

# Developing SDG indicators for the assessment of yield capacity, land use intensity and vulnerability of agricultural soils in Germany

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## Background & Objectives

Despite its central importance for food security, safeguarding ecosystem functions and sustainable climate protection, it is estimated that around 24 billion tons of fertile soil are lost every year due to improper use. In Germany, about 56 hectares of soil is damaged completely or partially every day. Where and in what quality soil is lost is not known in detail.

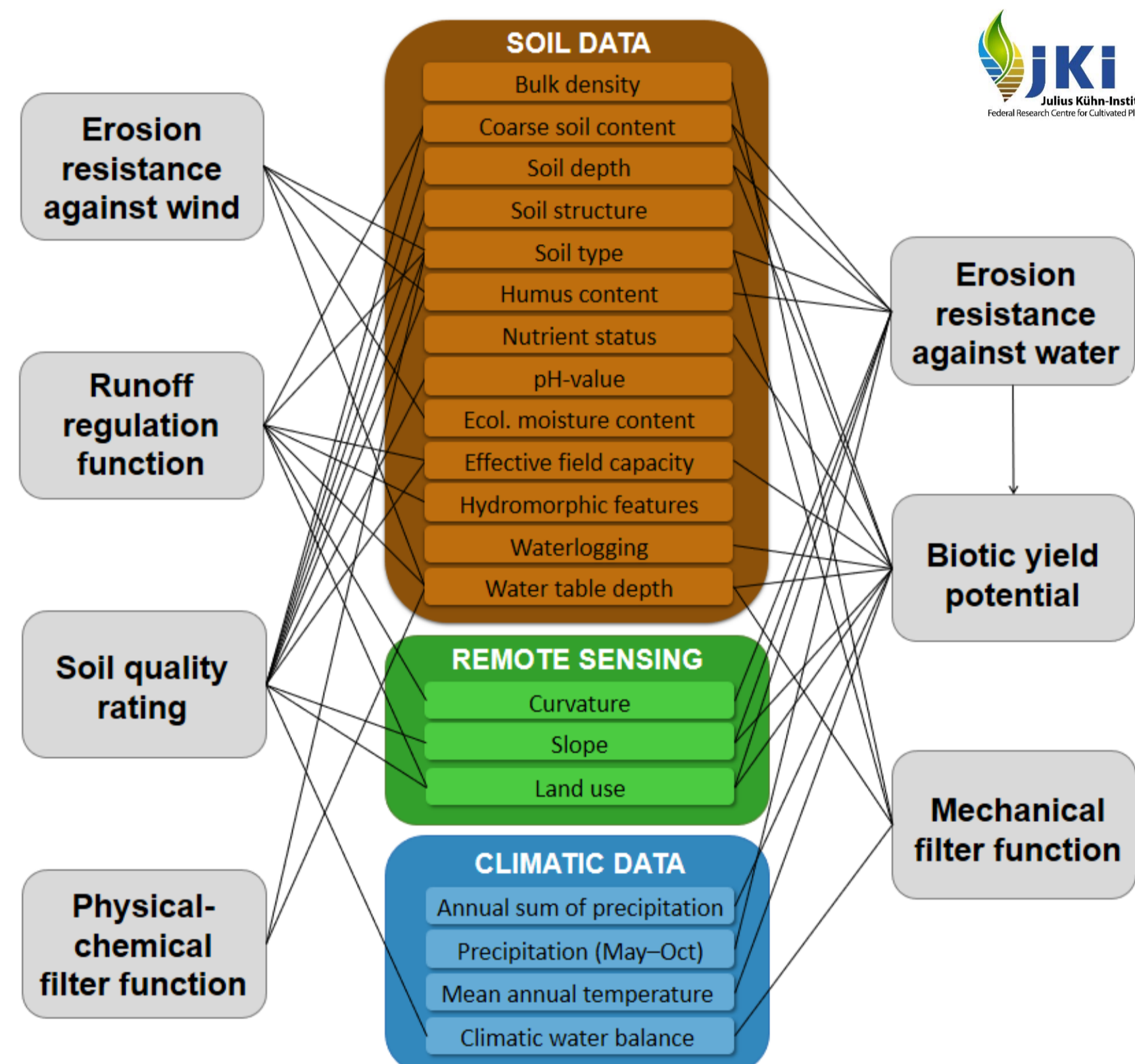
Our research within the **SOIL-DE** project therefore aims at:

