Combination of passive samplers to monitor the chemical status of 6 French rivers

A. Larrose, A. Assoumani, A. Dabrin, L. Dherret, J. Gahou, C. Margoum, J. Panay, A. Roussel-Galle, C. Miège, R. Recoura-Massaquant, A. François, M. Coquery

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Use of passive sampling in water monitoring program

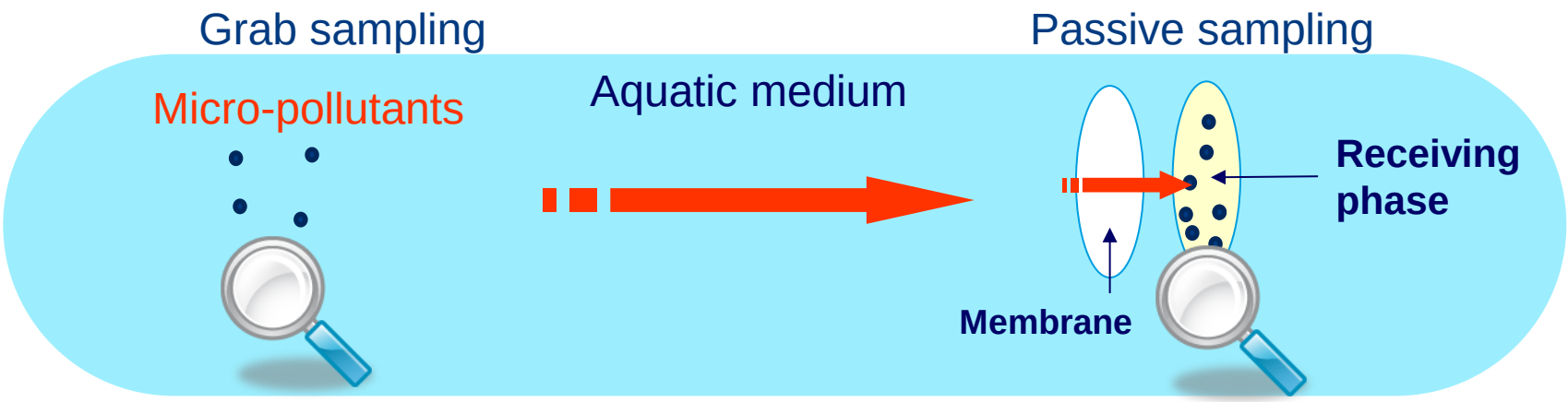
Grab sampling

Micro-pollutants

Aquatic medium

- **4 to 12 samples per year (for WFD)**
- **Low quantification frequencies for micropollutants**
- **« no diagnosis of water quality »**

Use of passive sampling in water monitoring program



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- *In situ* concentration of the compounds
- Temporal representativeness
- Time and cost effective vs grab/automated sampling

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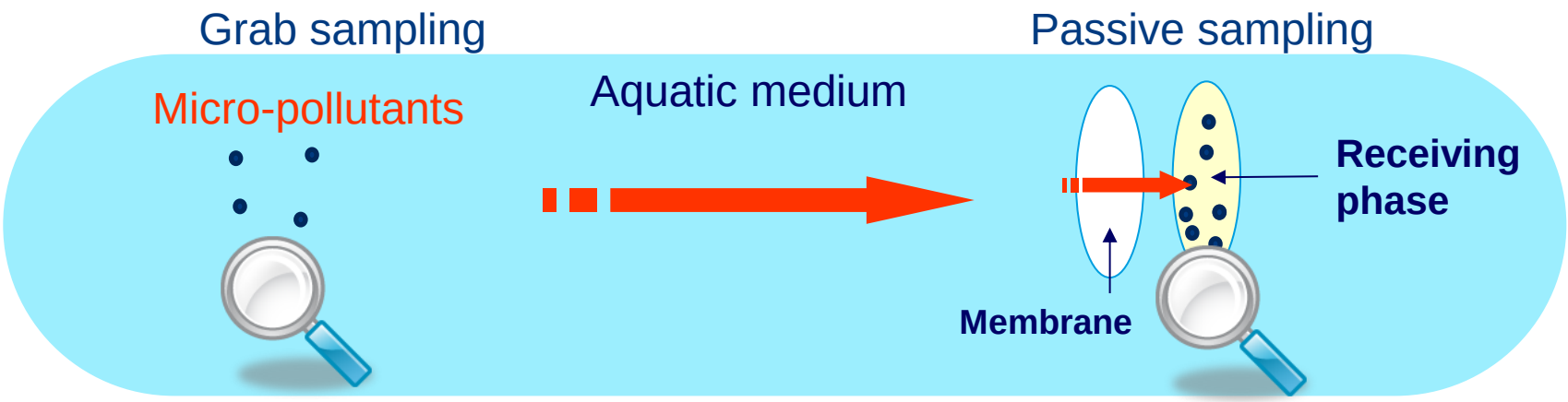

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- Temporal representativeness
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Applicability of passive samplers for water monitoring:
- validated from laboratory tests and *in situ* studies
- for pesticides, trace metals, pharmaceuticals

(Assoumani et al., 2014, 2015; Buzier et al., 2014; Morin et al., 2012; Poulier et al., 2014, 2015)

Objective: to test a combination of 3 passive samplers to evaluate pressures of contamination by micropollutants

Trace metals

DGT

Pesticides and pharmaceuticals

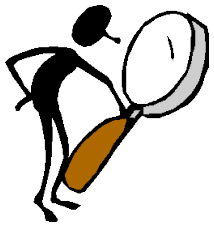
POCIS

pSBSE

Pesticides

- Diffusive Gradient in Thin films, DGT
- Passive Stir Bar Sorptive Extraction, pSBSE
- Polar Organic Chemical Integrative Sampler, POCIS

