



## Linking pesticide use data and water quality

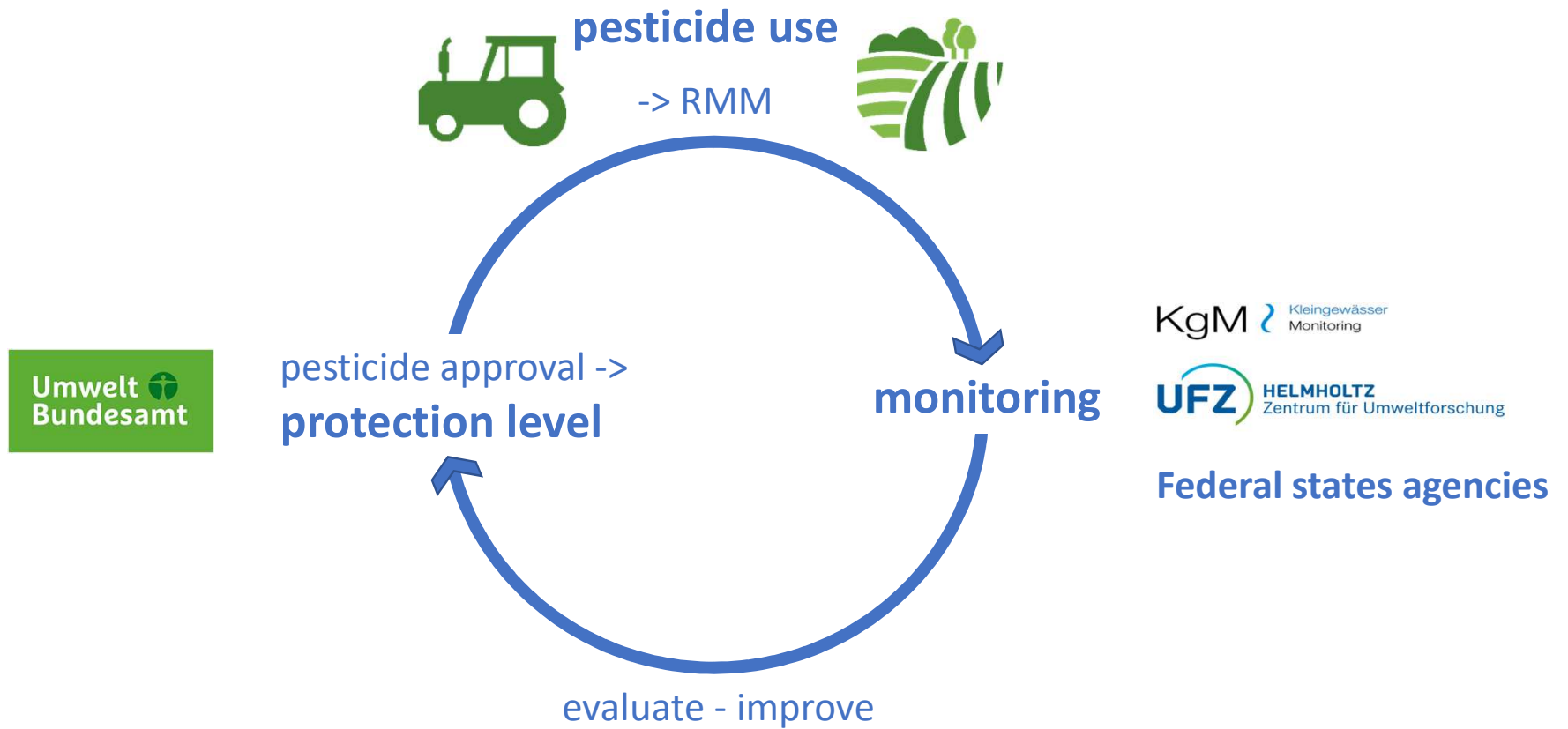
**Alexandra Müller**<sup>a</sup>, Jonas Gröning<sup>b, c</sup>, Stephan Nordheim<sup>b</sup>, Jörn Strassemeier<sup>b</sup>,  
Matthias Liess<sup>c</sup>, Kristina Hitzfeld<sup>a</sup>, Oliver Weisner<sup>a</sup>

<sup>a</sup> German Environment Agency (UBA), Section IV 1.3 Plant Protection Products, Germany

<sup>b</sup> Julius Kühn-Institut (JKI), Institute for Strategies and Technology Assessment, Germany

<sup>c</sup> Helmholtz Centre for Environmental Research (UFZ), Department of Ecotoxicology, Germany

# Background



# Targeted monitoring

## German small streams monitoring



> **100** agricultural sampling sites  
< 30 km<sup>2</sup> catchment  
> 20% agricultural land use



