





CEC-Partnership

PROJECTS

EMERCHE # 15760 I	RoutinEDA # 15747 I	CER-CEC # 15759 II	AdoX # 15756 II	SUSPECT # 15763 III
<p>Description Effect-directed Monitoring tools to assess Ecological and human health Risks of Chemicals of Emerging concern in the water cycle</p>	<p>Description Expanding the scope and downscaling the format of high throughput Effect-Directed Analysis for routine water cycle monitoring and effective control</p>	<p>Description Cost-Efficient Removal of Contaminants of Emerging Concern in Urban Waste Water Treatment Plants</p>	<p>Description A next generation adsorption-oxidation process for removal of CECs from municipal wastewater</p>	<p>Description Decision Support Tools for Risk-based Prioritization and Control of Contaminants of Emerging Concern</p>
<p>Participating Institutes Wageningen University & Research, Utrecht University</p>	<p>Participating Institute Vrije Universiteit Amsterdam</p>	<p>Participating Institute Radboud University Nijmegen</p>	<p>Participating Institute Technical University Delft</p>	<p>Participating Institutes Radboud University Nijmegen, Wageningen University & Research</p>
<p> </p>	<p></p>	<p></p>	<p></p>	<p> </p>
<p>Project Leader Prof. dr. ir. P.J. van den Brink, Wageningen University & Research, Aquatic Ecology and Water Quality Management (AEW)</p>	<p>Project Leader Dr. M.H. Lamoree, Vrije Universiteit Amsterdam, Department Environment and Health (E&H)</p>	<p>Project Leader Prof. dr. ir. A.J. Hendriks, Radboud University Nijmegen, Faculty of Science, Institute for Water & Wetland Research (IWWR)</p>	<p>Project Leader Prof. dr. ir. L.C. Rietveld, Technical University Delft, Faculty Civil Engineering and Geosciences, Watermanagement Department</p>	<p>Project Leader Prof. dr. A.M.J. Ragas, Radboud University Nijmegen, Faculty of Science, Institute for Water & Wetland Research (IWWR)</p>
<p>Project Members A B C</p>	<p>Project Members A B C</p>	<p>Project Members A B C</p>	<p>Project Members A B C</p>	<p>Project Members A B C</p>



Het SUSPECT-project

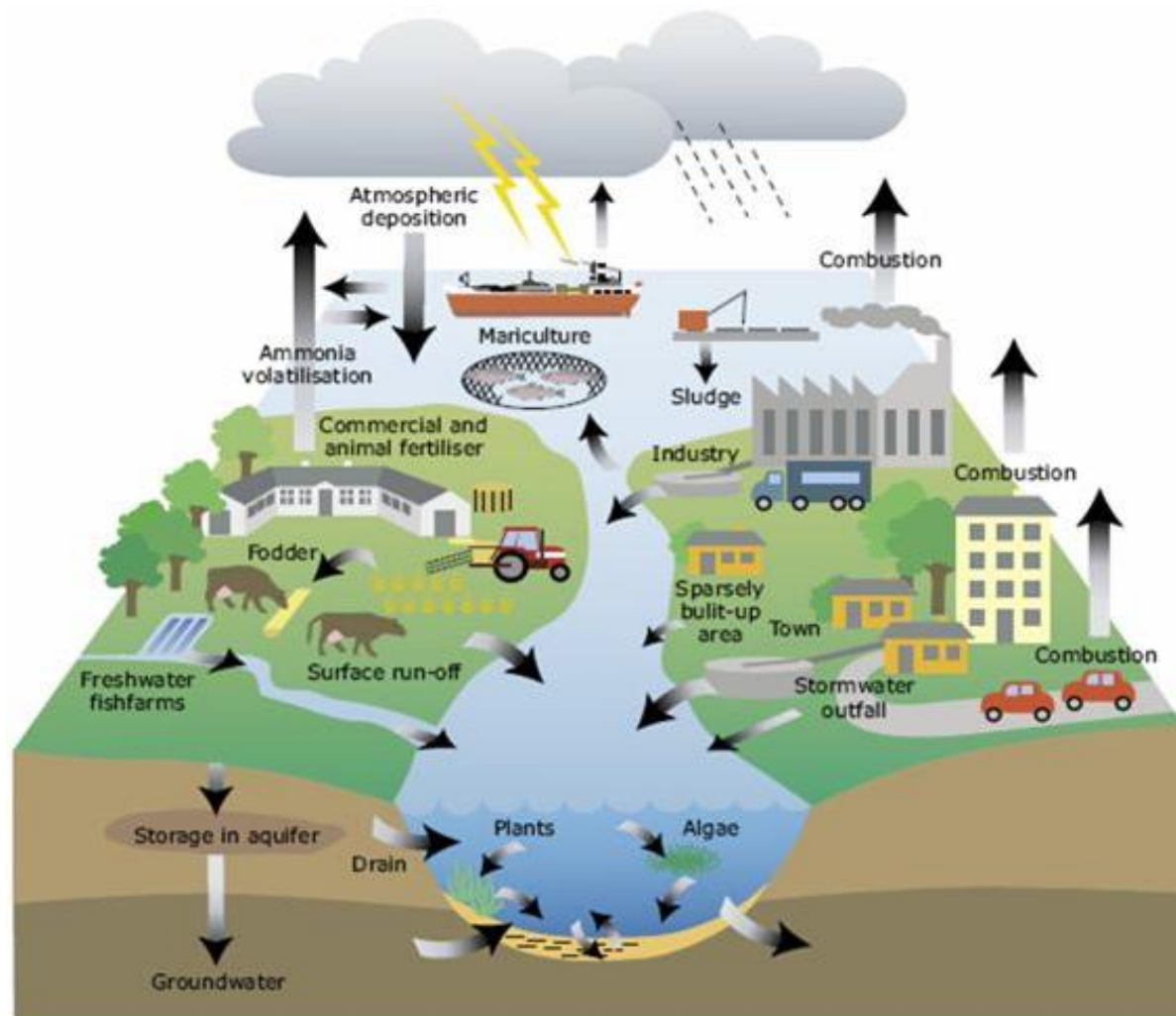
Decision Support Tools for Risk-based Prioritization and Control of Contaminants of Emerging Concern

Ad Ragas

Radboud Universiteit



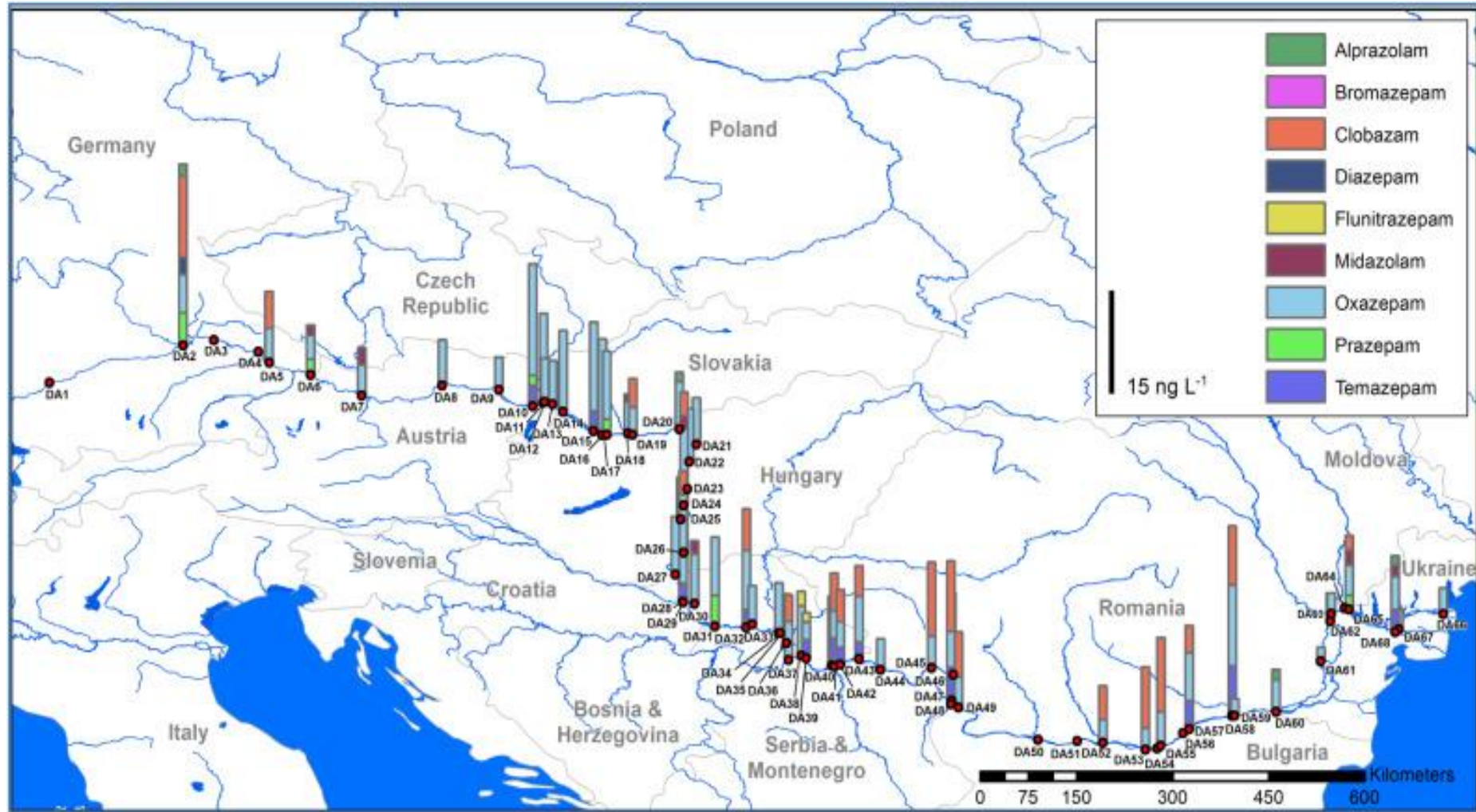
Effectief waterkwaliteitsbeheer?



- Reactief → Proactief
- 145 losse stoffen → Mengsels
- 145 stoffen → Nieuwe stoffen
- Meten → Meten + Modelleren



Meten = weten?



SUSPECT

Doelstelling SUSPECT

Ontwikkeling van ruimtelijk expliciet, beslissingsondersteunend instrumentarium voor vroege signalering, risico-gebaseerde prioritering en ketengericht management van opkomende stoffen (& *mengsels*)

- Urbane casus (humane medicijnen)
- Rurale casus (veterinaire medicijnen)
- Integratie casus



