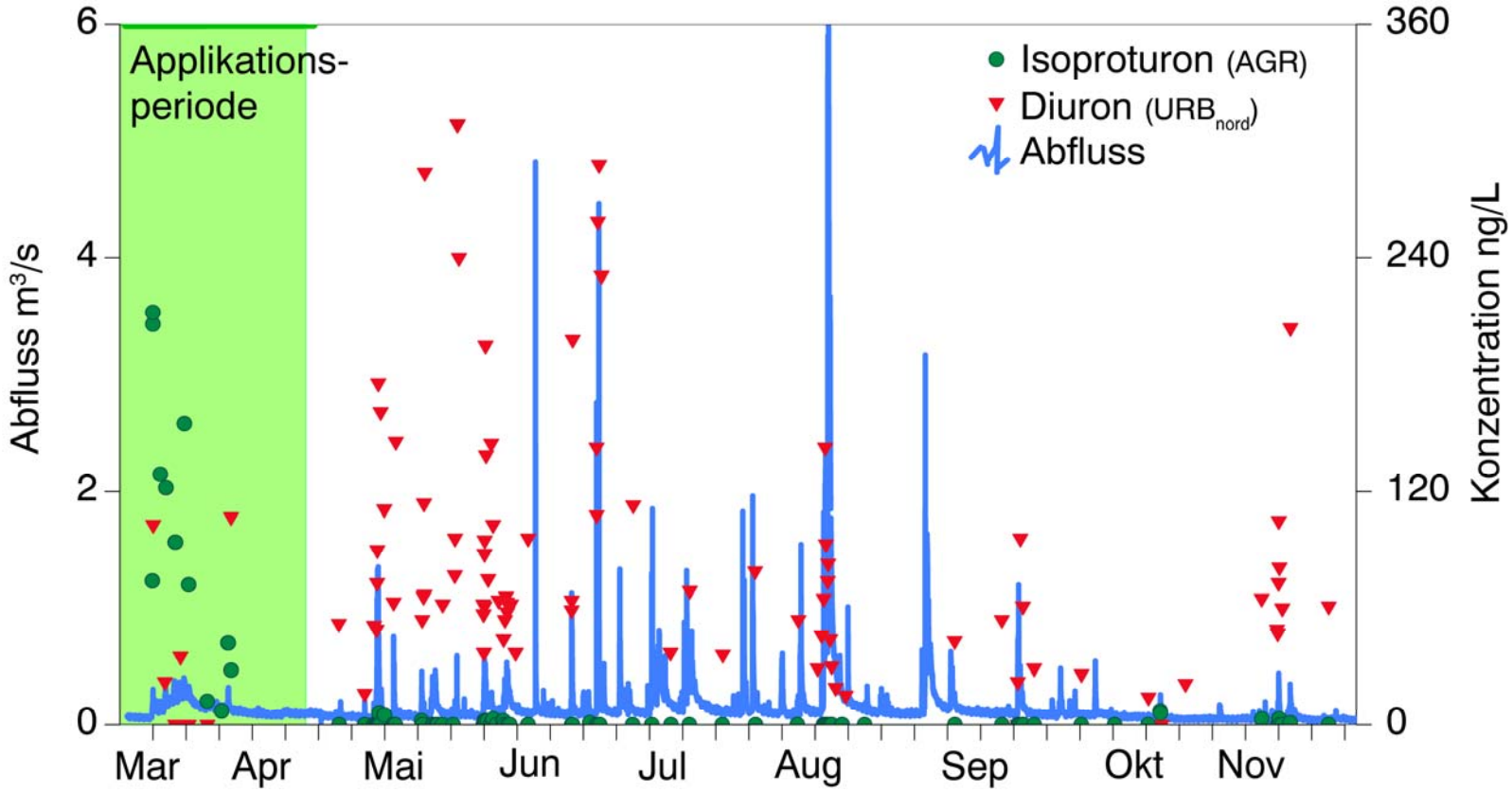


The **discharge dynamic** of the two catchments varies

Atrazine- concentrations usually increase with increasing discharge

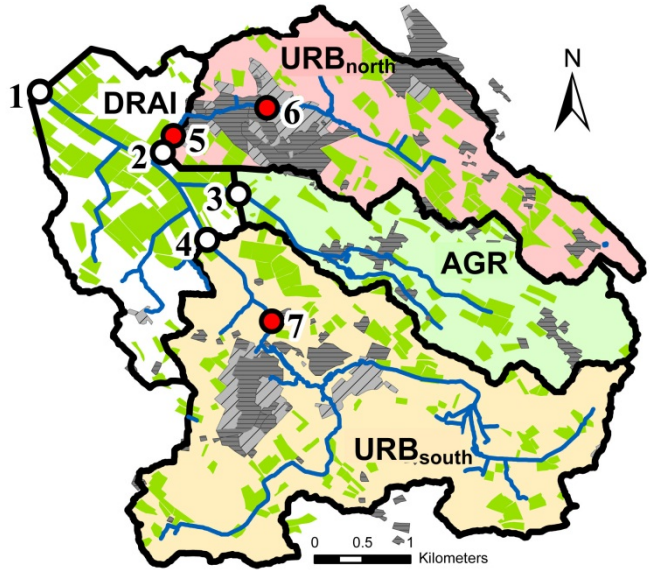