- 1) fully utilizing the potential of existing nation-wide basic soil data (BÜK200) to assess and localize soil functions and potentials,
- 2) exploring earth observation data (Landsat, Sentinel) to spatially explicit monitor soil quality and soil loss,
- 3) developing indicators of soil yield capacity, vulnerability and land use intensity and assessing soil loss quantitatively and qualitatively.

## Assessing soil functions and potentials

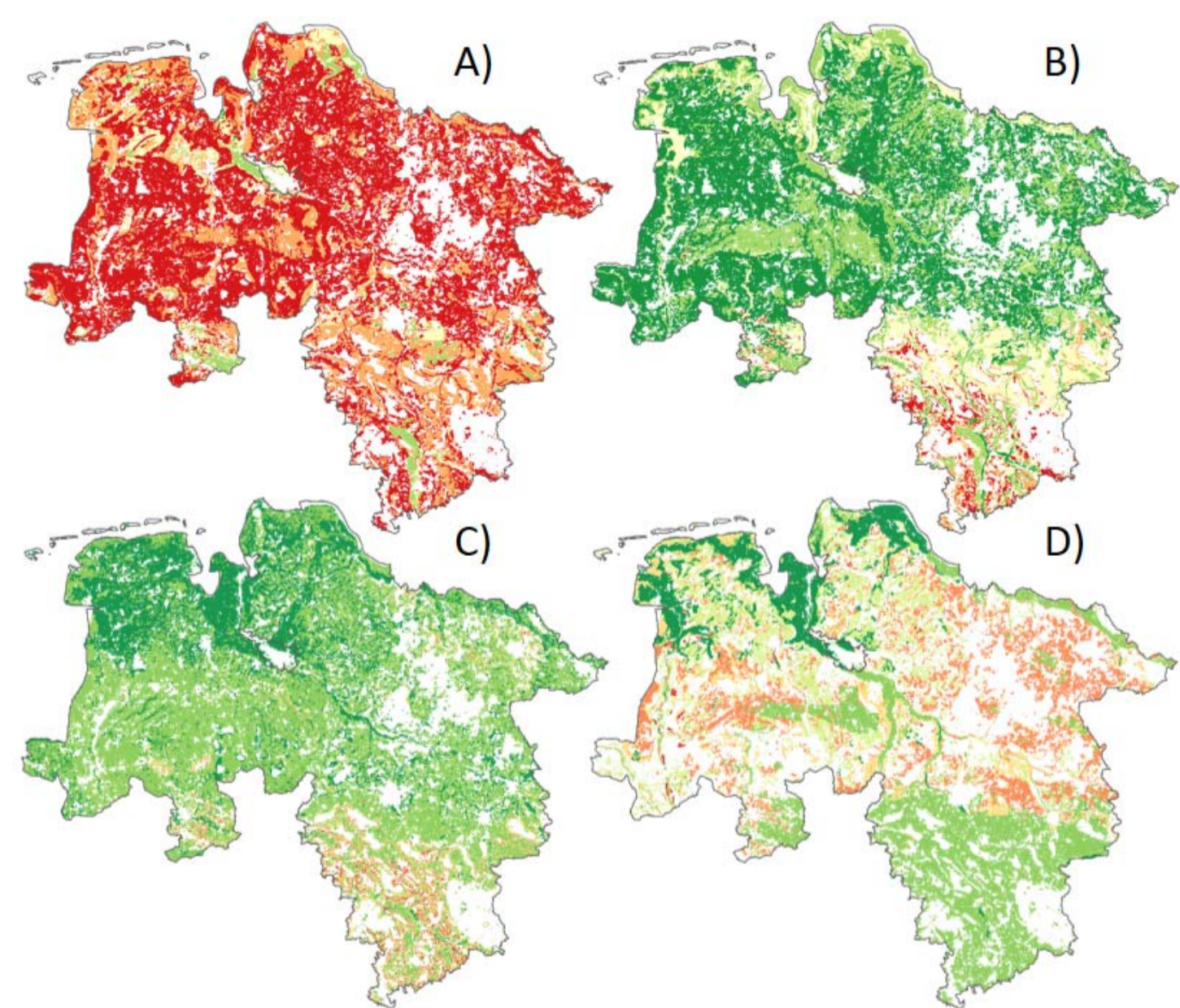
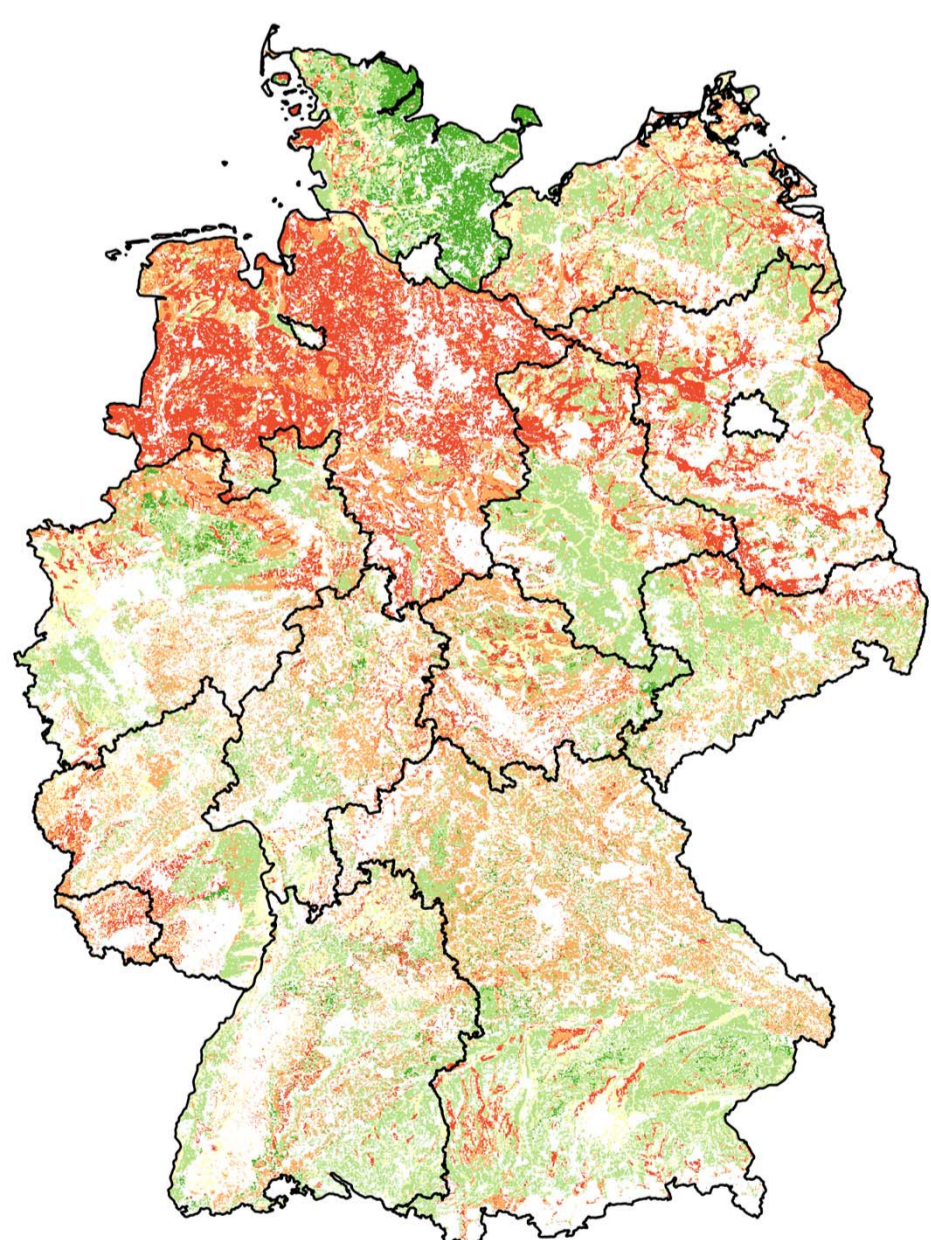
### Methods & data