event-triggered samples  
& grab samples



**75** active substances  
& macrozoobenthic sampling

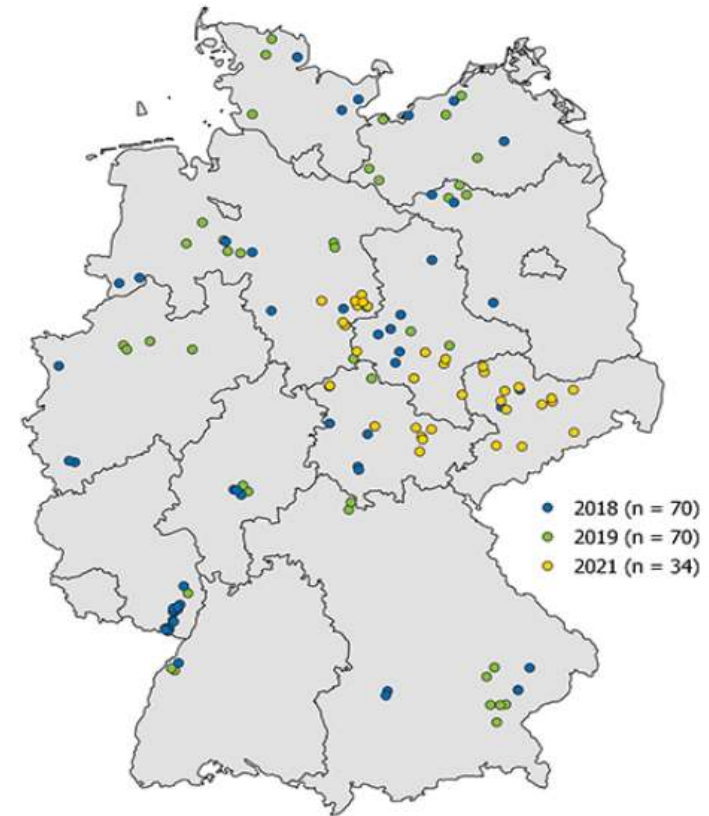


Water Research  
Volume 201, 1 August 2021, 117262



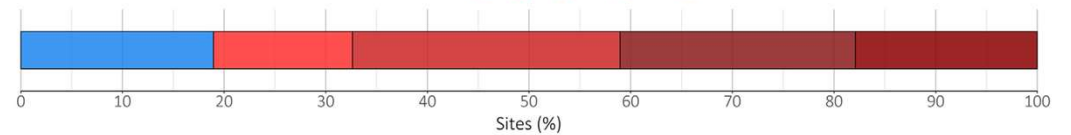
Pesticides are the dominant stressors for vulnerable insects in lowland streams

[www.ufz.de/kgm](http://www.ufz.de/kgm)



Sites

RAC exceedances 0 1 2-5 6-10 11+



# Availability of pesticide application data

real application data



**documented**

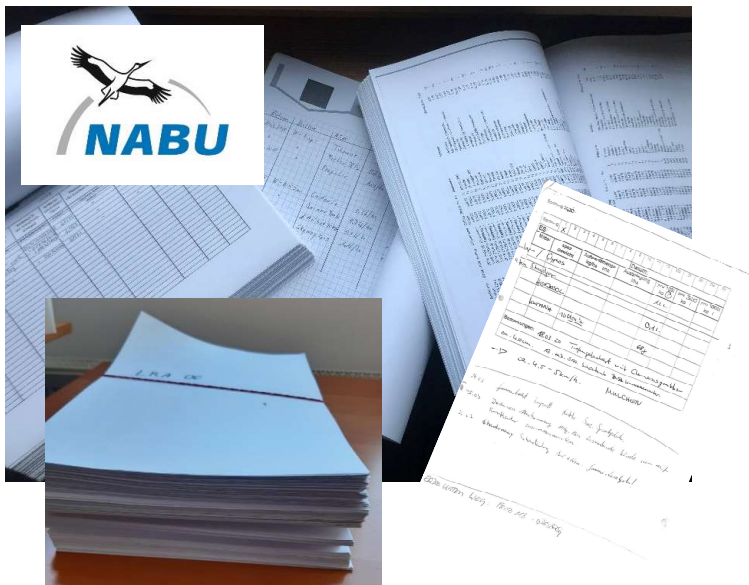
by the farmer in Germany (PflSchG §11 and (EC) Nr. 1107/2009, Art. 67)

- Name of product, application rate
- Date of application
- Treated area, crop

**demanded**

by an NGO in Germany and provided to the small streams monitoring project (Access to Environmental Information Directive (2003/4/EC), Aarhus Convention)

- analogue copies
- 61953 applications, 227 different active substances
- digitalisation challenging
- often inconclusive locality determination



