

Site selection and contextualisation of higher tier leaching studies

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Introduction

- SETAC EMAG GW paper on conducting monitoring studies proposes study designs and approaches to vulnerability assessment and context setting in relation to a range of potential specific protection goals
- What it does not provide are step-by-step “recipes”
- What does a typical process for site selection and context setting look like for a study targeting shallow groundwater with edge-of-field sampling (in porous aquifers)?
- How does it work out in real life?



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Steps in the process

- Problem formulation
- Identification of regions or areas of interest (AOI)
 - ▶ GIS evaluations
 - ▶ Vulnerability mapping
- Site search
 - ▶ Desk-based
 - ▶ On the ground
- Site selection and characterization
- Field study phase
 - ▶ sampling and analysis
 - ▶ in-situ capturing of scenario data and related information
- Contextualisation of results



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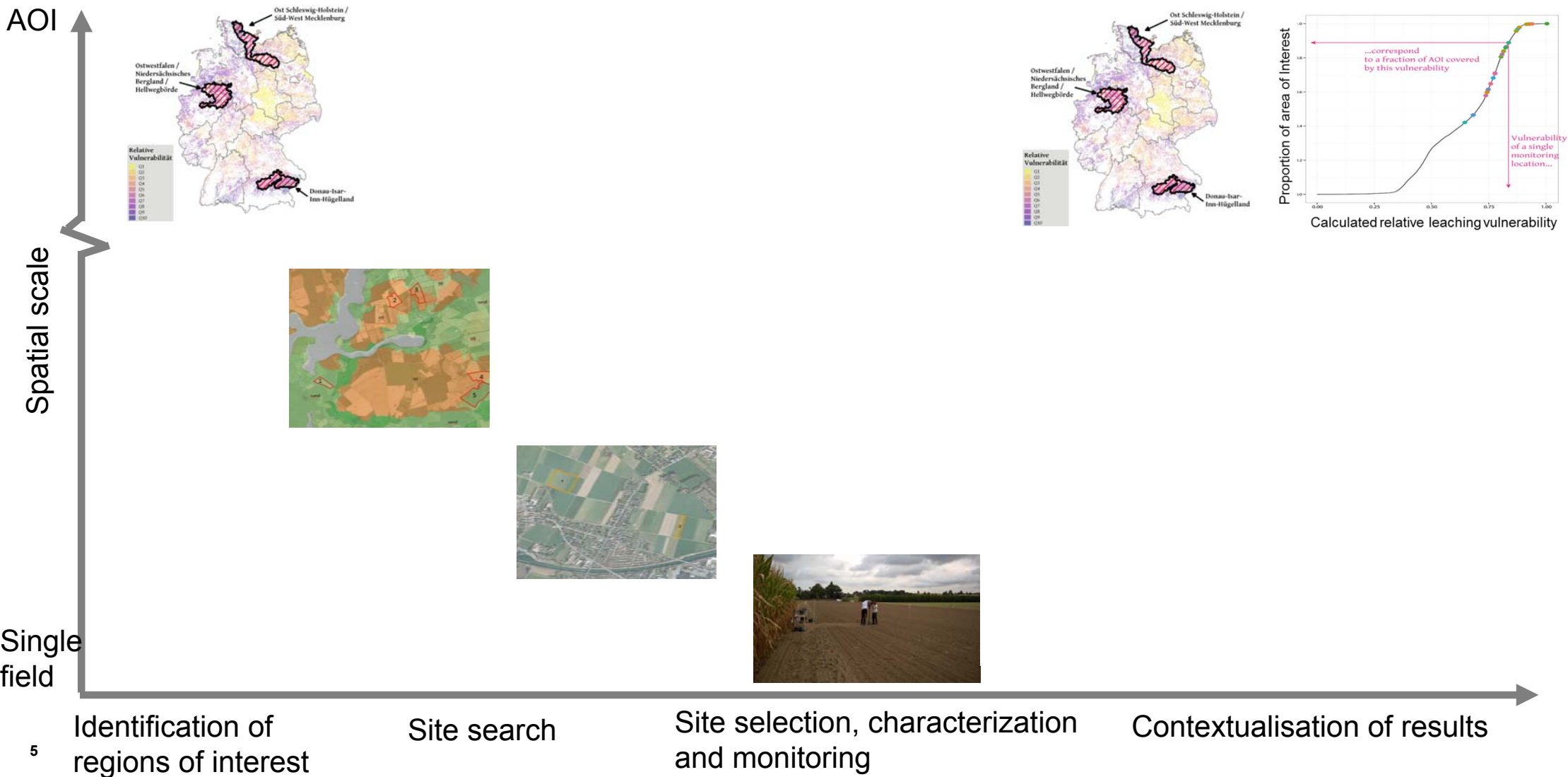
Problem formulation

