Monitoring- and Modelling System for the assessment of stress on groundwater resources and drinking water supply

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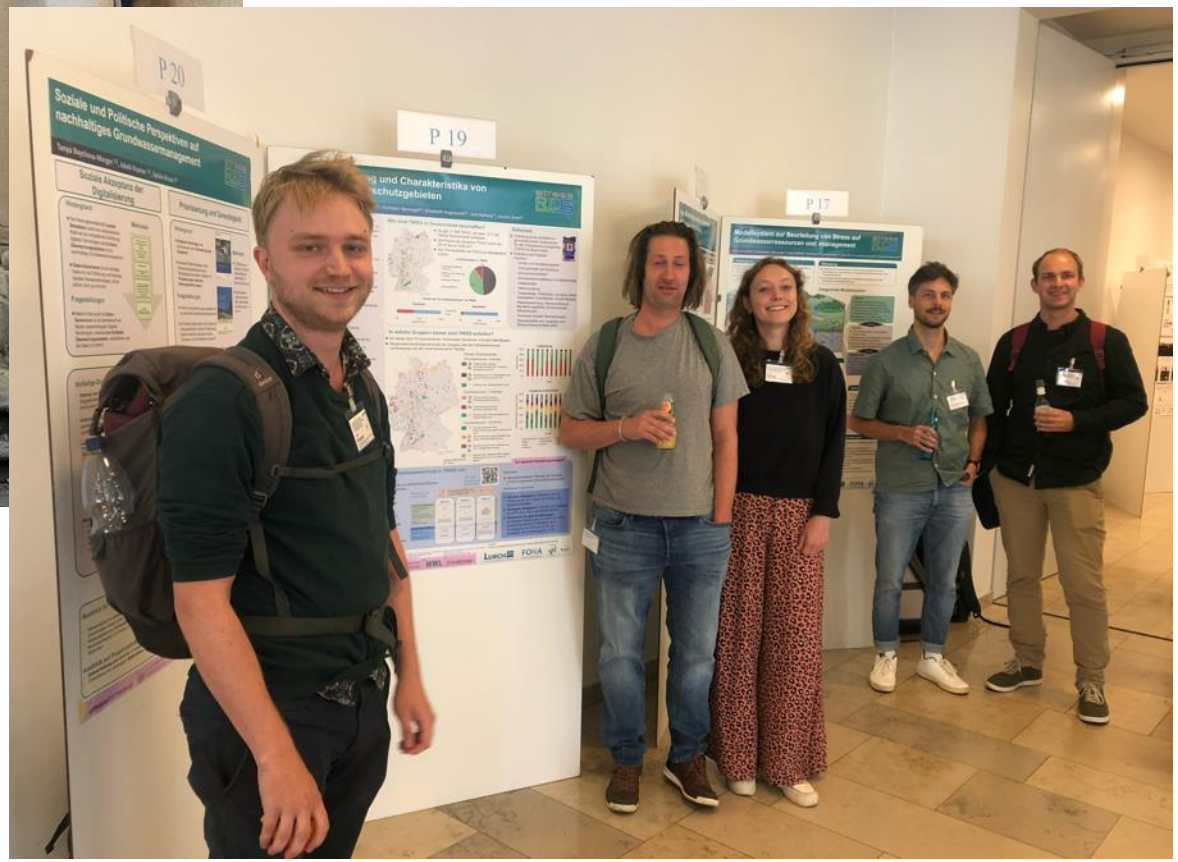
The StressRes Project Team!

Meeting, March 2024 in Hohenheim

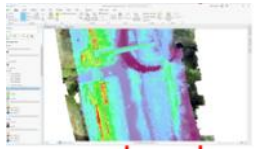
Last week in Frankfurt!

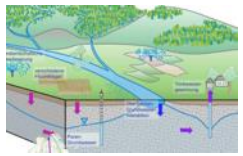


Background and Objectives

Stressors such as drought, competing water usages, pollution and climatic and economic changes require:

Interdisciplinary analyses, new monitoring tools and integrated models!