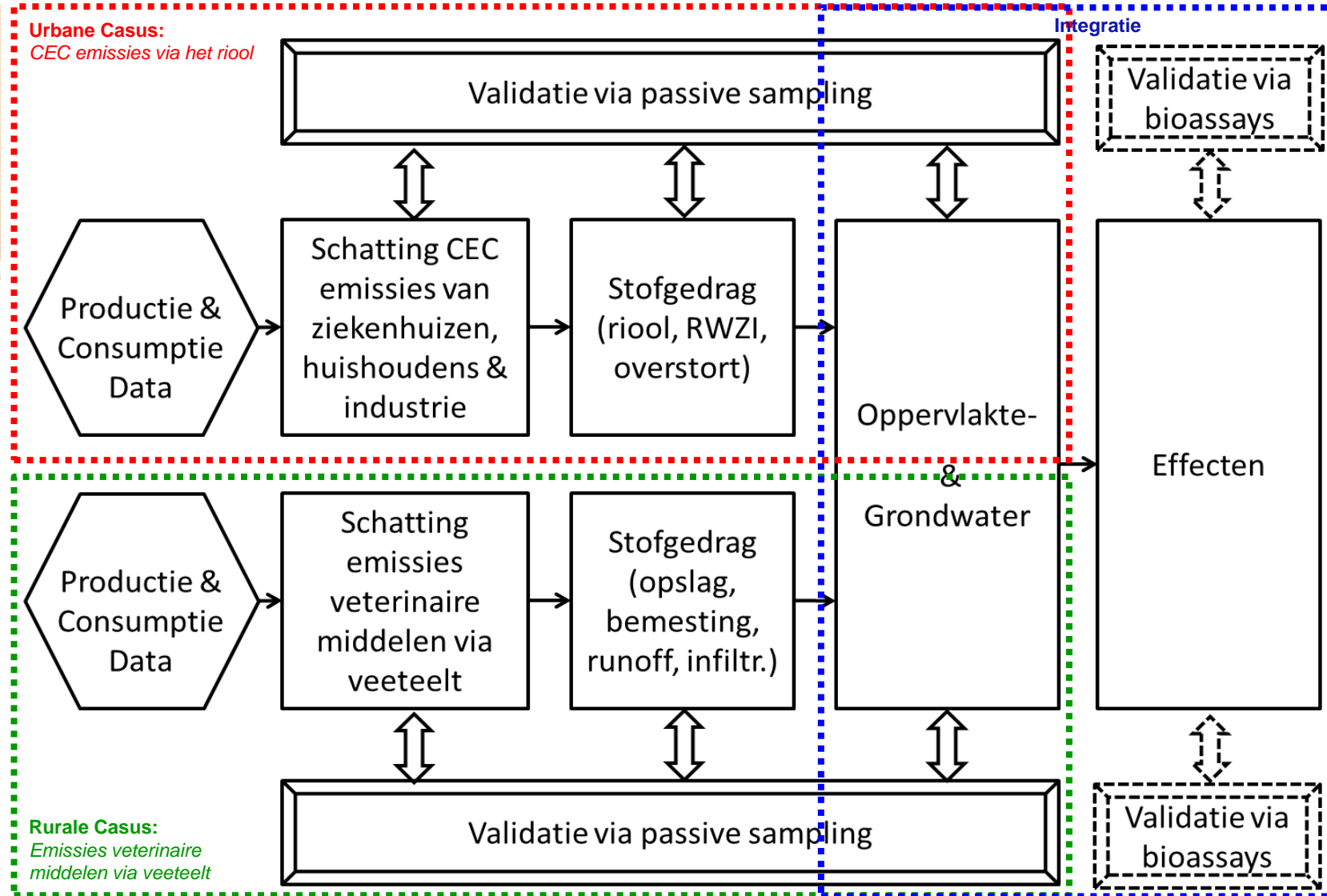
Structuur SUSPECT project



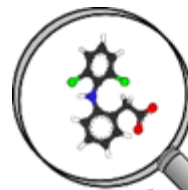
Caterina - Urbaan



Nikola - Ruraal



Francesco - Hydrologie



SUSPECT

The Usual SUSPECTs



Ad Ragas - RU



Leo Posthuma – RIVM/RU



Erwin Roex – Deltares/RIVM



Louise Wipfler – WUR



Doelen van de case studies

- Kunnen we obv gebruiksgegevens voorspellen wat er in stedelijke gebieden via RWZI's aan medicijnresten (en andere opkomende stoffen) in het oppervlaktewater terechtkomt?
- Kunnen we obv gebruiksgegevens voorspellen wat er in landelijke gebieden via afspoeling aan veterinaire medicijnresten in het oppervlaktewater terechtkomt?
- Kunnen we stedelijke en landelijke bronnen combineren om tot een voorspelling van de regionale oppervlaktewaterkwaliteit te komen?

=> Is dit nuttig?



Eindgebruikers



Rijksinstituut voor Volksgezondheid
en Milieu
Ministerie van Volksgezondheid,



WAGENINGEN
UNIVERSITY & RESEARCH

Deltares
Enabling Delta Life



Waterschap
De Dommel



Waterschap
Rivierenland



Waterschap
Aa en Maas



RIWA



brabant Water



GEMEENTE



Nijmegen

Radboudumc



Provincie Noord-Brabant



Rijkswaterstaat

provincie
Gelderland



KNMVD

Fidin

ZLTO



gnmf

gelderse
natuur en milieu
federatie



SUSPECT

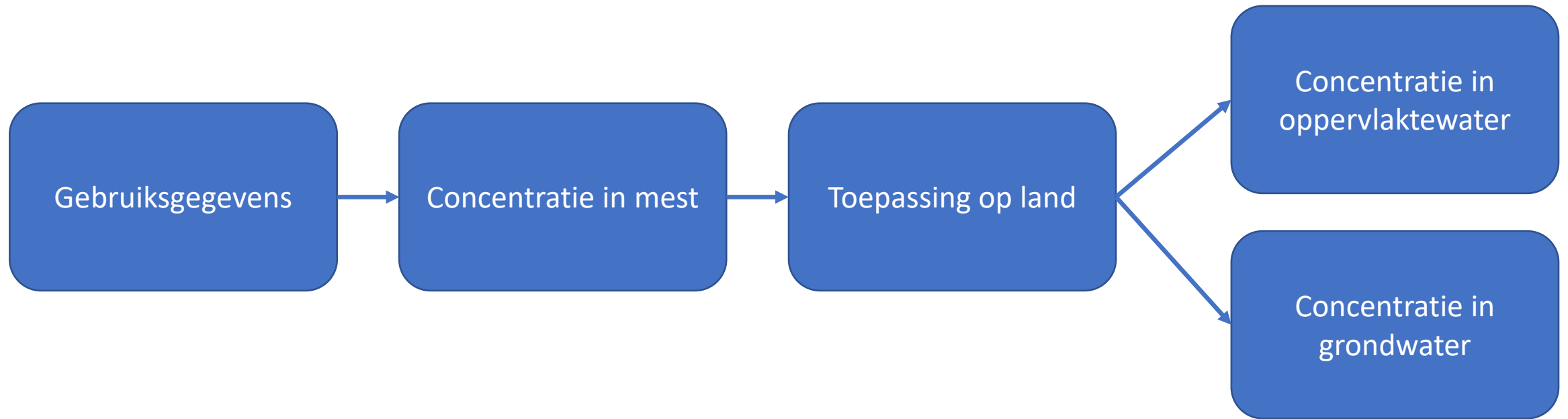
Rurale Casus

Veterinaire medicijnen in oppervlaktewater

Nikola Rakonjac

Wageningen University





Gebruiksgegevens

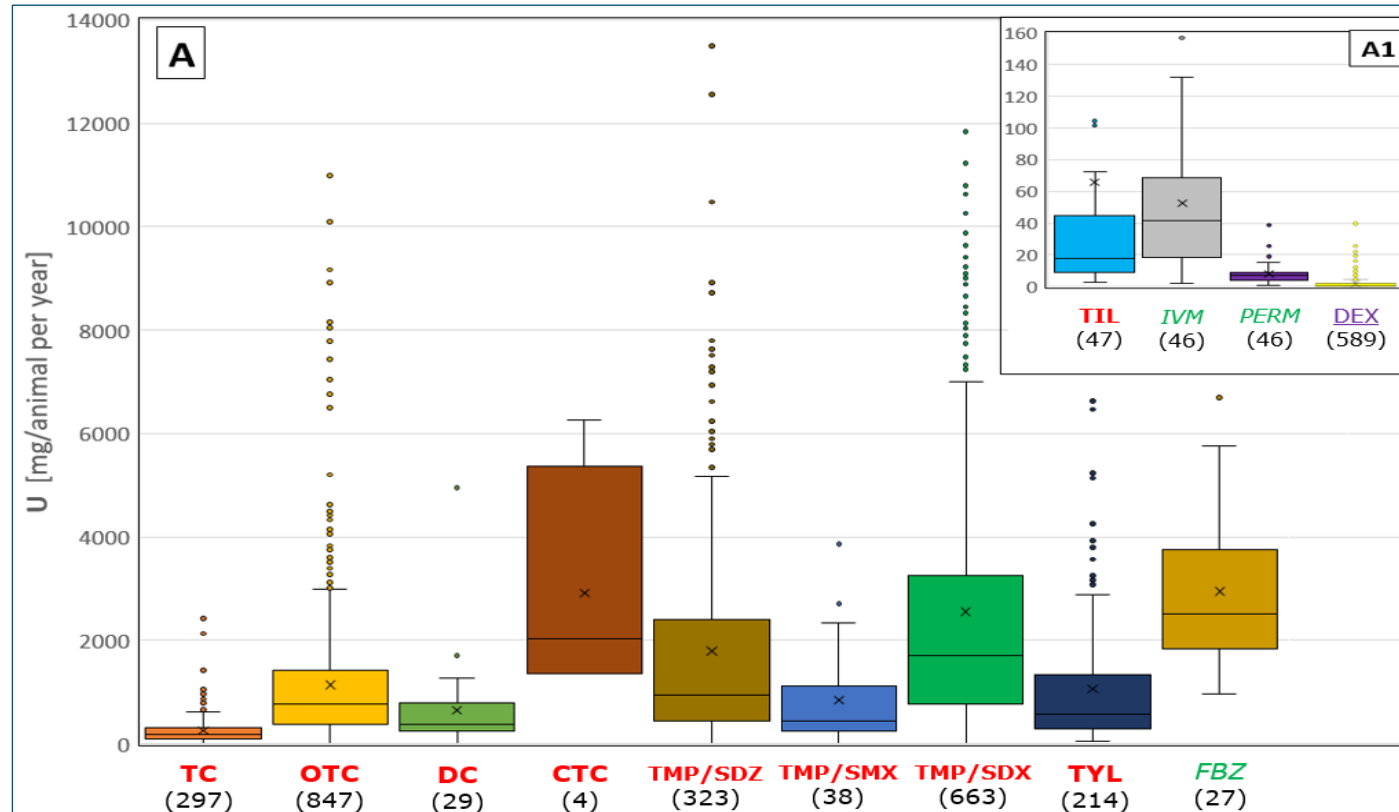
Usage of VPs for the period 2015-2018

Based on the yearly data coming from:

- 250 dairy cow farms, 60 sow farms, and 70 fattening pig farms (2-5% of the farms in the NL).



MASS USED



red – antibiotics; green – antiparasitics; purple - hormone

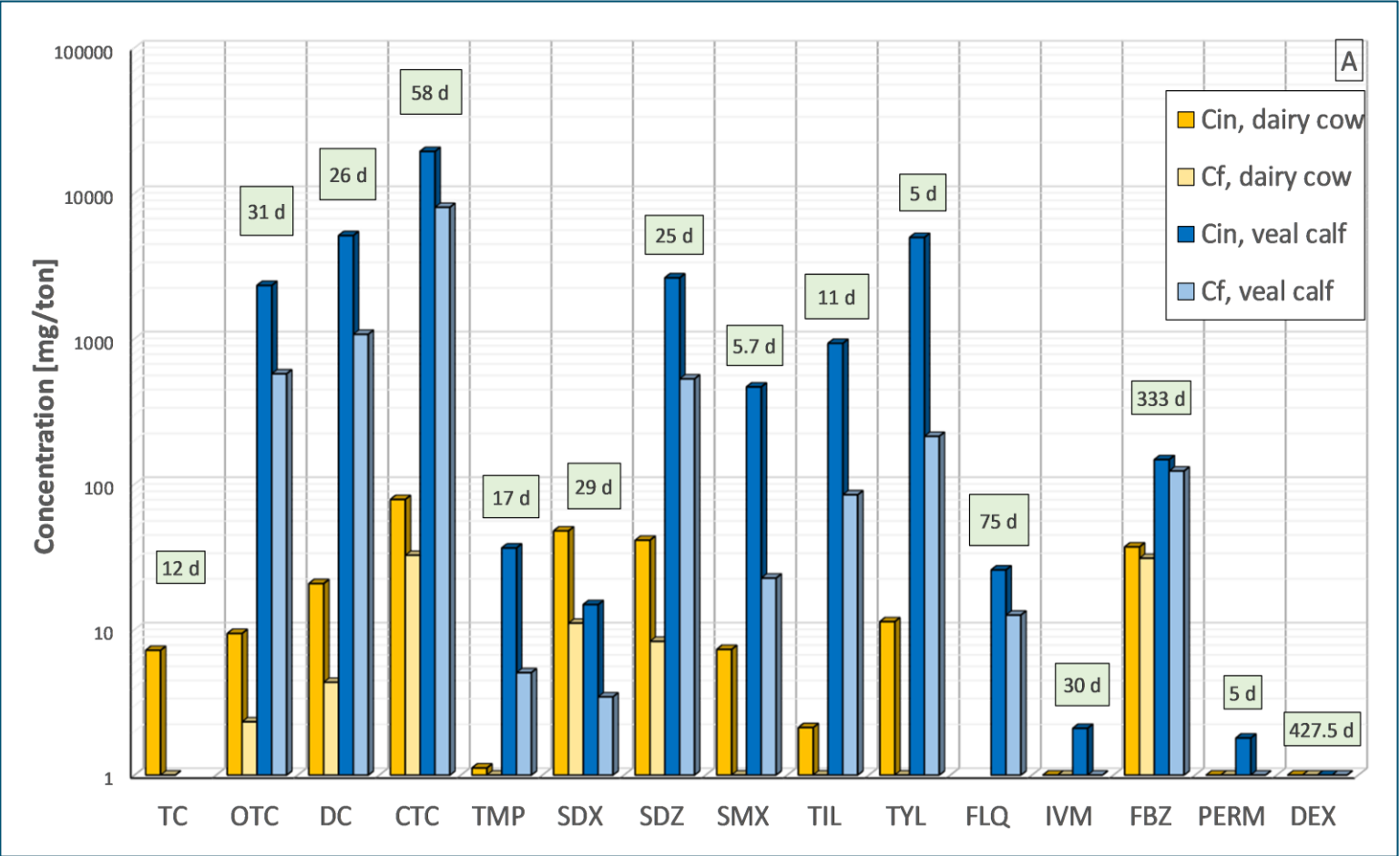
Distribution of use data in the dairy cow sector; Numbers in the legend indicate on how many farms the distribution is based on.



