



# Assessing the value and quality of German soils under agricultural use

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## Background and Objectives

- United Nations Sustainable Development Goals: halting and reversing soil degradation, protection and sustainable use of soil
- Loss of massive amounts of fertile soil worldwide due to improper land use
  - ≈ 66 ha per day in Germany
- Main issues: soil erosion, land area claims for housing estate, transportation, and pollution
- Lack of precise spatial location and assessment of loss of valuable soil (fertility+productivity)
  - no verifiability
- SOIL-DE project aims for a nationwide and statewide record of soil threat, fertility and impairment of soil functions by land use changes
  - detection of land loss over the past ten years
  - determination of soil fertility
  - identification of risk areas (high soil loss rates and high soil productivity)

## Preliminary Results

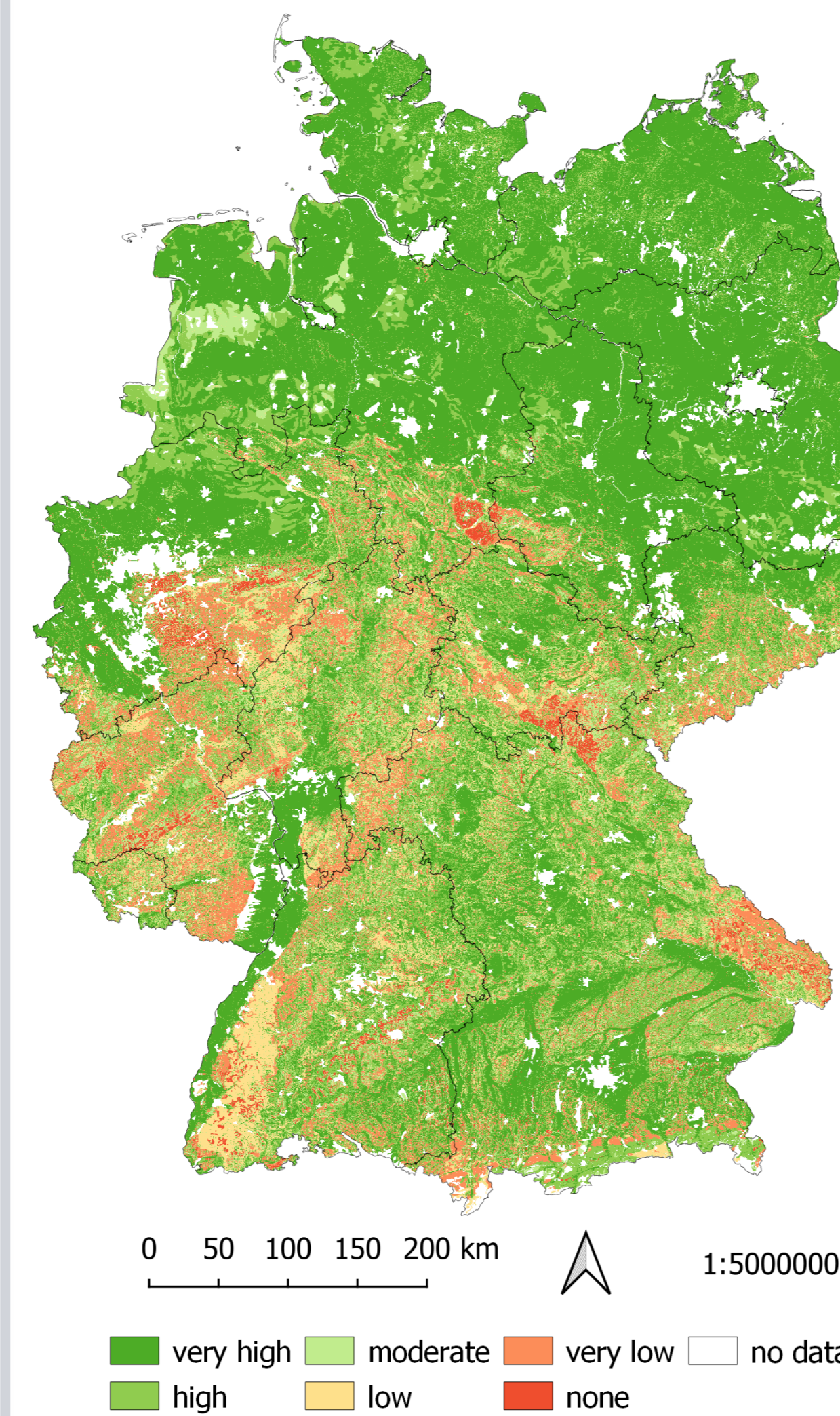


Figure 1 Resistance to water erosion based on BÜK1000.