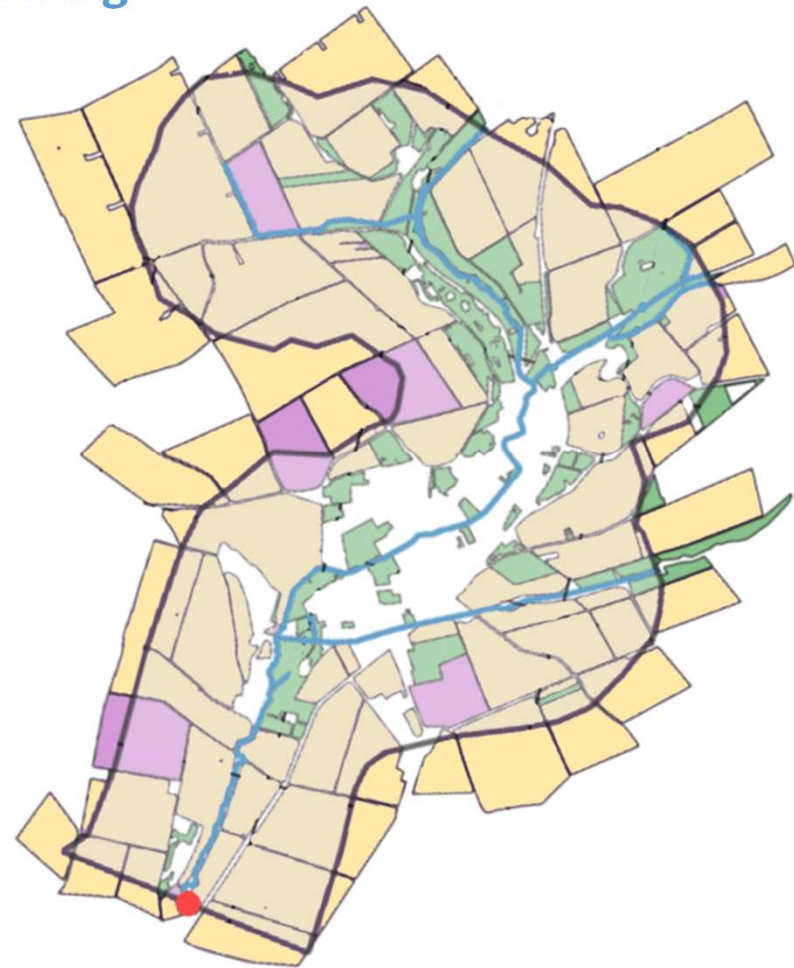
# Project objectives

## Linking pesticide use data and water quality monitoring

**Can risk drivers be identified from application data?**

**Which factors facilitate pesticide inputs into streams?**

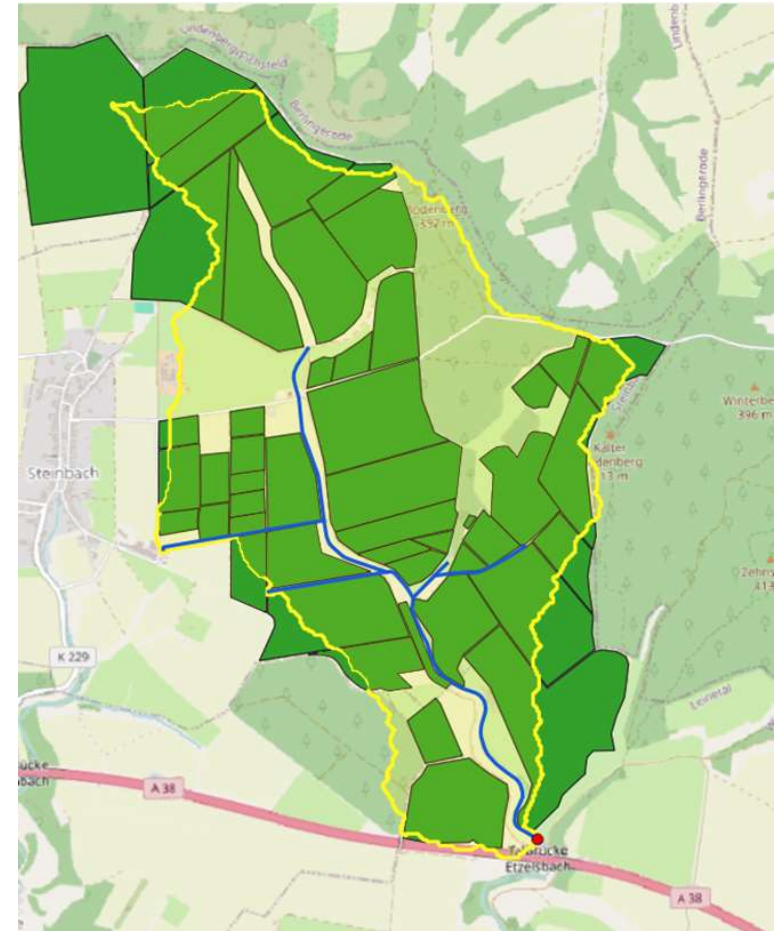
**Can application data identify sources and input pathways of PPP residues?**



# Linking PPP application to pesticide exposure and risk in streams

## A catchment study

- 5.1 km<sup>2</sup> in central Germany
- 46 fields, 6 different crop types

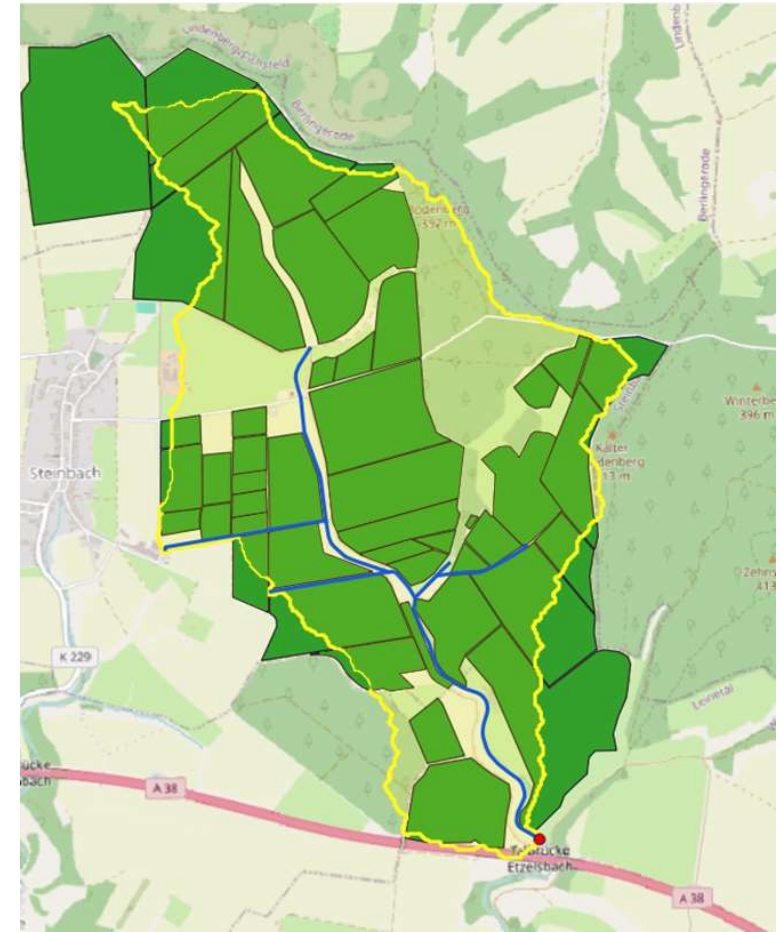


# Linking PPP application to pesticide exposure and risk in streams

## Application data


- 5.1 km<sup>2</sup> in central Germany
- 46 fields, 6 different crop types
- 20 different active substances applied

active substance	amount (g)
Thiacloprid	324
Acetamiprid	80
Foramsulfuron	723
Flufenacet	4523
Nicosulfuron	528
Pethoxamid	10206
Bromoxynil	931
MCPA	3300
Tritosulfuron	225
Florasulam	1
Epoxiconazol	4144
Azoxystrobin	4904
Tebuconazol	3802
Fenpropidin	822
Propiconazol	3151
Fluxapyroxad	3722
Isopyrazam	63
Prochloraz	220
Triadimenol	75