- **Situation:** Analysis of spatial, political und economic conditions and stressors
- **Monitoring direct und indirect groundwater recharge:**
  - Surface water – groundwater interaction
  - Observation with remote transmission of data (incl. water quality)
- **Model Stress Tests:** Stress Test analysis with a coupled model (agriculture-surface water-groundwater-water use)
- **Stress Test-Demonstrator:** Translation of results into generalized and widely applicable 'event scenarios'

Governance situation for groundwater-drinking water management

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Jakob Kramer
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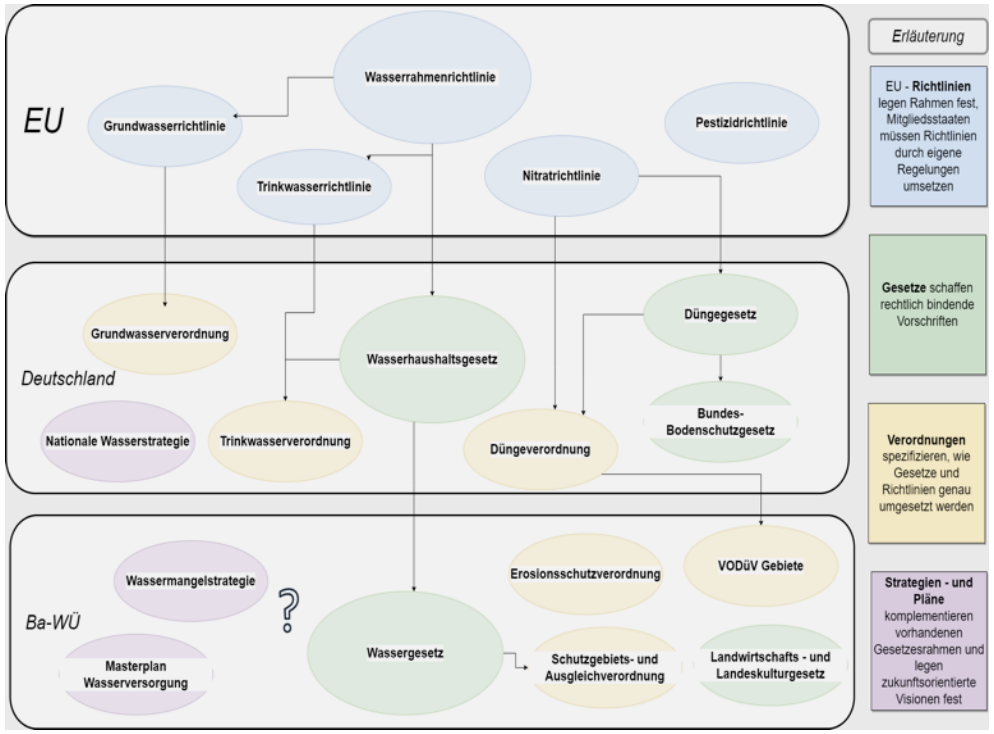
> s. Poster

Policy Analysis
Agriculture-Water



➢ Multi-level governance with nested but uncoordinated policies - difficult to respond to recent strategies

Two interview studies

1. Priorities in decision making
2. Social acceptance of digital solutions

- Water rights / water allocation decisions differ strongly

➢ Objective rules/criteria vs room for individual decisions

- Real time monitoring as a decision criterion is used more by utilities than by agencies

➢ Slow uptake of digital solutions due to privacy issues, data security etc.

Spatial analysis of all drinking water protection areas in Germany

- How are landscapes of DWAs characterized?
- Can they be grouped into similar situations?