The targeted compounds

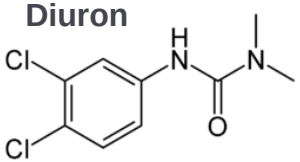


5 trace metals

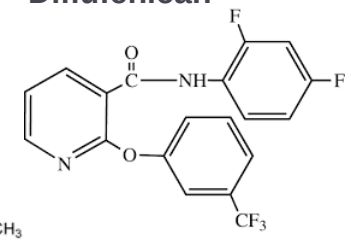
21 pesticides

39 pharmaceuticals

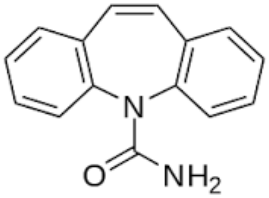
Diuron



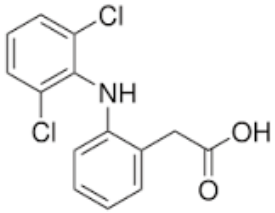
Diflufenican



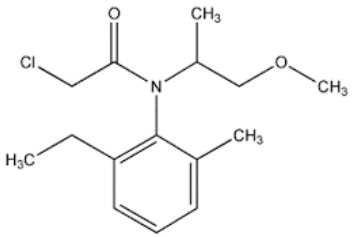
Carbamazepine



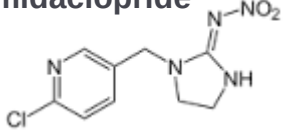
Diclofenac



Metolachlor



Imidaclopride

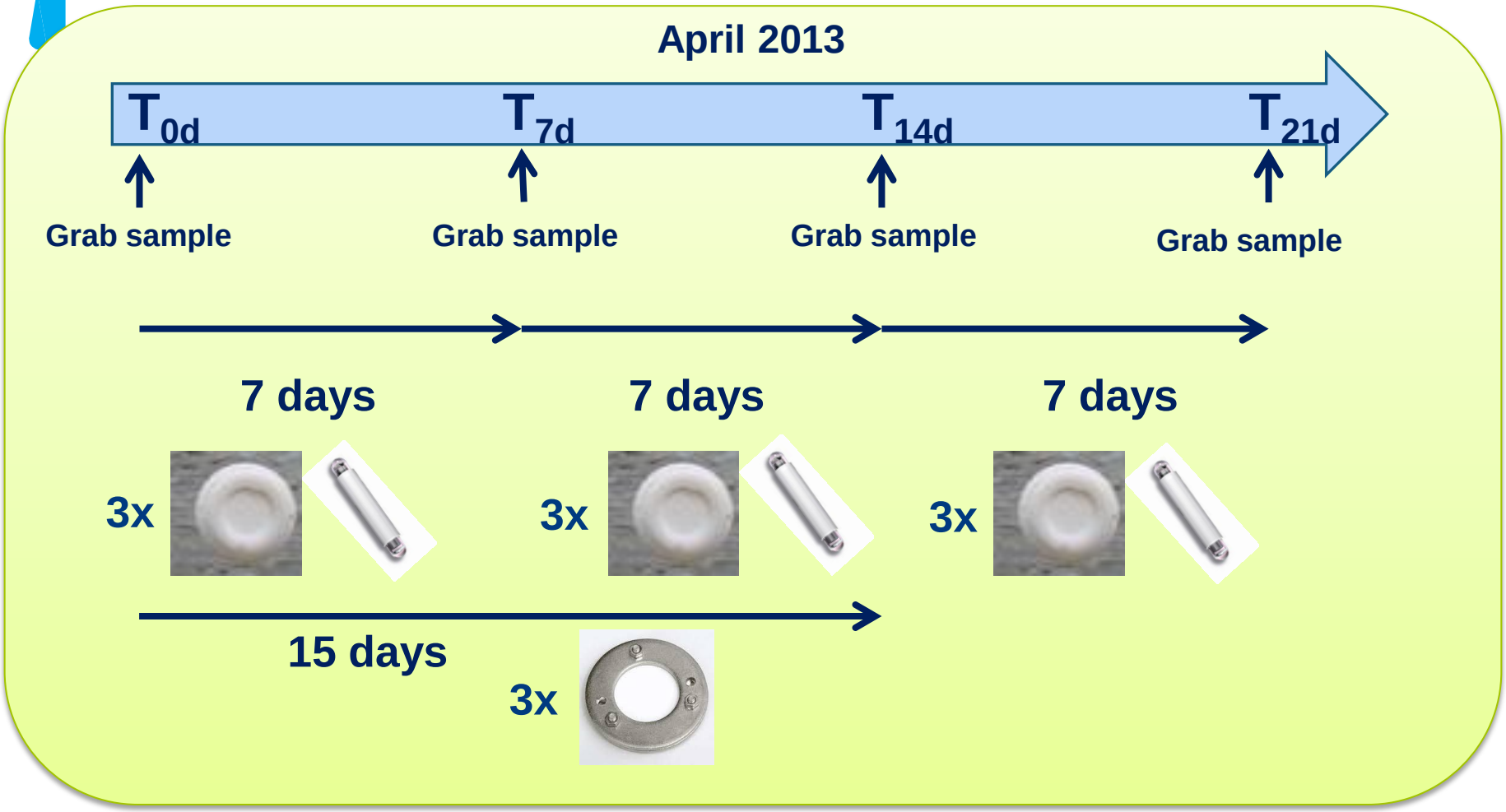


wide range of chemical properties

of analytical techniques
ICP-MS, UHPLC-MS/MS...

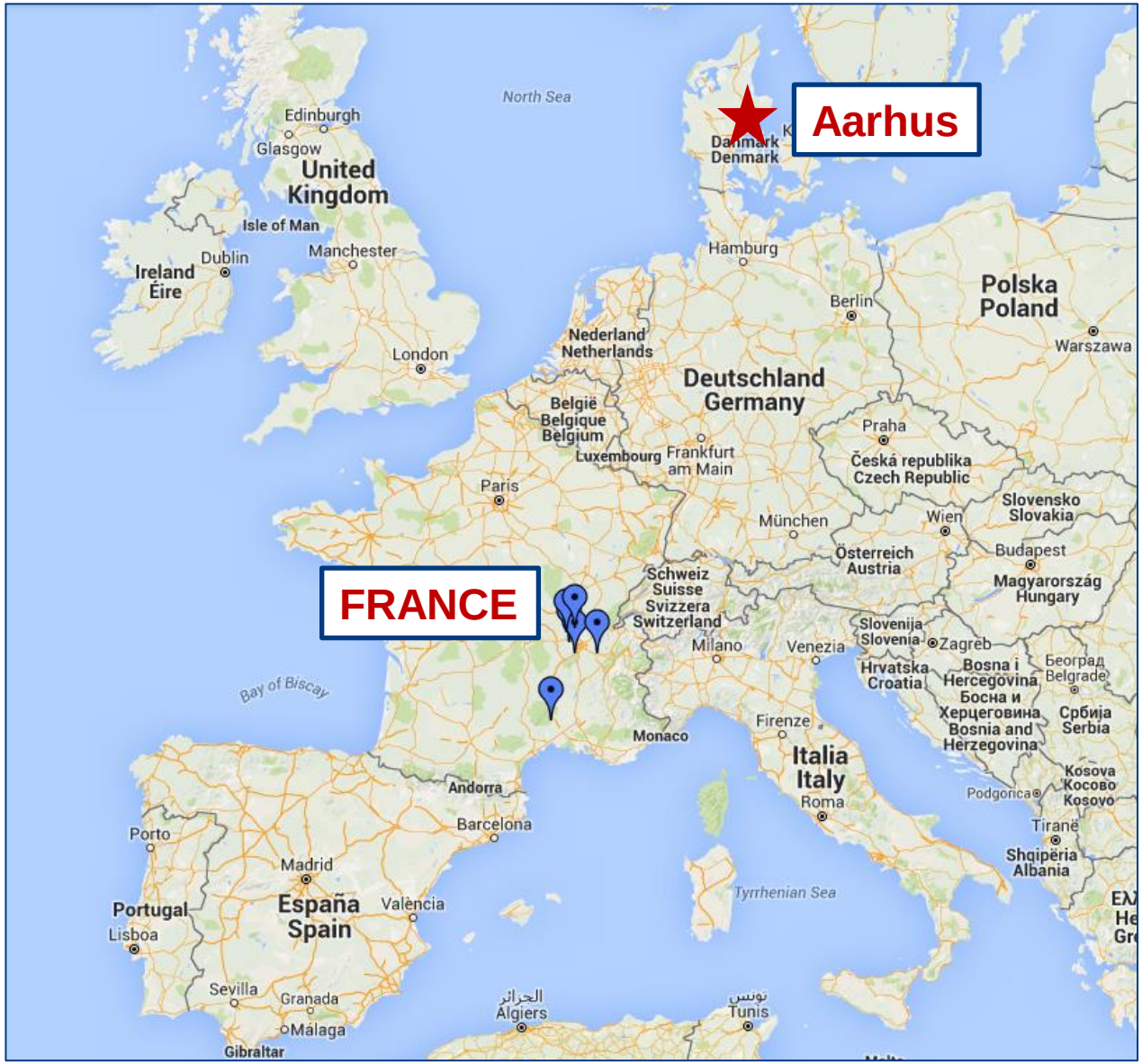
of environmental concentrations
from <1 ng/L to 100 µg/L

