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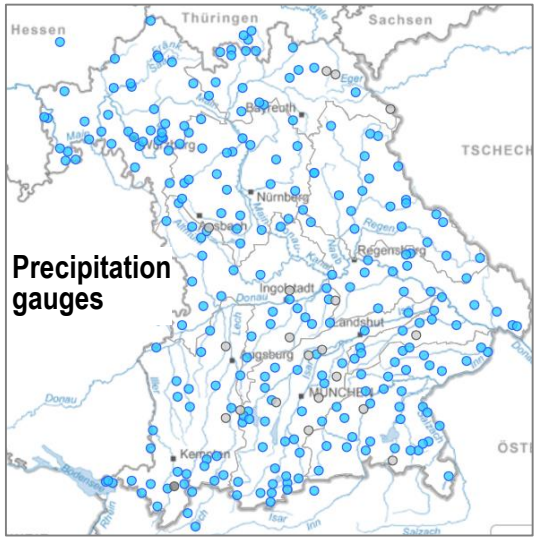
Bavarian Scientific Institute
for Agriculture

Capturing Hydrolological And Sedimentological Connectivity from Cropland Plots to Catchments - Integrating Experimental Sites into a Multi-Scale Approach

Johannes Mitterer and Florian Ebertseder

EGU 2025 – HS2.3.1

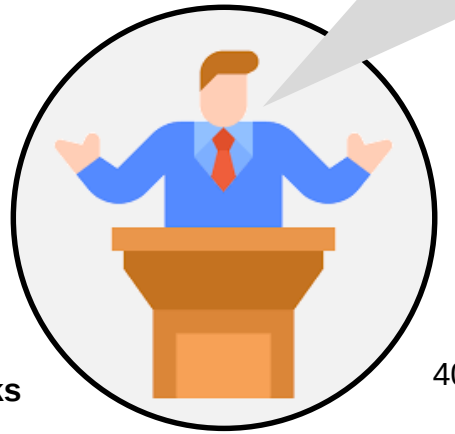
A common starting point…

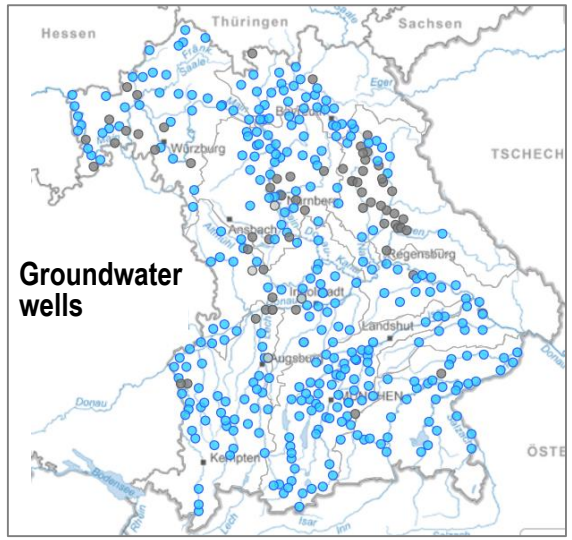


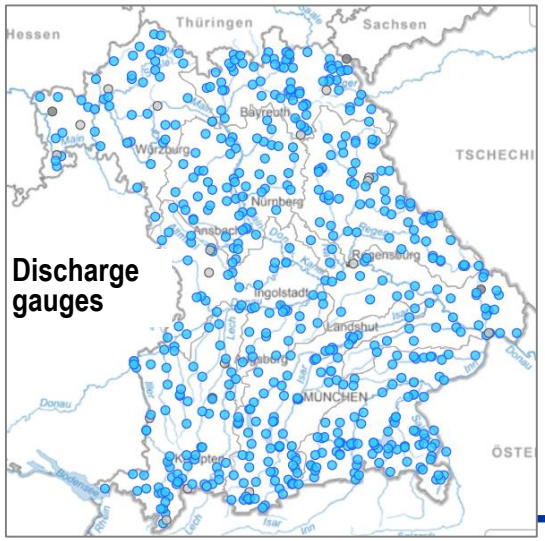
Yearly erosivity	+78%
# erosive events	+20%
Event erosivity	+43%
Heavy P intensity	+25%
Heavy P amount	+14%
Yearly P intensity	+7%
Yearly P amount	+2..3%

(Mohr/Kunz 2013, Mueller/Pfister 2011, Lenderink / van Mejigaard 2008, Bürger et al. 2014, Rahmsdorf 2018)

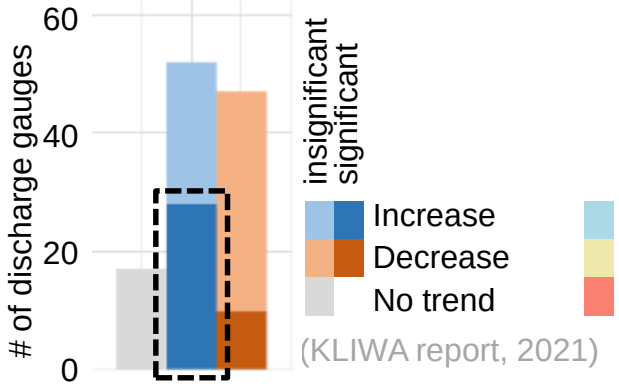
1. What are the **reasons**?
2. What are the **options**?
3. **Which** should be applied **where** and **when**?



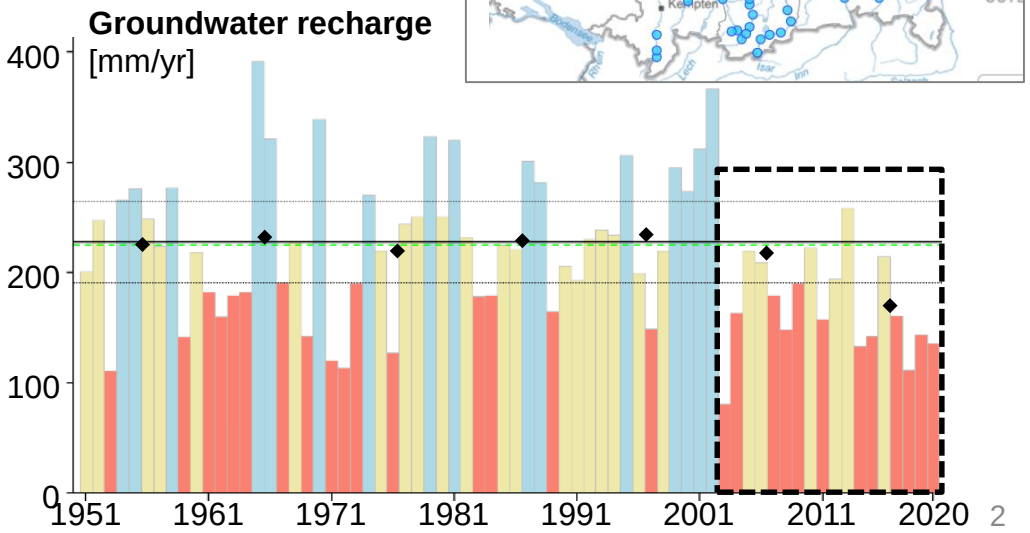




Trends in **summer flood peaks** (1932-2020, GER south)