Concentrations in mest

VPs concentrations in soil-applied manure

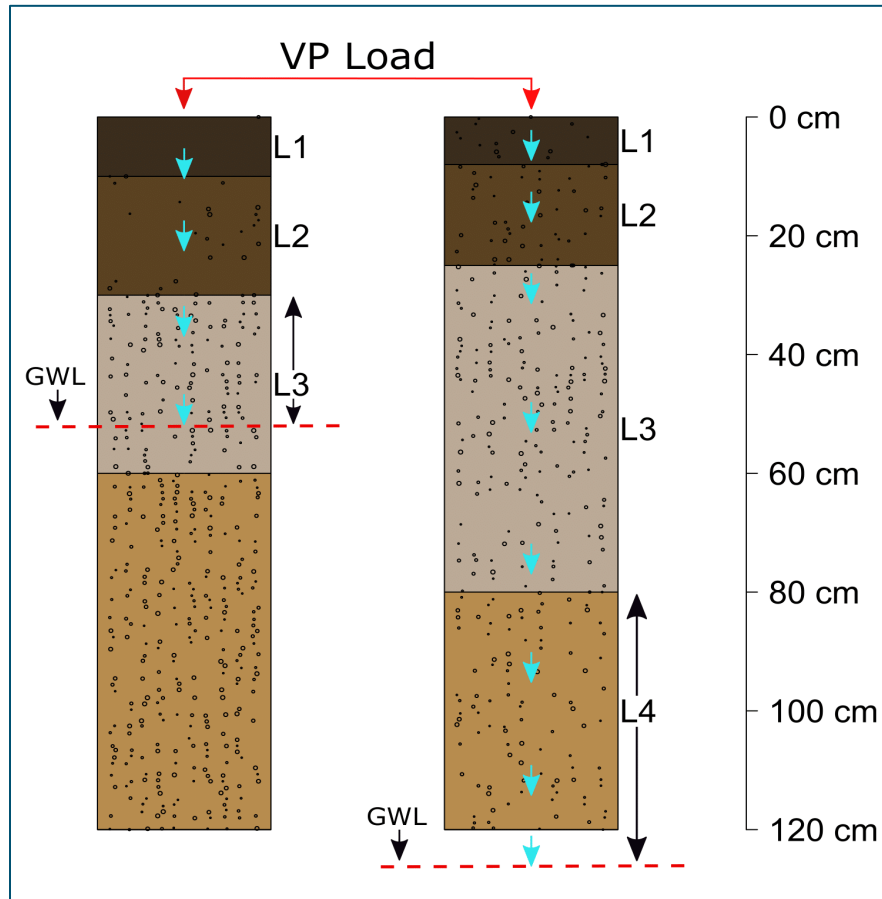
(based on used quantities, excretion rates, and modeled dissipation in storage)



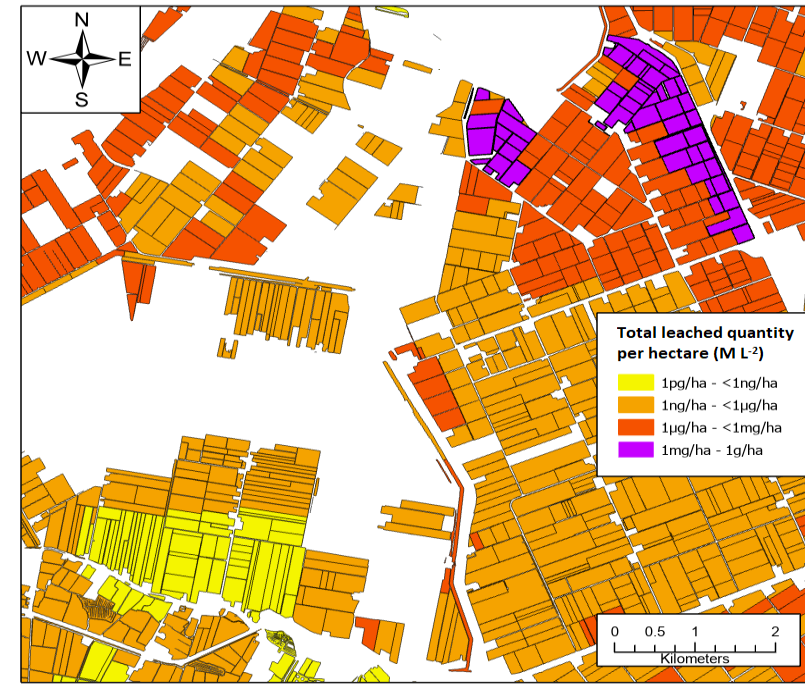
Concentrations of VPs in manure prior to storage (Cin) and after 6 months of storage (Cf). On the x axis are compound names.



Uitspoeling naar grondwater



Conceptual model

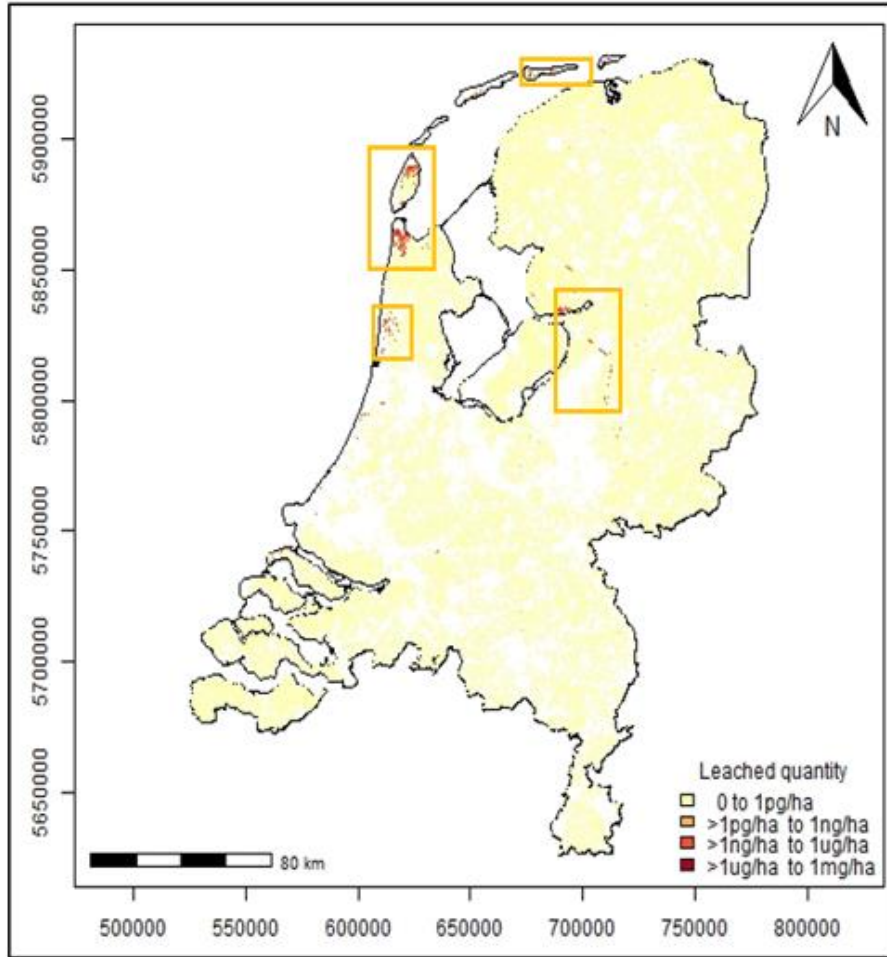


- Spatially distributed. Variability in use, manure types, soil/crop types, and groundwater level.
- Model applied at national scale;
- 1.1 million fields simulated;
- Relevant VPs are selected based on prioritization done in the Chapter 1.

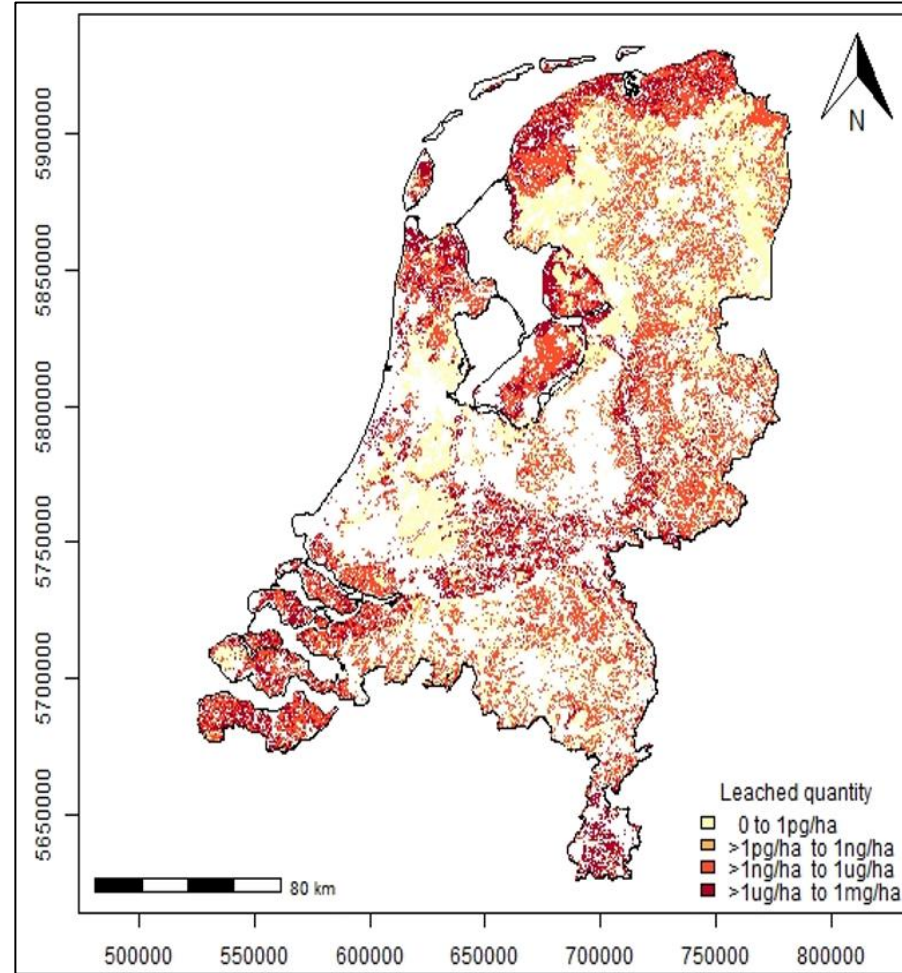


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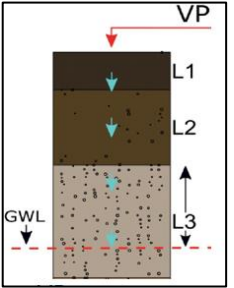
Twée voorbeelden