One month sampling campaign



- **deployment in 6 contrasted watersheds**

Selected watersheds: different land-use and human activities

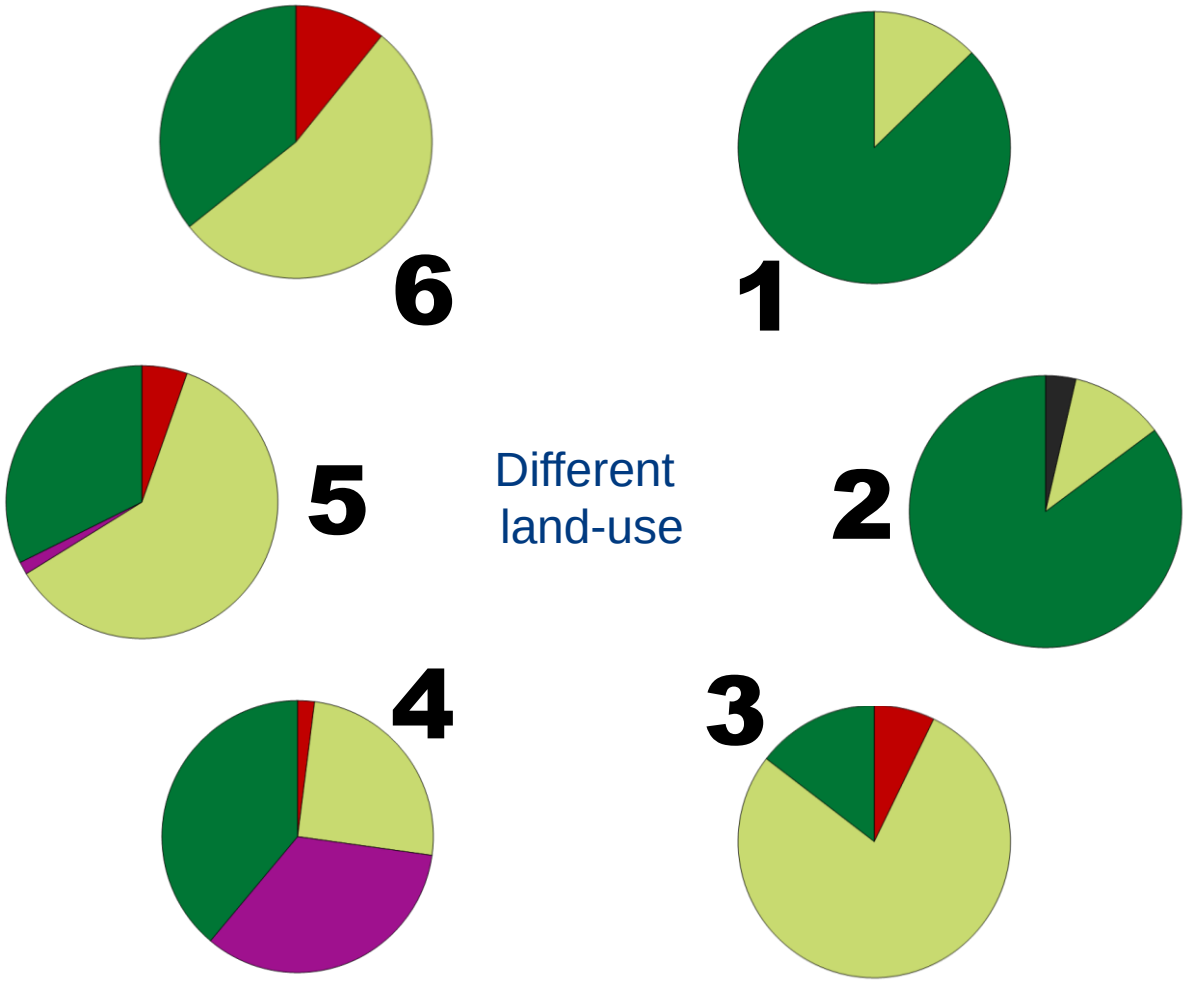


Selected watersheds: different land-use and human activities

GIS : CorineLandCover

Land-use

- Forest
- Mine
- Agriculture
- Vineyard
- Urbanized area



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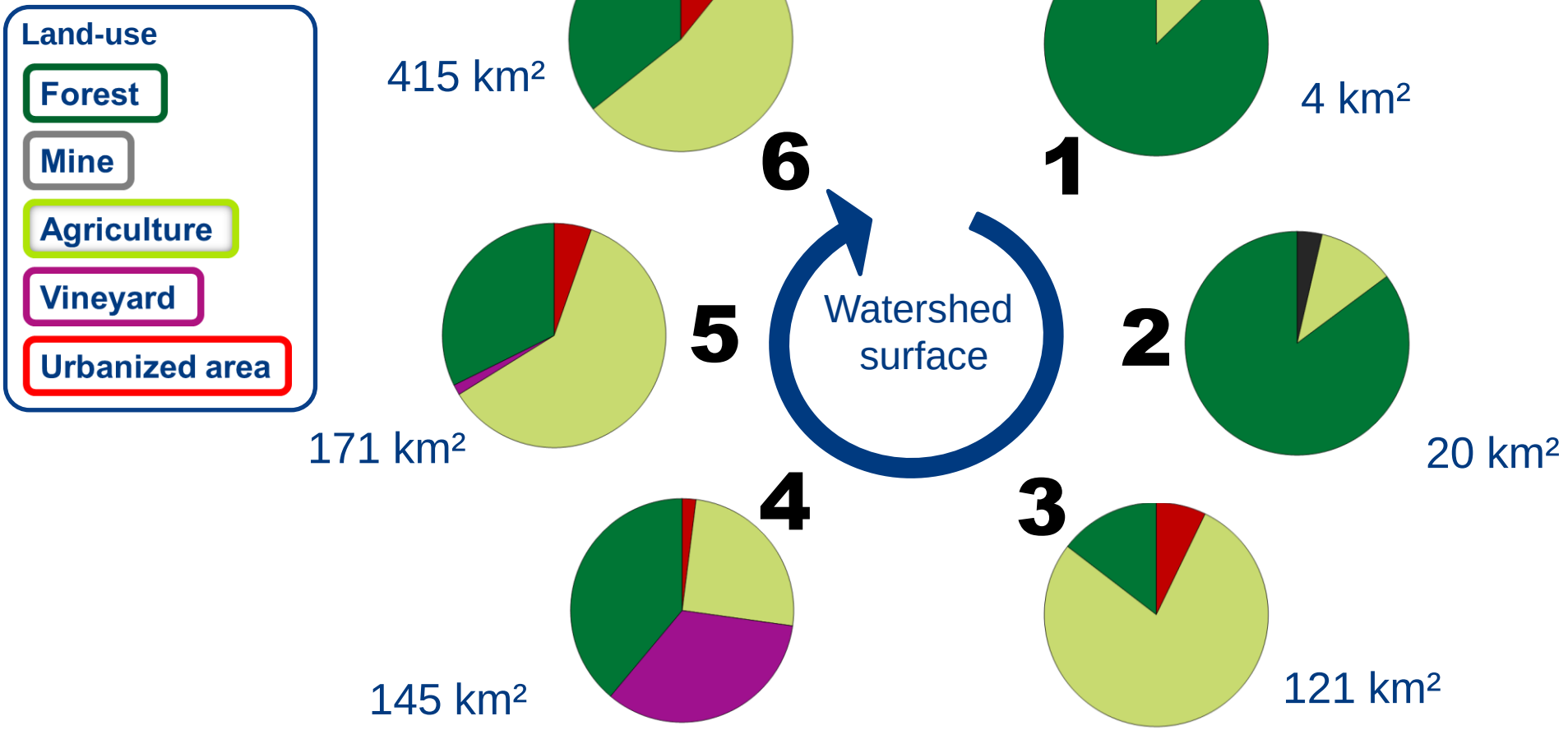
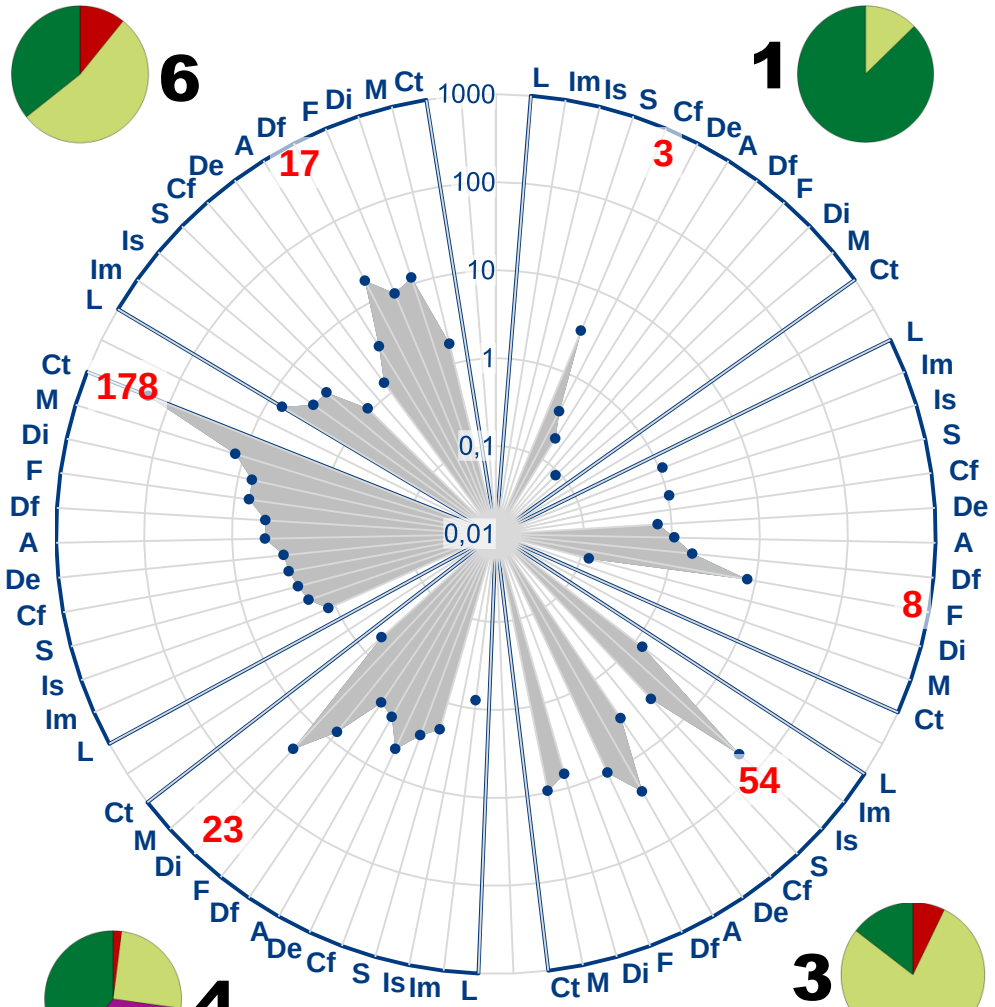


Contamination by compound – Pesticides

11 quantified pesticides (ng/L)

L	Linuron
Im	Imidacloprid
Is	Isoproturon
S	Simazine
Cf	Chlorfenvinphos
De	Deisopropylatrazine
A	Atrazine
Df	Diflufenican
F	Fenitrothion
Di	Diuron
M	Metolachlore
Ct	Chlortoluron