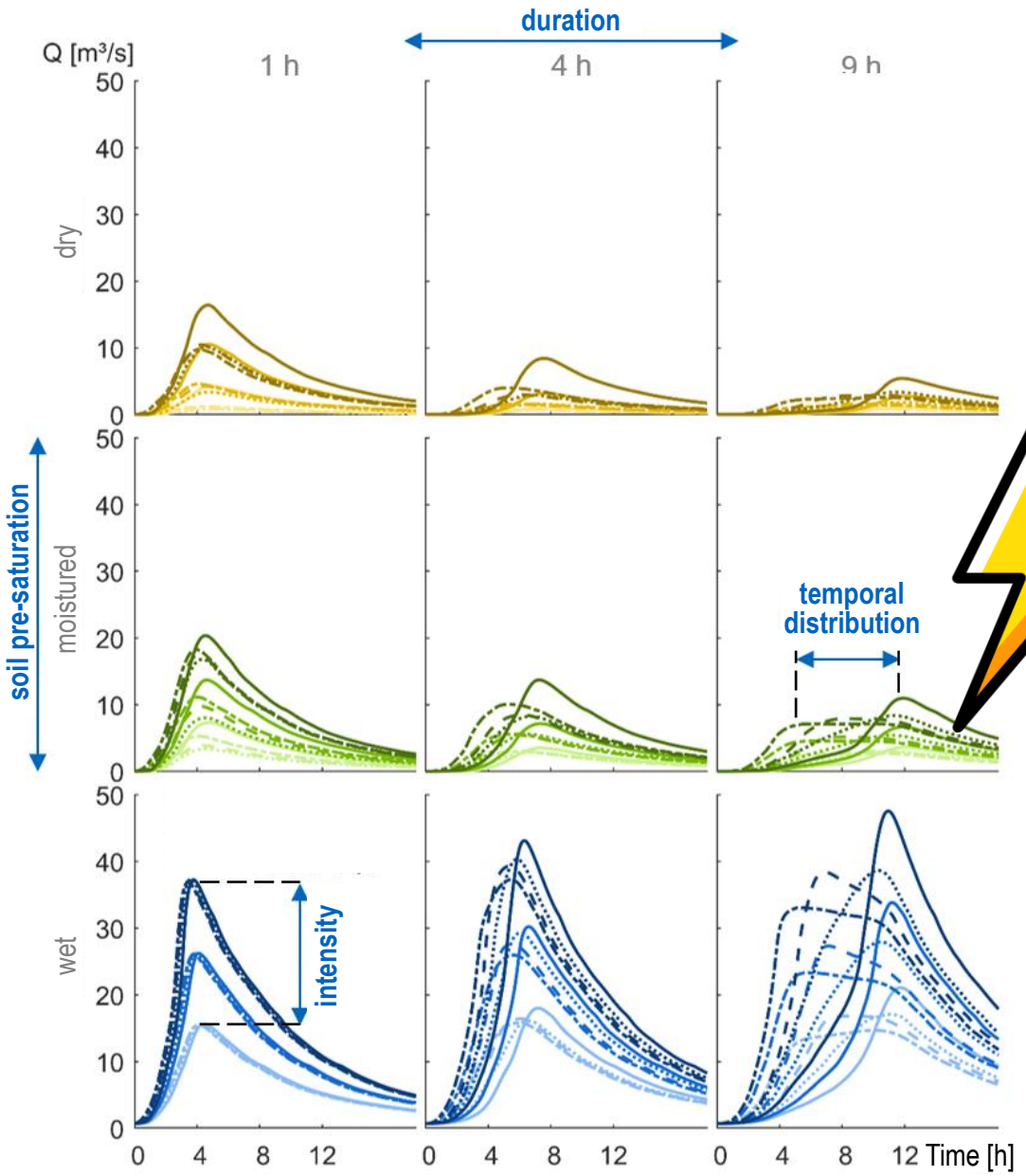


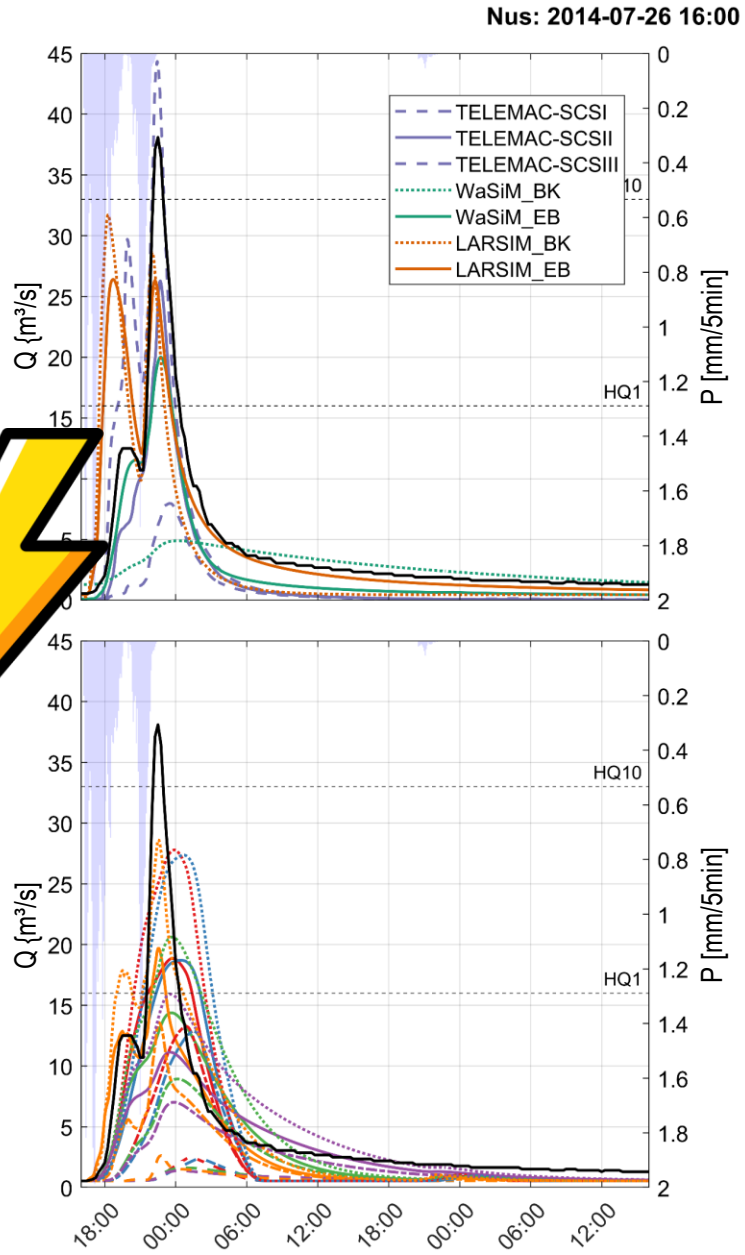
(KLIWA report, 2021)