# Linking PPP application to pesticide exposure and risk in streams

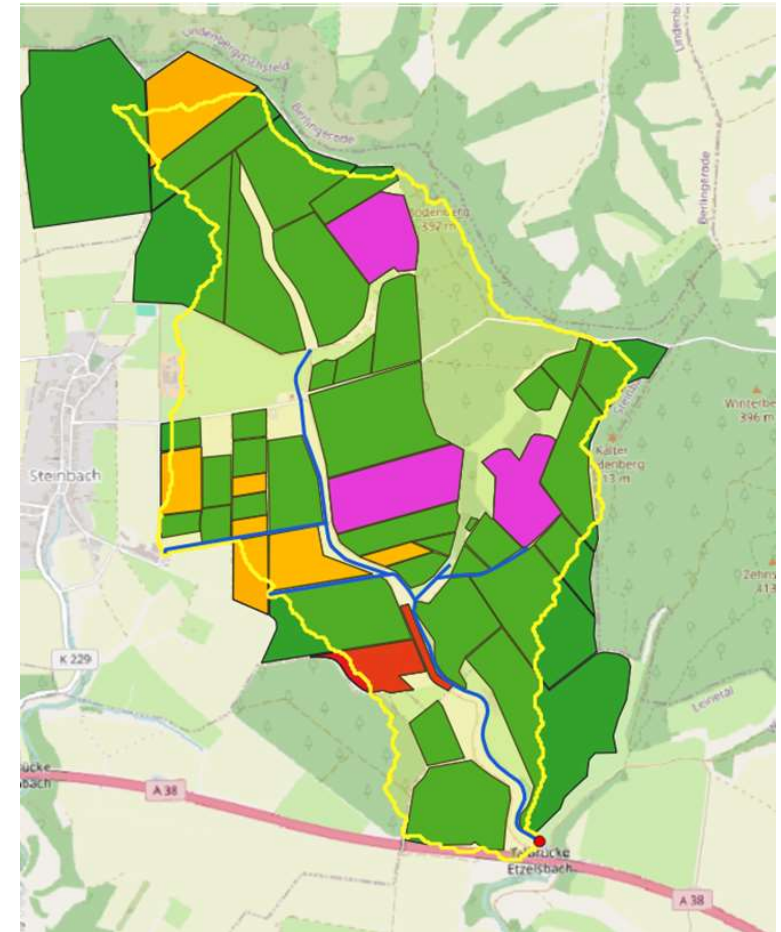
## Application data

- 5.1 km<sup>2</sup> in central Germany
- 46 fields, 6 different crop types
- 20 different active substances applied
- 12 fields with maize 
- Application of

**NICOGAN** (40 g/L Nicosulfuron)


**MaisTer power** (30 g/L Foramsulfuron)

active substance	amount (g)
<b>Foramsulfuron</b>	<b>723</b>
Flufenacet	4523
<b>Nicosulfuron</b>	<b>528</b>
Pethoxamid	10206
Bromoxynil	931
MCPA	3300
Tritosulfuron	225
Florasulam	1



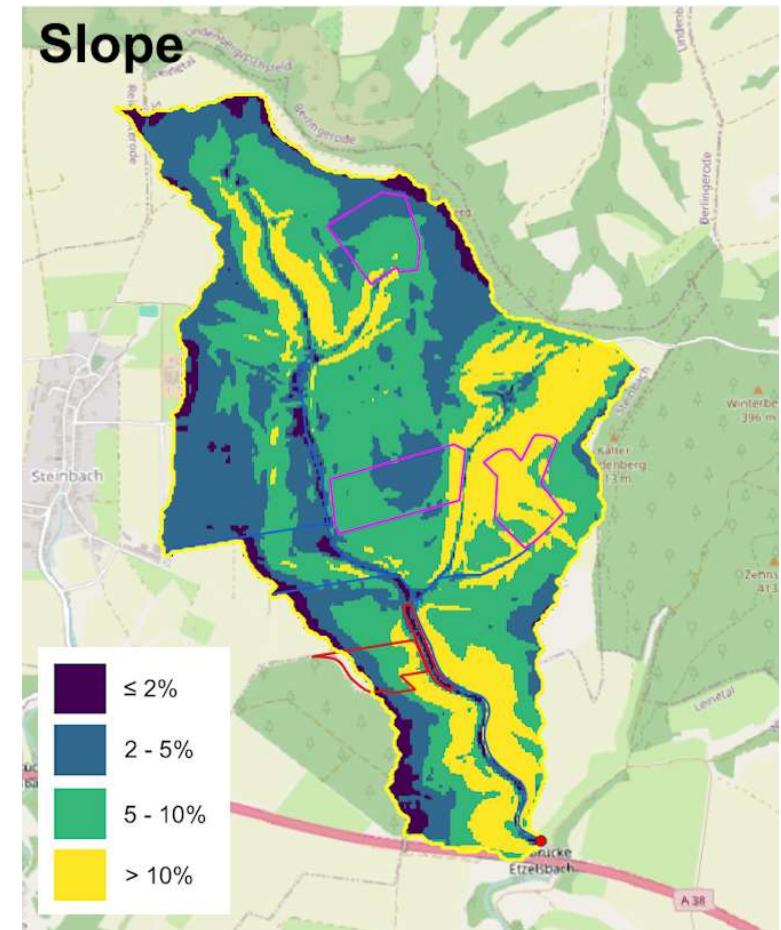
# Linking PPP application to pesticide exposure and risk in streams