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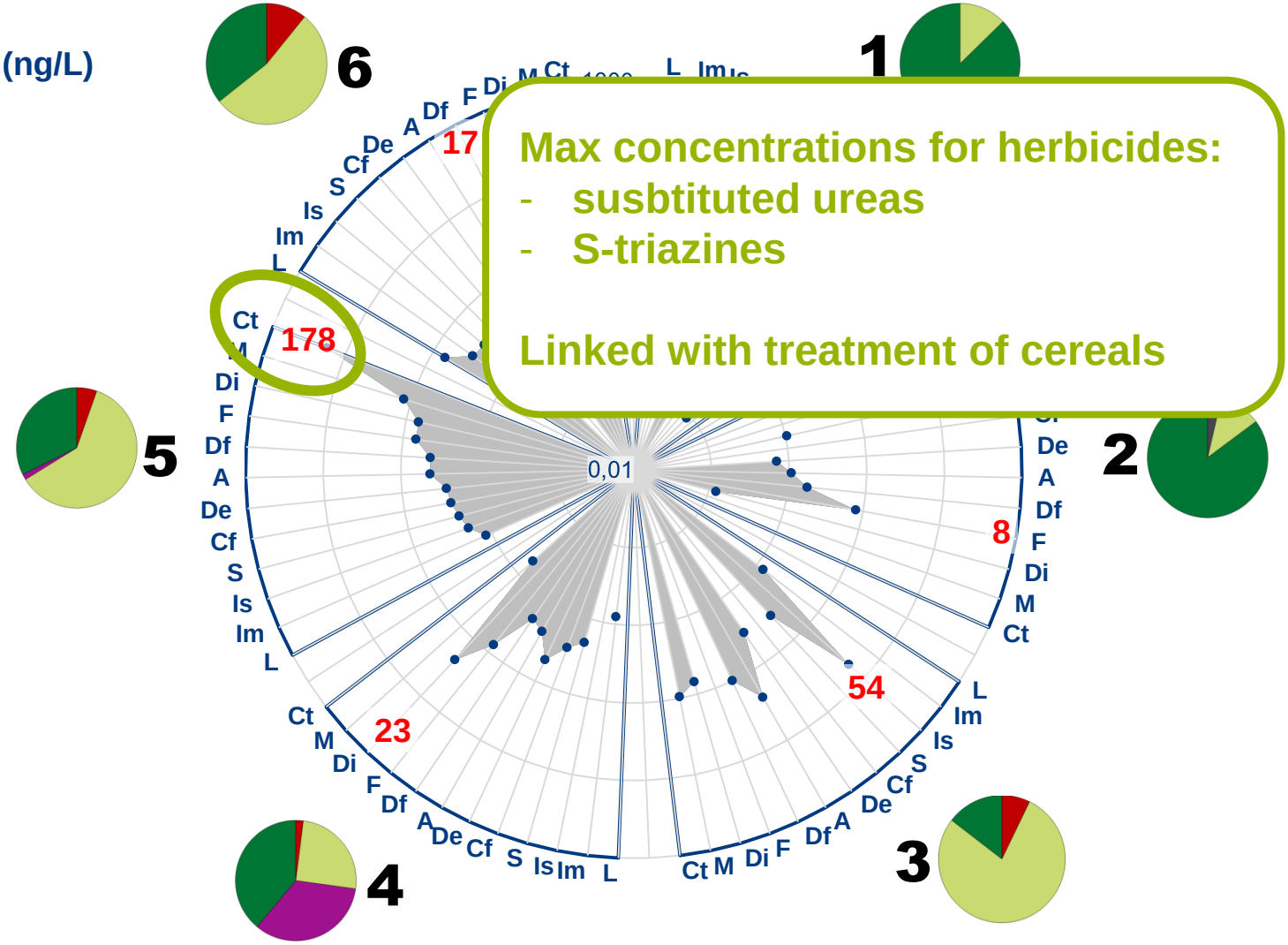
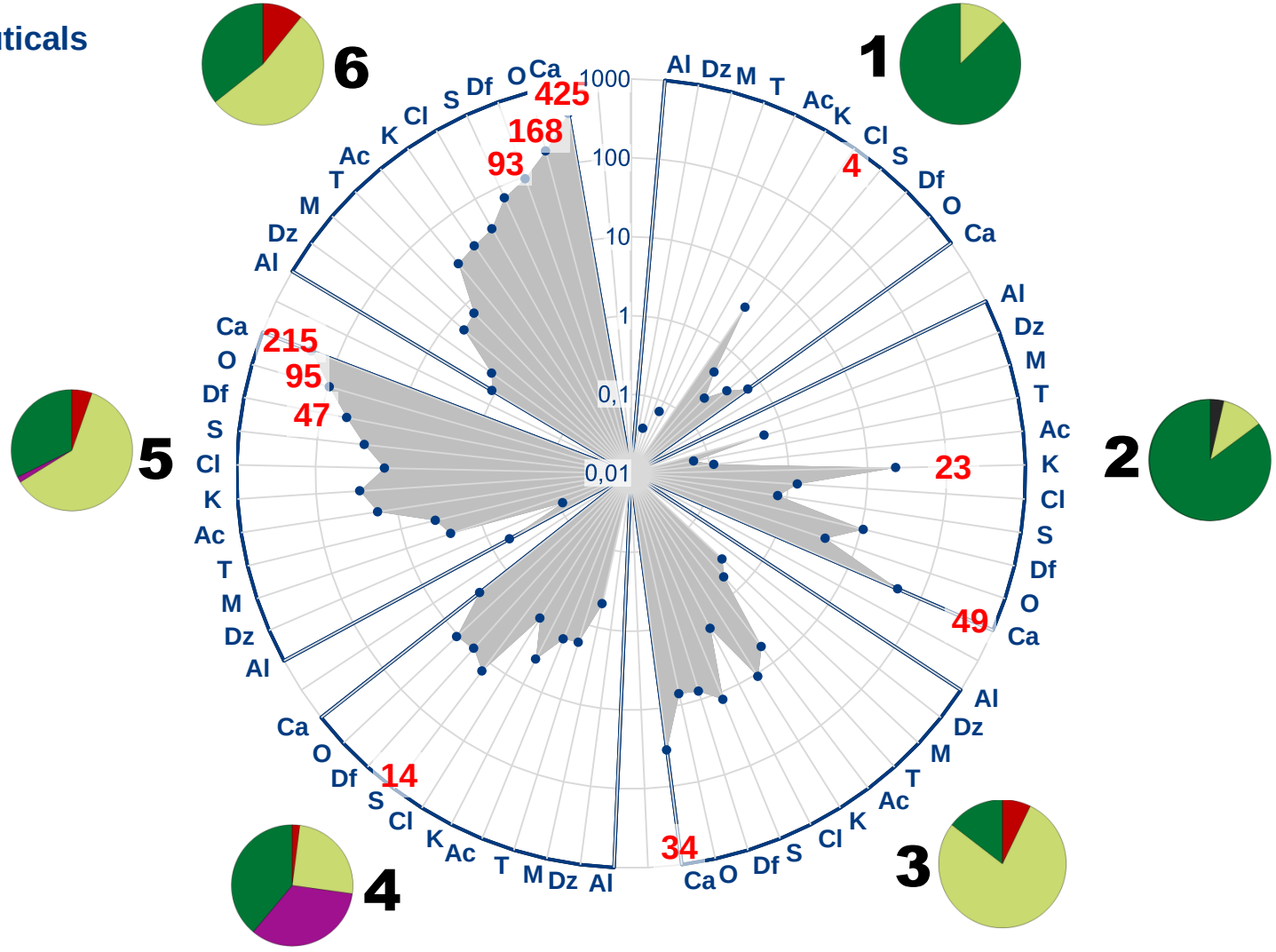


Contamination by compound – Pharmaceuticals

11 quantified pharmaceuticals (ng/L)

Al	Alprazolan
Dz	Diazepam
M	Metoprolol
T	Trimethoprim
Ac	Acebutolol
K	Ketoprofen
Cl	Claritromycin
S	Sulfamethoxazole
Df	Diclofenac
O	Oxazepam
Ca	Carbamazepine



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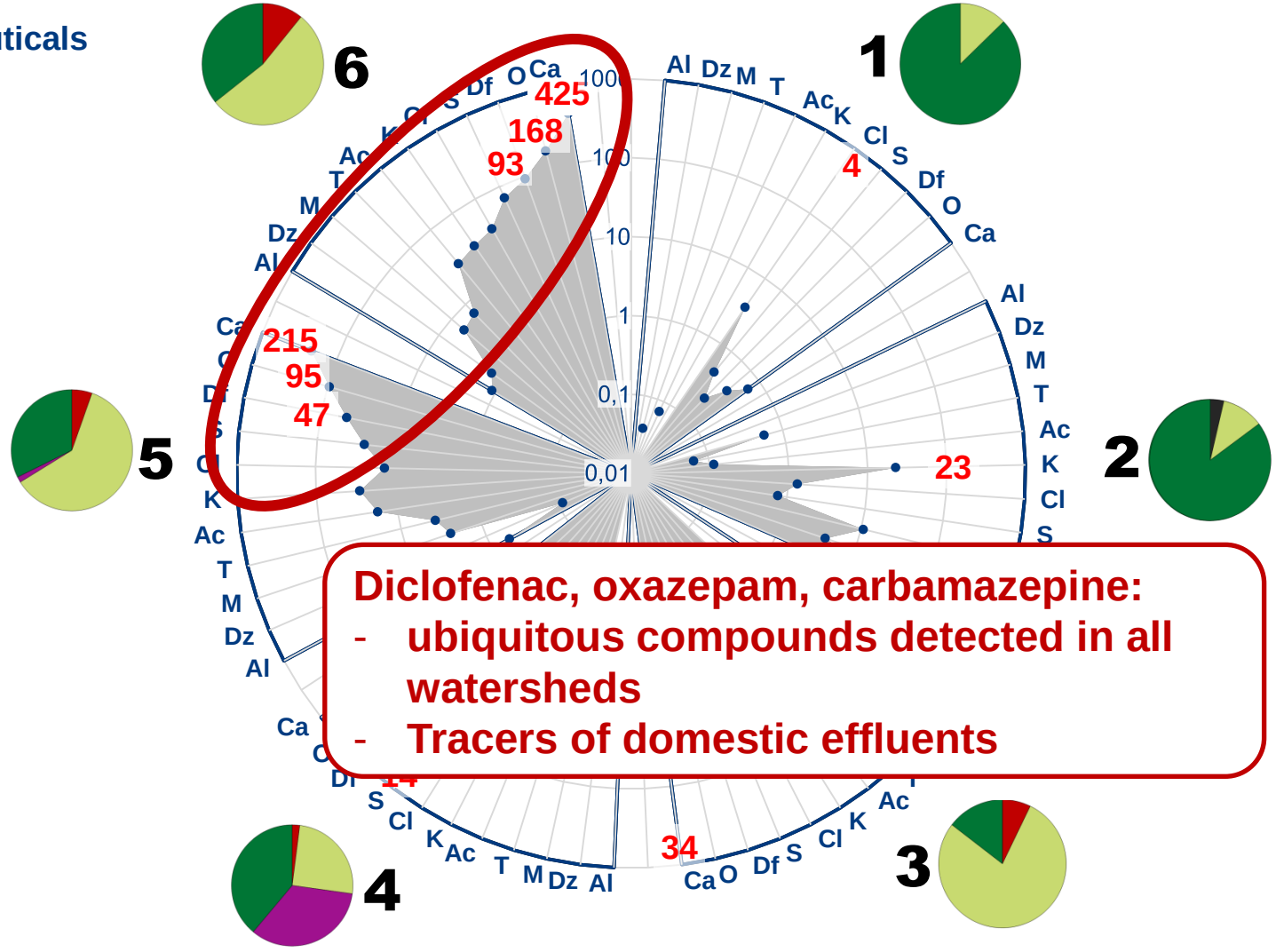