Sulfadiazine – national leaching map



Dexamethasone - national leaching map

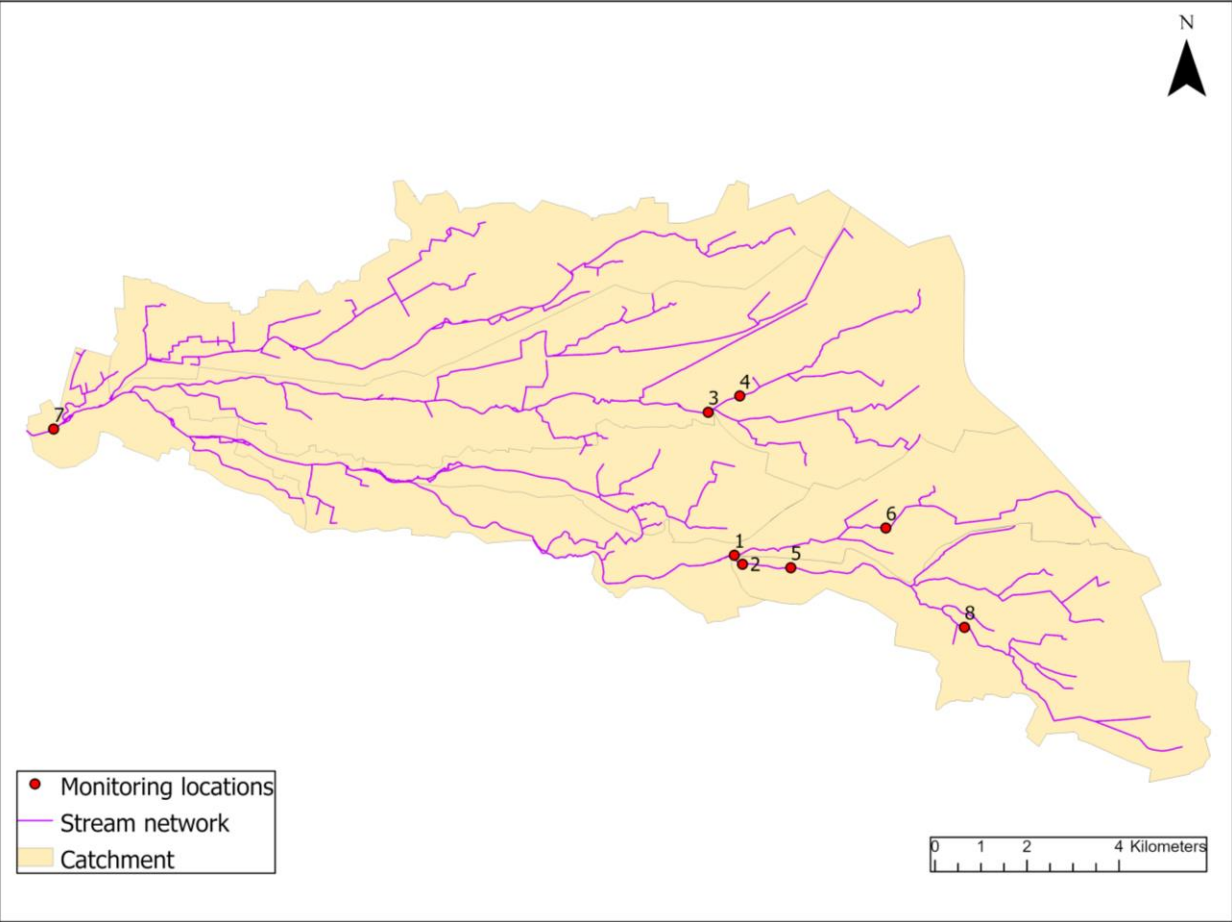


SOIL/GROUNDWATER
TRANSFER



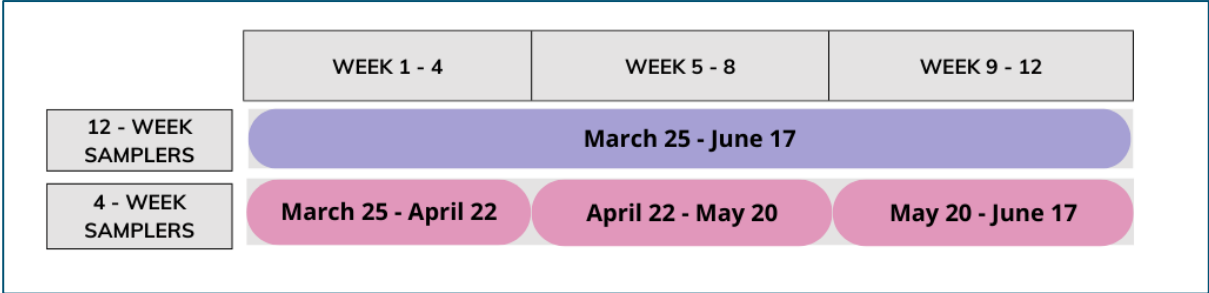
SUSPECT

Afspoeling naar oppervlaktewater



Selected agricultural catchment

- Passive sampling with Speedisk® ;
- Barneveld region, mid March to mid June 2020;
- 8 locations, 46 targeted compounds;

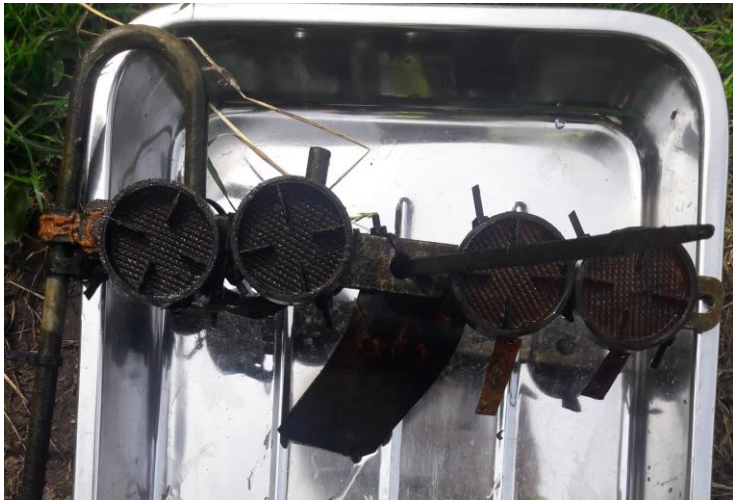


Sampling scheme





Passive sampler

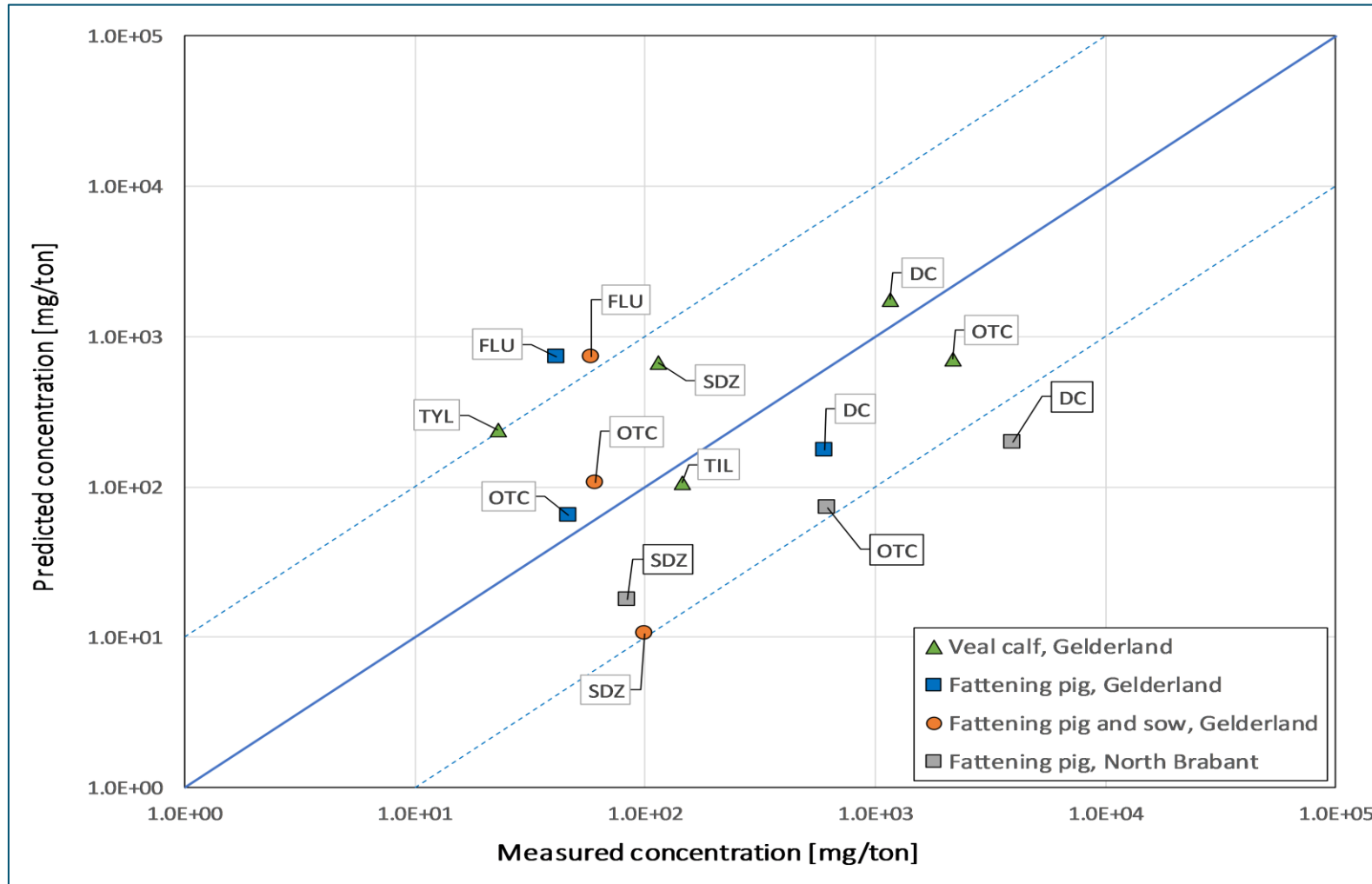


Aangetroffen stoffen

Compound	Type	Cas no.	No. of detected locations
Flumequine	Antibiotic	42835-25-6	8/8
Sulfadiazine	Antibiotic	68-35-9	8/8
Sulfamethoxazole	Antibiotic	723-46-6	8/8
Tilmicosine	Antibiotic	108050-54-0	8/8
Trimethoprim	Antibiotic	738-70-5	7/8
Flubendazole	Antiparasitic	31430-15-6	8/8
Fipronil sulfone	Metabolite	120068-36-2	7/8
Estrone	Hormone	53-16-7	8/8
Benzyl dimethyl - dodecyl ammonium chloride (BAC-C12)	Biocide	139-07-1	8/8
Benzyl dimethyl - tetradecyl ammonium chloride (BAC-C14)	Biocide	139-08-2	8/8
Benzyl dimethyl - hexadecyl ammonium chloride (BAC-C16)	Biocide	122-18-9	8/8
Didecyl dimethyl - ammonium chloride (DDAC-C10)	Biocide	7173-51-5	8/8



Validatie



The solid line marks the ratio of 1:1, dotted lines differ a factor 10 from 1:1.



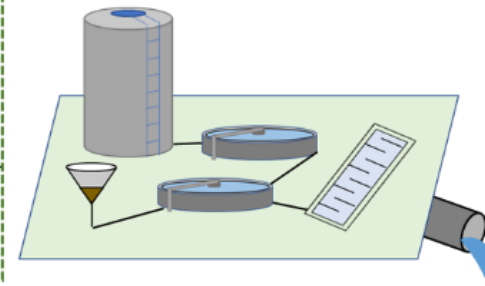
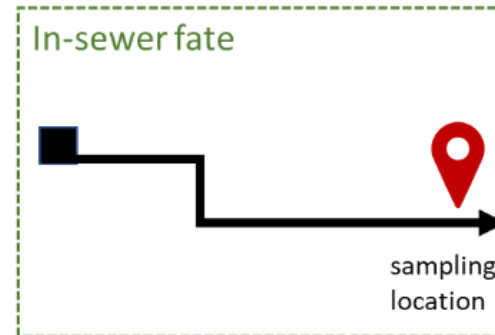
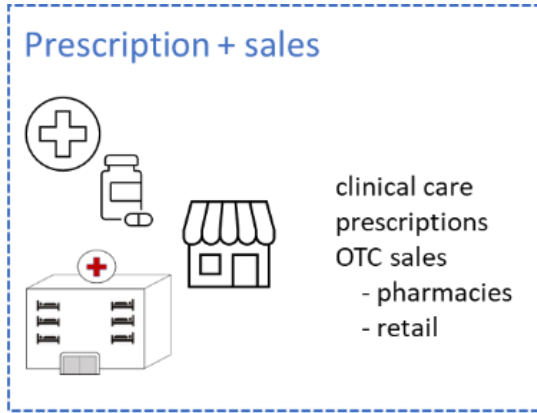
Opkomende stoffen in het stedelijk gebied

Caterina Zillien

Radboud Universiteit



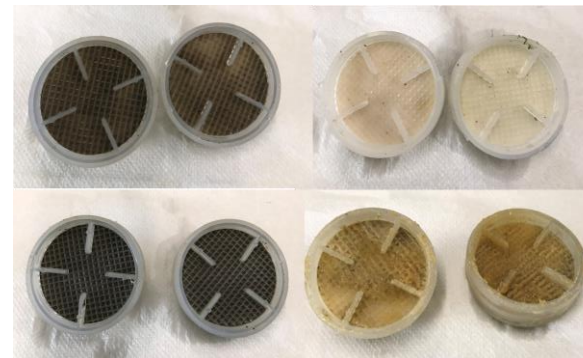
Emissieschatting



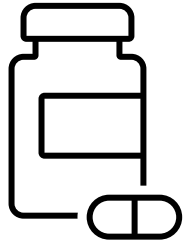
Case study: Nijmegen



- Nationale voorschrijfgegevens vs. lokale gebruiksgegevens
- GIPdatabank vs. SFK + Radboudumc + verpleeghuizen + nationale OTC



Invoergegevens



1. Informatie consumptie

GIPdatabank.nl

Stichting Farmaceutische Kengetallen



Radboudumc



Nielsen



1. Informatie excretie



Geneesmiddeleninformatiebank

DRUGBANK online

Farmacotherapeutisch Kompas

Clarivate

Web of Science™



Wel of geen excretiefraction gebruiken?