### Nationwide (100x100 m Raster)

- High resistance to water erosion in lowland zones of northern and central Germany and river valleys (Fig. 1)
- Lower resistance to wind erosion and low buffer function in northern part of Germany
- Good filter function and flow regulation in most areas, except for low mountain ranges
- BPY low for histosols, planosols and stagnosols
- Generally similar results for SQR (Fig. 2); for eastern part of Germany lower potential than BPY
- Difference between drier and wetter years visible in water erosion resistance and BPY

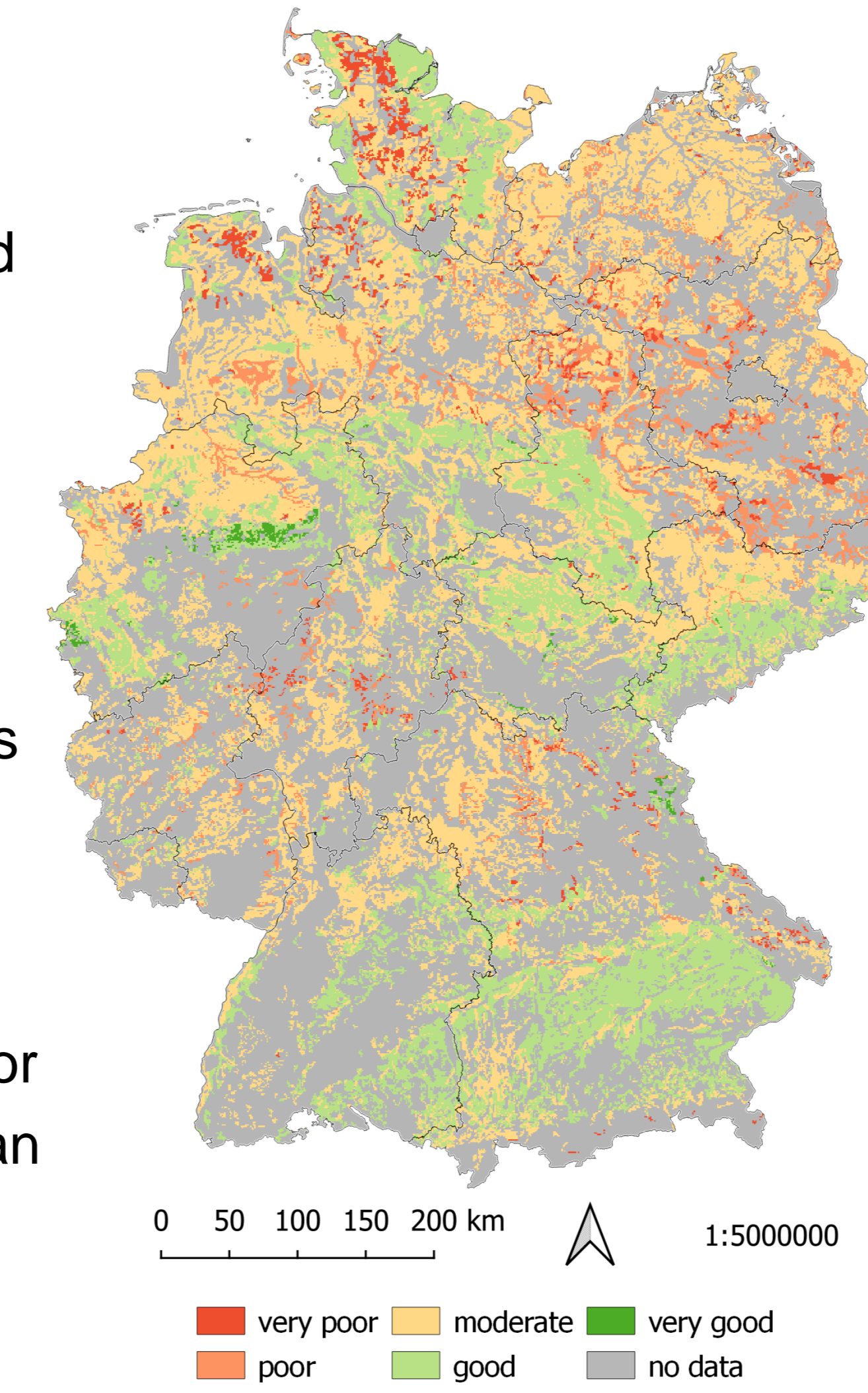


Figure 2 Soil quality assessment of the soil quality rating (SQR) score based on BÜK1000.