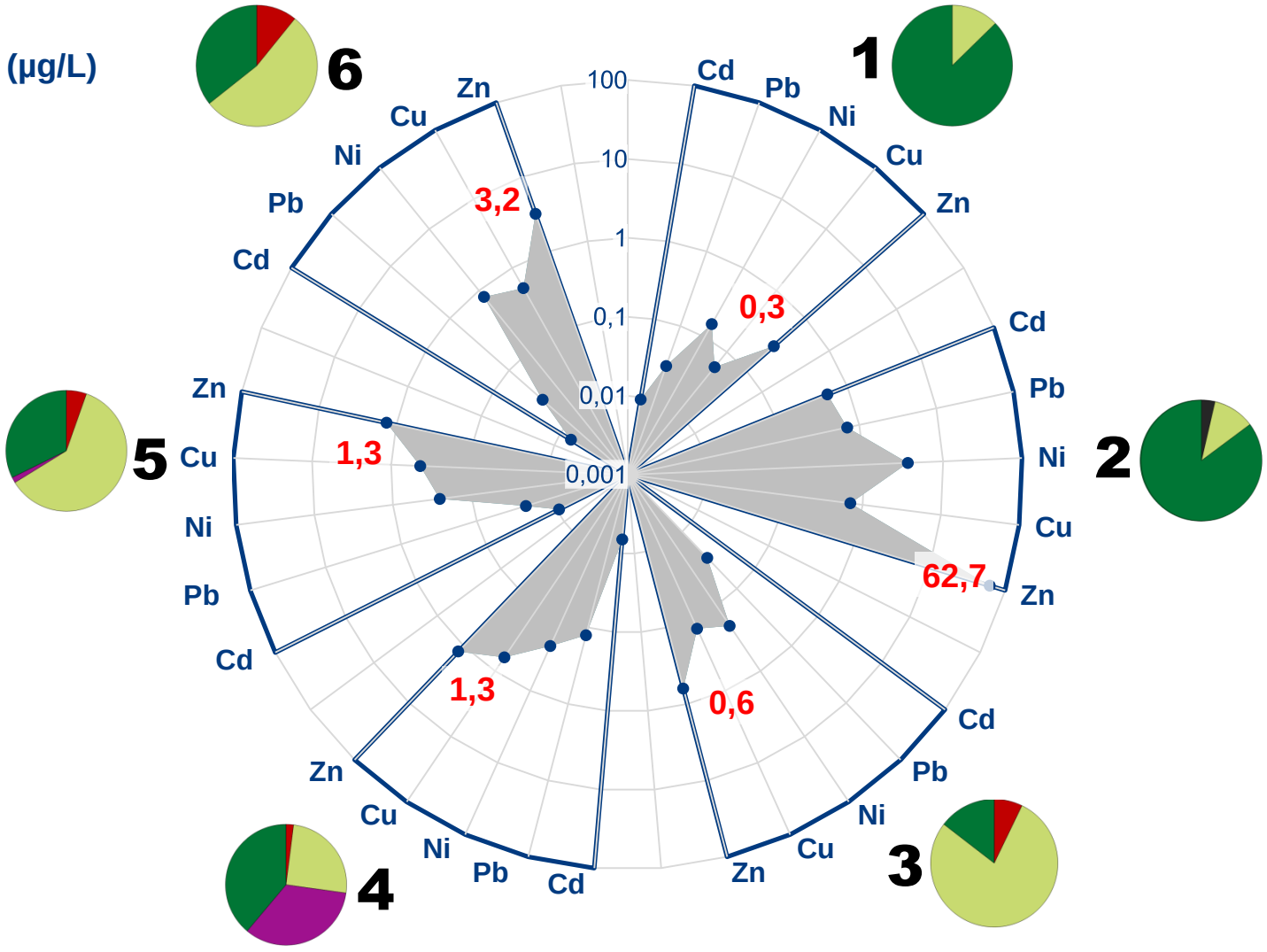
Diclofenac, oxazepam, carbamazepine:
- **ubiquitous compounds detected in all watersheds**
- **Tracers of domestic effluents**

Land-use
- Forest
- Mine
- Agriculture
- Vineyard
- Urbanized area

Contamination by compound – Trace metals

5 quantified trace metals (µg/L)

Cd	cadmium
Pb	lead
Ni	nickel
Cu	copper
Zn	zinc



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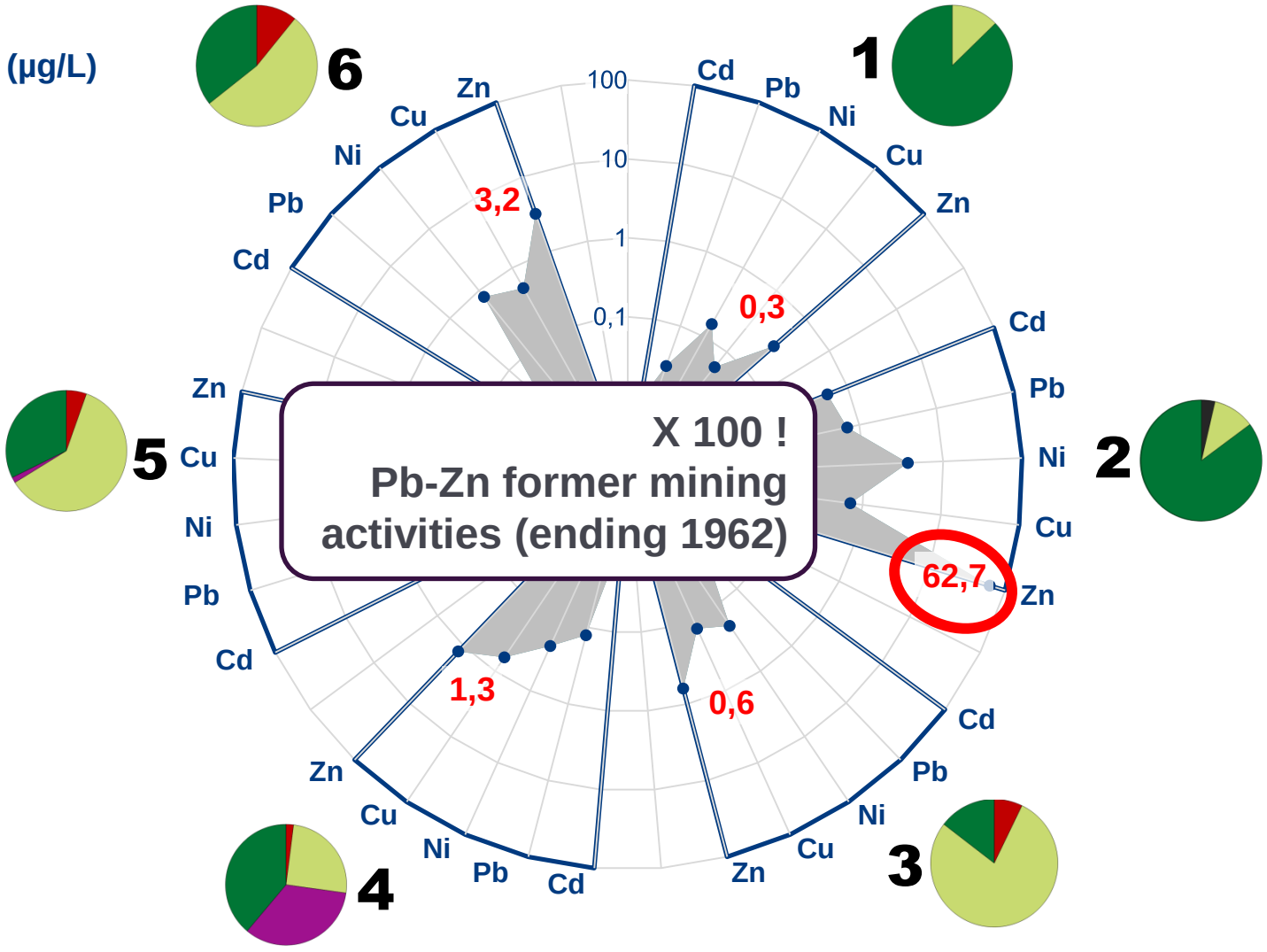