- Problem formulation is the first step in environmental risk assessment (ERA) where policy goals, scope, assessment endpoints, and methodology are distilled to an explicitly stated problem and approach for analysis.
- Particularly important when the specific protection goal or regulatory purpose drives the study design
- So at the beginning we should ask the questions
 - ▶ What do we want to measure and for what purpose?
 - ▶ Where do we want to measure and in what timeframe?
 - ▶ At how many sites?
 - ▶ What characteristics should the sites have?

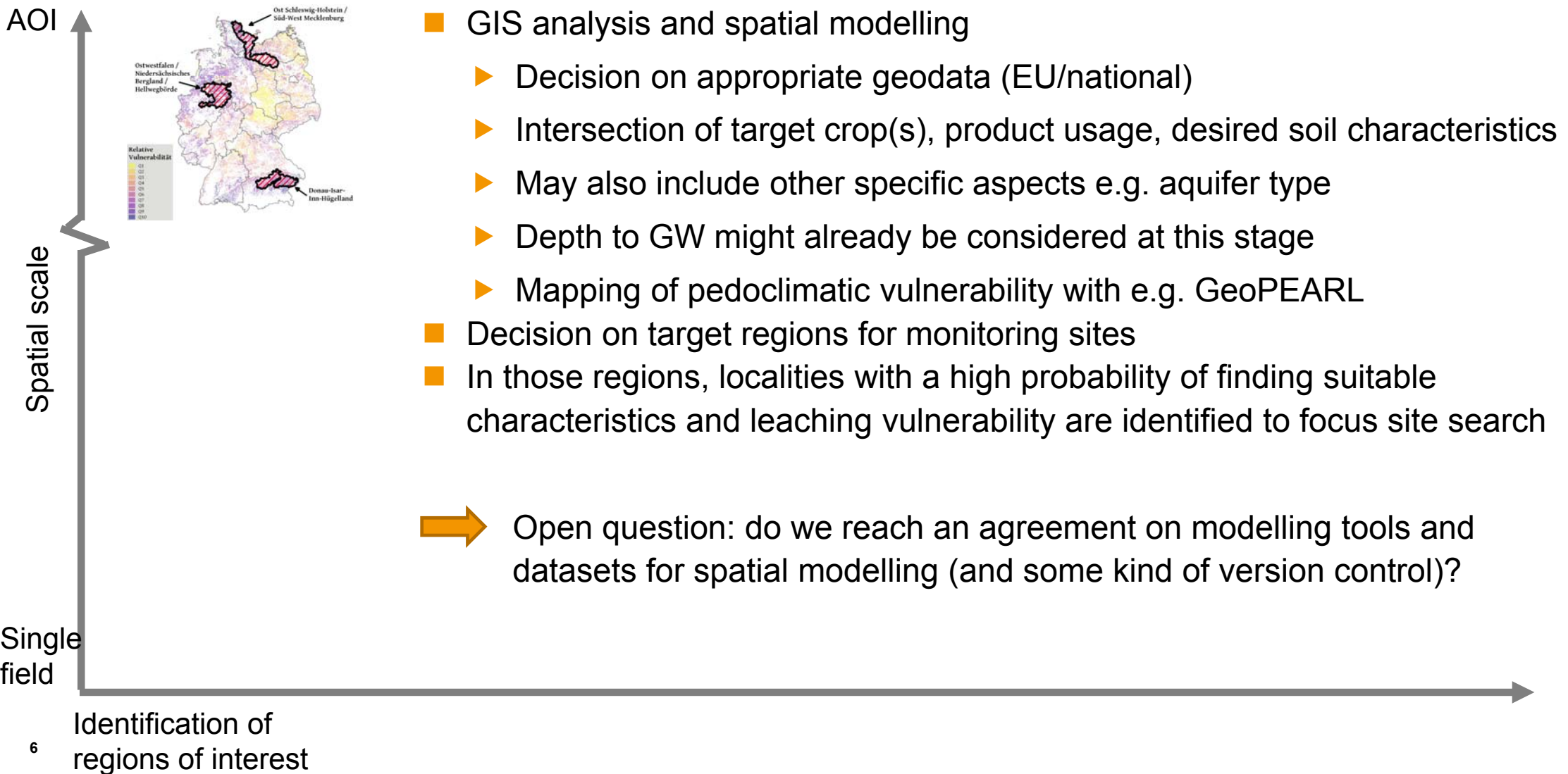