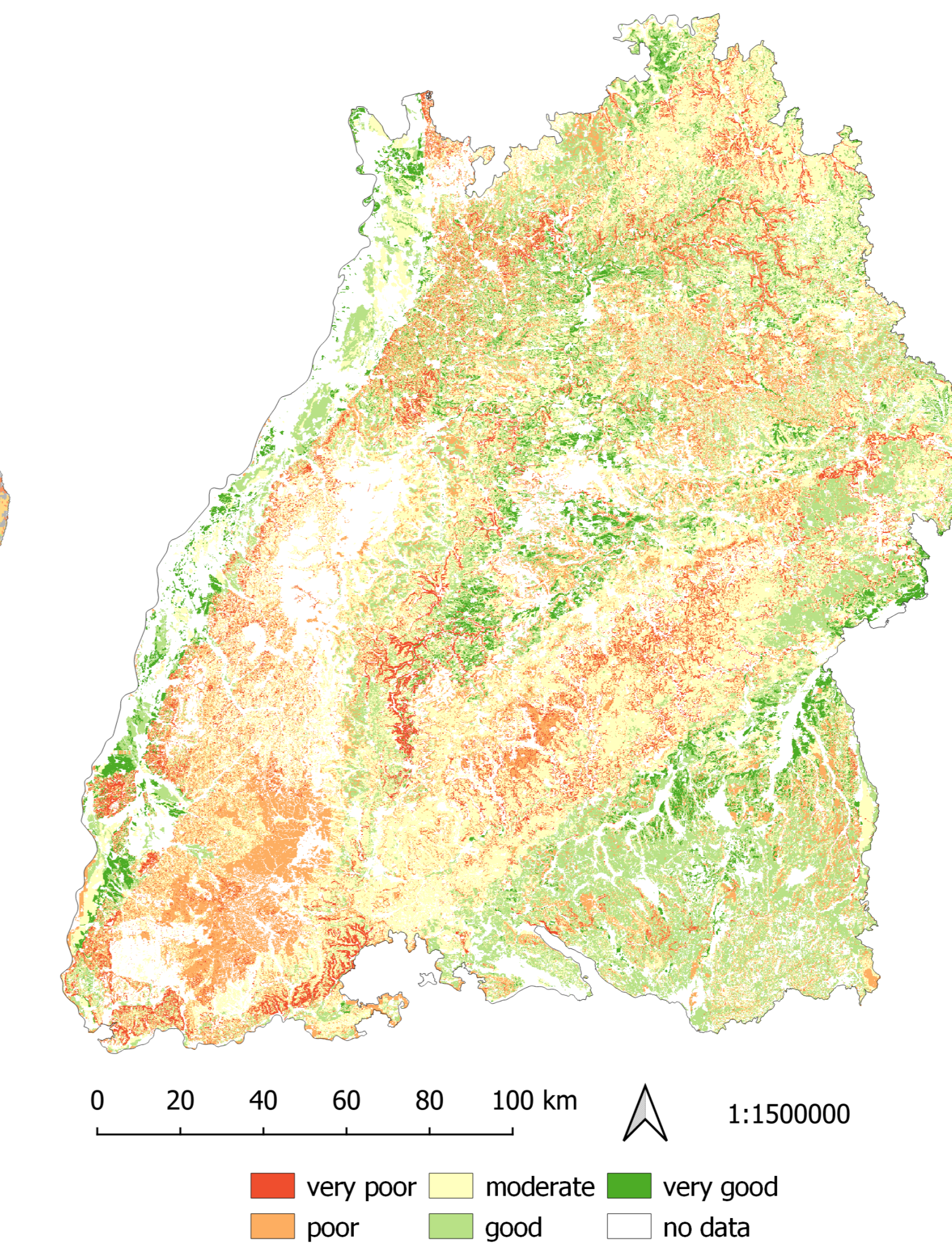


Figure 3 Biotic potential yield (BPY) of Baden-Wuerttemberg based on the federal state soil map (1:50,000)

### Statewide (10x10 m Raster)

- Results in higher resolution available for Baden-Wuerttemberg
- Low BPY (Fig. 3) of forests because of pending differentiation of land use

## Next Steps

- Include land use and land usage intensity from remote sensing data
- Capture bio-climatic function as soil indicator
- Implementation of soil indicators nationwide using BÜK200 and additionally regionally for all federal states
- Determination of loss of soil areas as well as risk areas

