Christian-Albrechts-Universität zu Kiel

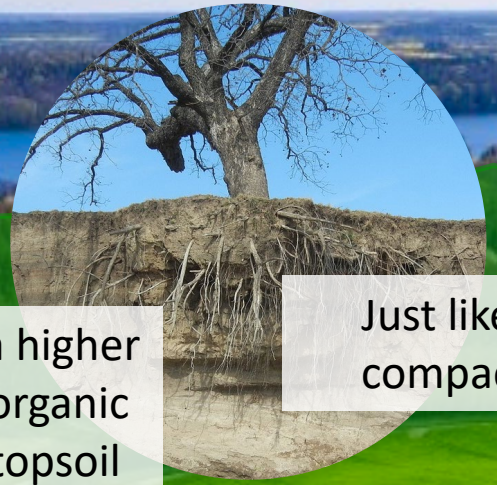
SWAT Conference 08-12, July 2024
in Strasbourg, France

Comparison of different parameter settings on the transport of pesticides and their transformation products

PhD-project at Kiel University
Anne-Kathrin Wendell, K. Bieger, B. Guse, P. Wagner,
J. Kiesel, U. Ulrich, N. Fohrer

Spatial heterogeneity of soils in eco-hydrological models: Essential or negligible?

Drainage systems change the soil structure and are mainly installed in wet areas



Grassland has a higher proportion of organic matter in the topsoil

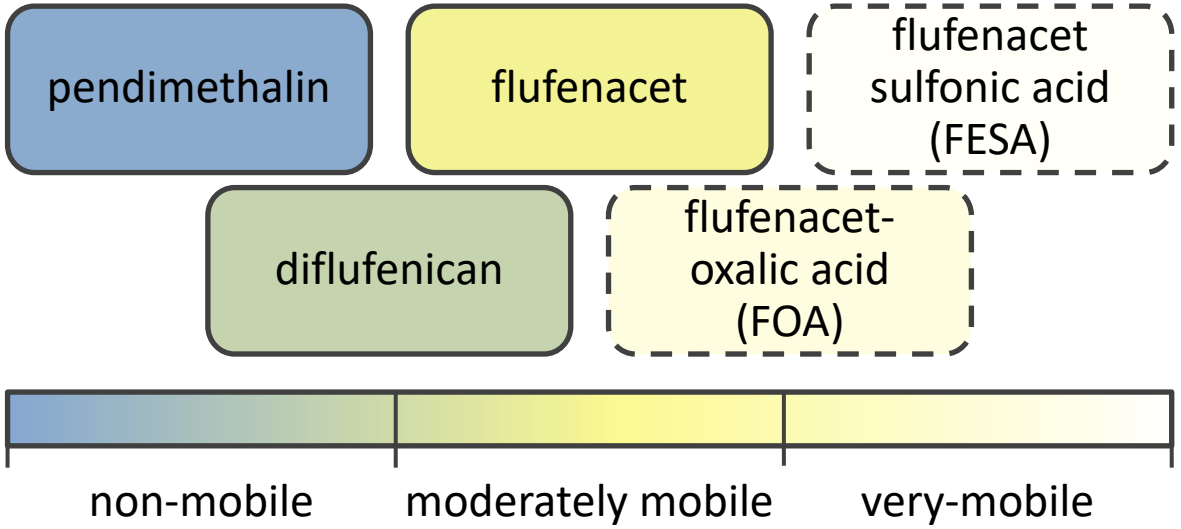
Just like soil compaction

Large heterogeneity of subsurface transport conditions

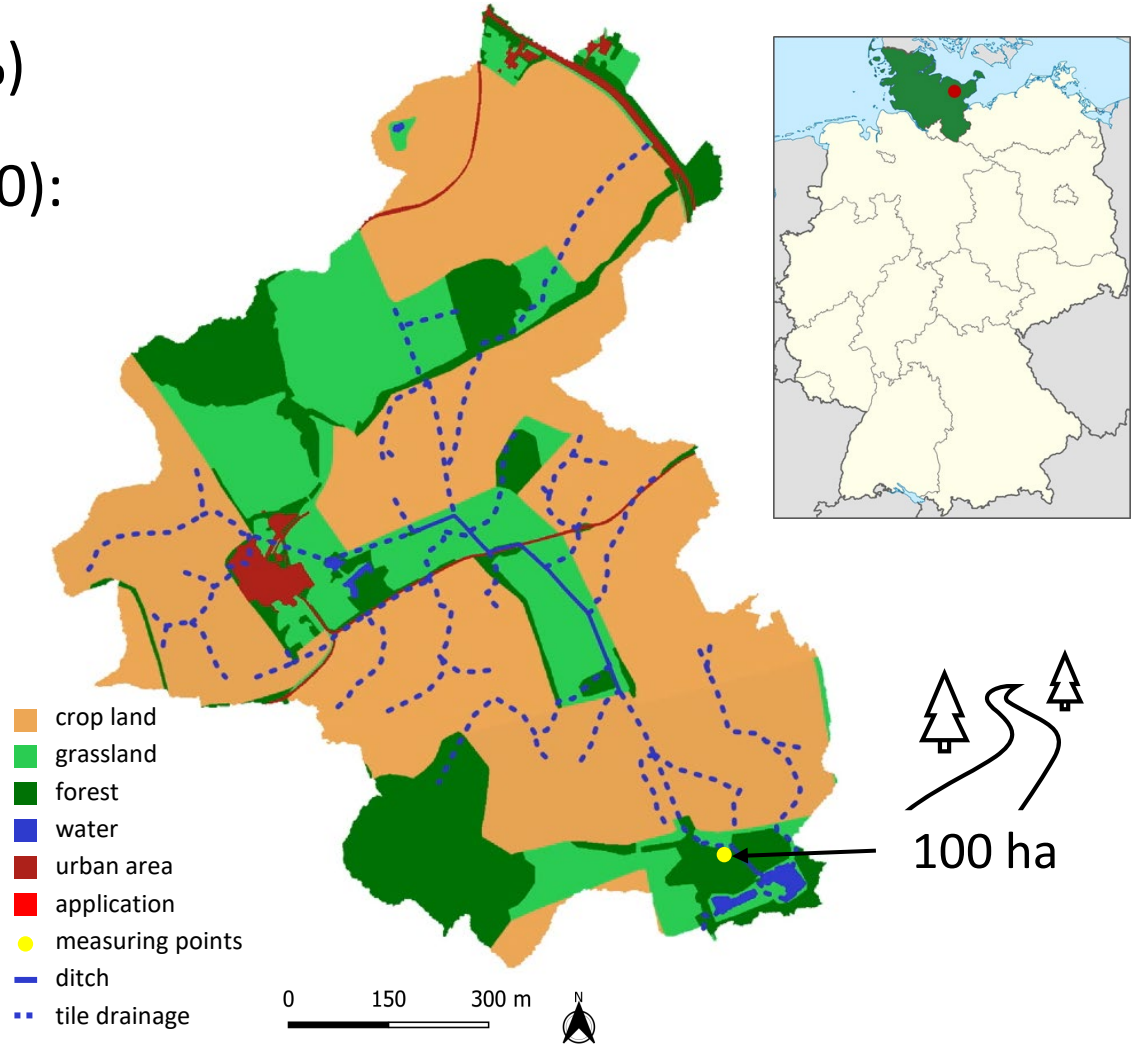
General information: Catchment area/farm