Scenario	Dataset	Xi [%]	SSPB [%]	remarks
Consumption <i>f_{ex} = 1, ex metabolites</i>	National	370	245	n _{API} = 23
	Local	555	497	n _{API} = 23
Excretion parent compounds <i>f_{ex} = parent</i>	National	157	-40	n _{API} = 26
	Local	245	-6	n _{API} = 26
Total excretion <i>f_{ex} = parent + conjugate</i>	National	157	15	n _{API} = 26
	Local	245	24	n _{API} = 26

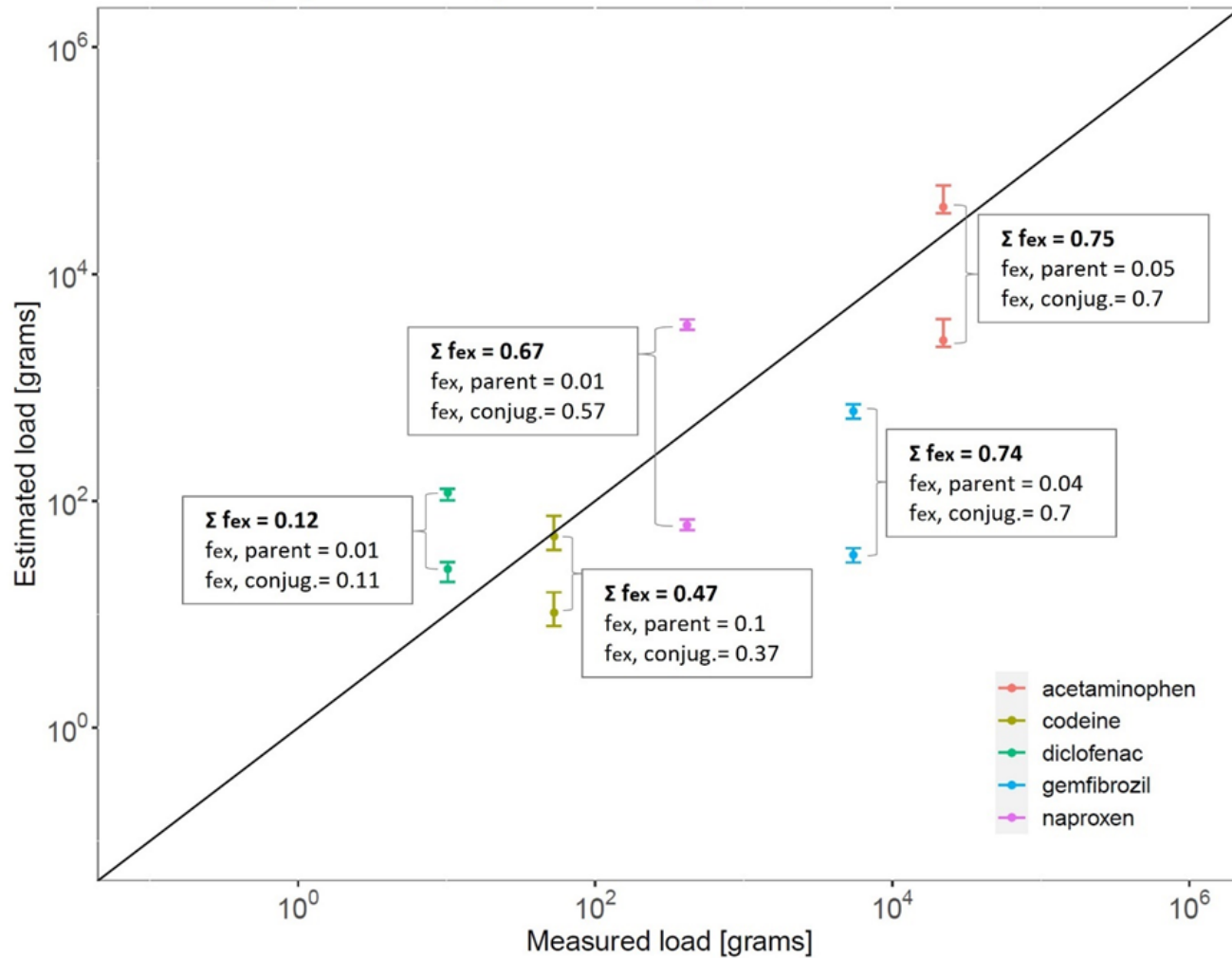
→ Excretiefractionen belangrijke stap in emissieschatting!



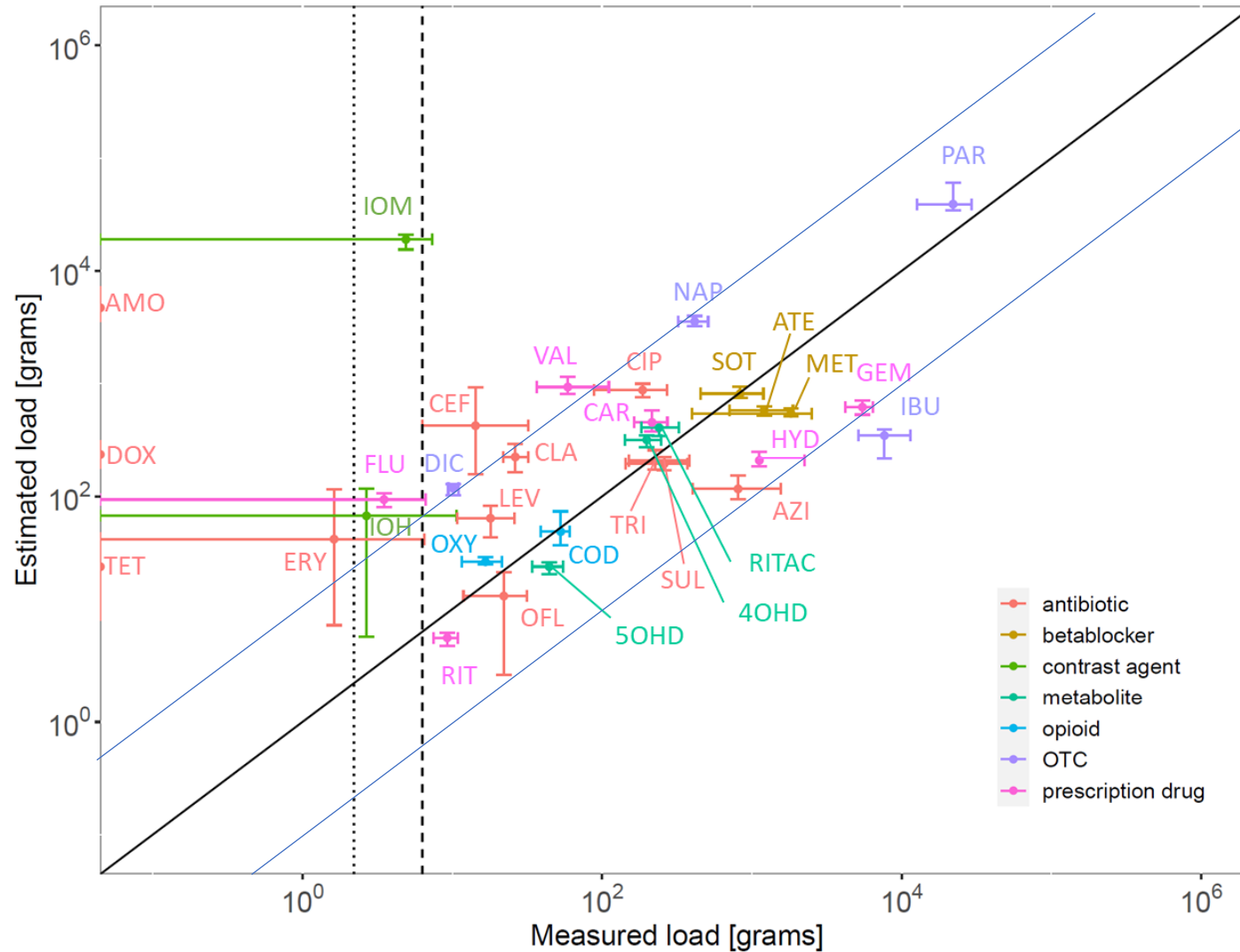
Conjugaten – wel of niet mee nemen?

Accounting for back-transformation of conjugate metabolites

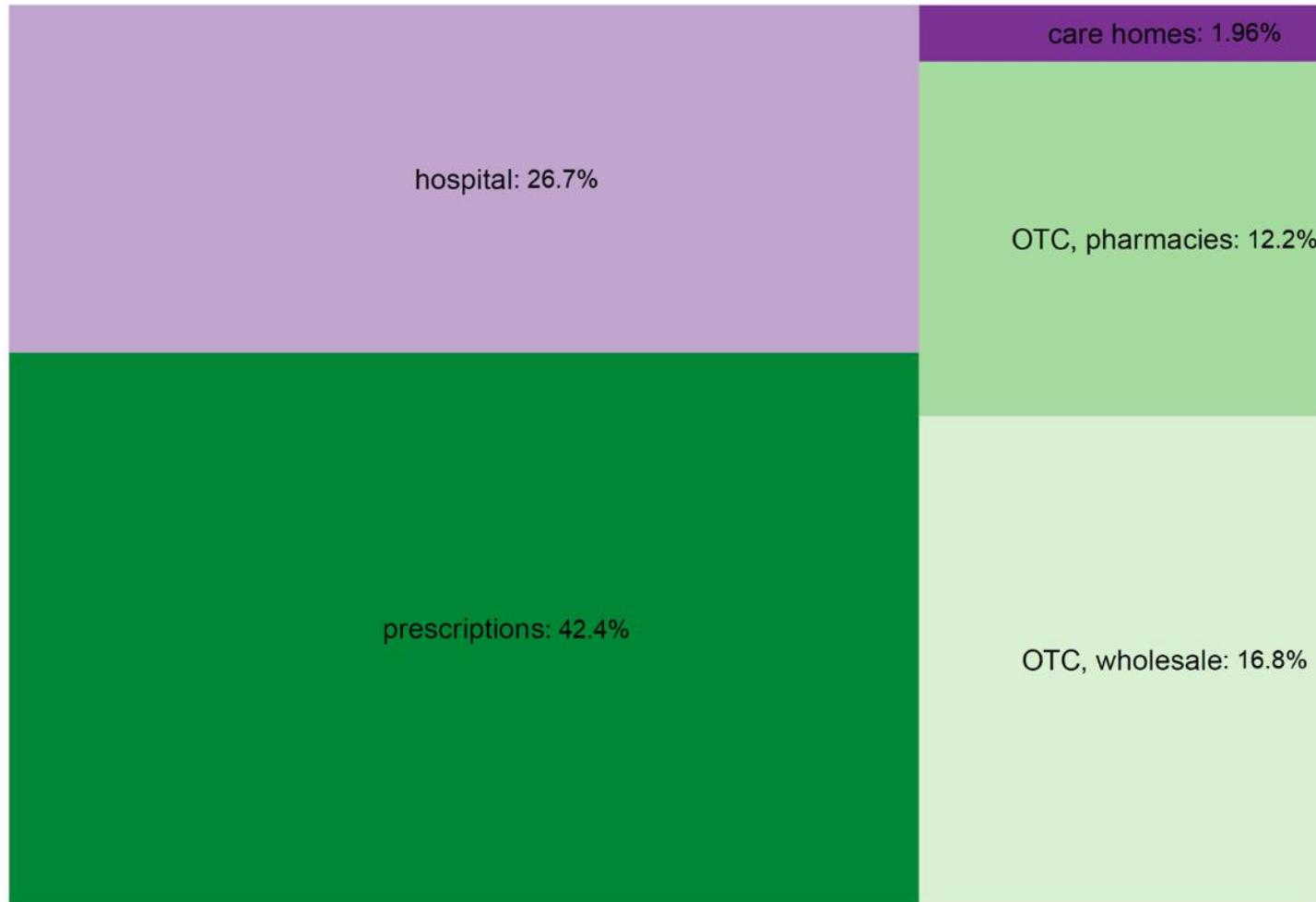
Data for WWTP Nijmegen in 2020. Consumption based on monthly data on local scale.



Resultaten emissieschatting Nijmegen



Added value: meer inzichten in bronnen



Tijdtrends in consumptie



Estimating pharmaceuticals pollution in river basins with mixed urban-rural land uses

Francesco Bregoli

Department of Environmental Science, Radboud University, Nijmegen.

Department of Water Resources and Ecosystems, IHE Delft Institute for Water Education, Delft.