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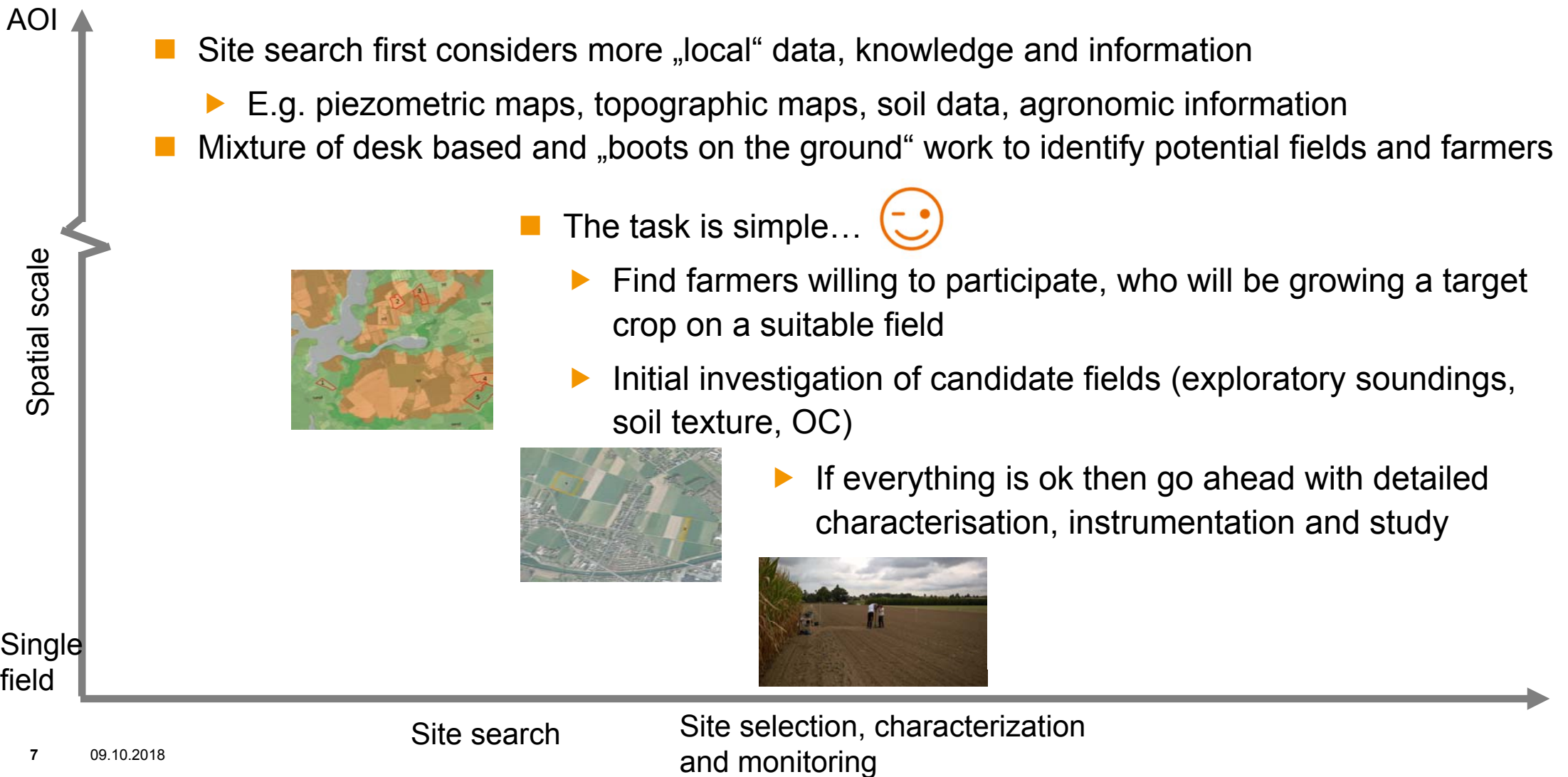
Spatial scales of selection, monitoring and contextualisation



Identification of areas of interest



Site search



Site search – suitability

■ „typical“ criteria (assuming cooperative farmer with target crop)

- ▶ Sandy soil, low OC
- ▶ High recharge, porous aquifer
- ▶ Shallow, unconfined groundwater
- ▶ Not a perched water table
- ▶ Flat topography
- ▶ Acceptable hydraulic gradient
- ▶ Not too much GW fluctuation
- ▶ No surface water influences
- ▶ No potential point sources
- ▶ Not drained