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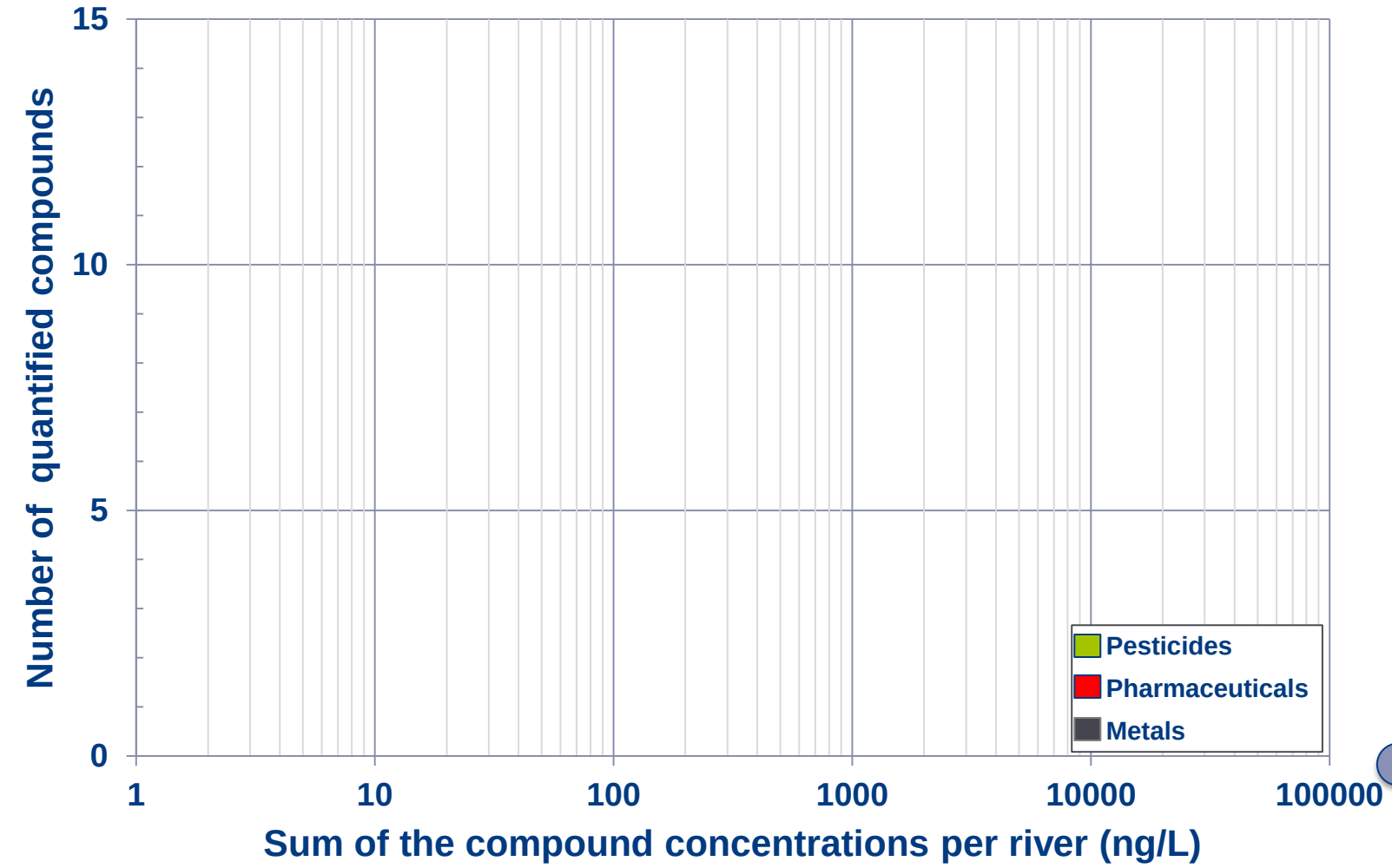
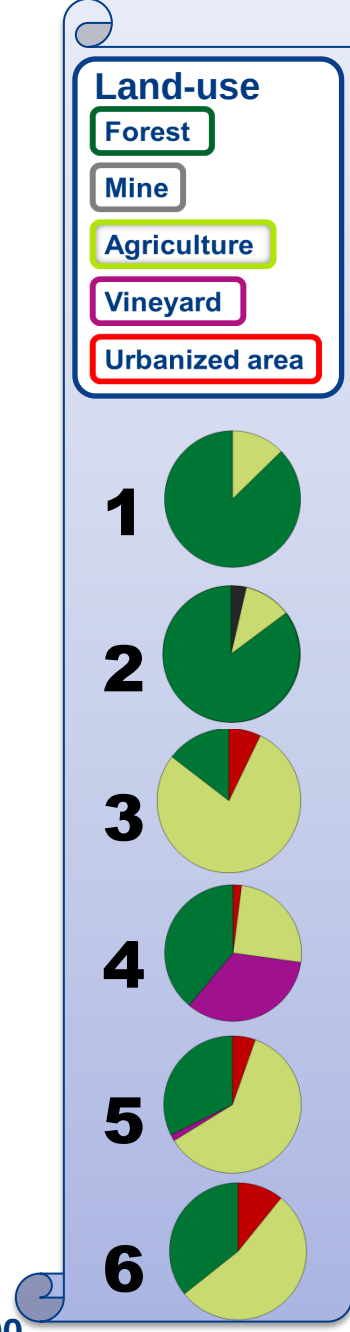
Pesticide pressures of contamination





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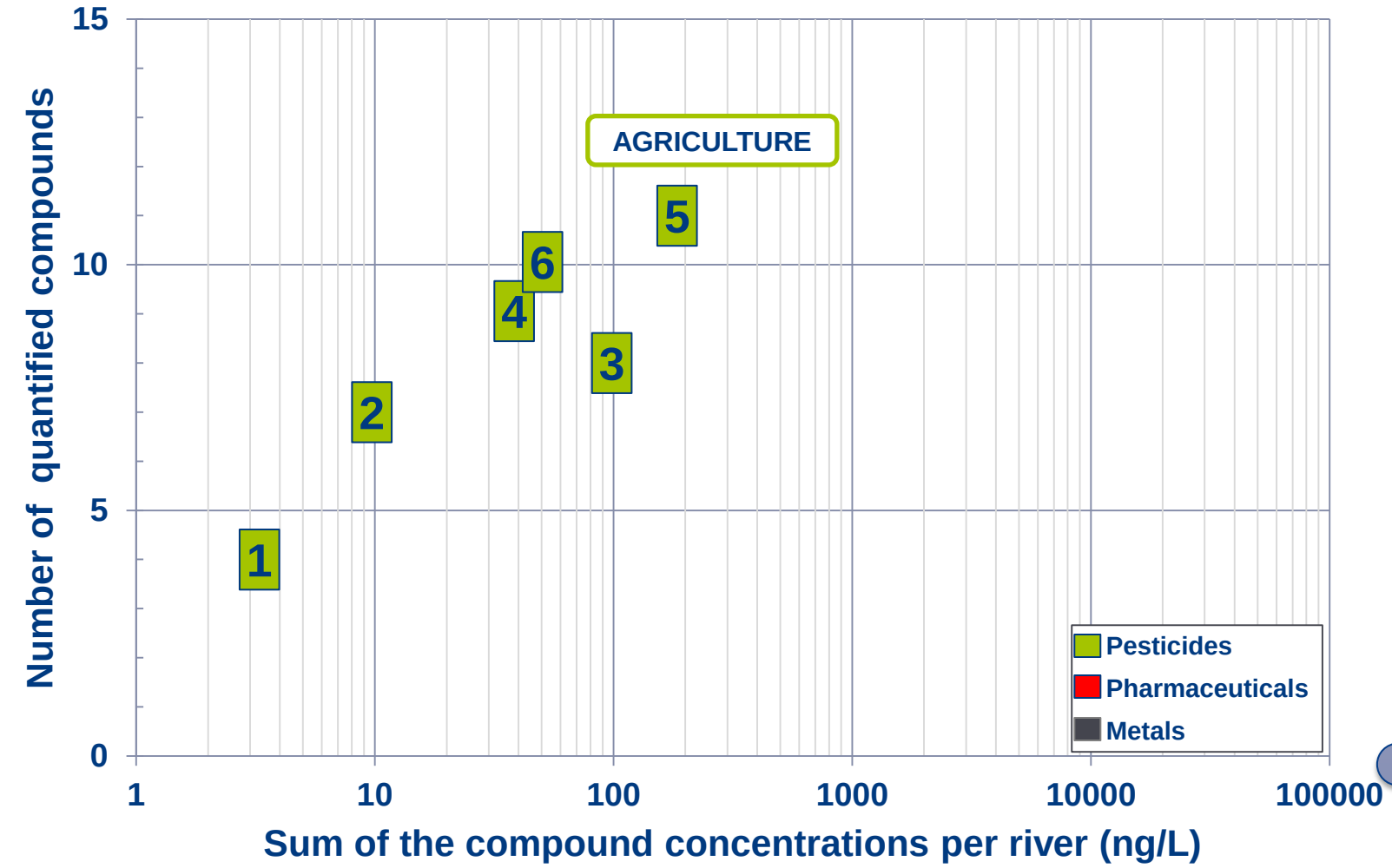