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11 406 DWAs
In Germany

- Different definitions per federal state

➢ Different overall areas (5% to 30%)

Geo-Data: interdisciplinary attributes

- Area, elevation, etc.
- Hydrogeology, groundwater drought response time
- Climate
- Land cover and agricultural use details (e.g. stock density, crop type, %pasture, %irrigated, no. of farms
- Type of water supply source, demand, population, water cost
- .....
- Generalized maps of water quantity and quality 2022 (acc. to EU water framework directive reports)

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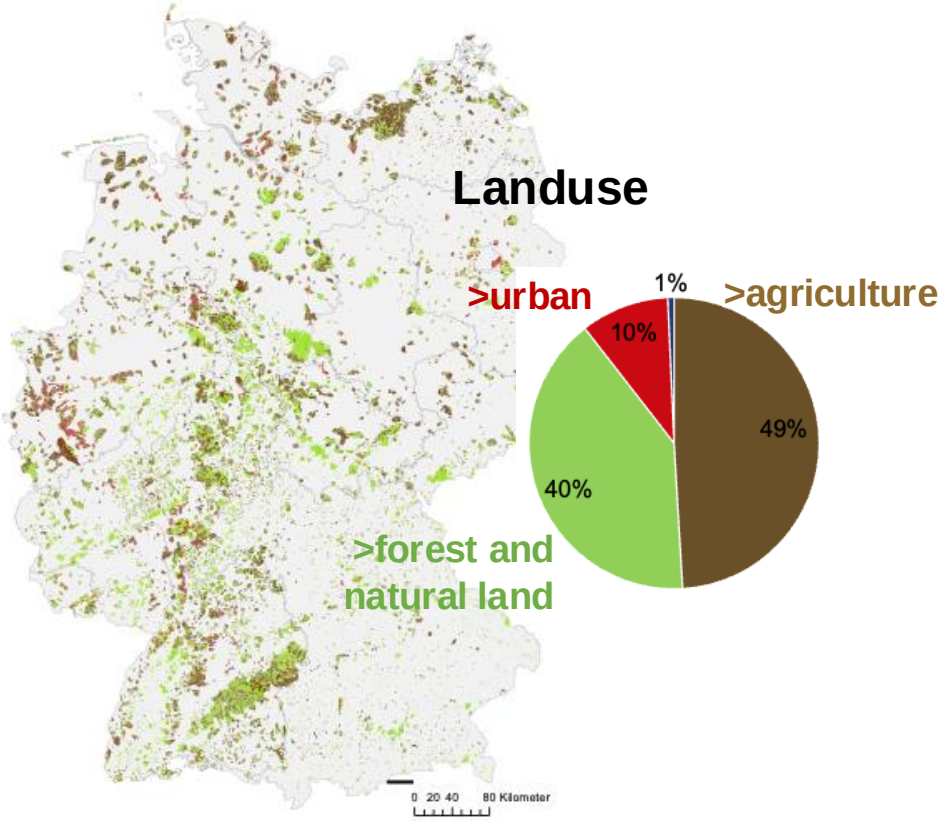
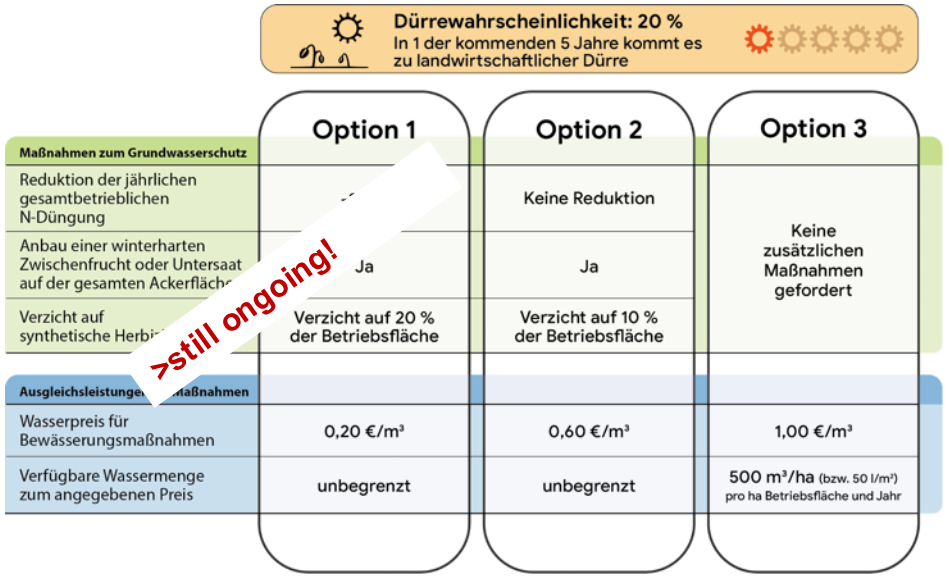