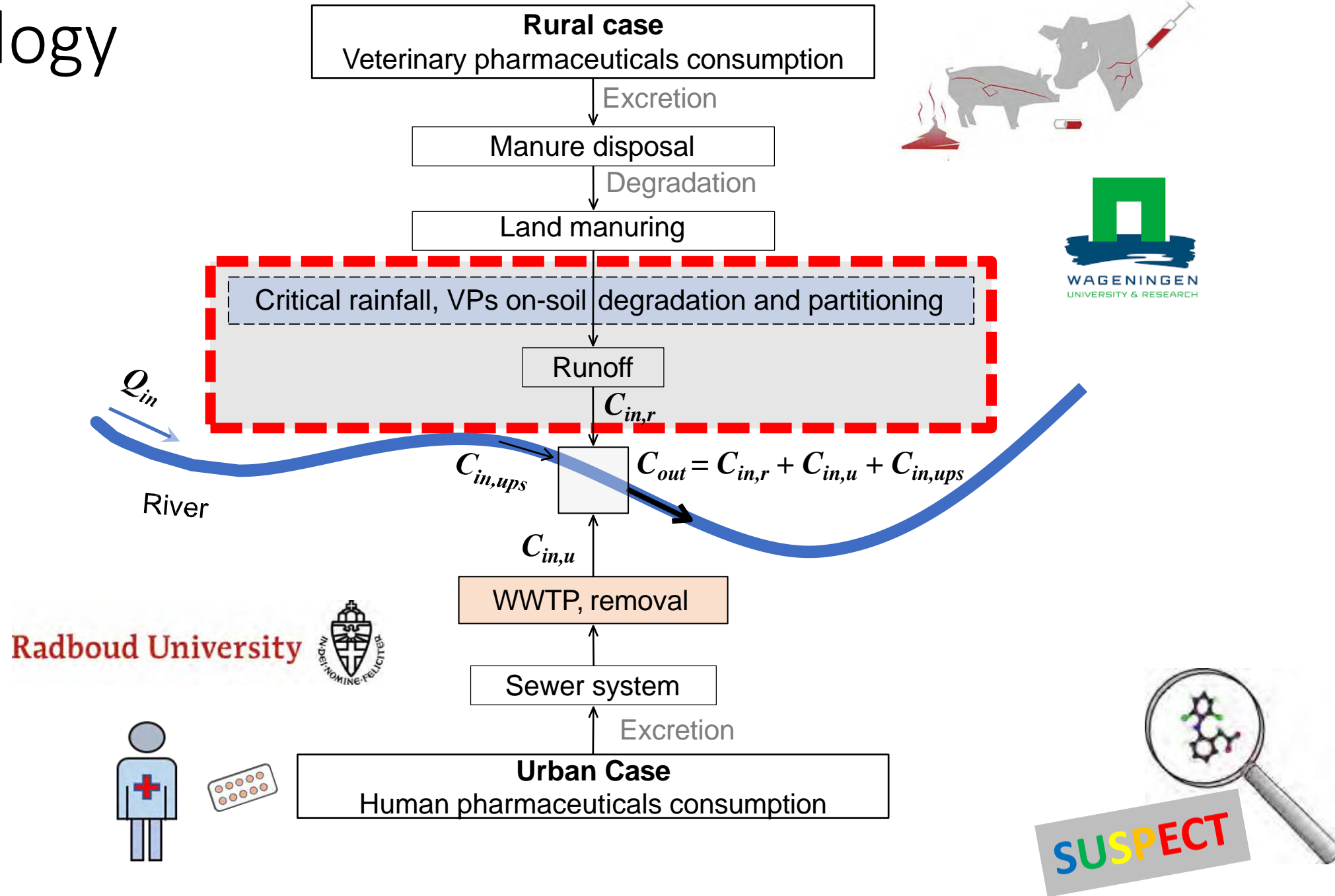


Introduction

- Thousands of (veterinary-) **pharmaceuticals** are used every day and are **found** in **soils and surface waters**. This contamination is mainly originated from **rural** (diffuse sources) and **urban** areas (point sources from waste water treatment plants).
- In the **SUSPECT** research project, we selected an useful **hydrological and water quality** model tool to **integrate** the **rural** and **urban** sources and predict the environmental concentration in rivers.
- The **goal** is to provide spatial and temporal **exposure information** for **risk assessment and management**.



Methodology



Case of study – Eem Catchment

Utrecht and Gelderland provinces, Vallei en Veluwe waterboard

MODELLING TOOL

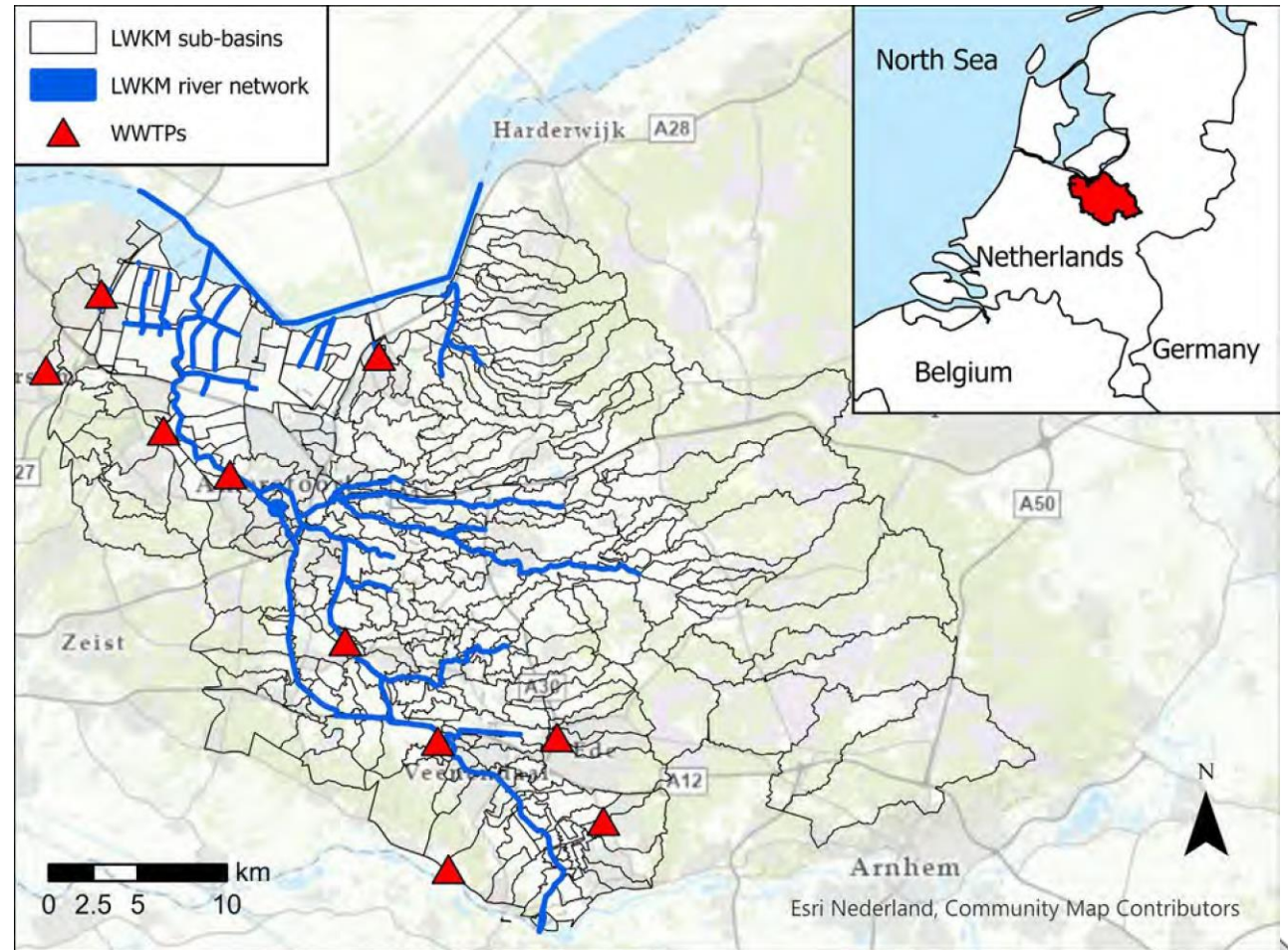
Deltares

Hydrological and Water Quality model WFD – LWKM

- Prediction of contaminants concentration in rivers
- Seasonal: one prediction per season
- Point sources from WWTPs (points)
- Diffuse sources from agricultural fields (polygons)