- **Assessment framework:**
  - BA-LVL after Marks et al. (1992)
  - Müncheberg Soil Quality Rating after Müller et al. (2007)
- **Land use:** CORINE Land Cover (CLC) inventory 2018 from Copernicus Land Monitoring Service and Sentinel-1/2
- **Weather:** German Meteorological Service (DWD)
- **Soil:** Soil survey 1:200.000 (BÜK200, BGR) with soil profile assignment based on CLC inventory 2018
- **Relief:** Digital terrain model, 10m grid size (DGM10, BKG)



Marks, R. et al. [Hrsg.], 1992. Anleitung zur Bewertung des Leistungsvermögens des Landschaftshaushaltes (BA-LVL). Forschungen zur deutschen Landeskunde, Band 229. Müller, L. et al., 2007. The Müncheberg Soil Quality Rating (SQR). Leibniz-Centre for Agricultural Landscape Research (ZALF) e. V., Germany.

### Biotic yield potential



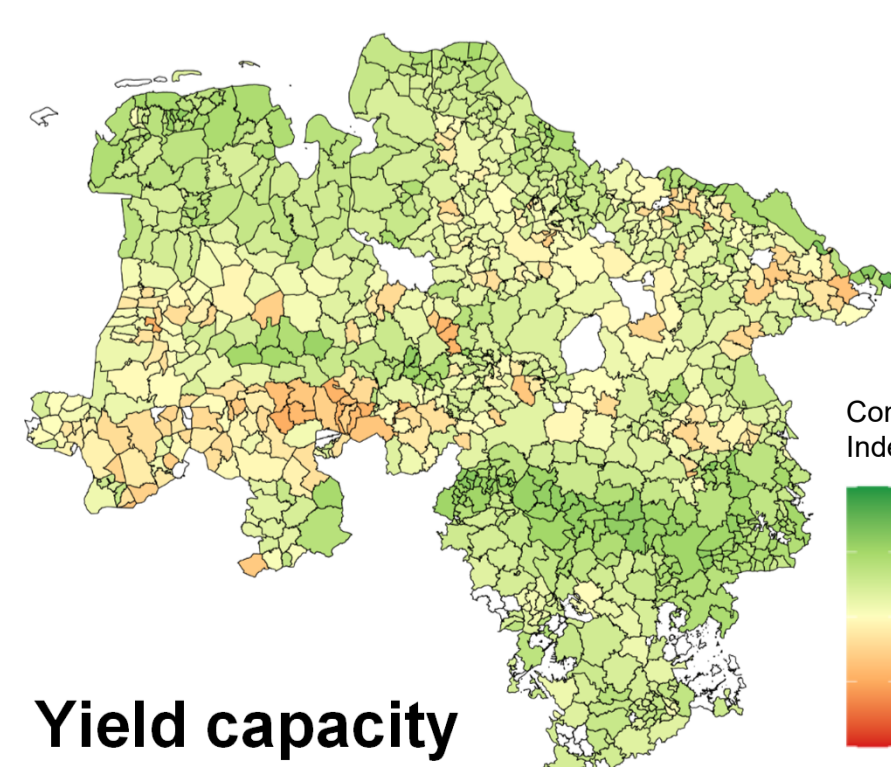
A - Physical-chemical filter, B - Mechanical filter, C - Erosion resistance water, D - Erosion resistance wind