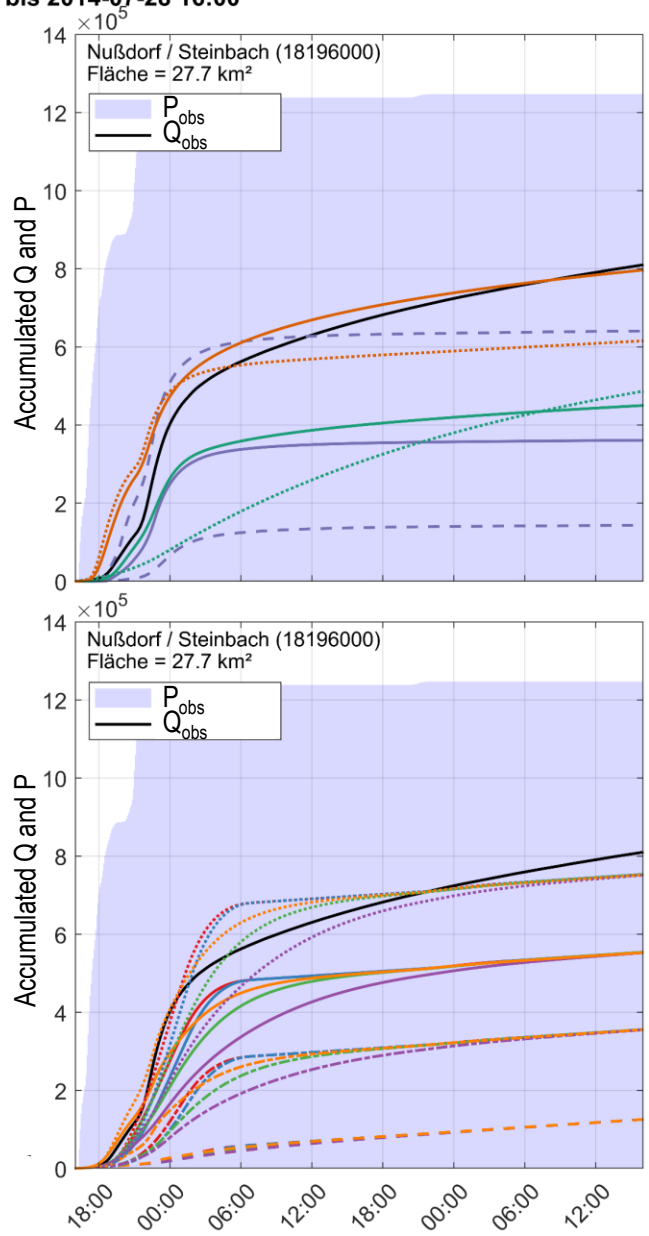


Modeling scenarios as solution?

(project HiOS, 2021, unpubl.)

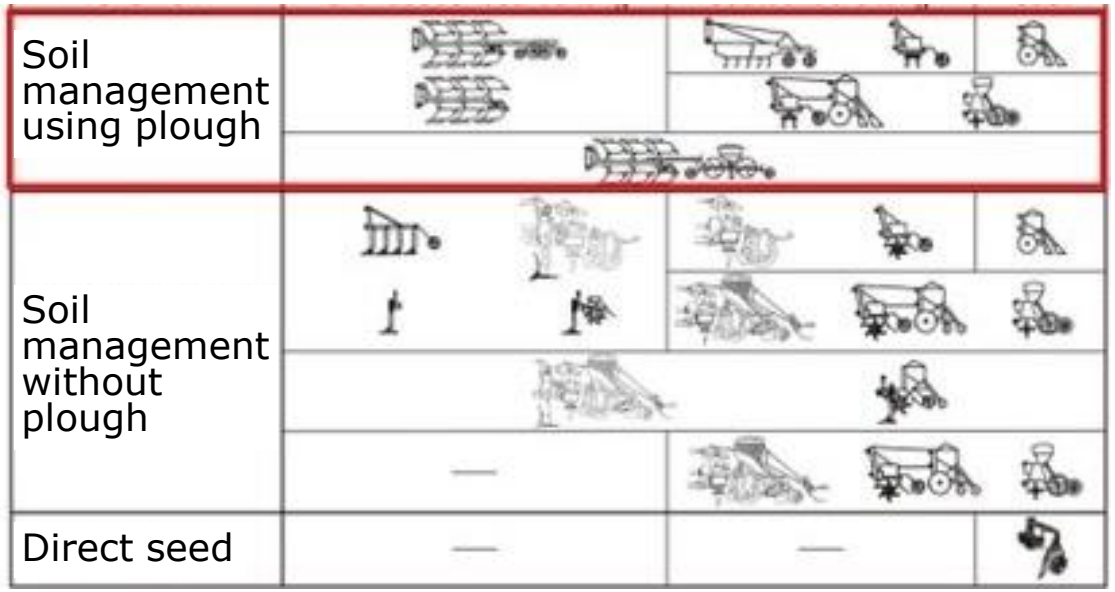






What does „cropland“ mean hydrologically?

>50% of Bavarian catchments are dominated by agriculture!



Übersicht und Einordnung von Bodenbearbeitungsverfahren (Quelle: KTBL, Kuratorium für Technik und Bauwesen in der Landwirtschaft 1998. Bodenbearbeitung und Bodenschutz - Schlußfolgerungen für die gute fachliche Praxis. Arbeitspapier 266.)