Analyis of the acceptance of groundwater protection by farmers

Survey as Discrete Choice Experiment



- N-Reduction more accepted than herbicide-Red.
- Requested waiver for irrigation water cost acc'ly

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Monitoring developments: gw recharge and nitrate leaching

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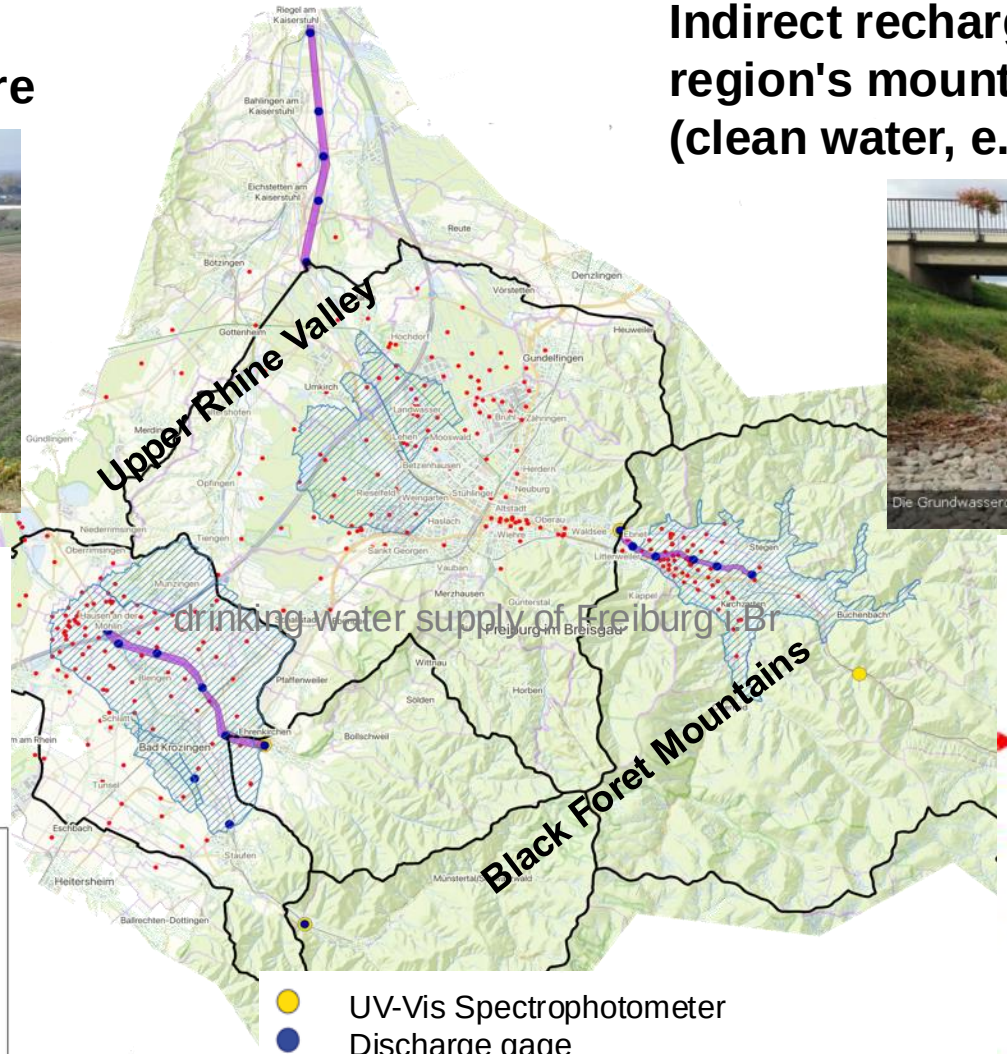
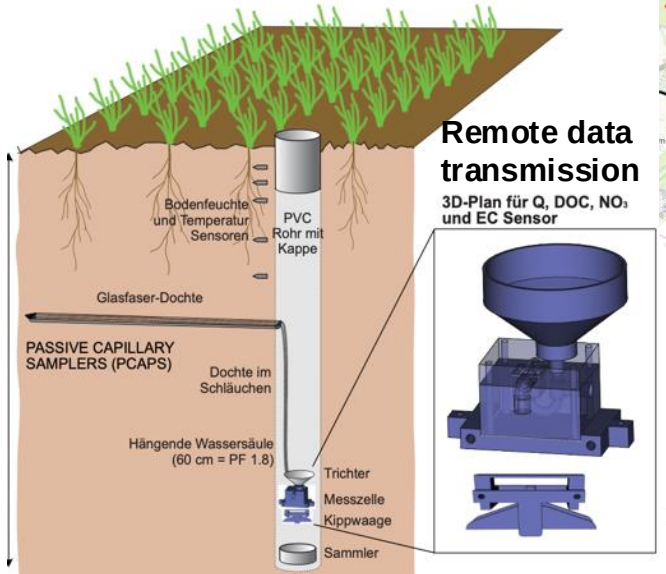
LURCH Grundwasser nachhaltig bewirtschaften