Mecoprop – concentrations depend on the activity of the urban drainage system (CSO)

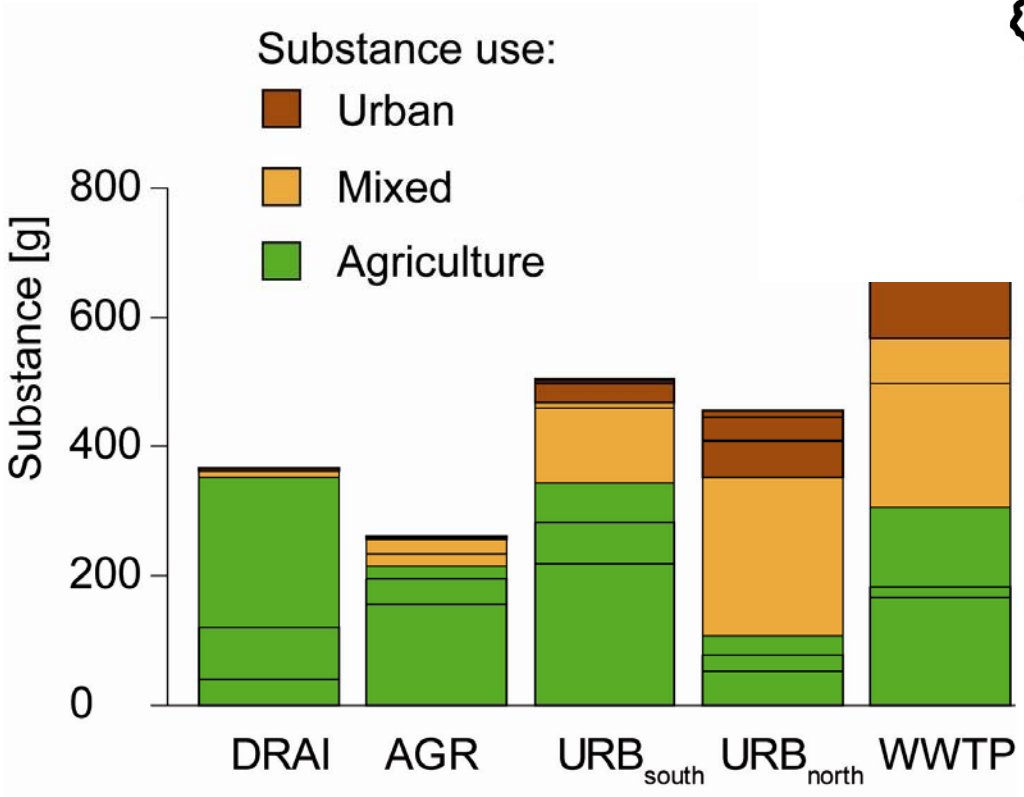
Seasonal dynamics



Concentrations of agricultural pesticides are elevated during application seasons, biocides maybe constantly elevated.