### Soil quality index

- Determination of an area-weighted comparative index (CI) for user-defined reference units (e.g. municipality) after Thiery et al. (1991)

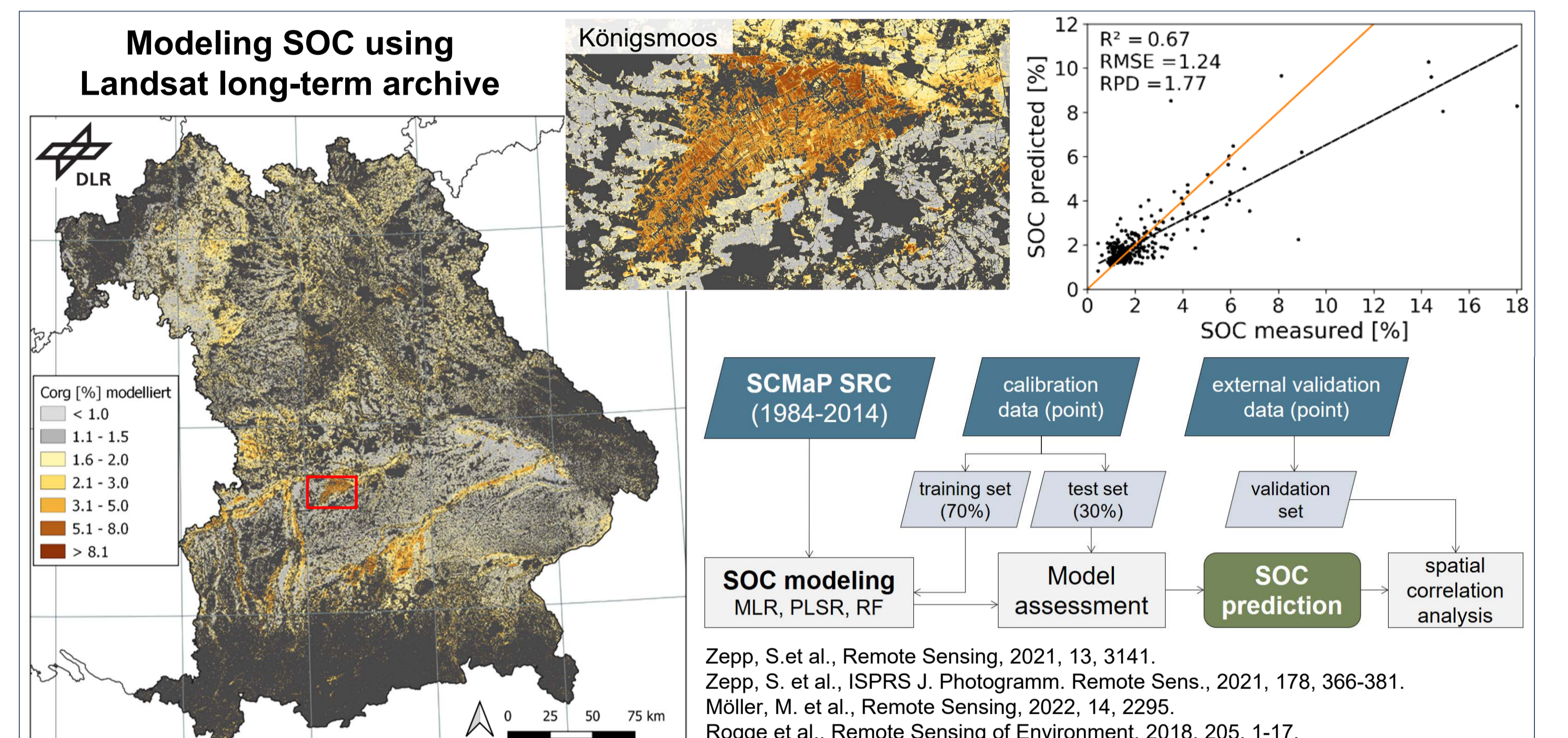
$$Indicator = \sum_{i=1}^N W_i * Soil\ function_i$$