- Drainage network: 6.3 km (: 13%; : 87%)
- Measuring (daily mixed samples, 2016 - 2020):
  - Dry: Sep. 2016 to Feb. 2017 (Ø 52 mm/month)
  - Wet: Oct. 2017 to Jan. 2018 (Ø 102 mm/month)

Study area



(Lewis et al. 2016)



Model information

Model structure

- Tile drains (TD): 30 m buffer zone
- SWAT+ 60.5.4

Model evaluation

- Calibration of hydrology and pesticides: manual

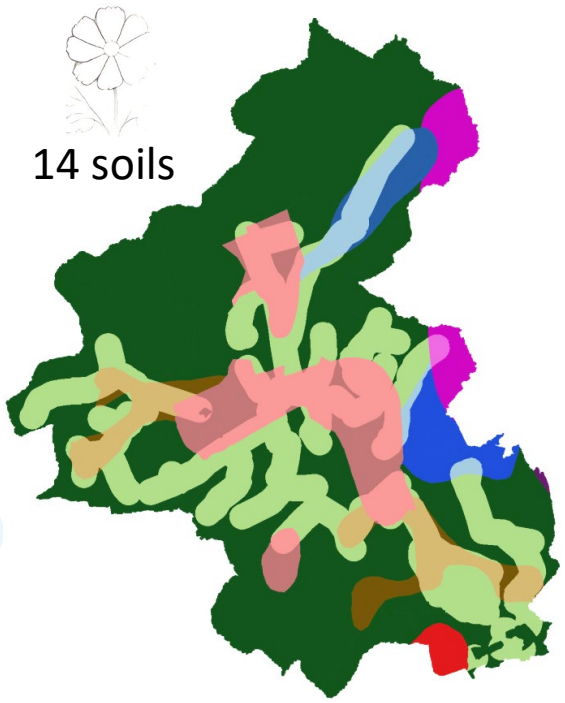
Method

	Hydrology	Pesticide
Calibration	Even months	Every second week
	KGE 0.83	KGE -0.06 / KGE 0.72 / KGE 0.65
Validation	Uneven months	Every first week
	KGE 0.79	KGE 0.26 / KGE 0.52 / KGE 0.62
Reasons	Contrasting weather conditions	High level of non-stationarity

Spatial heterogeneity of soils and the implementation in SWAT+

Method

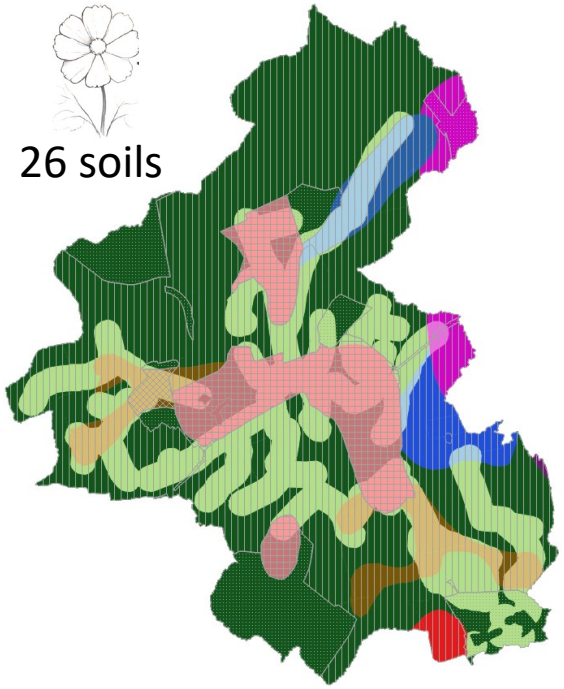
14 soils



TD
- Luvisol
- Gleysol
- Stagnosol
- Histosol
- Cambisol
- Colluvic Gleysol
- Stagnosole-Luvisol