Quelle: terraHorsch

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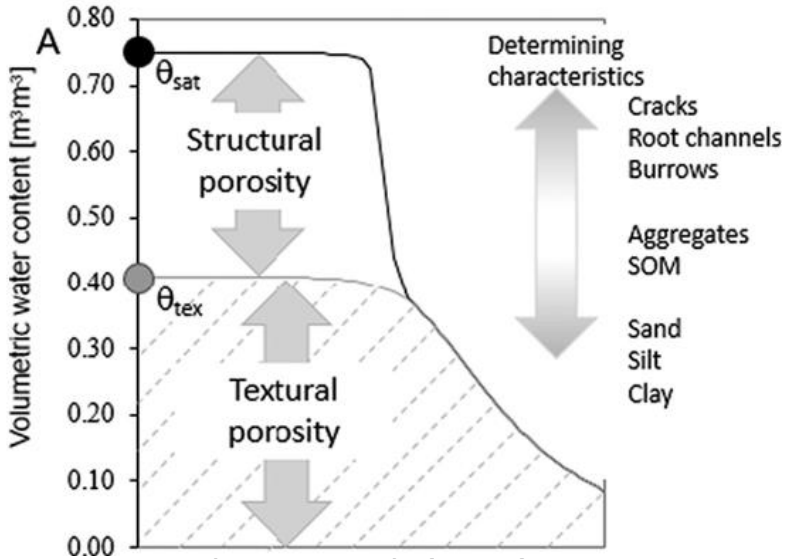
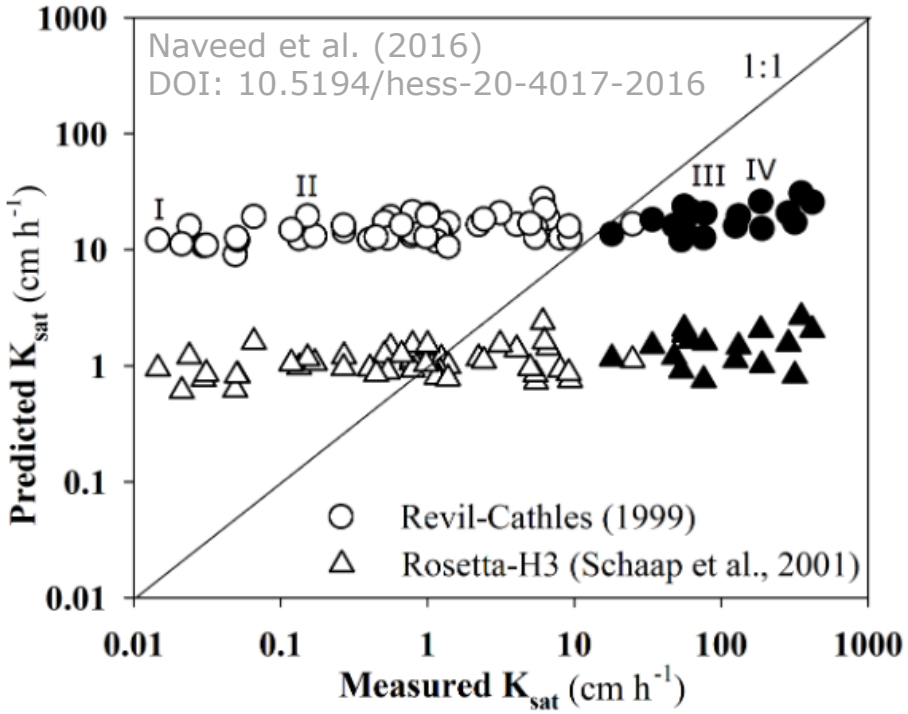
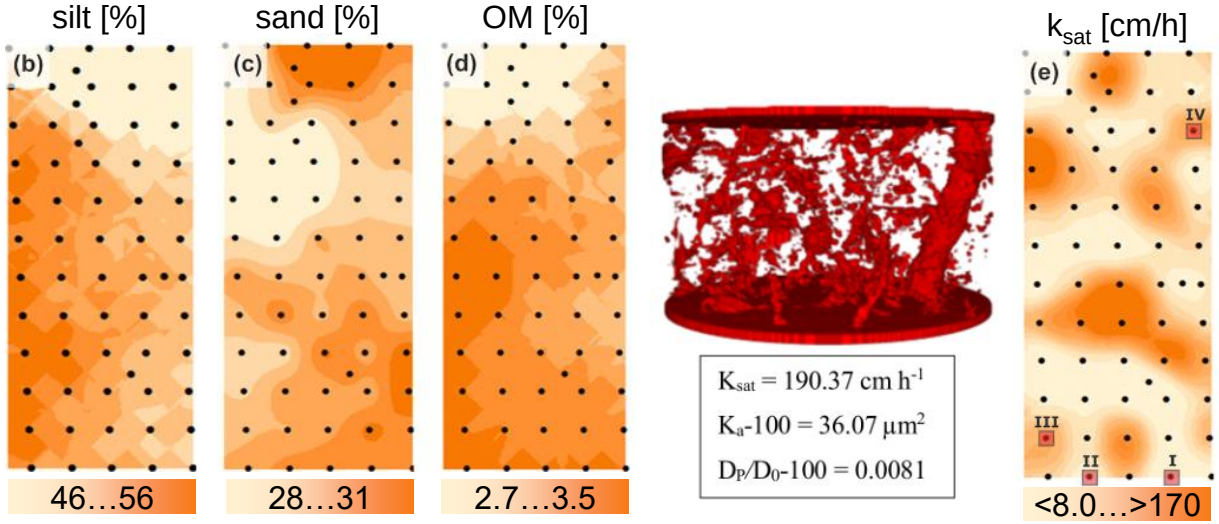
The blind spot in soil-hydrological modeling: Structural porosity in space and time



Robinson et al. (2022)
DOI: 10.1016/j.scitotenv.2022.158506
Bronstert et al. (2023)
https://doi.org/10.1002/hyp.14875



Mitterer et al. (2024)
(unpublished)



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Challanges for modeling plot scale measures on catchment scale

Plot scale (0.001-0.1 km²) Lower meso-scale (0.3-2.0 km²) Upper meso-scale (10-100 km²)

Challanges:

- Limited process understanding under agricultural management
- Limited knowledge on scaling effects of processes
- Disatisfying data availability of small-scale features on catchment scale
- High spatial and temporal complexity

→ **Larger area on cost of process, spatial and temporal complexity**
→ Limited (and partially false!) predictions/projections for scenario simulation

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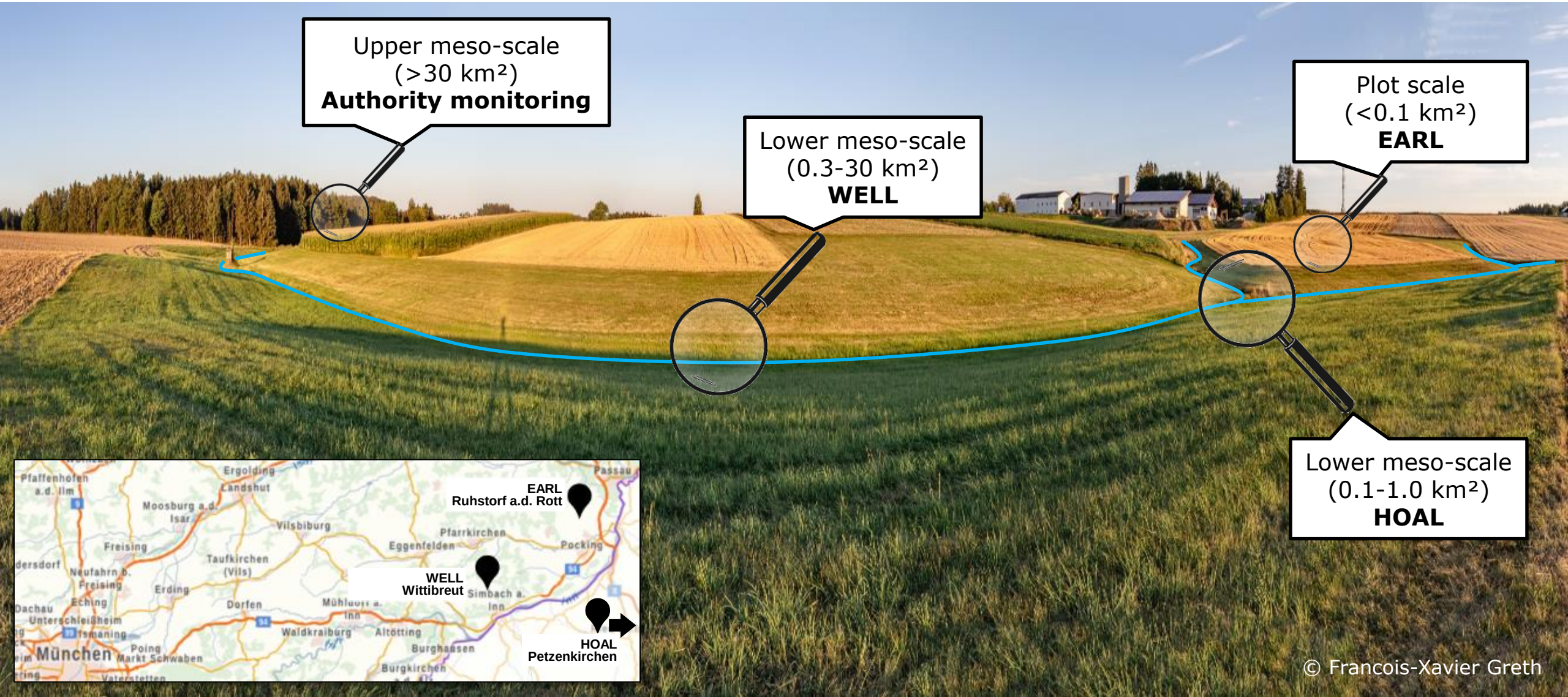
Multi-scale Integration of Experimental Sites

Important note: **All are within the same landscape unit**, the pre-alpine tertiary hills and integrate in terms of their scale focus