## Material and Methods

- Soil indicators: evaluation of landscape ecosystem capacity (BA-LVL; Marks et al., 1992) and Muencheberg Soil Quality Rating (SQR; Müller et al., 2007)
- Soil information at different spatial scales nationwide (BÜK1000 (1:1,000,000), BÜK200 (1:200,000)) and regional per federal state (1:25,000 or 1:50,000)
- Climatic data from the German weather survey (DWD)
- Remote sensing data from SENTINEL-1 and LANDSAT including land use and usage intensity
- Digital elevation model (DEM)

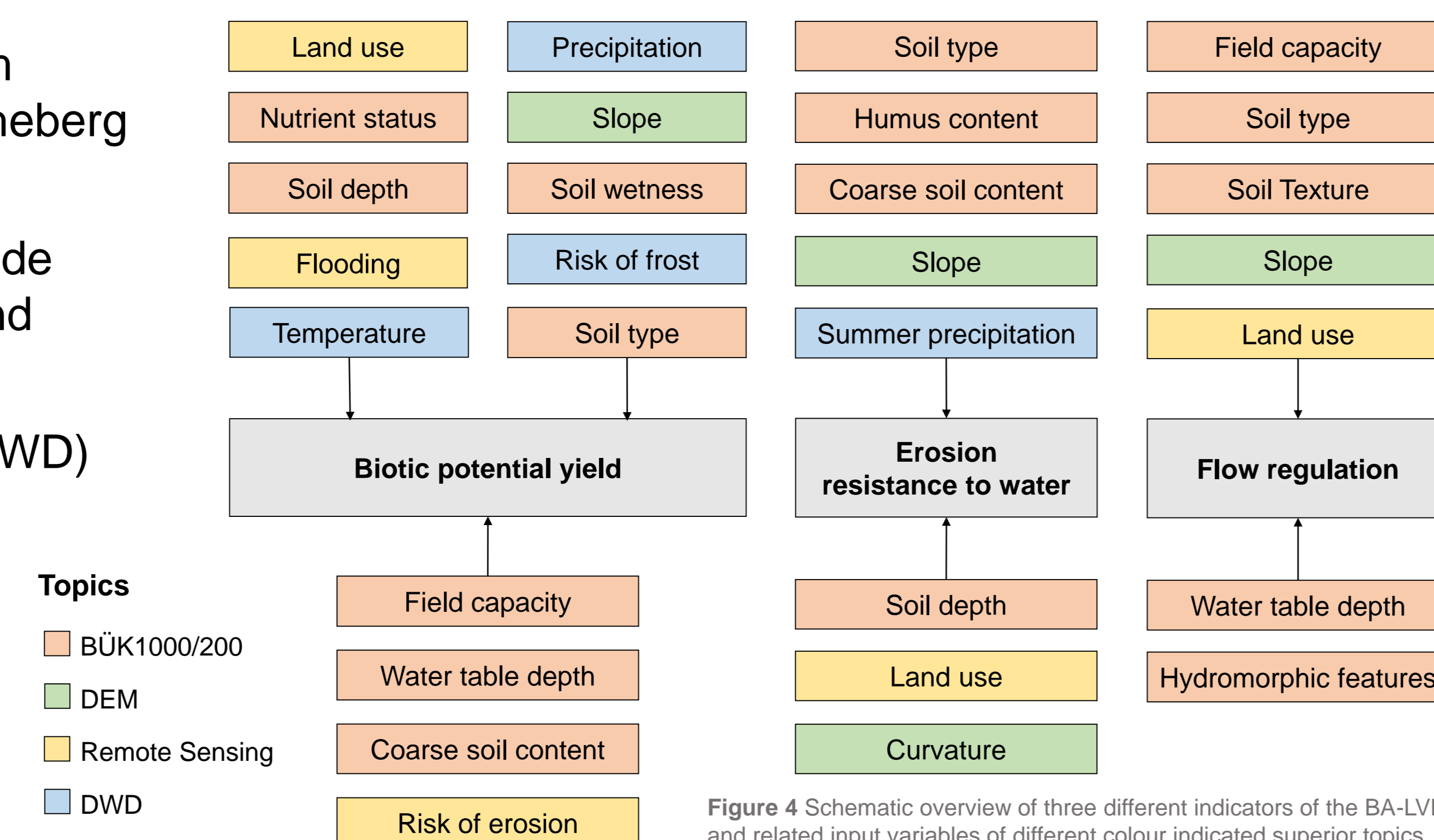


Figure 4 Schematic overview of three different indicators of the BA-LVL and related input variables of different colour indicated superior topics.