## GIS analyses

- 5.1 km<sup>2</sup> in central Germany
- 46 fields, 6 different crop types
- 20 different active substances applied
- 12 fields with maize 
- Application of


**NICOGAN** (40 g/L Nicosulfuron)

**MaisTer power** (30 g/L Foramsulfuron)



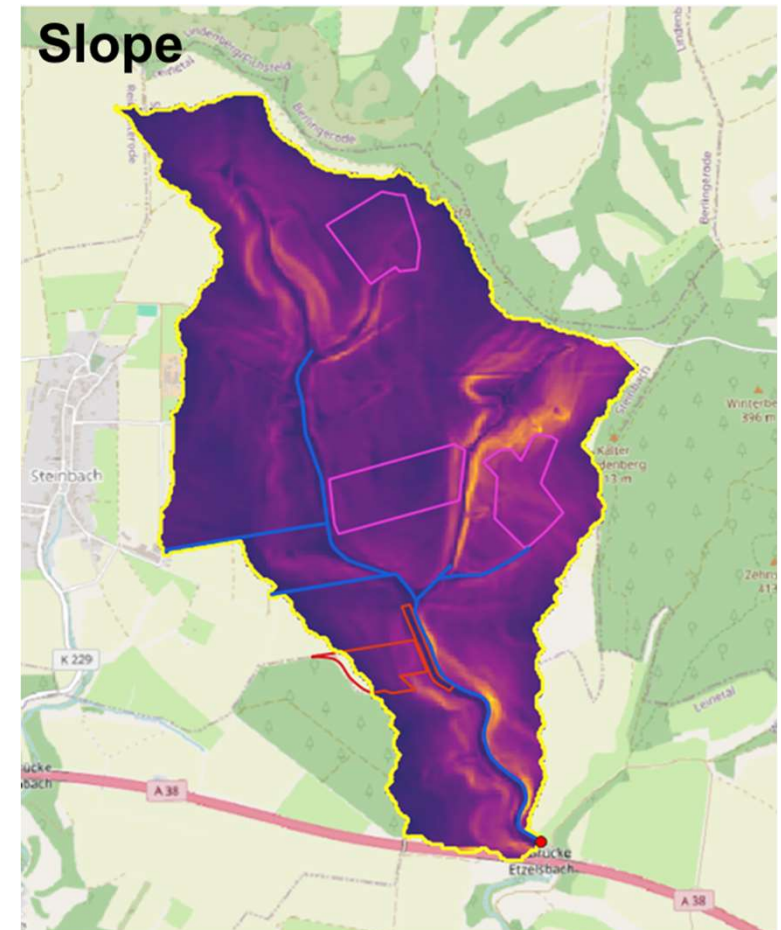
# Linking PPP application to pesticide exposure and risk in streams

## GIS analyses

- 5.1 km<sup>2</sup> in central Germany
- 46 fields, 6 different crop types
- 20 different active substances applied
- 12 fields with maize 
- Application of


**NICOGAN** (40 g/L Nicosulfuron)

**MaisTer power** (30 g/L Foramsulfuron)



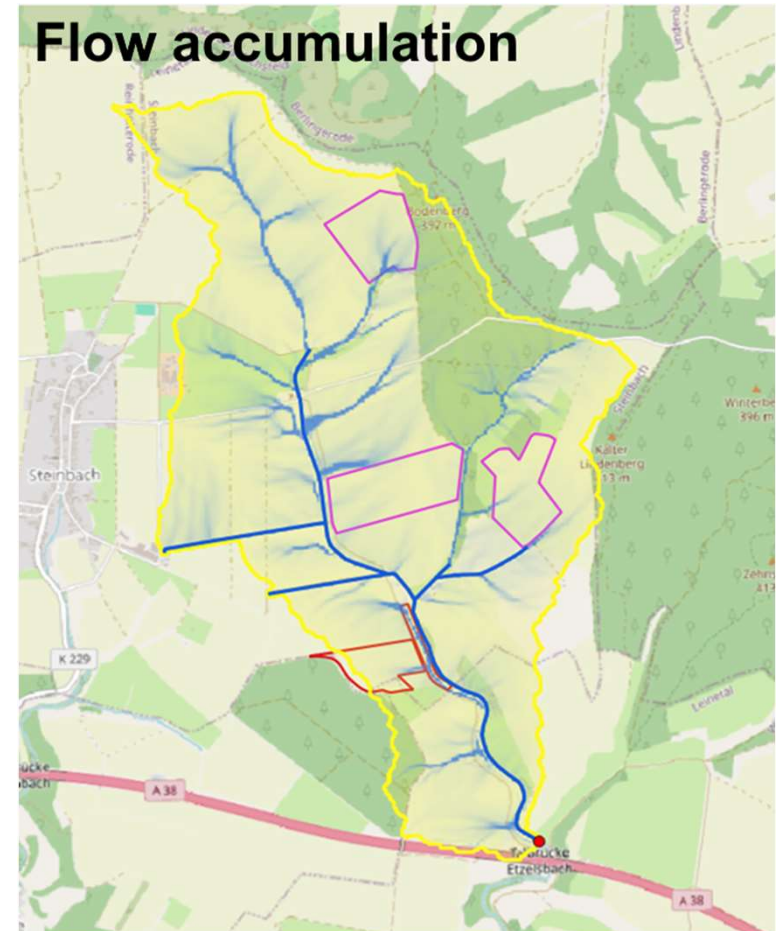
# Linking PPP application to pesticide exposure and risk in streams