Typical soil map

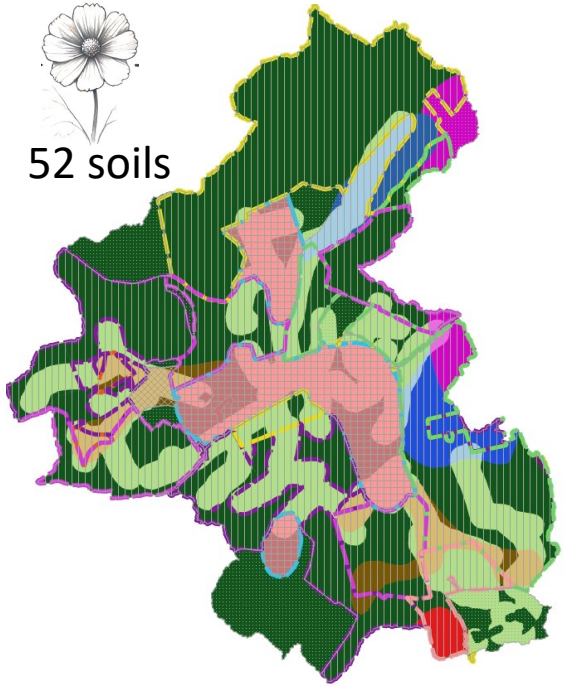
26 soils



Maximum rooting depth according to land use

- Crop land
- Grassland
- Forest
- Yard

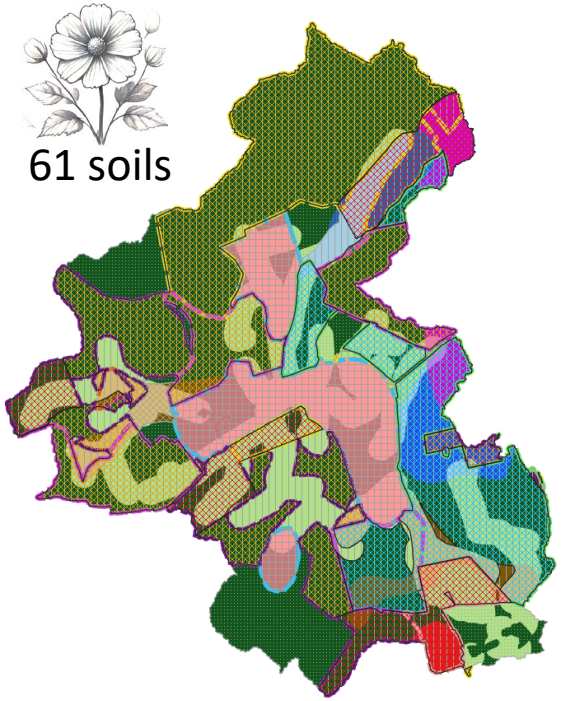
52 soils



Particle size*

- Loamy sand
- Heavy loamy sand
- Loam
- Organic matter
- Slightly loamy sand
- Sandy loam
- Loam over organic matter

61 soils

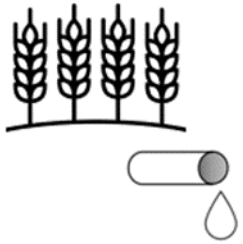


Condition of fertility*

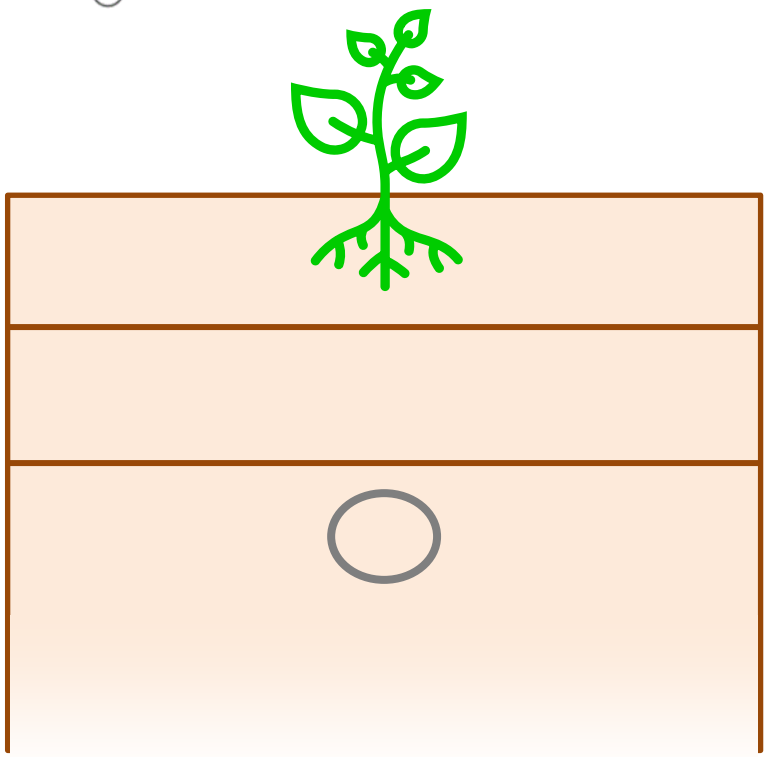
- Condition of medium fertility
- Transition state
- Condition of lower fertility