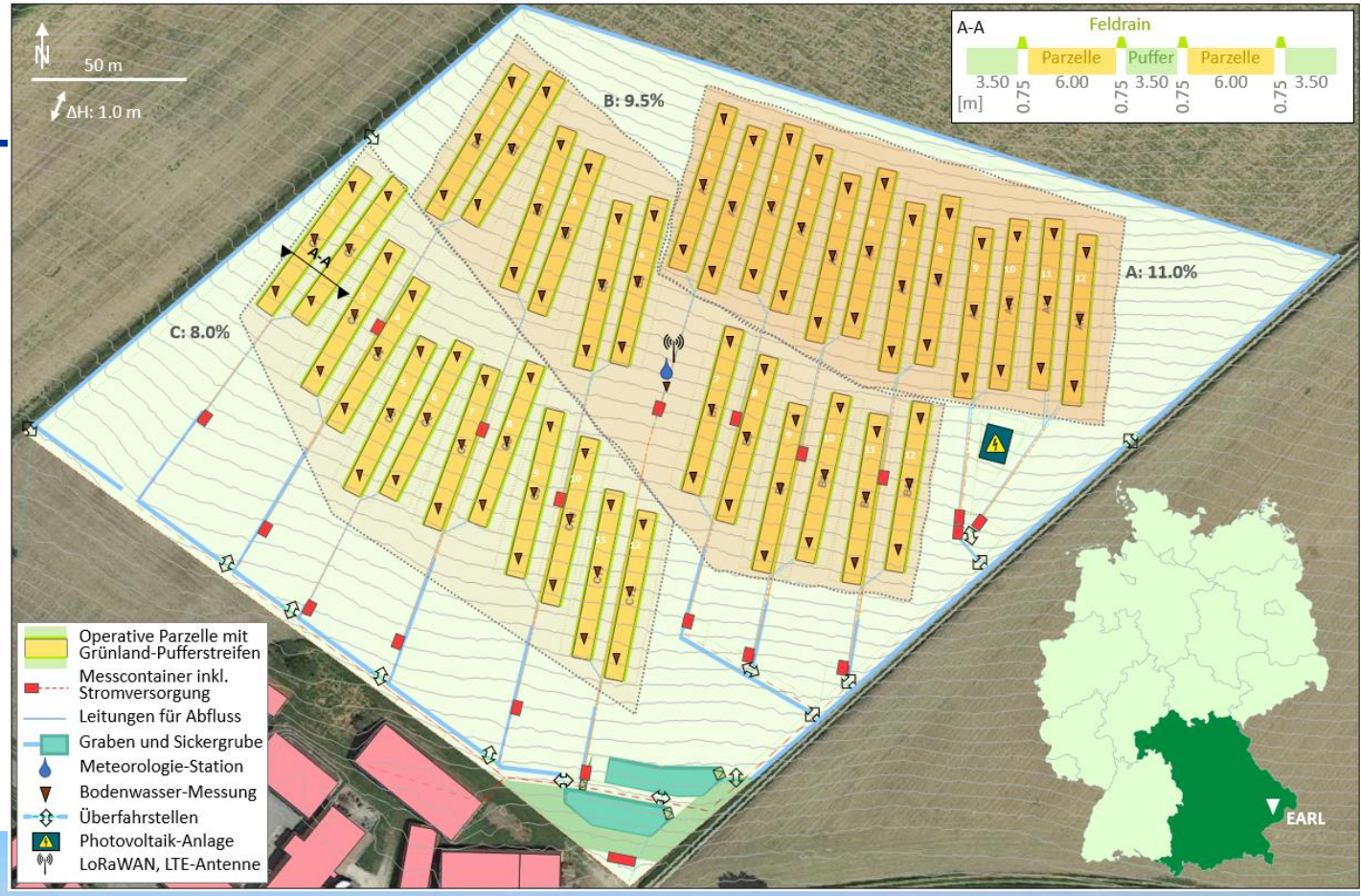


The Erosion And Runoff Laboratory

Some design criteria:

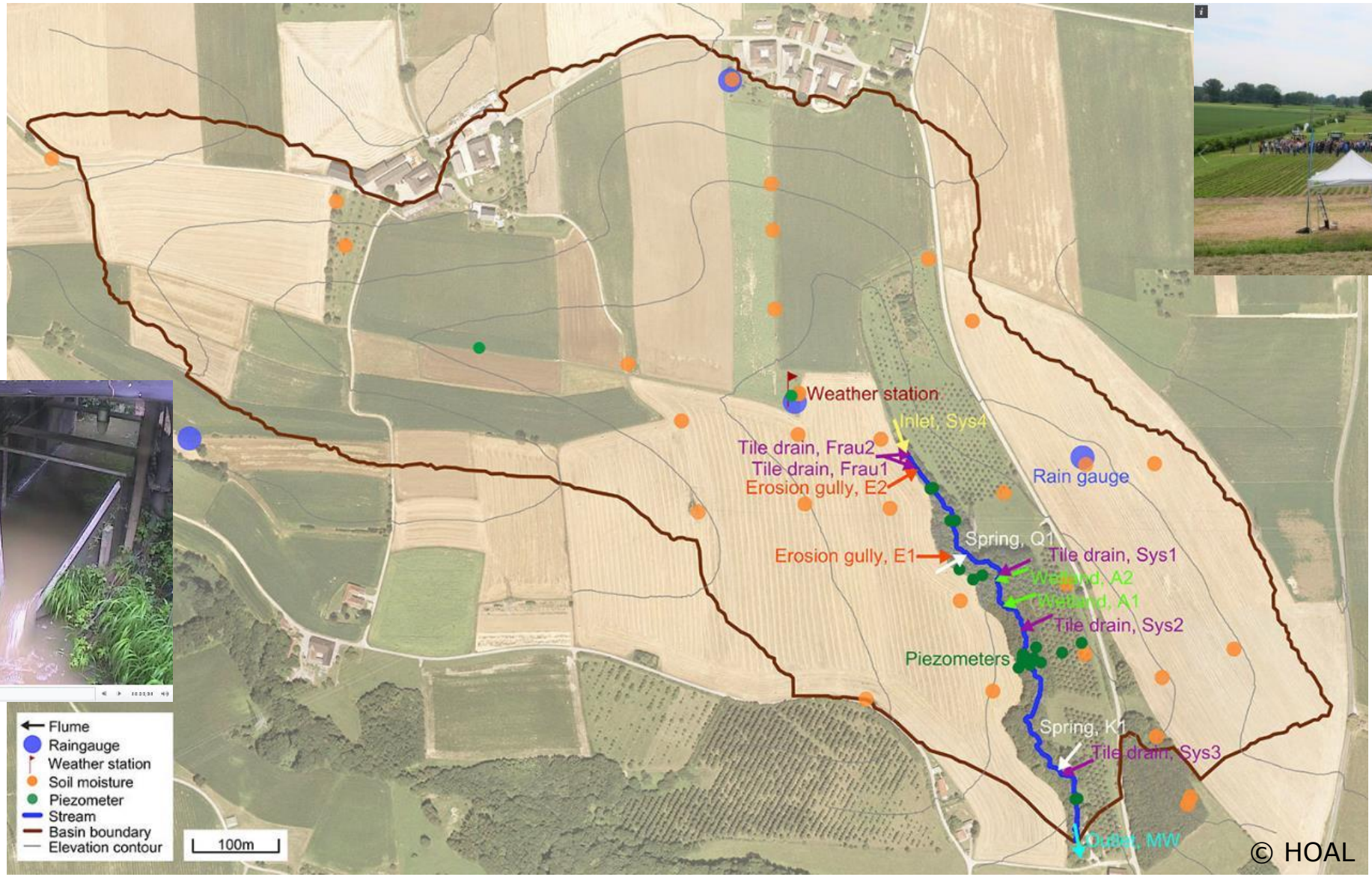
- **Scientific plot-scale monitoring platform**
- **Long-term experiment** (>10 years)
- Parcels with different **cropland schemes** (crop rotation and soil management)
- Large enough for **standard machinery**
- **Statisticly reliable** design
- **Open data portal** and collaborative approach

