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Variability of pesticide transport and transformation patterns in lentic small water bodies

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Small water bodies at risk

- are located in or adjacent to agricultural fields
- current exposure and processes guiding the pesticide input not understood yet due to few monitoring campaigns
- fulfill multiple ecosystem services (e.g. retention of water and pollutants) and serve as a hot spot of biodiversity

This study presents results of a sampling of 10 lentic small water bodies in 2015/2016. The objectives are to

1. **characterize pesticide/transformation product (TP) input patterns**
2. **associate pesticide data with site characteristics, hydrological data and physicochemical parameters**
3. **identify drivers of pesticide input**

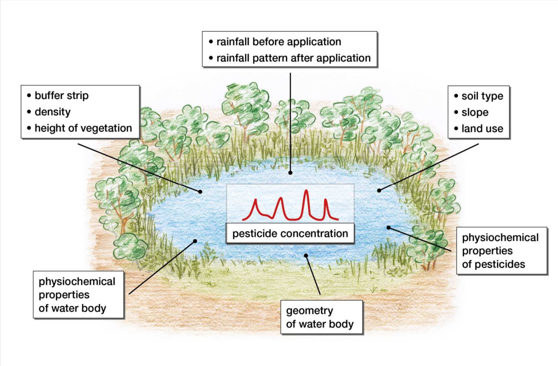


Fig. 1: Factors affecting the input of pesticides and their TPs into lentic small water bodies

Methods

Autumn: grab samples were taken event-based

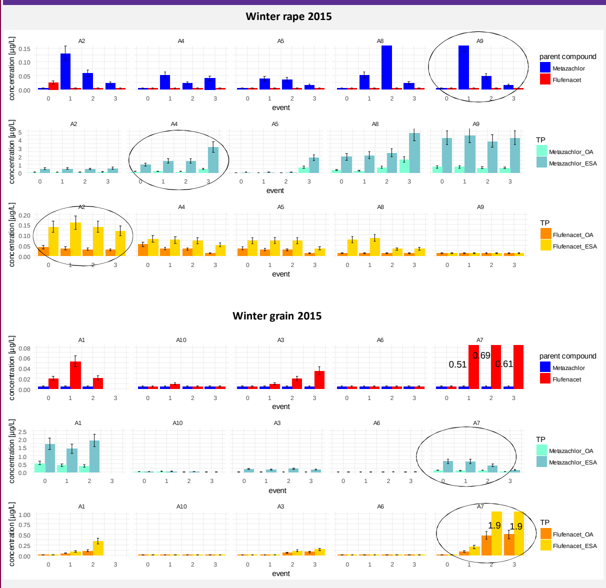
- once before application, three times after rainfall events following the application
- analysis of herbicides metazachlor and flufenacet and their TPs –oxalic acid (OA) & sulfonic acid (ESA) with LC-MS/MS (recovery rates of 80-120 %; LOQ 0.01 and 0,025 µg L^{-1})

Spring: one grab sample was taken (not event-based)

- at beginning of July after all pesticides had been applied
- target-screening of 101 pesticides and seven TPs with LC-MS/MS (recovery rates of 80-120 %; LOQ 0.01 – 0.2 µg L^{-1})

Site characteristics and **physicochemical parameters** were mapped/measured or derived from official data

Selected results



Concentrations highest after 1st rainfall

TP concentrations increased over time

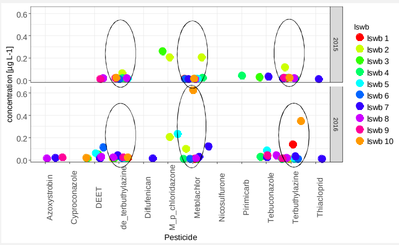
TP residues from previous year application

No patterns for flufenacet

TP concentrations increased over time

TP residues from previous year application

Fig. 2: Pesticide concentrations in lentic small water bodies in autumn 2015 (2016 not displayed) with A1-A10 = lentic small water bodies



Metolachlor, terbuthylazine and its TP desethylterbuthylazine detections in each lentic small water body -> no application in the last years

Fig. 3: Positive findings of pesticide contaminations in lentic small water bodies (lswb) after spring application in 2015 and 2016; de_terbuthylazine=desethylterbuthykazine; m_p_chloridazone=methyldesphenylchloridazone

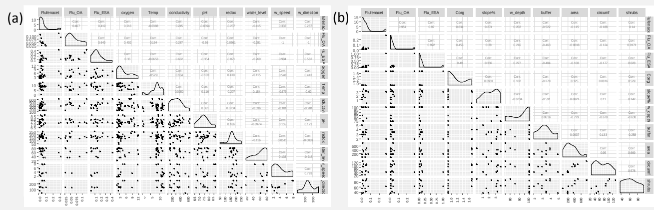


Fig. 4: Correlation between measured target compound concentrations and **physicochemical values** (a) and between median target compound concentrations and **site characteristics** for lentic small water bodies located in grain fields 2015 and 2016; Flu_OA/ESA=flufenacet-OA/ESA; w_speed/ direction=wind speed/direction; w_depth=mean water depth; buffer=mean width buffer stripe; circumf=circumference

Significant correlations between pesticide concentrations and site characteristics/ physicochemical values of the water samples were not determined with the available data (n=53), which are not normally distributed. Outliers caused high r.

Outcome

- **Similar transport patterns were observed for the more mobile metazachlor, but not for flufenacet**
- **Transformation products were detected in higher concentrations than parent compounds, positives even one year after application of parent compounds**
- **No attribution of site characteristics/physicochemical values to pesticide concentrations due to scarce data base**
- **Rainfall before and after application are the most crucial drivers of input (wet autumn 2015, dry autumn 2016)**
- **Target screenings reveal ubiquitous dissemination of selected compounds-> long-term transport/sediment release???**

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