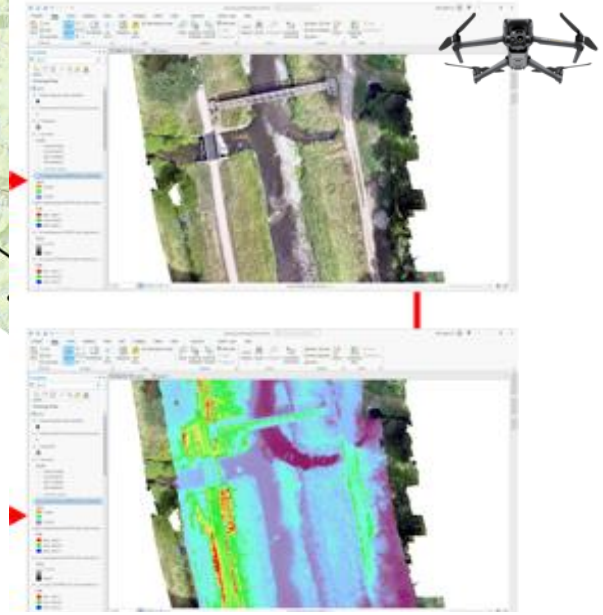
Direct recharge in DWAs with high % agriculture

Indirect recharge typical in region's mountain-lowland setting (clean water, e.g. low nitrate)





Mini-"UV-Vis-Spectrophotometer" (LED+photodiode)



Drone-mounted thermography to detect gw-sw

Model integration – work in progress

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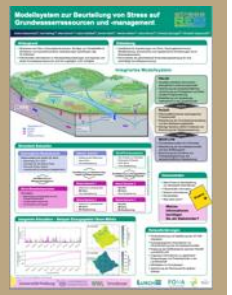


PALUD (UHOH)

- Economic-ecologic landuse model
- Incl. adaptation measueres

coupling

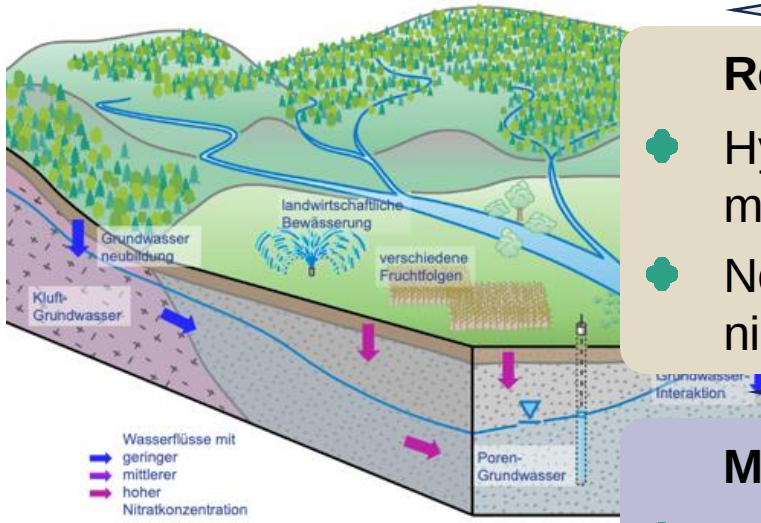
RoGeR (HF)