■ These are often mutually exclusive, or just not representative for the target crop

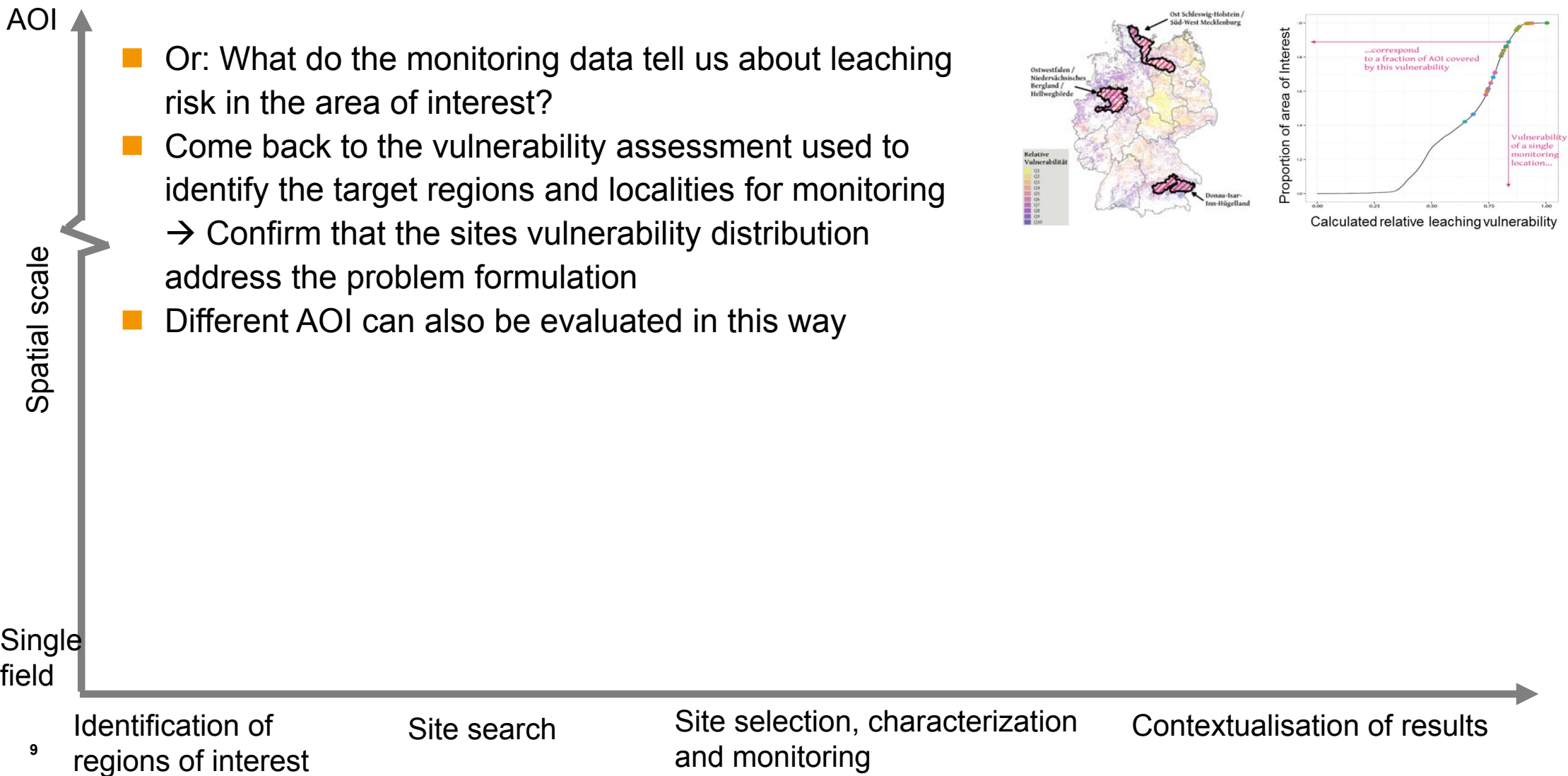
➡ Compromises are unavoidable. Do we go for vulnerability, or representative situations?