$$CI = \sum_{i=1}^N Area\ share_i * Comparison\ group_i / N$$

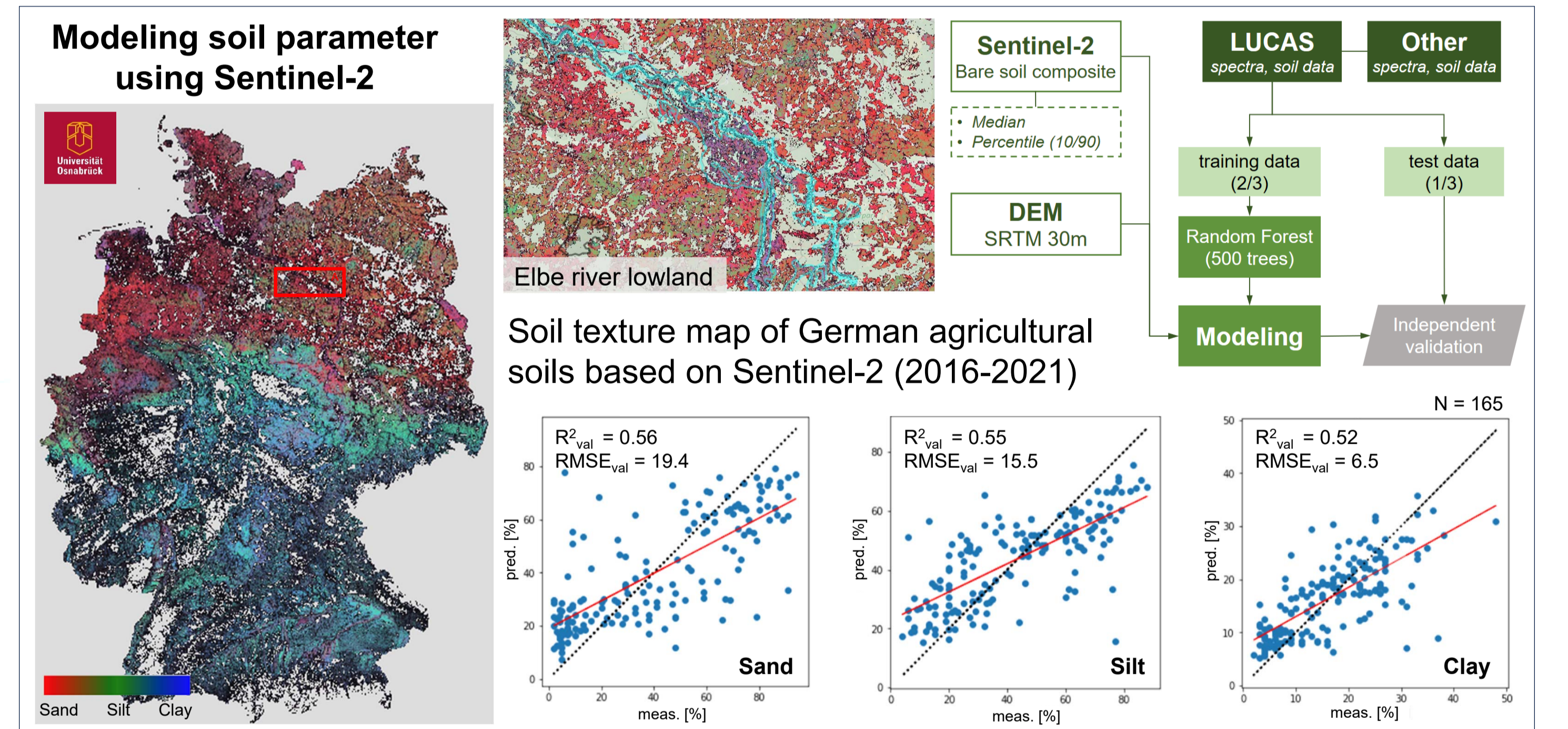


Thiery, J., et al., 1991. Arch. Acker-Pflanzenbau Bodenkd. 35 (3): 171-183, Berlin, Germany.