*Reichsbodenschätzung 1934

Further spatial adjustments



Tile drains 65 cm deep



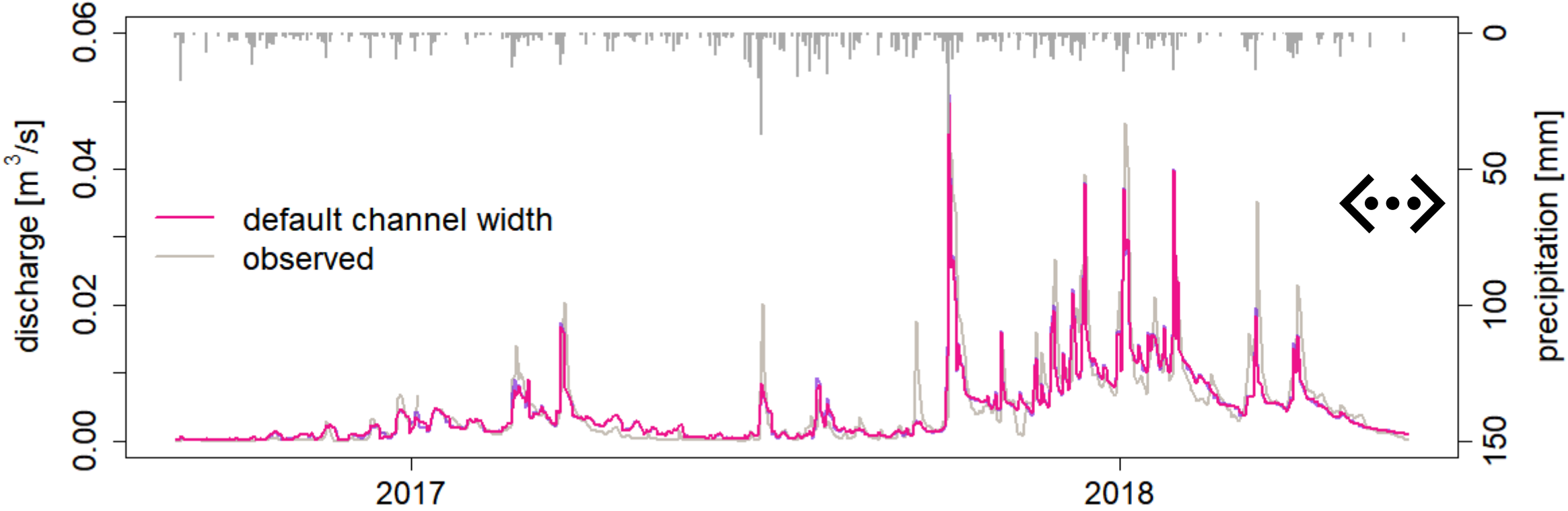
Influence of too wide channels

Method

Hydrology

Results

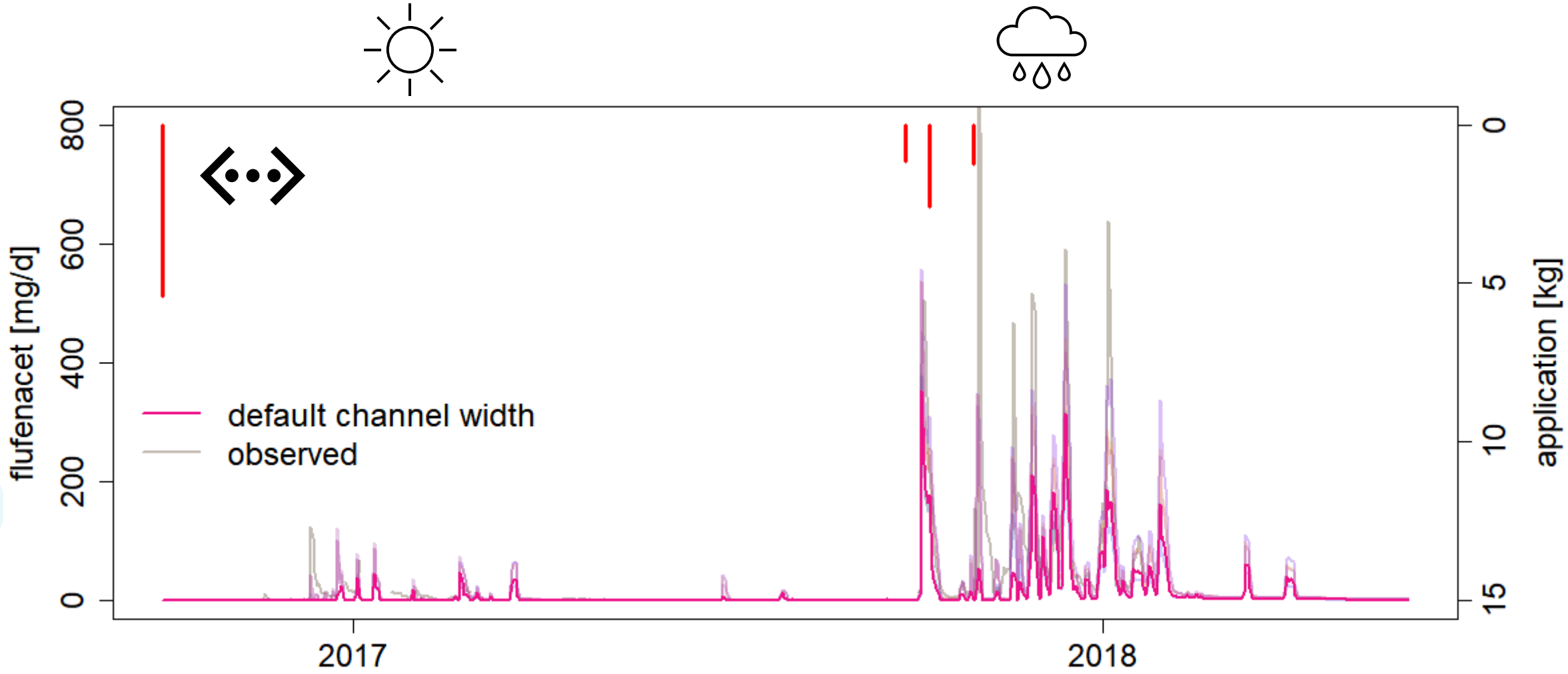
How does soil heterogeneity affect discharge?