## GIS analyses

- 5.1 km<sup>2</sup> in central Germany
- 46 fields, 6 different crop types
- 20 different active substances applied
- 12 fields with maize 
- Application of

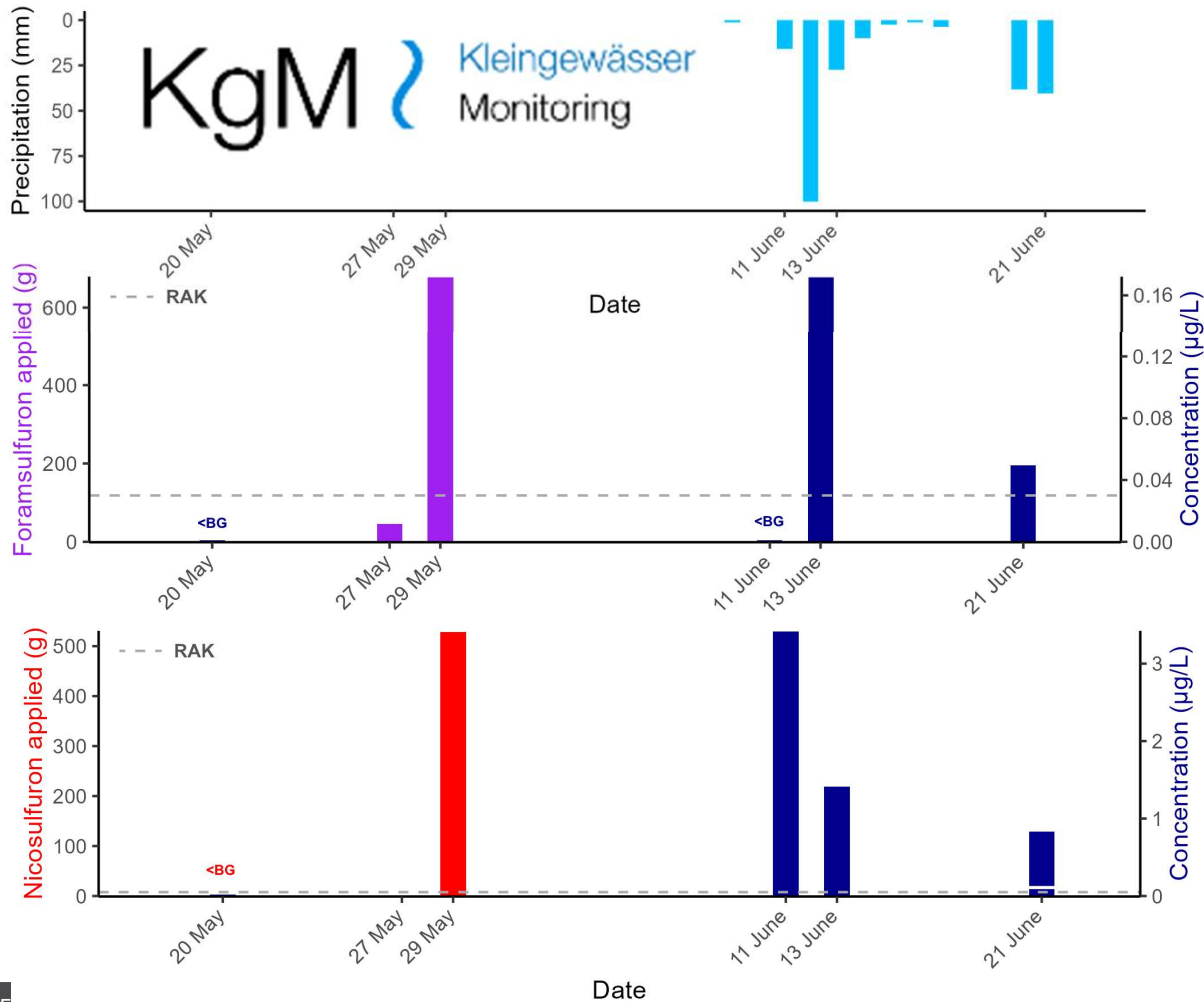
**NICOGAN** (40 g/L Nicosulfuron)