## Reflectance composites & spectral modeling



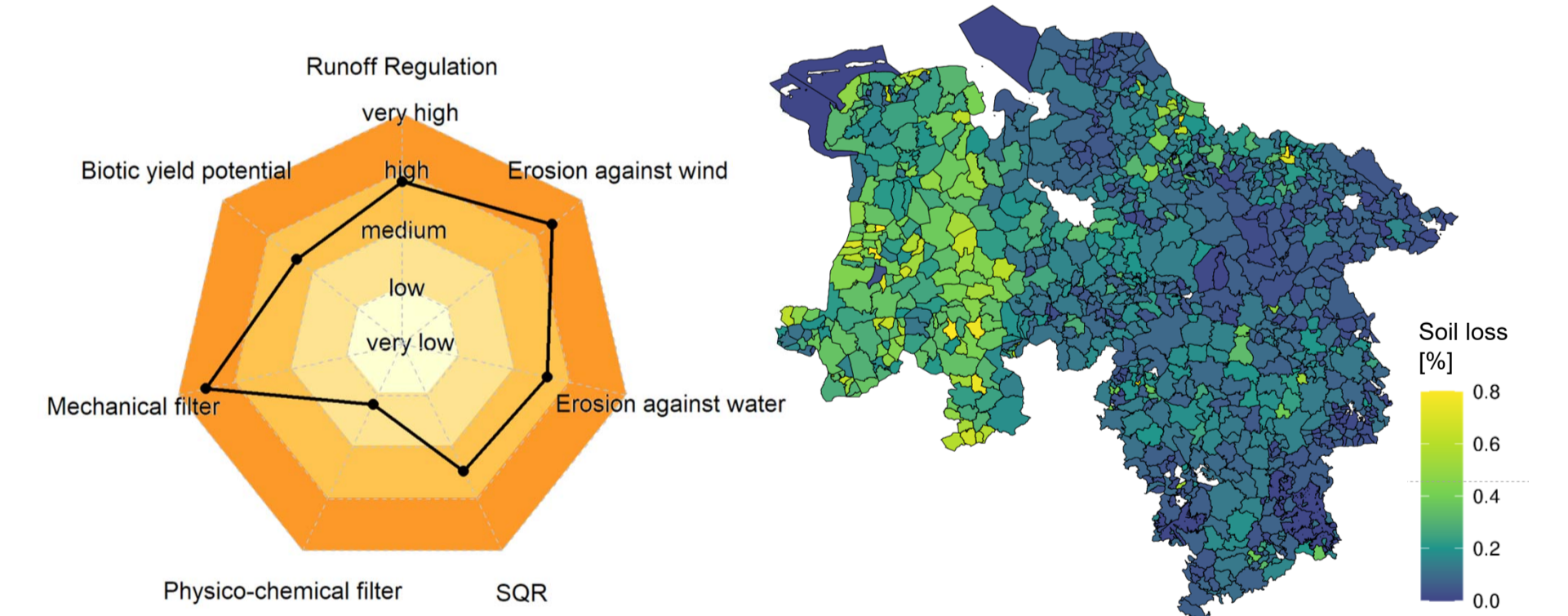
Zepp, S. et al., Remote Sensing, 2021, 13, 3141.  
 Zepp, S. et al., ISPRS J. Photogramm. Remote Sens., 2021, 178, 366-381.  
 Möller, M. et al., Remote Sensing, 2022, 14, 2295.  
 Rogge et al., Remote Sensing of Environment, 2018, 205, 1-17.