Results

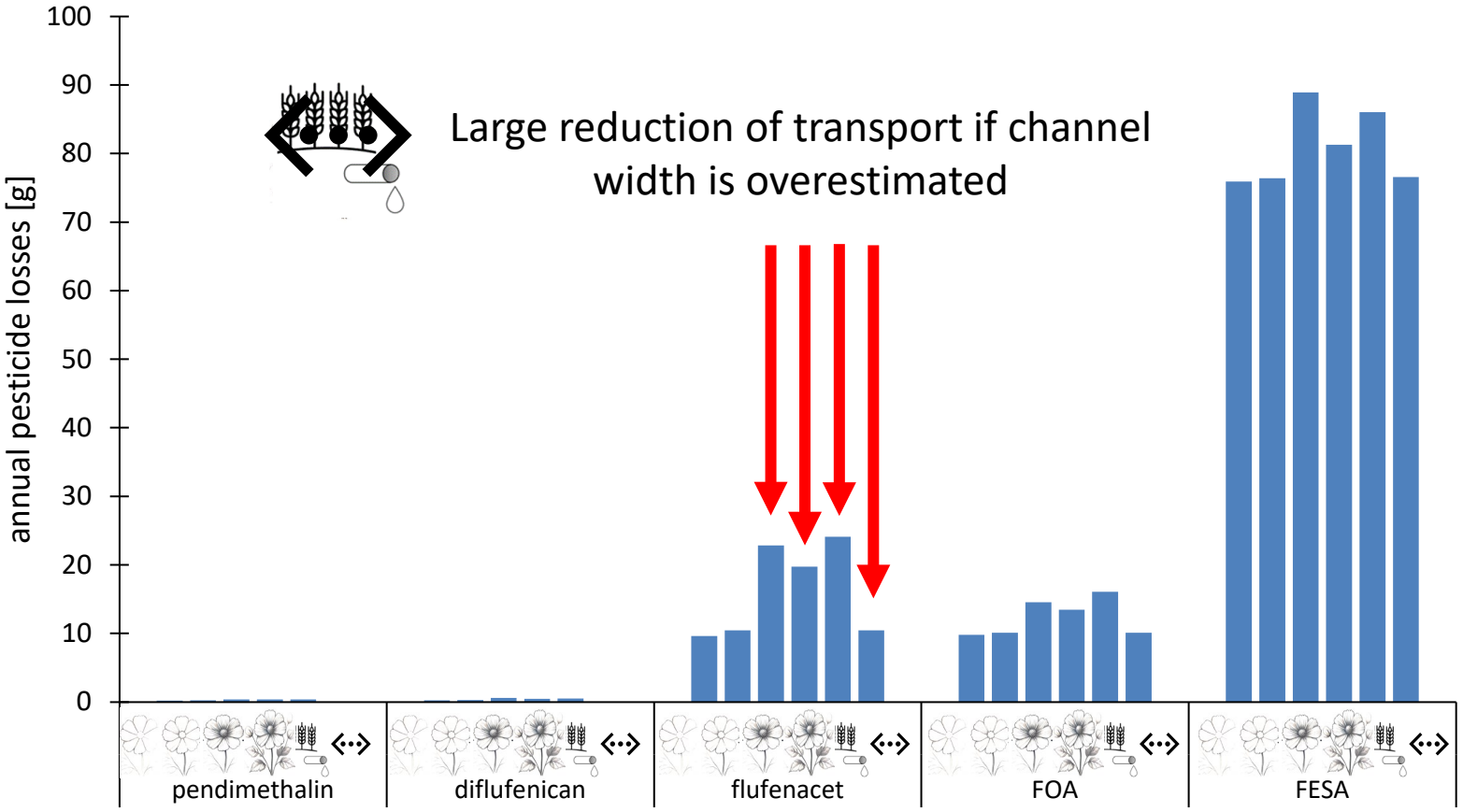
Pesticides

What is the influence of soil heterogeneity on pesticide transport?