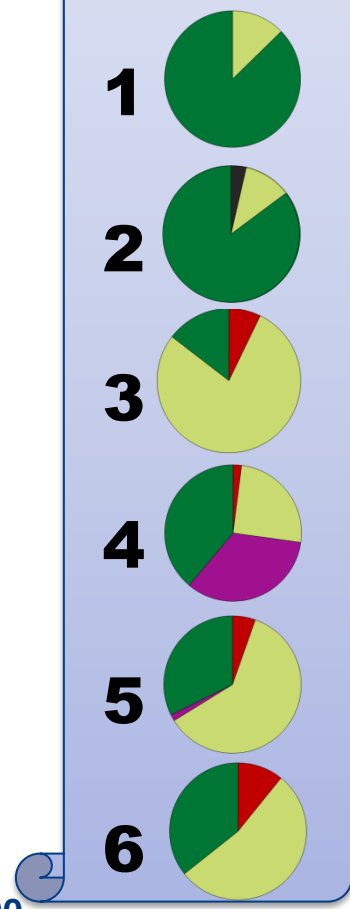

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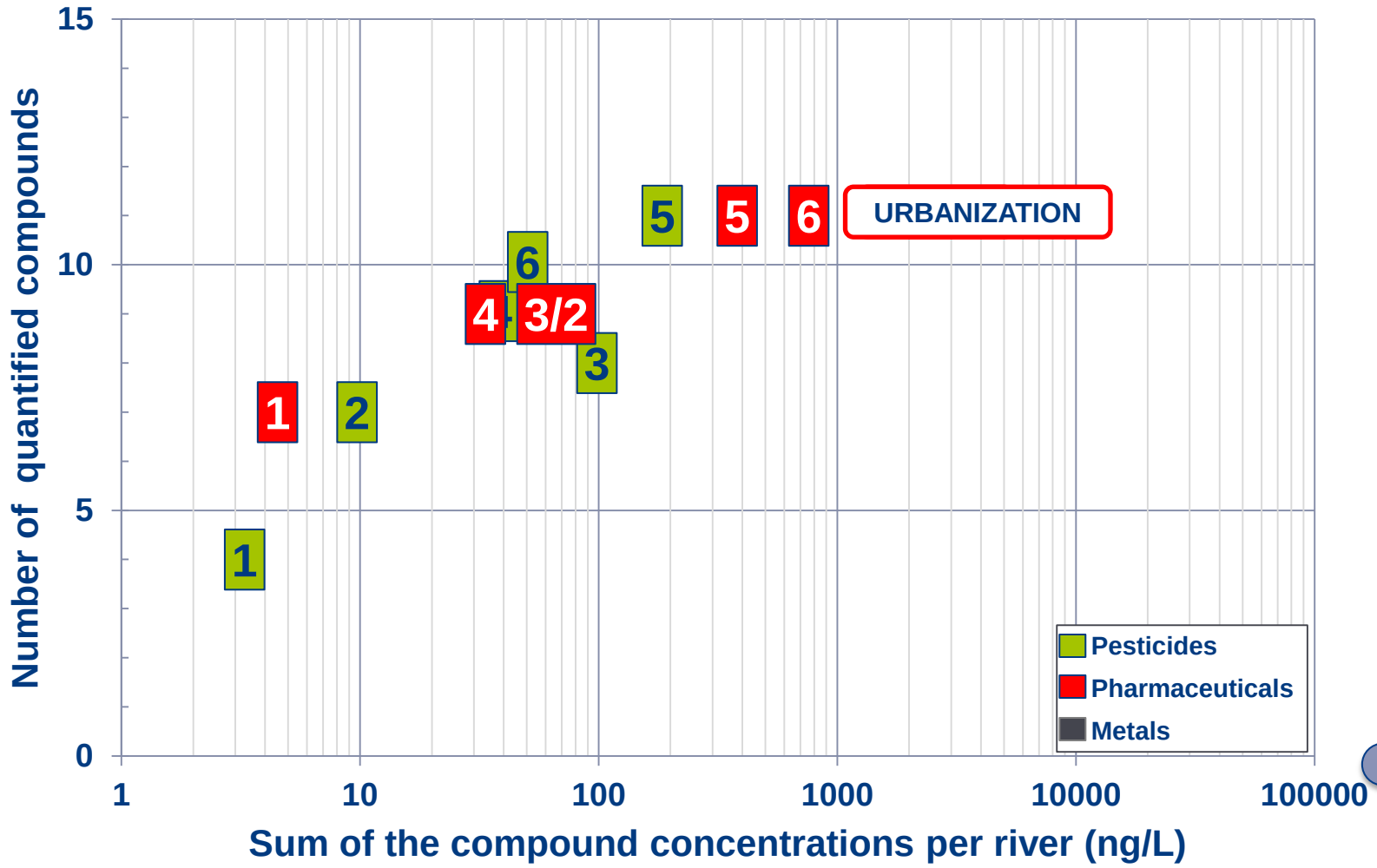
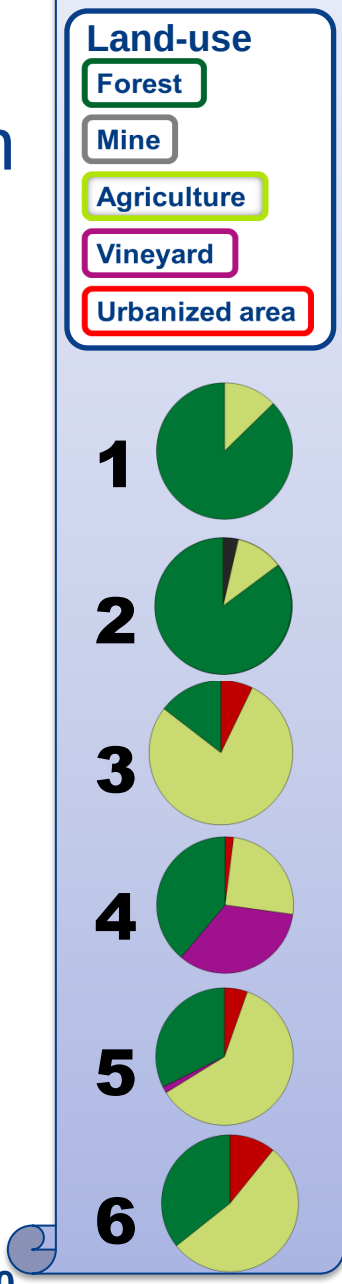
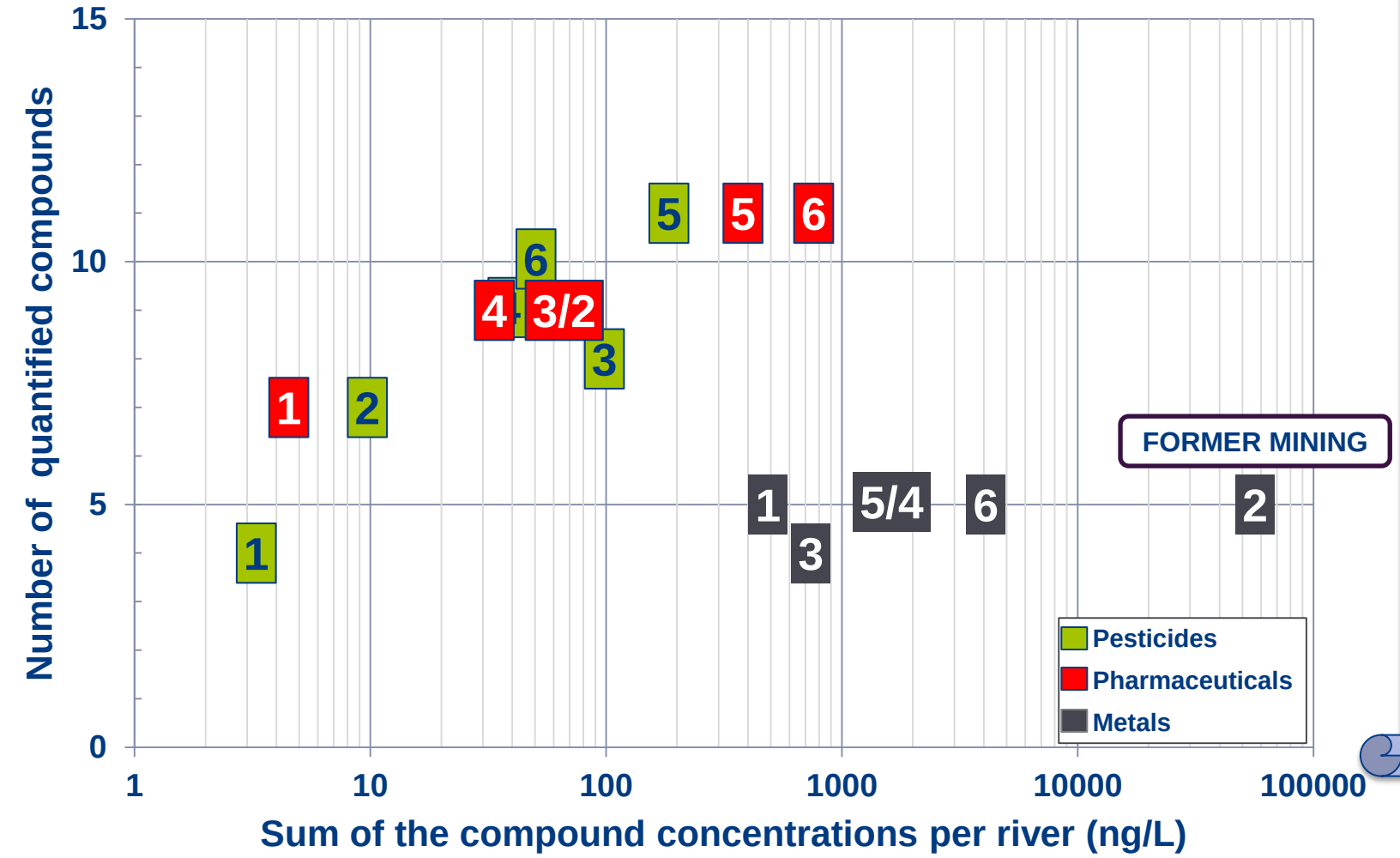
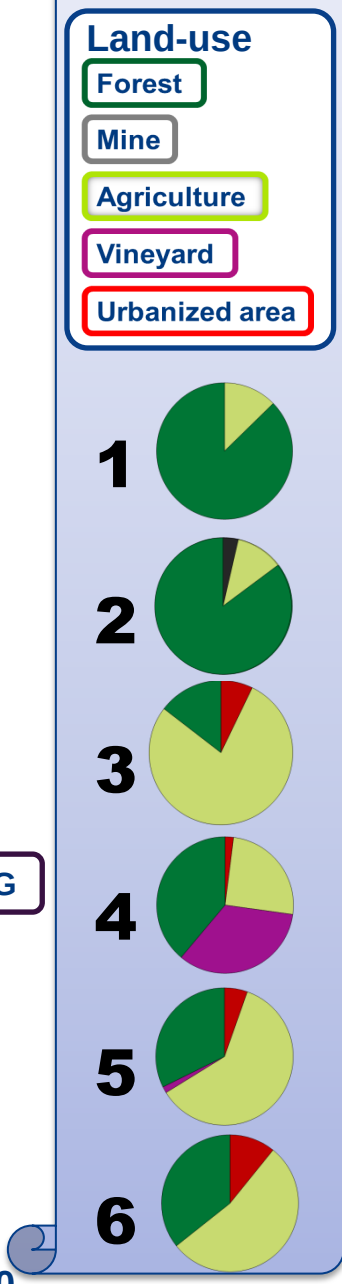