## Evaluation of soil loss

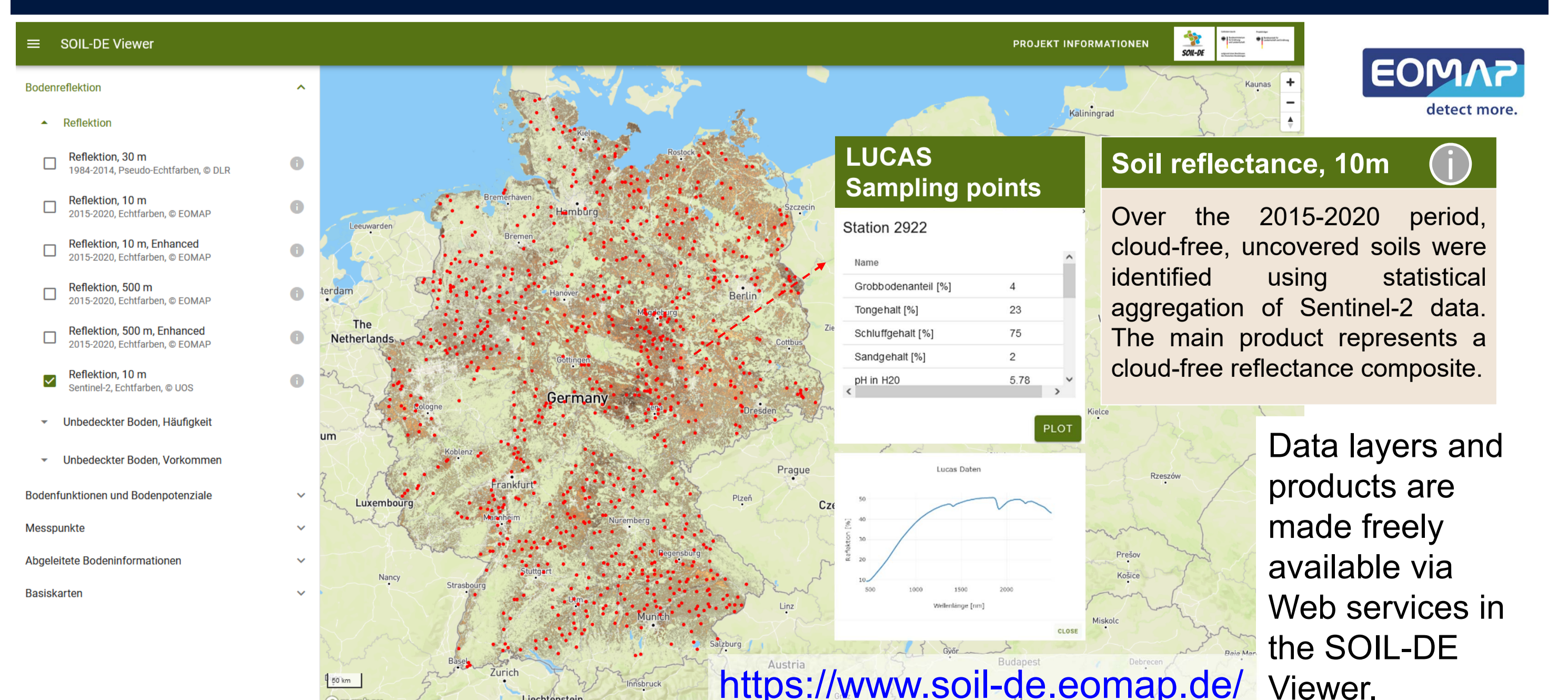


- Copernicus Land Monitoring „Imperviousness” HRL products capture percentage and change of soil sealing
- Reference years: 2006, 2009, 2012, 2015, 2018
- Quantification of soil loss and its qualitative assessment is done using „change layers” (20m), soil functions and CLC 2006 and CLC 2012



Period	Soil loss total [ha]	Soil loss agriculture [ha]
2006-2009	4197.1	2401.9
2009-2012	5306.7	3022.9
2012-2015	2114.5	441.6
2015-2018	9626.6	6902.3

## SOIL-DE Viewer



<https://www.soil-de.eomap.de/>

Data layers and products are made freely available via Web services in the SOIL-DE Viewer.