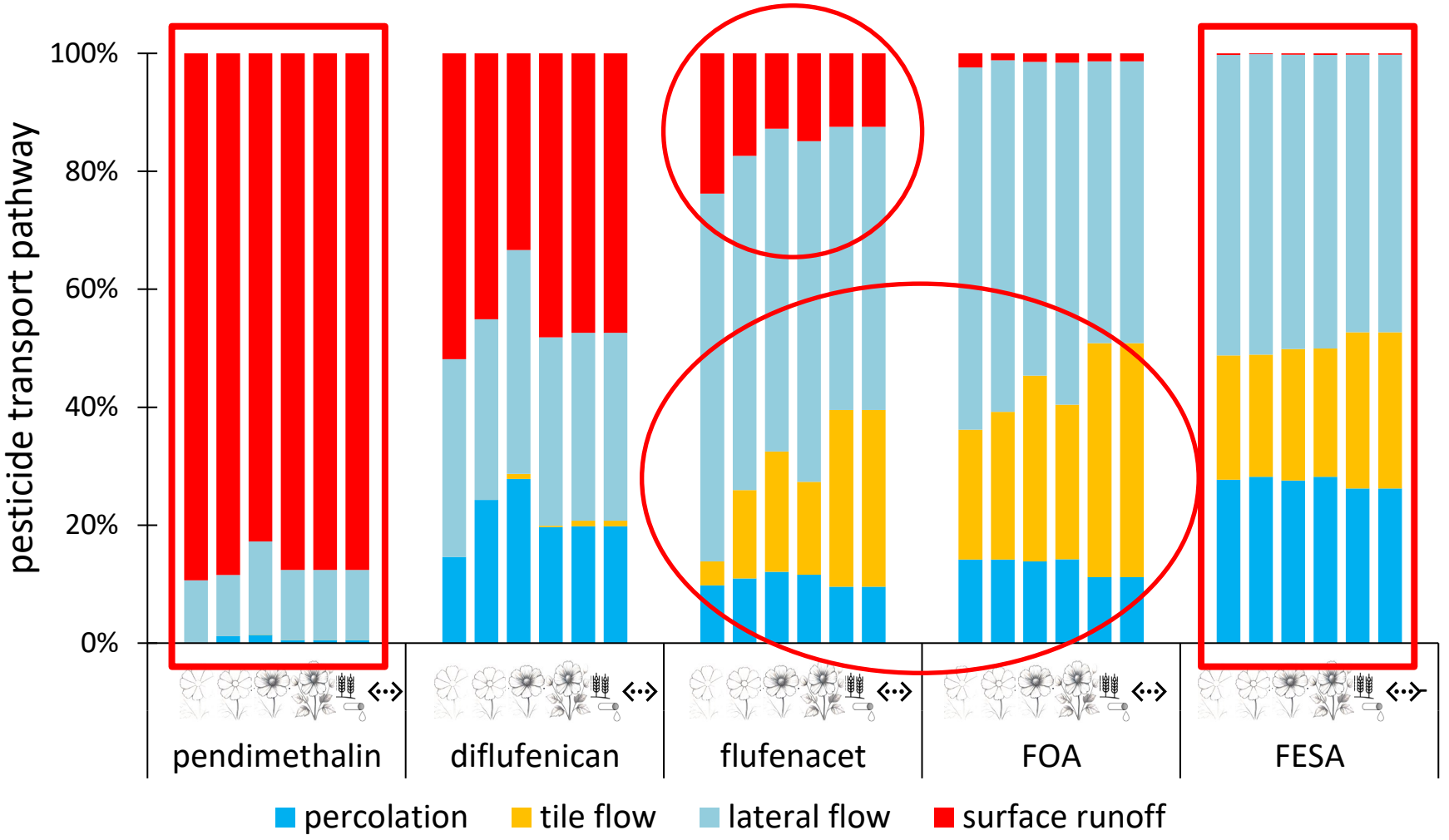
Results

Difference in total pesticide losses



Results

Difference in the importance of the transport pathway

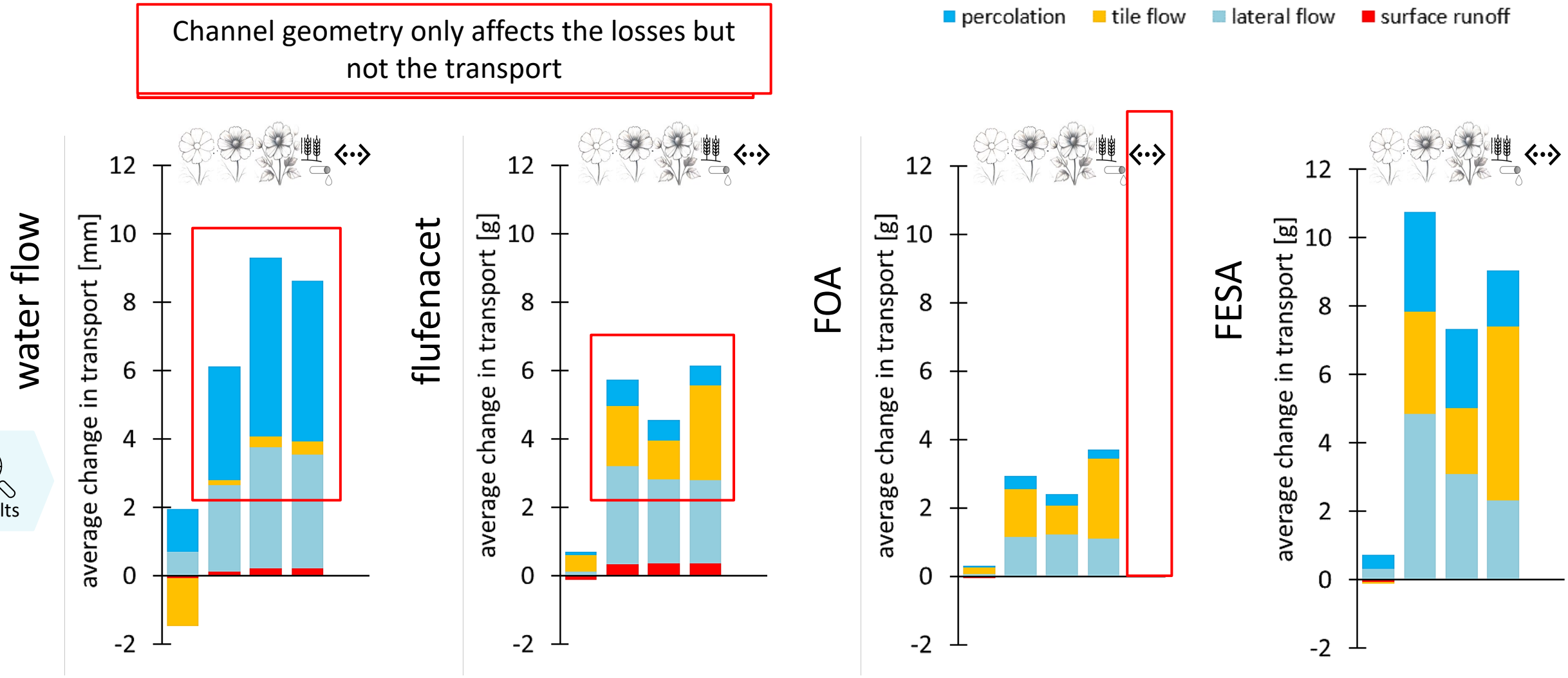


Surface runoff are becoming **less** important

Results

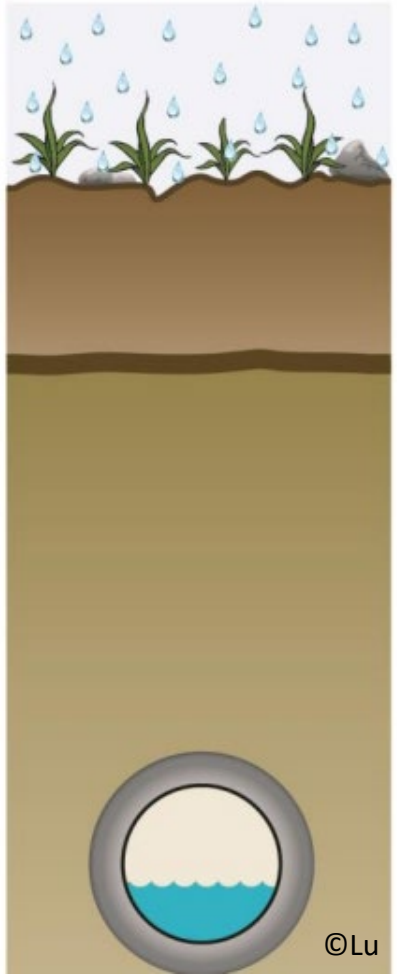
Changes in transport according to the **base scenario**