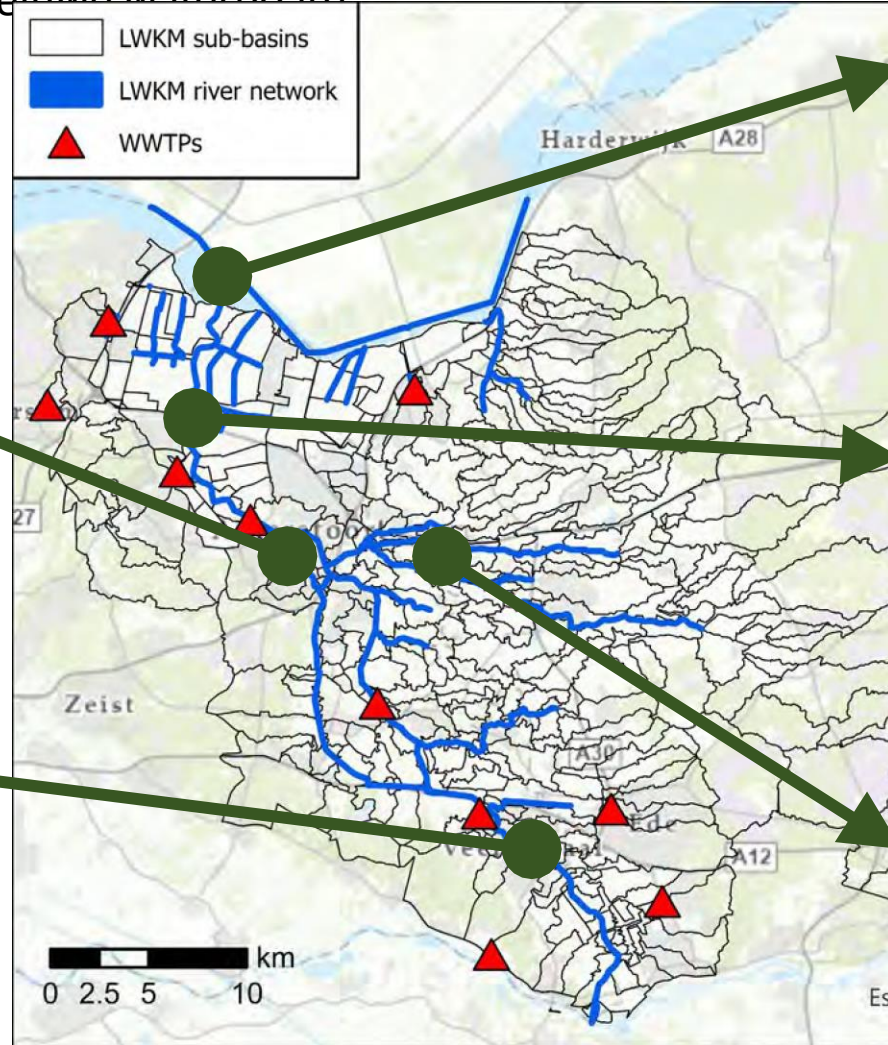
SUSPECT



SUSPECT

Case of study – Eem Catchment

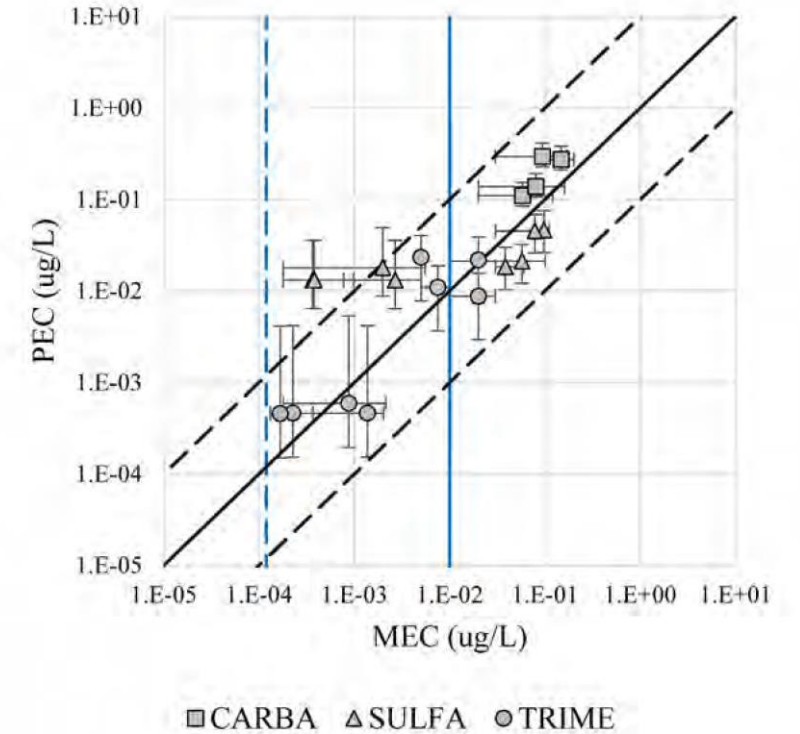
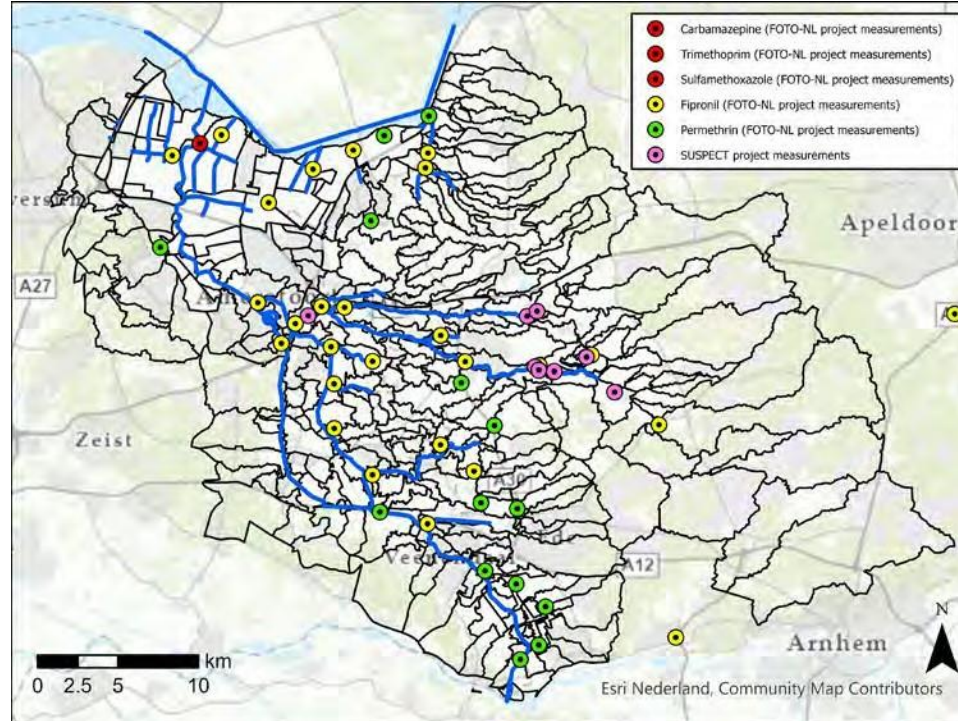
Utr... en Veluwe waterboard



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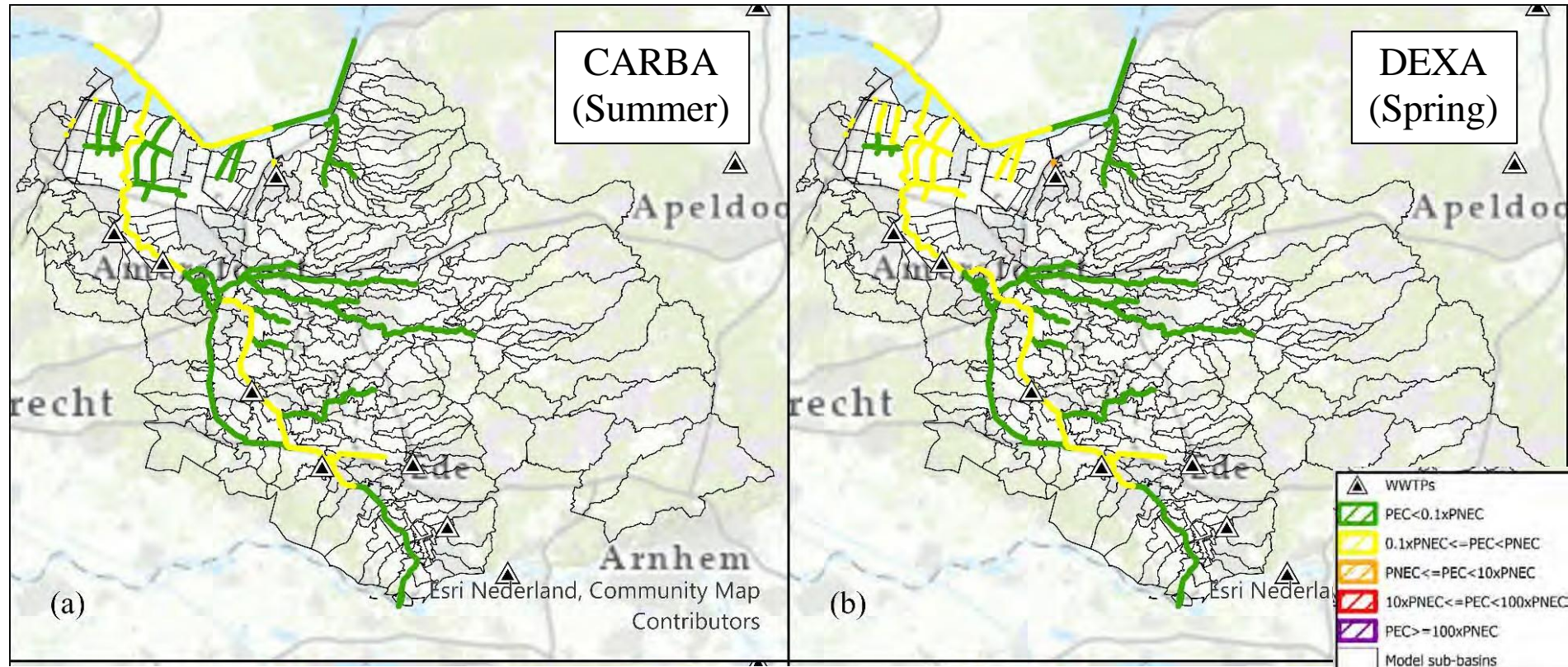
Model validation

Compound	Source
Carbamazepine	U
Fipronil	U
Trimethoprim	U+R
Sulfamethoxazole	U+R
Permethrin	U+R
Dexamethasone	U+R



SUSPECT

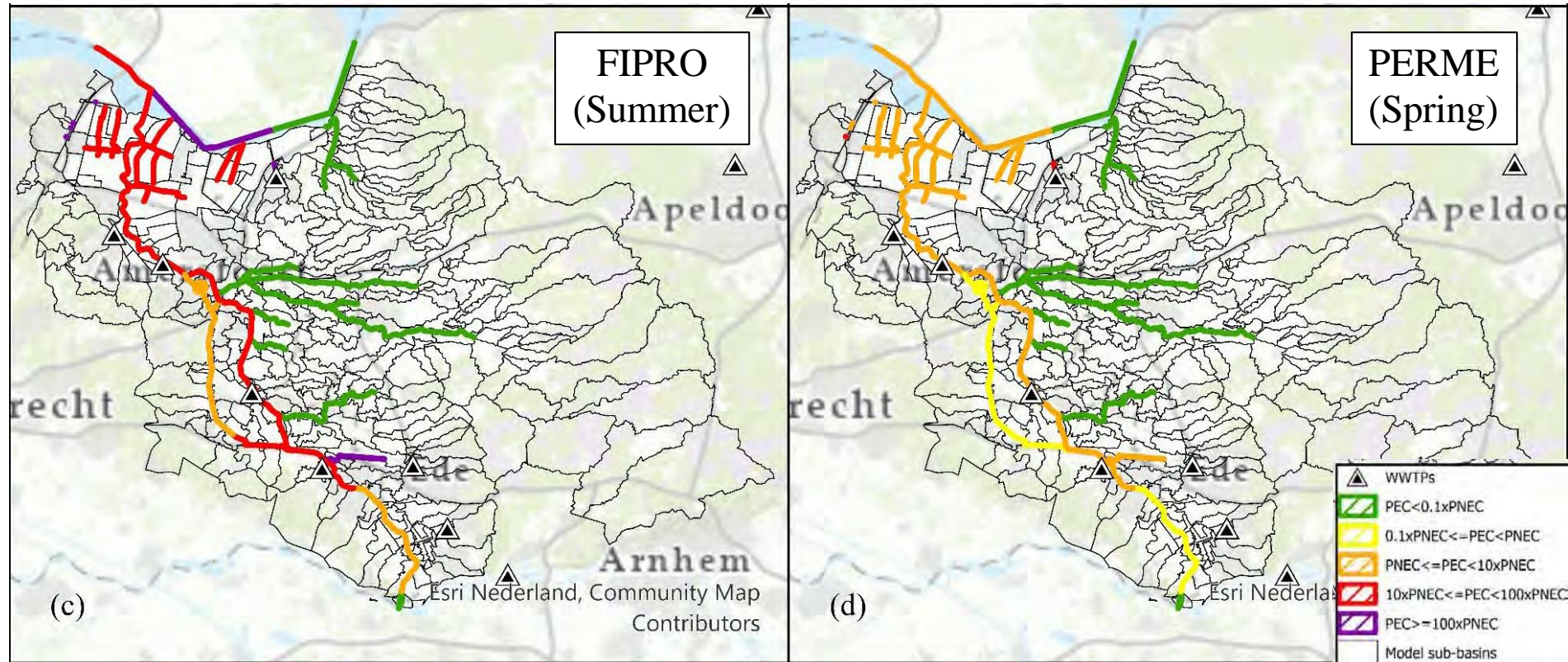
Results



PNEC = Predicted no effect concentration
(EQS = Environmental quality standard)



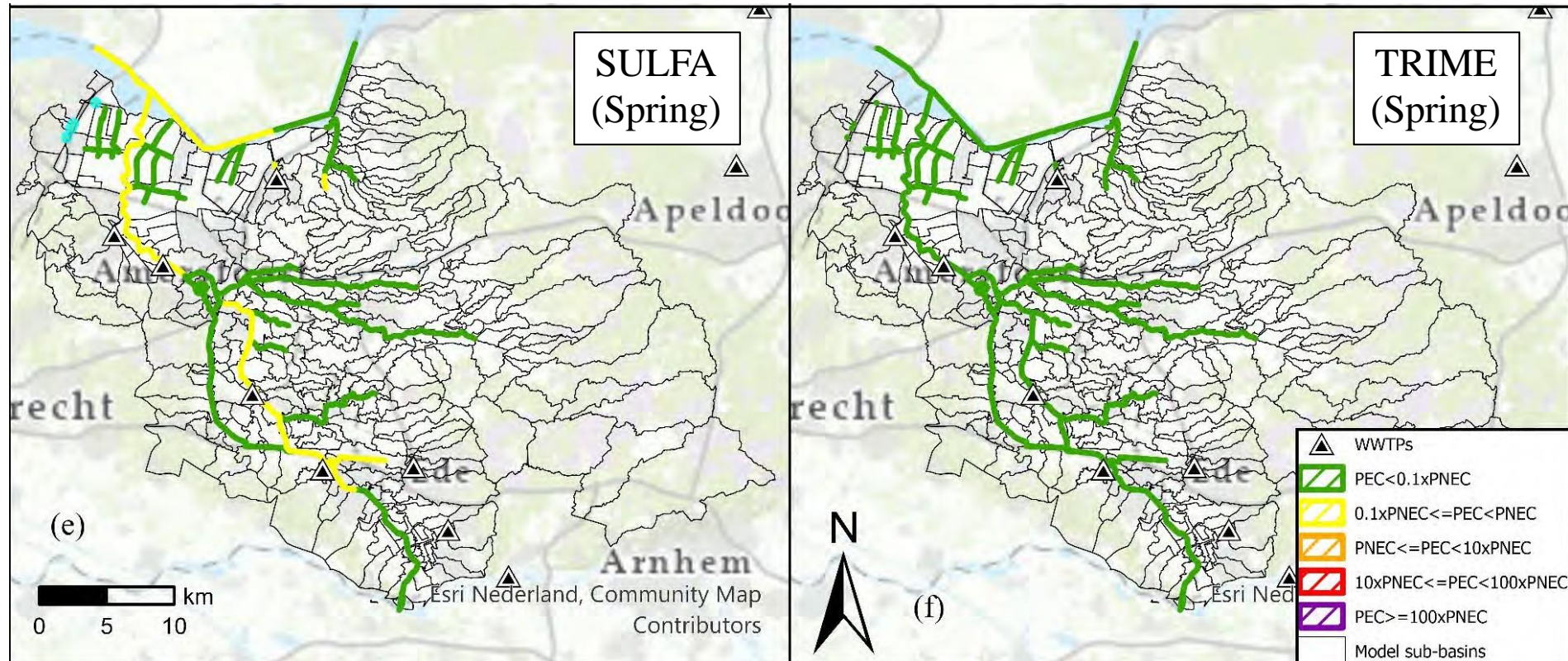
Results



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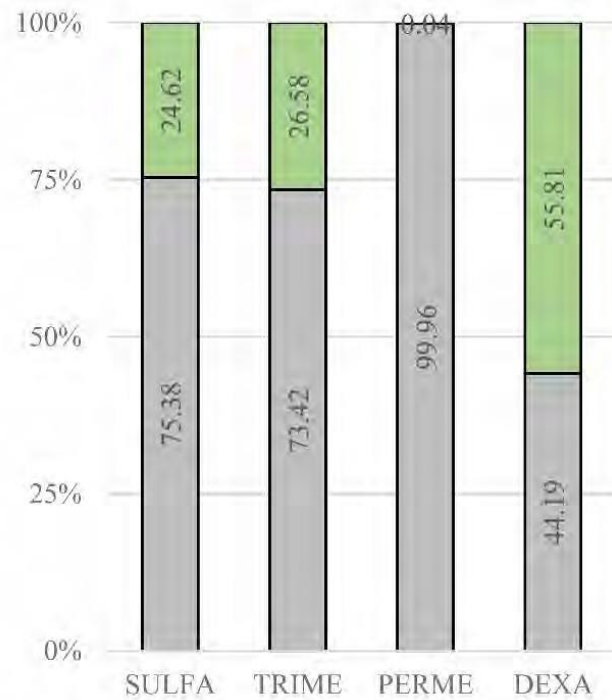
Results