Interested? **Visit SSS10.2, Friday, 5:50 pm**



The Hydrological Open Air Laboratory

Petzenkirchen
(Austria)



Long-term
monitoring

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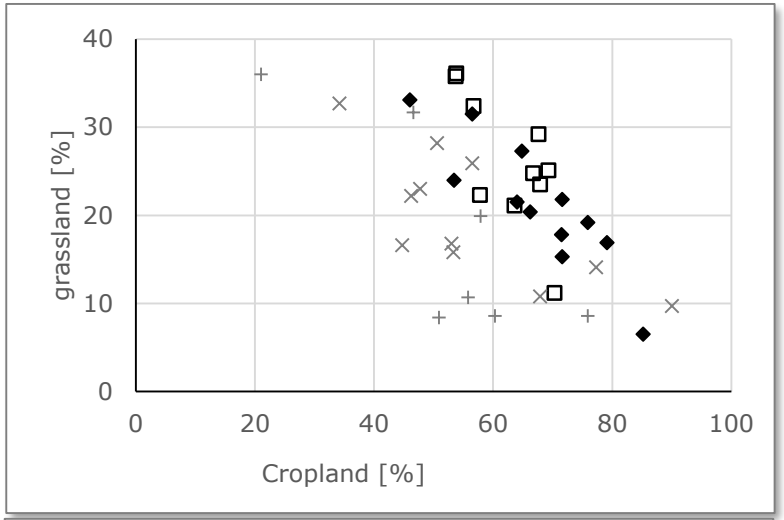
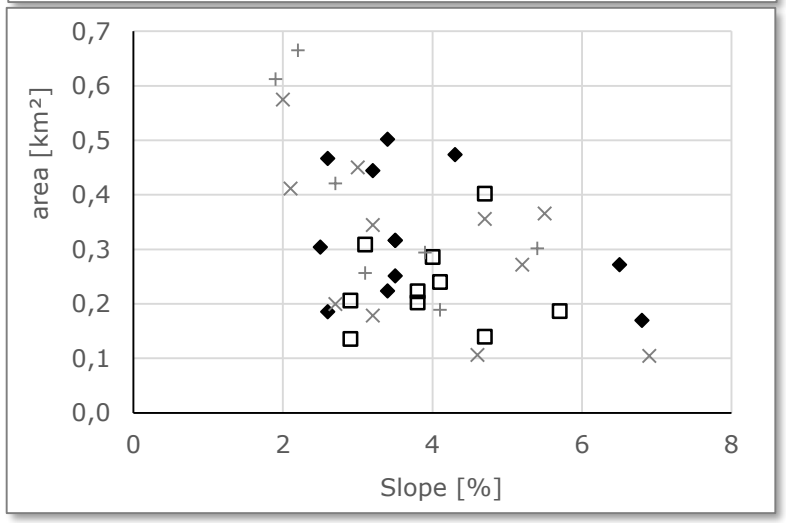
The Water and Environmental Landscape Laboratory – WELL