Loads

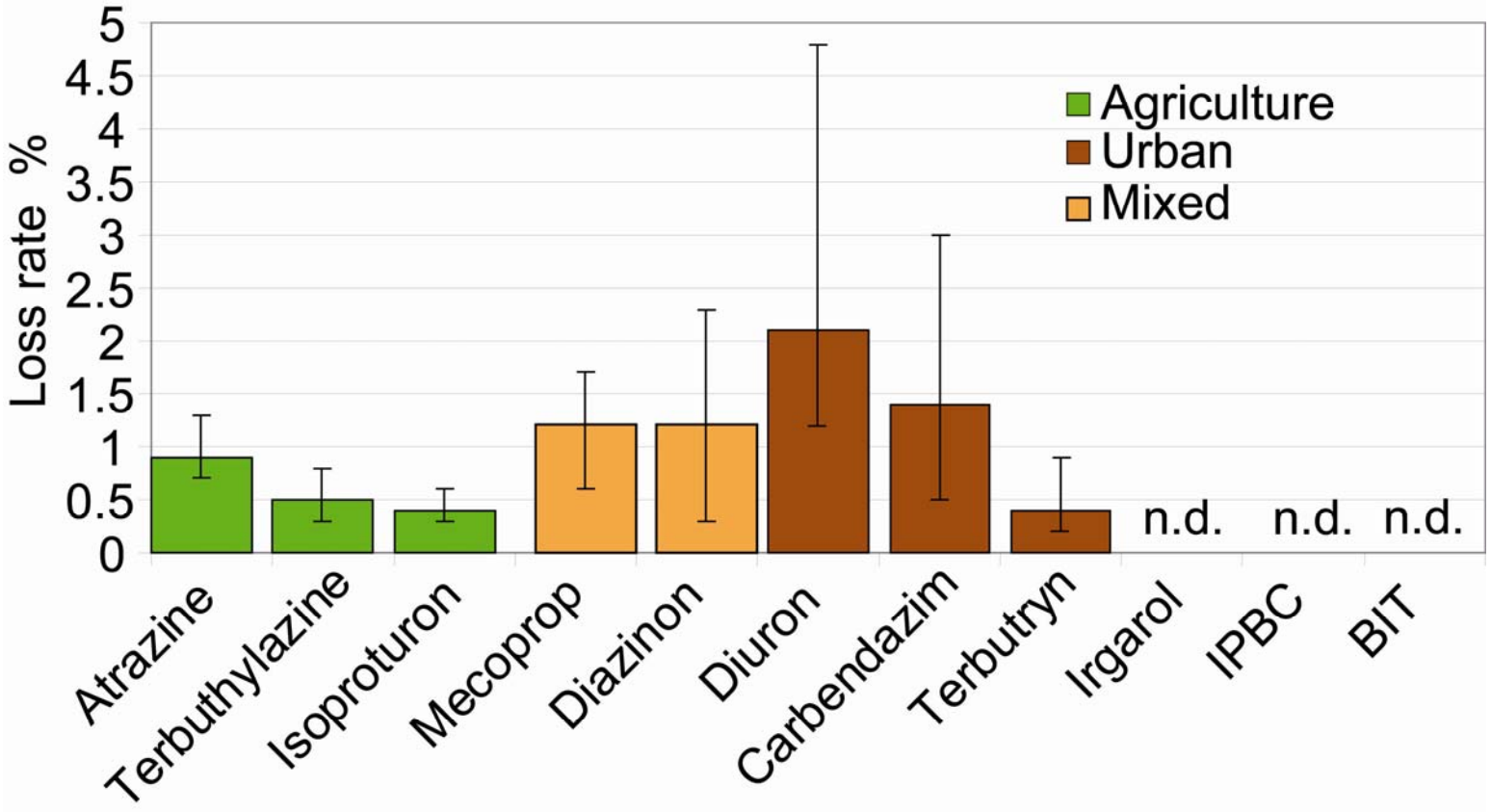




Catchments show distinct load patterns depending on the land use!