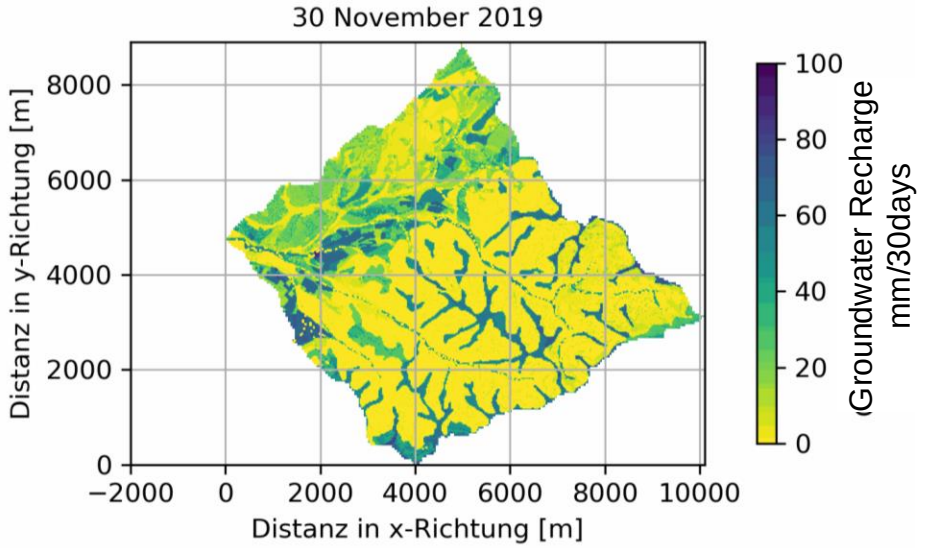
- Hydrological process modell →
- New: irrigation demand, nitrate leaching

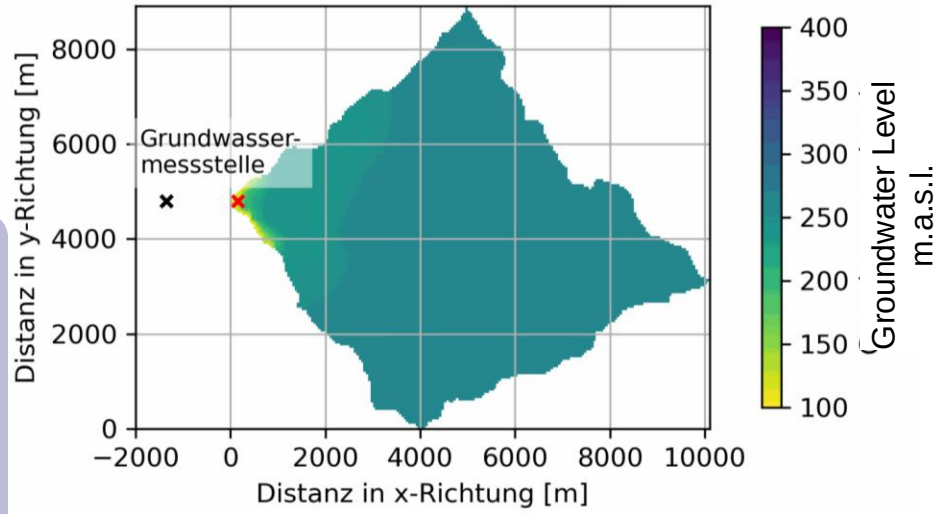
coupling

MODFLOW (UHyS)