Trace metal pressures of contamination

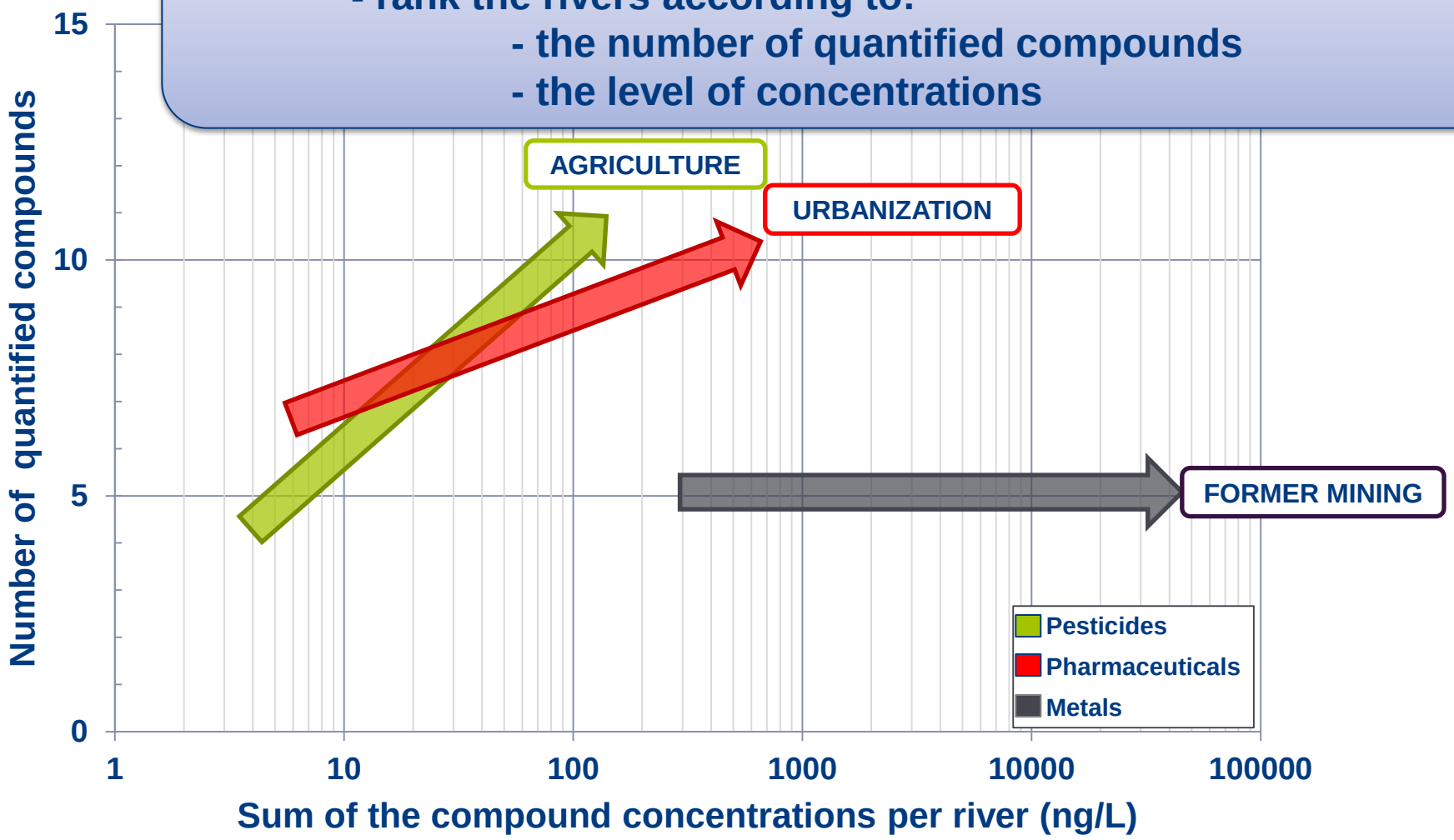




Conclusion

Combination of pSBSE, POCIS and DGT allowed to:

- **identify anthropogenic pressures**
- **rank the rivers according to:**
  - **the number of quantified compounds**
  - **the level of concentrations**



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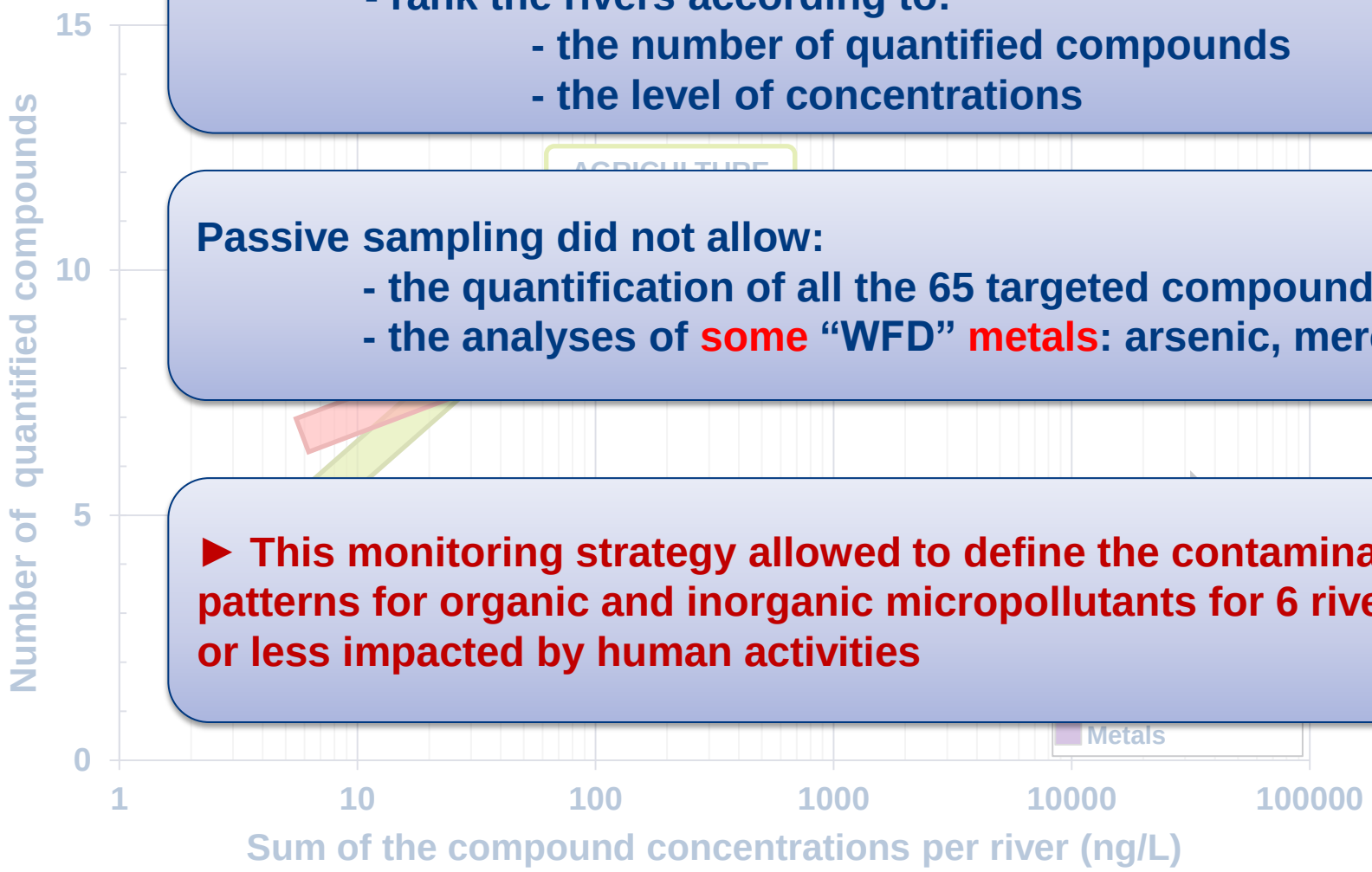
  - **the level of concentrations**

Passive sampling did not allow:

- **the quantification of all the 65 targeted compounds**
- **the analyses of some "WFD" metals: arsenic, mercury**

► This monitoring strategy allowed to define the contamination patterns for organic and inorganic micropollutants for 6 rivers more or less impacted by human activities



Thanks to the ANR GAMMA project (2012-2015)

Gammarus fossarum

- **Objective: Development of biological and chemical tools for water quality assessment**
- **Challenge: Improve reliability and ecotoxicological relevance of caged-organism biotests « Gammarus fossarum »**

- Interdisciplinary research group:

Ecotoxicology, biochemistry, molecular biology, ecophysiology, evolutionary biology, mathematical modelling, environmental chemistry

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UNIVERSITÉ MONTPELLIER 2 SCIENCES ET TECHNIQUES

Project supported by The French National Research Agency

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Thank you for your attention