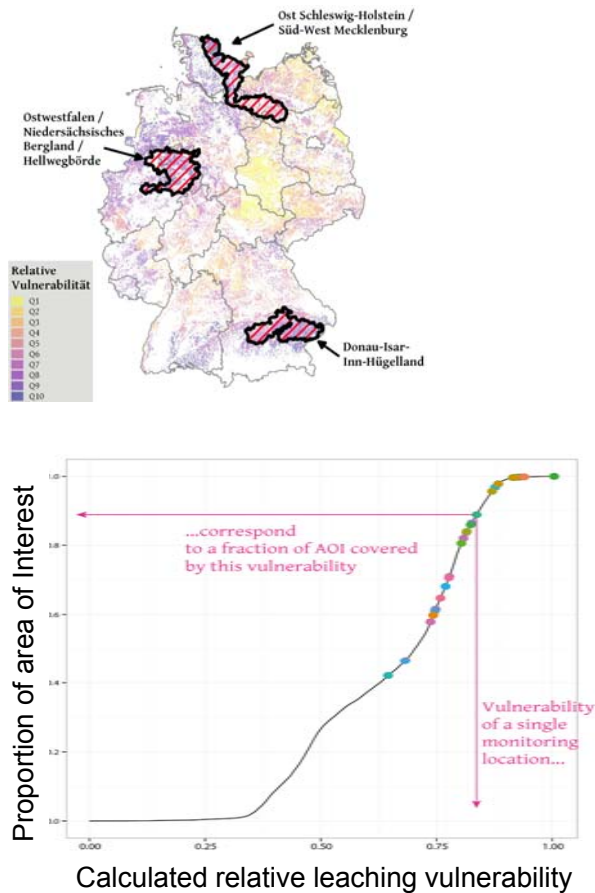
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Contextualisation of results

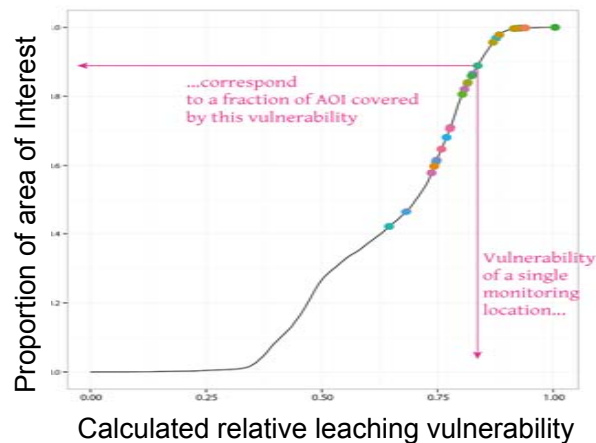
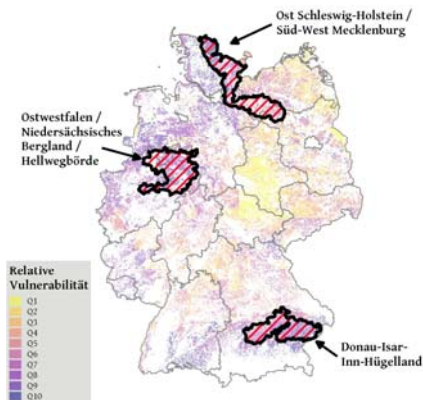


Contextualisation of results



- Statistical distribution (CDF) of leaching vulnerability can be simply derived from the spatial model for the AOI
- Monitoring sites are placed on the curve according to their calculated leaching vulnerability values based on in-situ measurements.
- The proportion of the Area of Interest having lower or higher leaching vulnerability than the monitoring sites can then be derived.
- Aggregated GIS data used in spatial modelling may not coincide with the conditions at a certain field in the grid cell
- Therefore the site-specific data are used to compare the leaching vulnerability of the monitoring sites with the spatial model for the AOI.

Contextualisation of results



- If the key question defined by the problem formulation is that the monitoring sites
 - a) should be **representative** for the range of conditions in the AOI, then the sites should be distributed over the vulnerability curve (less vulnerable as well as highly vulnerable situations)
 - b) should meet a predefined protection goal **covering** the whole vulnerability range, then some sites in the high vulnerability area are appropriate and sufficient

Conclusions

- A proper problem formulation is essential
- Site selection & contextualisation of higher tier leaching studies are two sides of the same coin
 - ▶ Partially same methodology (GIS and vulnerability analysis)
 - ▶ A-priori vs. a-posteriori analysis
- Compromises in site selection are unavoidable. Do we go for vulnerability, or representative situations?
- If monitoring sites should
 - ▶ be **representative** for the conditions found in the AOI, then their vulnerability should stretch over the whole vulnerability curve representing less vulnerable as well as highly vulnerable situations
 - ▶ meet the predefined protection goal and **covering** the whole vulnerability range, then some sites in the high vulnerability area are appropriate and sufficient



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