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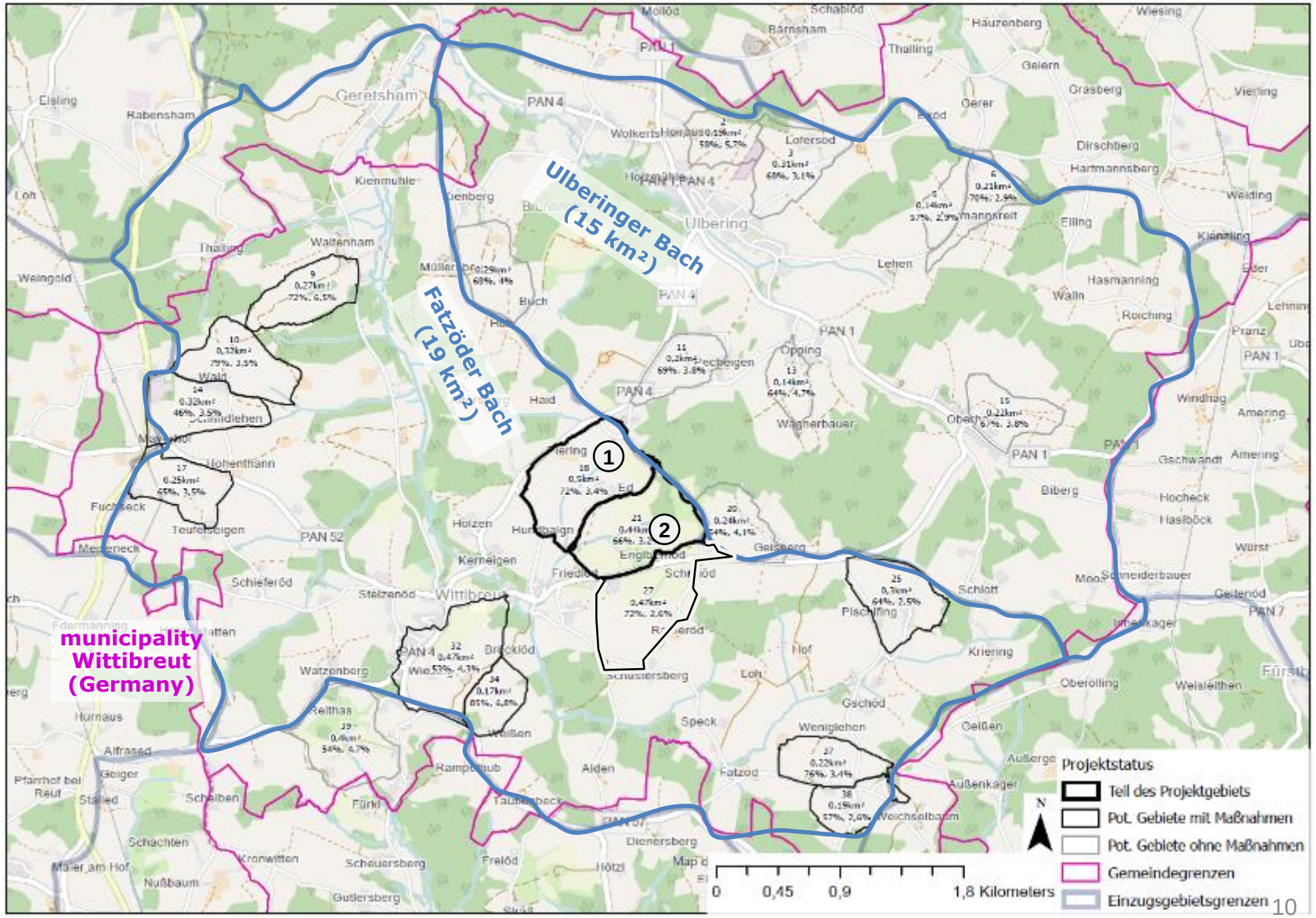
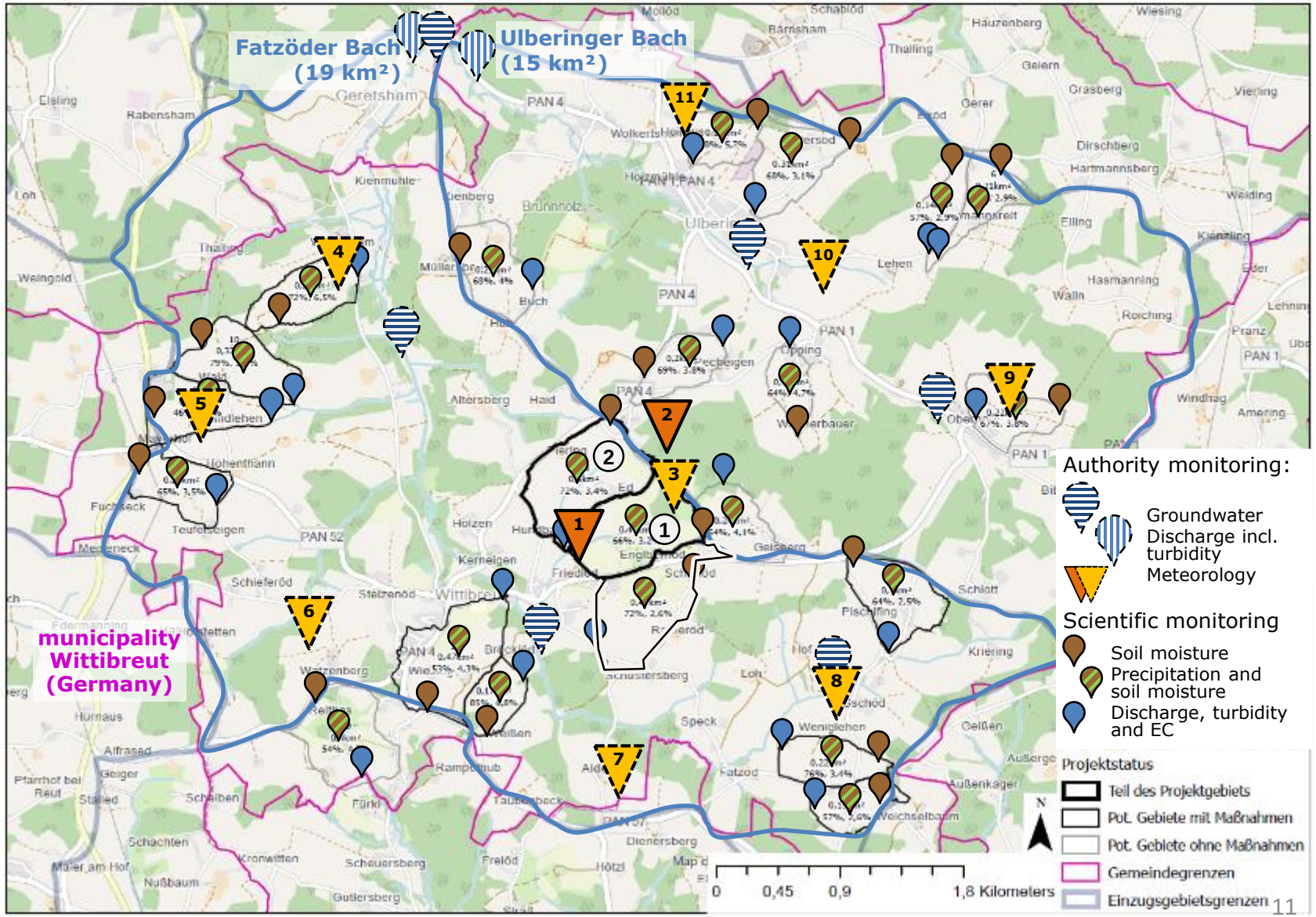


Monitoring Strategy in WELL: Get data about plot-scale details at catchment-scale

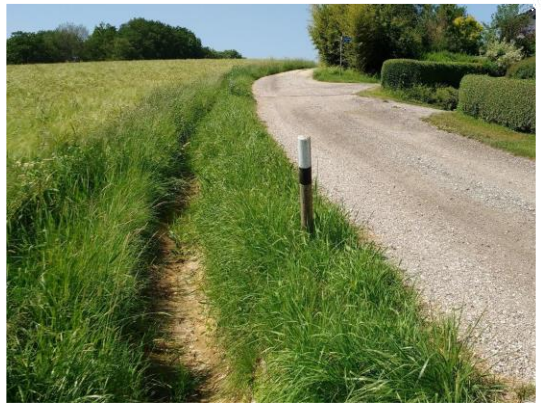


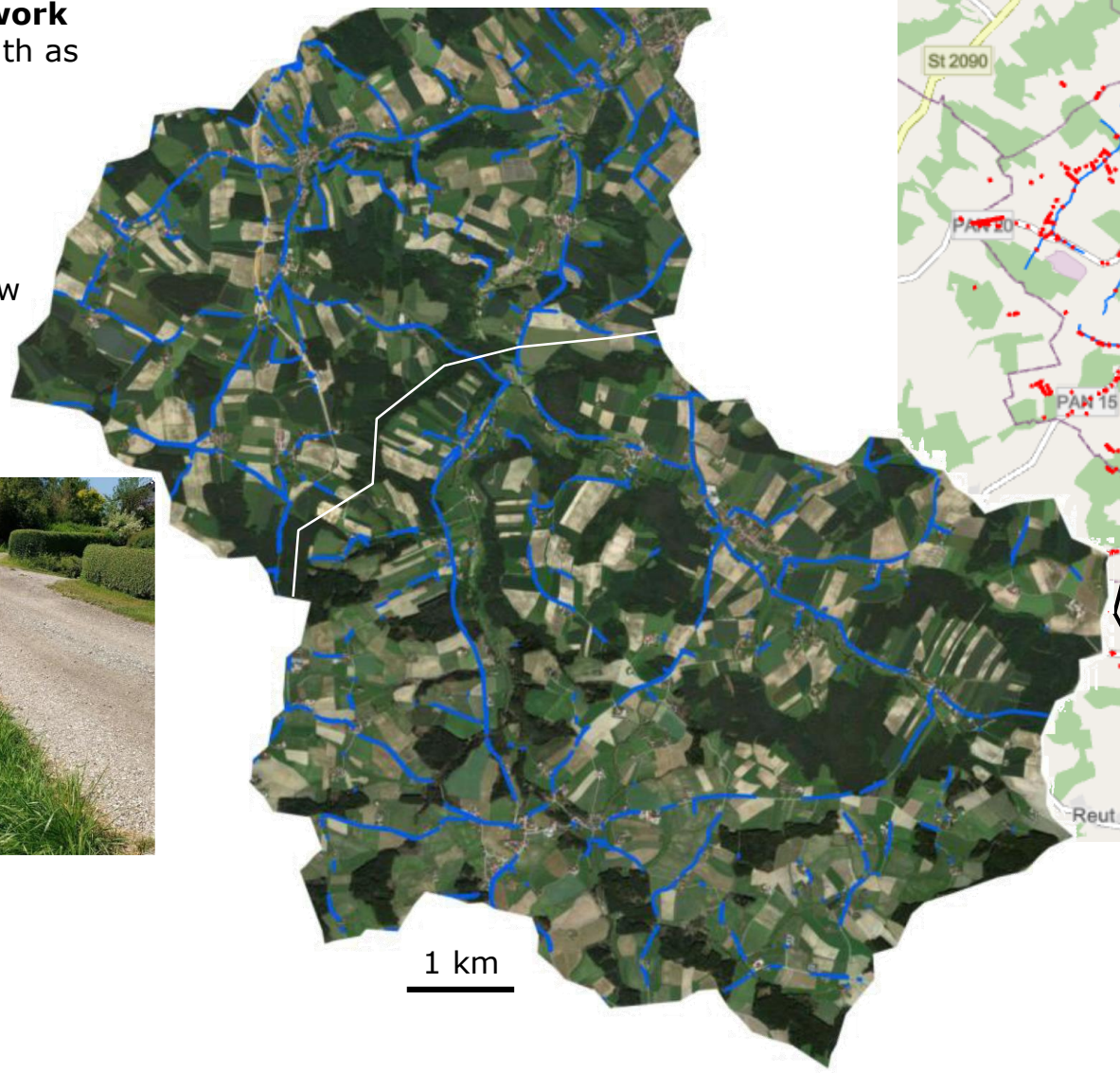
What about soil data?