- Groundwater and transport
- Abstractions: drinking water, irrigation

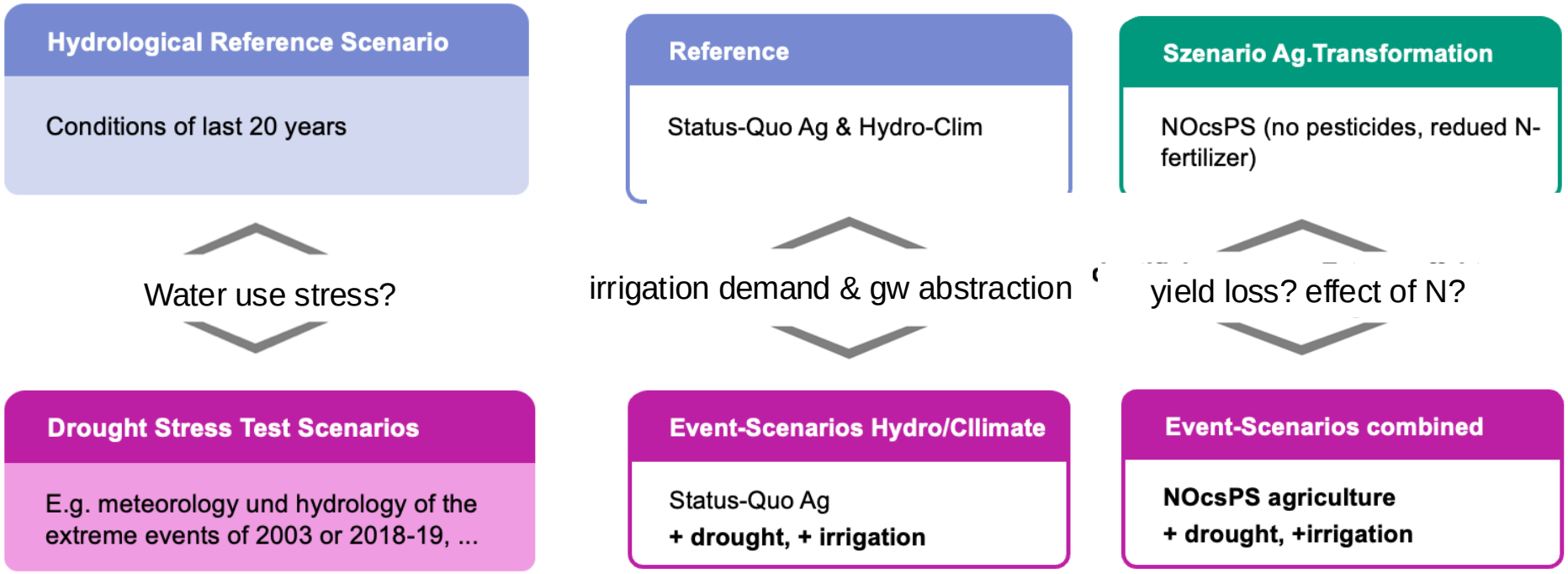






Targeted Stress Test Scenarios – planned work

- Targeted "stresstest" scenarios instead of climate projections
- Initial Scenarios: combinations of known drought events with different crop scenarios and with/without irrigation
- Co-designed stakeholder scenarios: 'future' storylines combining multiple usages and transformations



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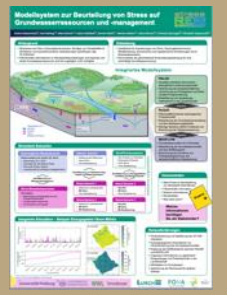

First results and further planning

- Many recent triggers for transformation
  - ➢ Pressure at all governance levels
  - ➢ Hesitation in decisions, lacking digital solution implementation
- Typical 'situations' can be identified, but
  - ➢ Harmonized data availability or acces (e.g. of real. drinking water catchment areas) lacking
- Monitoring/Messung
  - ➢ New sensors, new opportunities locally – scalable?
- Integrative modelling of agriculture-hydrology-hydrogeology necessary
  - ➢ But, complex, time and data consuming – applicability?
- Event Stresstest-Scenarios als Tool
  - ➢ Test if more targeted and more applicable than climate projection ensemble model chains