**MaisTer power** (30 g/L Foramsulfuron)



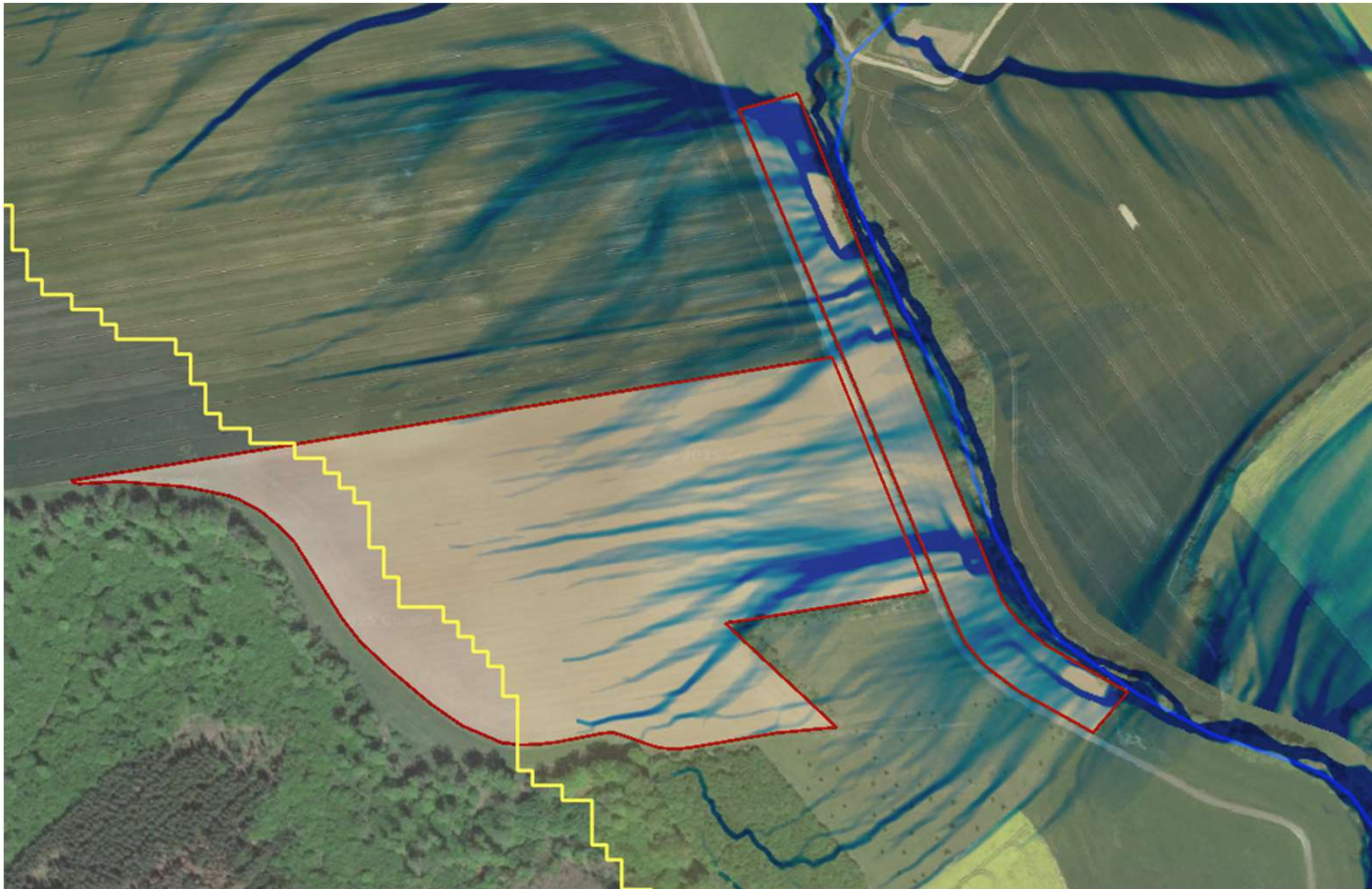
# Linking PPP application to pesticide exposure and risk in streams

## Monitoring data



# Linking PPP application to pesticide exposure and risk in streams

## Effectiveness of mitigation measures



- 10-20 m vegetated buffer strip between field and stream
- Flow accumulation analysis reveals flow paths through the buffer strip
- Effectiveness of buffer strips might be reduced by these accumulated flow paths