Loss rates

$$\text{Loss rate} = \frac{\text{Measured load}}{\text{Consumption}}$$



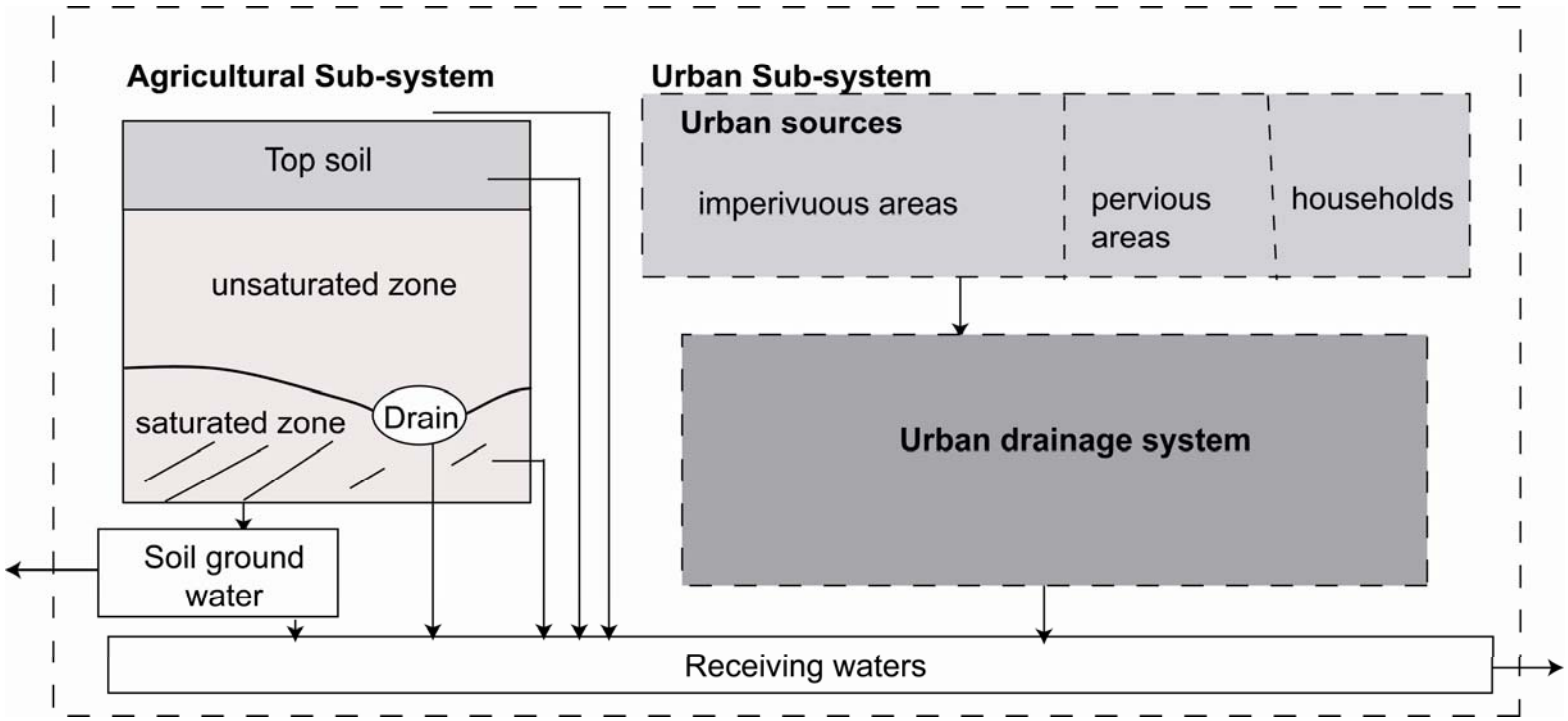
Loss rates of urban used compounds can be higher.

Some compounds with a high use were not detected.