Channel geometry only affects the losses but not the transport



Results

Conclusion

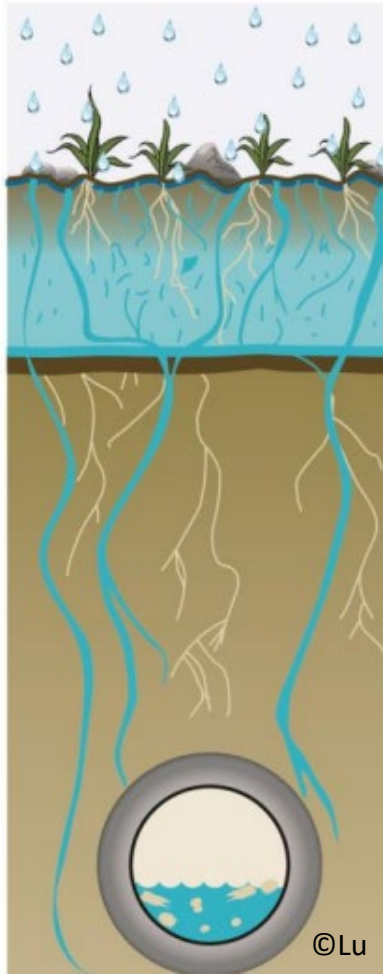


The impact on hydrology seems to be **negligible**.

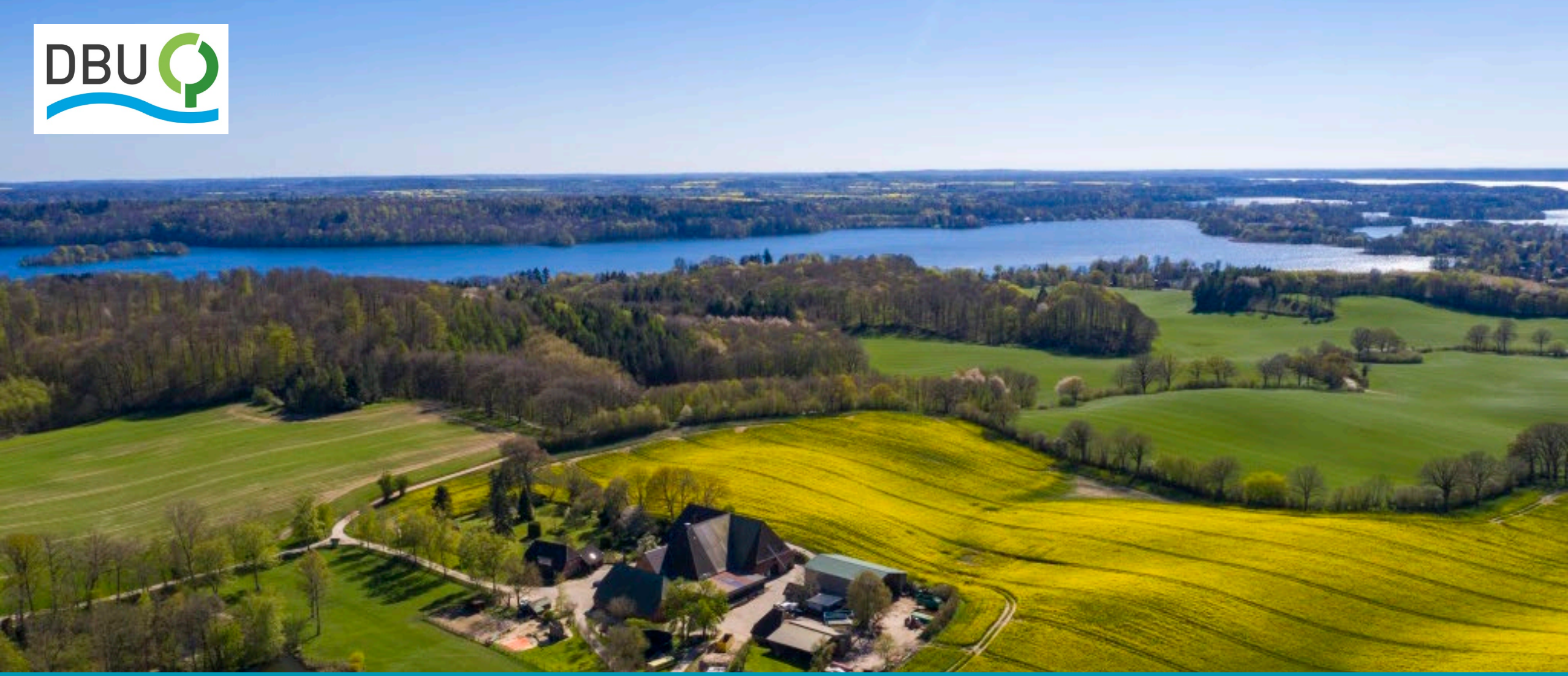
The modelling of pesticide transport benefits from a **higher resolution** of the soil classification.