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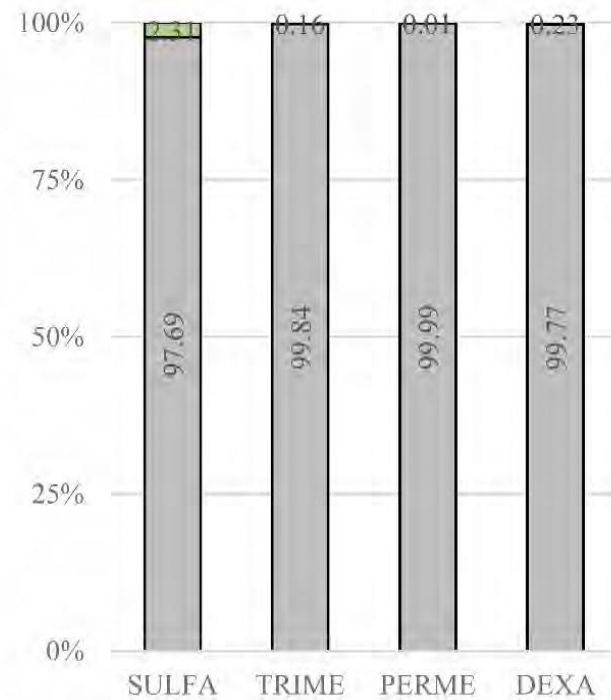


Contribution of sources to river contamination



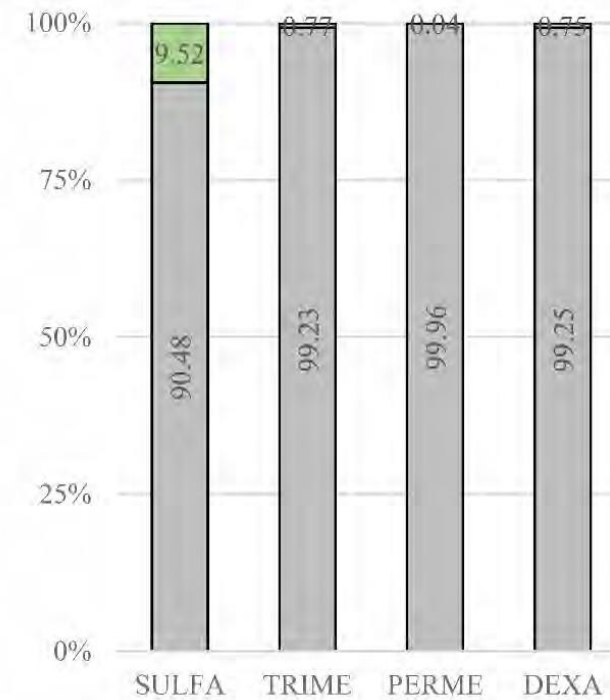
(a) ■ Urban ■ Rural

% of total loads to
sewage (urban)
or crops (rural)



(b) ■ Urban ■ Rural

% of total loads
to rivers (effluents)

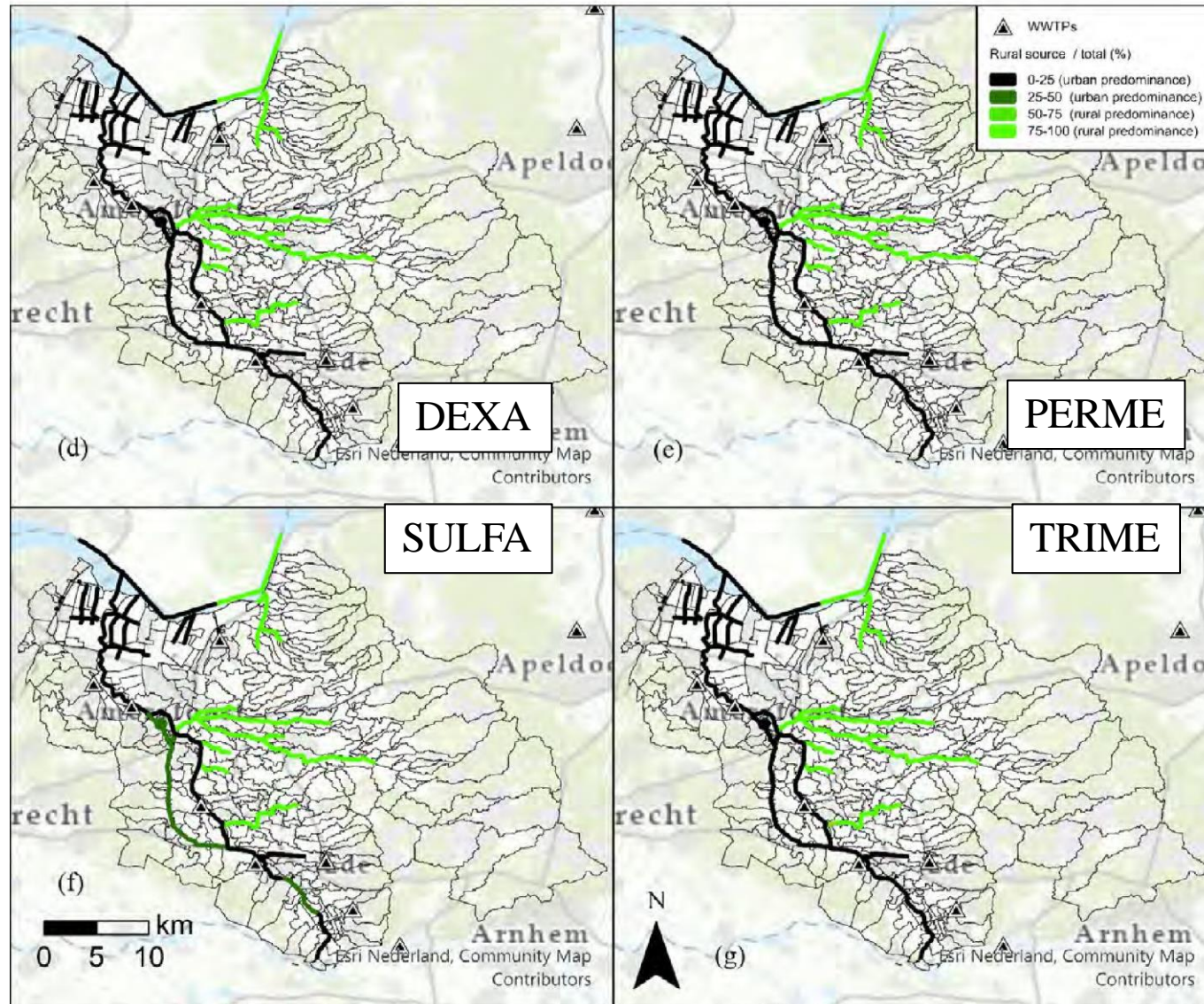


(c) ■ Urban ■ Rural

% of total loads
at Eem River outlet



Contribution of sources to river contamination

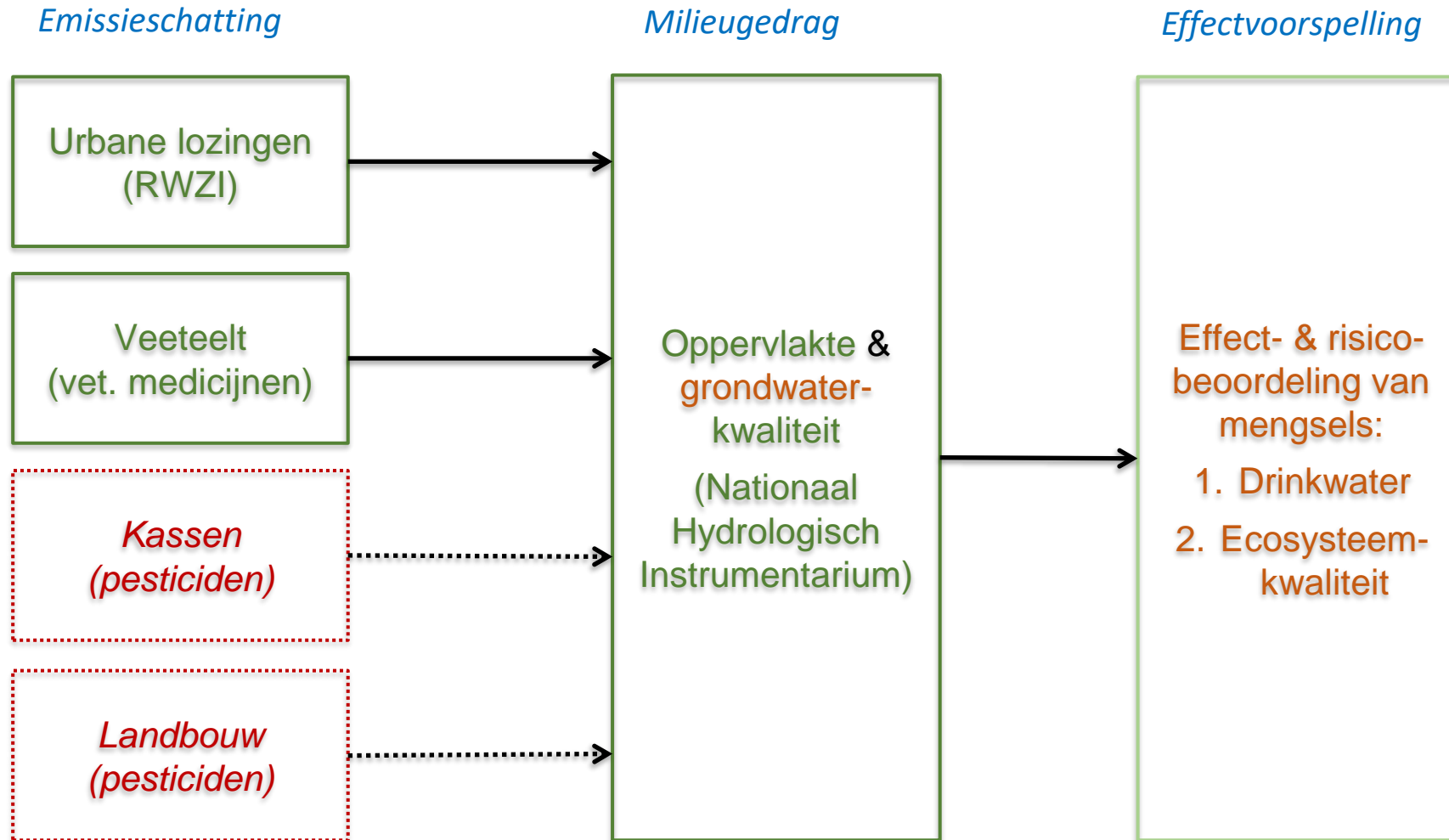


Take home messages

- We showed that **with** our **modelling approach** we can **predict** well the **concentration of pharmaceuticals** in surface waters of basins with **mixed rural-urban land uses** (validation).
- In Eem catchment, the results show that predicted concentration **often exceeded the water quality standard**, also where water quality standards are lower than the limit of detection.
- **Spring** and **Summer** are the most polluted seasons due to higher combined rural-urban input (Spring) and lower dilution in rivers (Summer).
- In the study area, **urban sources contribute notably more** than rural sources to **pharmaceuticals loads** to rivers.



Visie: nationaal modulair waterkwaliteitsmodel



SUSPECT – onderdeel van:

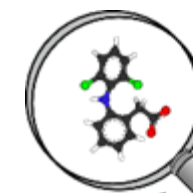


stowa

KWR Watercycle
Research
Institute



STW
Partnership
connecting innovators



SUSPECT