Modeling approach

Agriculture

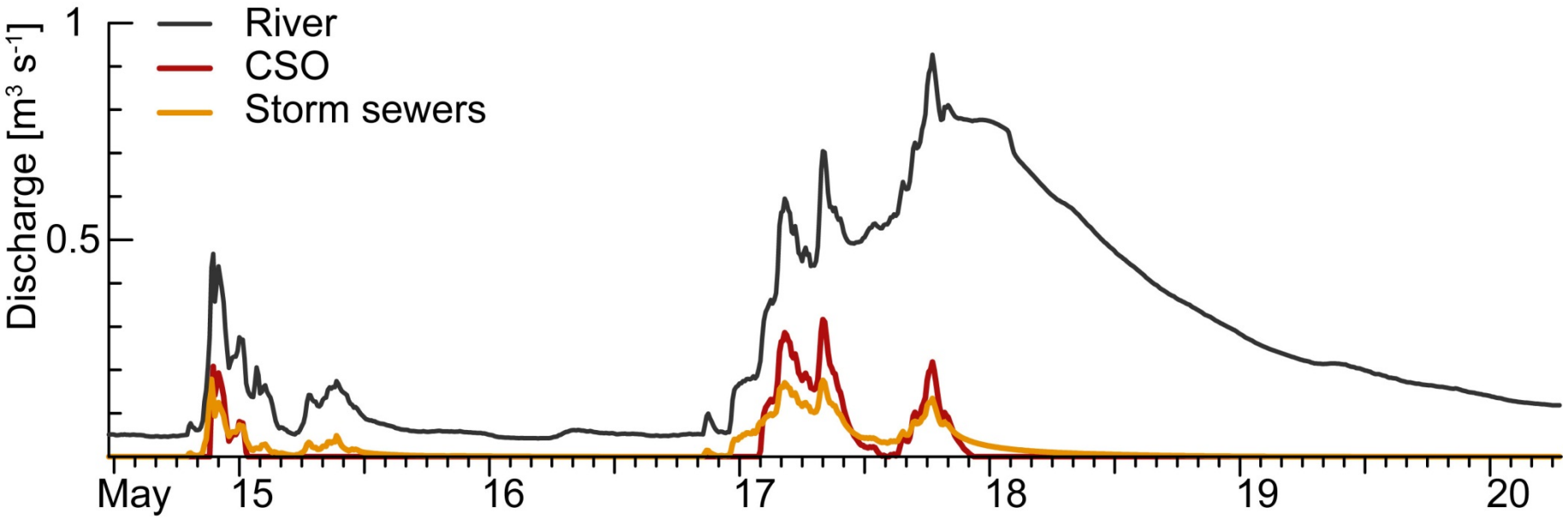
Urban



- Model as simple as possible
- All relevant process and sources
- High temporal resolution (used: 15min)

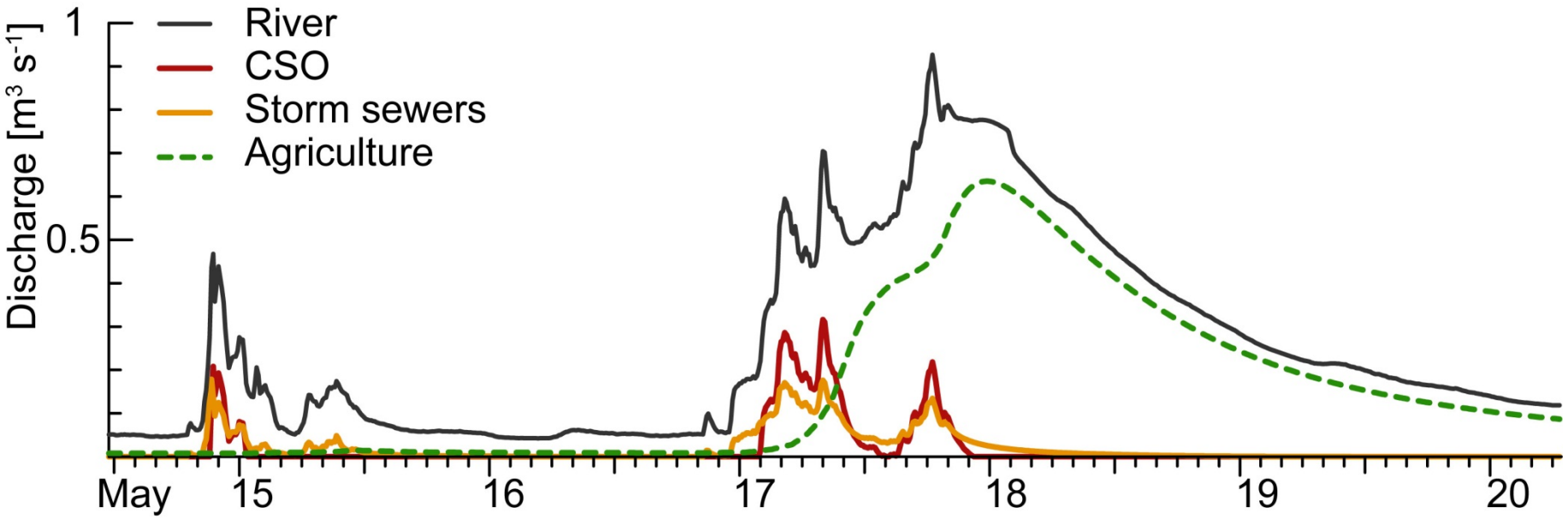
Model Results

Discharge components



Model Results

Discharge components



In the beginning discharge consists mostly of urban water

Agricultural system does not always react to rainfall

Conclusions

- Land use results in distinct chemical fingerprints (dynamic & occurrence)
- In the beginning of events river discharge consists mostly of urban storm water.
- Loss rates from urban uses can be higher.
- Knowledge about biocide consumption is limited.

Agricultural as well as urban systems have to be considered!

Thank you for listening!

and

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