Pesticides that have **sufficient mobility** but are still influenced by **soil properties** are more affected.

The **location of tile drains** and soil stratification have an influence on the amount of pesticide losses.



Conclusion



Thank you for your attention

awendell@hydrology.uni-kiel.de

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Model evaluation

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Method

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	KGE 0.83 (α 0.85, β 1.04, r 0.93)	Non-mobile: KGE -0.06 (α 0.31, β 0.23, r 0.80) Moderately mobile: KGE 0.72 (α 0.95, β 0.89, r 0.77) Very mobile TPs: KGE 0.65 (α 0.68, β 1,04, r 0.87)
Validation	Uneven months	Every first week
	KGE 0.79 (α 0.84, β 0.99, r 0.86)	Non-mobile: KGE 0.26 (α 1.10, β 0.46, r 0.50) Moderately mobile: KGE 0.52 (α 0.68, β 0.73, r 0.76) Very mobile TPs: KGE 0.62 (α 0.71, β 1,10, r 0.78)
Reasons	Contrasting weather conditions	High level of non-stationarity

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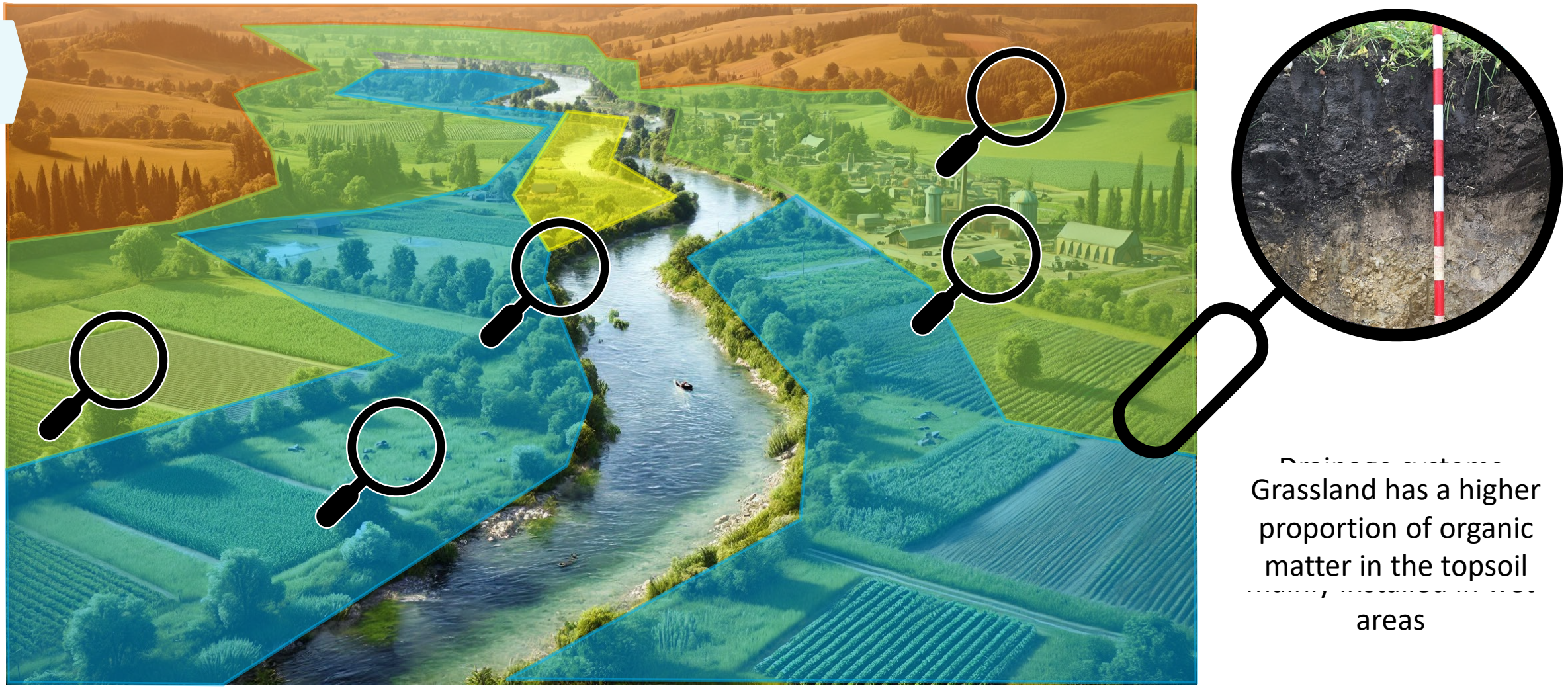
Motivation



Grassland has a higher proportion of organic matter in the topsoil

areas