- Estimation of suitability of soils for agricultural use and potential yield – **SQR** (Fig. 5)
- Landscape's ecosystem capacity (Fig. 4) to...
  - ...produce biomass and ensure it's constant repeatability – **biotic potential yield (BPY)**
  - ...counteract soil erosion caused by wind and water beyond the natural measure – **erosion resistance**
  - ...retain surface water in the ecosystems, reduce immediate runoff and thereby balance runoff conditions – **flow regulation function**
  - ...protect the subsurface from penetration of unwanted substances due to the low permeability of the soil or degradation of these substances or due to good buffering capacity or filter properties – **filter, buffer and transformation function**

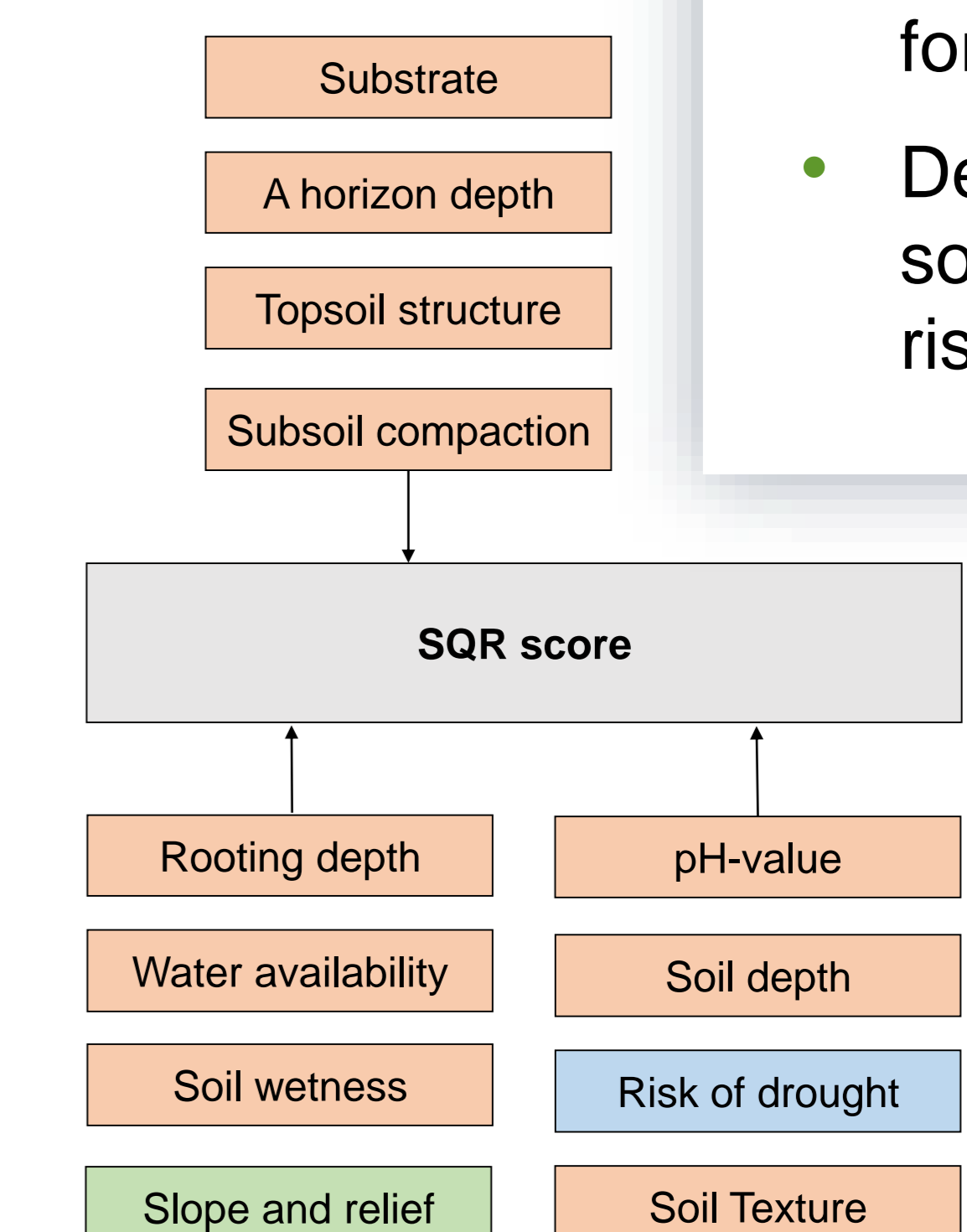


Figure 5 Schematic overview of input variables of different superior topics for the soil quality rating (SQR) score consisting of 8 basic (top) and 4 selected risk input variables (bottom).