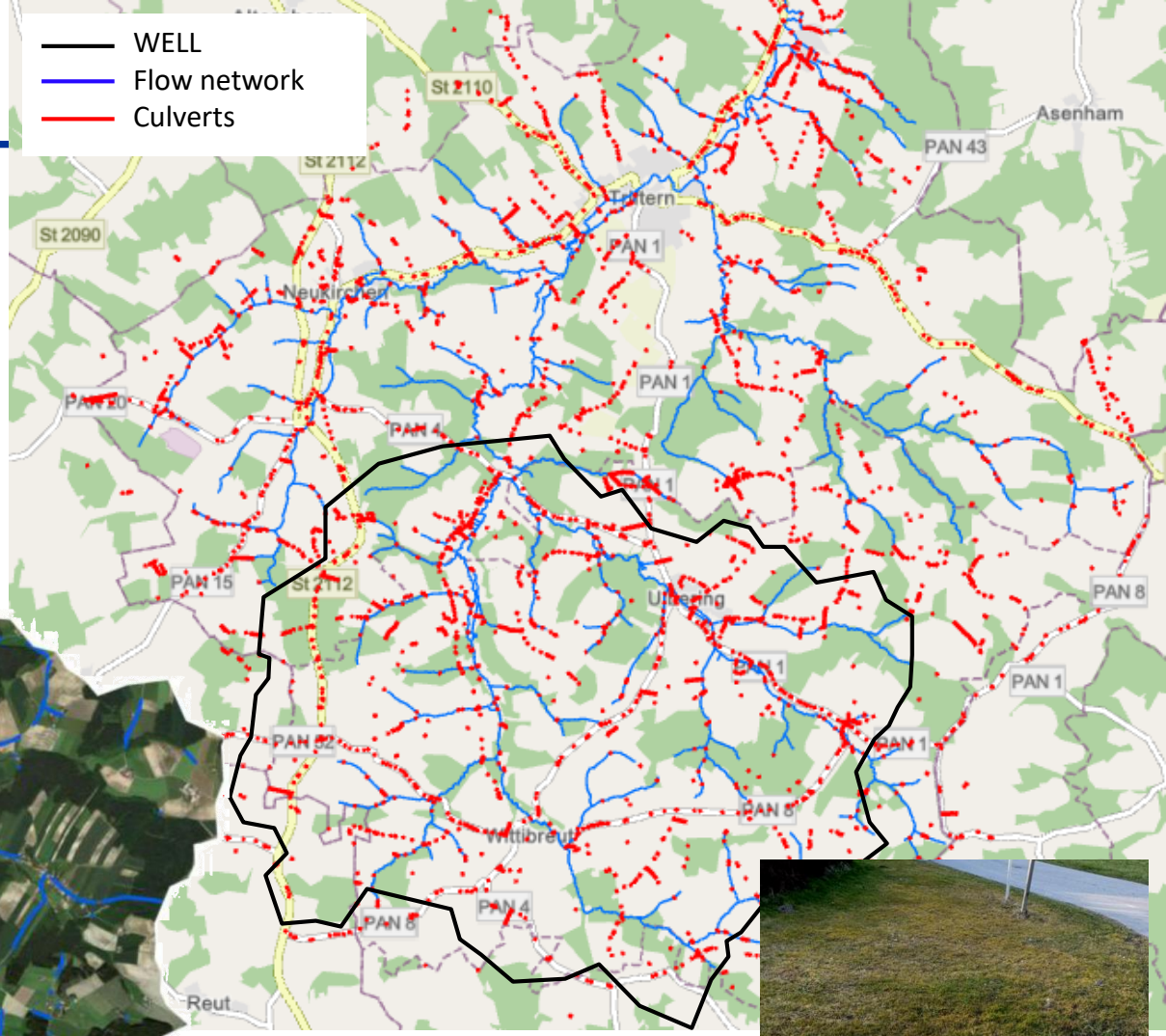
Example: Water Infrastructure

Secondary flow network
is about the same length as natural flow network
(Kordetzky 2019)

Secondary flow network







About 3,000 c**ulverts**
within 70 km²
(= 50 per km²)
(Einzinger 2023)

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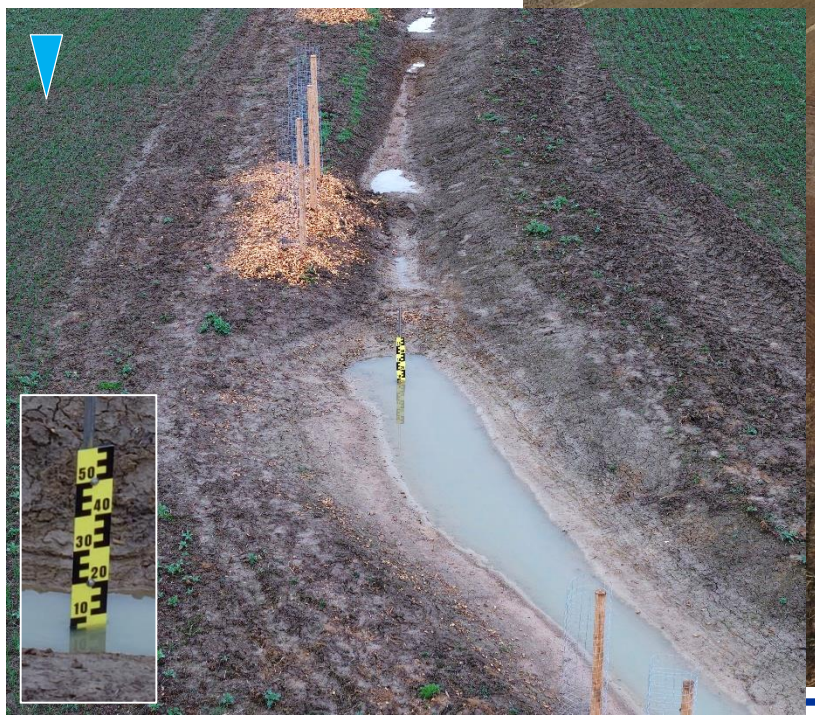
Plotskale monitoring within WELL: Masterline Agroforestry Site

(AgroMEDA project)



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Thank you.
Do you have any ideas or questions?

Johannes Mitterer and Florian Ebertseder