**NICOGAN** (40 g/L Nicosulfuron)

# Linking PPP application to pesticide exposure and risk in streams

## Effectiveness of mitigation measures

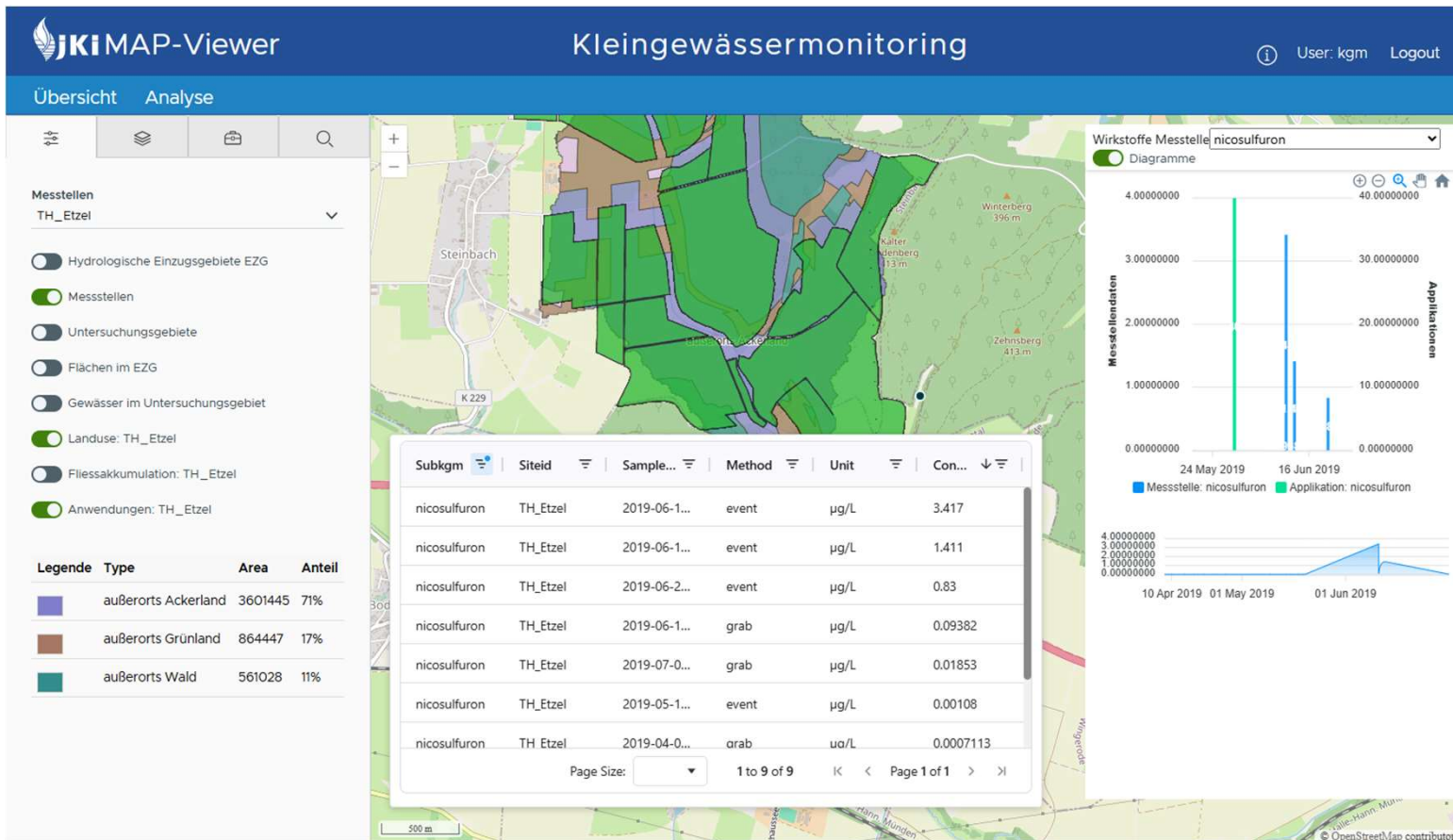


- 40 m vegetated buffer strip between field and stream
- Other fields are connected via only temporary ditches > 500m flow path to the permanent stream

**MaisTer power** (30 g/L Foramsulfuron)

# JKI MAP-Viewer

## A tool for data presentation and analysis



- Visualize and assess PPP data
- Perform database queries (filter, aggregate entries)
- Provision of additional data on land use, hydrology, precipitation...
- Allows in-depth analysis of PPP applications and pesticide concentrations

## Further analyses planned

- Calculate and evaluate risk indicators (e.g. RQ, PLI) for all catchments, as a possibility for prospective risk assessment in future

$$RQ_{\text{applied}} = \text{applied amount} / \text{RAC}$$

$$RQ_{\text{measured}} = \text{concentration} / \text{RAC}$$

Active ingredient	Amount applied (g)	RQ <sub>applied</sub> (x10 <sup>9</sup> )	RQ <sub>measured</sub>
Foramsulfuron	723	21,5	5,1
Flufenacet	4522	12,7	1,2
Nicosulfuron	528	5,9	38,0
Pethoxamid	11700	3,8	4,2
Bromoxynil	931	3,6	3,9
MCPA	3300	0,8	0,0
Tritosulfuron	225	0,1	0,0
Florasulam	1,25	0,0	0,1

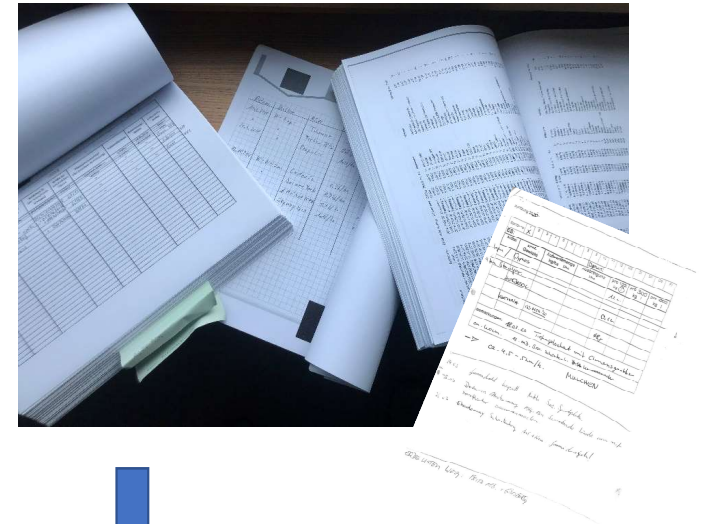
- Nicosulfuron and Foramsulfuron exceeded RACs the most
- ✓ High potential risk of these substances could be derived from application data

- Identify factors or combination of factors promoting pesticide inputs to streams, to derive field-specific risk potentials and improved mitigation measures

- Information on the implemented RMM would be very helpful for this

# Implications in the context of the future SAIO Regulation

- Access restrictions to PPP application data and the high effort required for subsequent collection and digitalisation are currently hindering the comprehensive source-identification of PPP inputs into water bodies
- Regulation (EU) 2022/2379 (SAIO) and Implementing Regulation (EU) 2023/564 specify the digital recording and storage (minimum requirements)
- transitional period 2025-2027, MS plan implementation with varying degrees of ambition
- Application of treated seeds and the actual risk mitigation measures are still not covered
- an accessible database in accordance with the requirements of data protection is required for risk assessment and research



**Regulation (EU) 2022/2379** of the European Parliament and of the Council of 23 November 2022 on statistics on agricultural input and output (SAIO)

# Thank you for your attention

**Alexandra Müller**, Jonas Gröning, Stephan Nordheim, Jörn Strassemeyer, Matthias Liess, Kristina Hitzfeld, Oliver Weisner

[alexandra.mueller@uba.de](mailto:alexandra.mueller@uba.de)

**website „Kleingewässermonitoring“**

<https://www.ufz.de/kgm/index.php?de=44480>

<https://de.wikipedia.org/wiki/Kleingewässer-Monitoring>

**JKI MapViewer** (available from the end of 2025)

<https://sf.julius-kuehn.de/mapviewer/>