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Investigating soil quality indicators of German soils under agriculture using soil information on different spatial scales

Annelie Säurich, Heike Gerighausen, and Markus Möller
Julius Kühn-Institut, Institute for Crop and Soil Science, Germany (annelie.saeurich@julius-kuehn.de)

Soils are effective storage, filter, buffer and transformation systems that remove water, nutrients and pollutants from natural sources and anthropogenic emissions. Due to the habitat, regulatory and utilisation functions, soils are most worthy of protection. Among other things, the United Nations Sustainable Development Goals aim to protect soil and stop and reverse global soil degradation. In Germany alone around 56 ha of soil are damaged partly or completely in their soil functions daily, however, there is a lack of spatially explicit resolution information on the quality of German soils and its losses.

Therefore, the objective of this study is to explore and utilize new sources of information to adapt and improve multiple existing soil quality evaluations and associated indicators. Furthermore, the SDG indicator 15.3.1 'Proportion of land that is degraded over total land area' is to be supported and assessed. Here, the focus lies on land cover, including information on land use, land productivity and soil loss due to land use change, built-up areas and infrastructure expansion. A combination of basic soil, climate, and site-specific data, as well as recent land use data derived from remote sensing (Sentinel-1/2), will be used. The soil quality indicators are determined using different scales of soil data to detect and evaluate possible discrepancies as well as assets and drawbacks of the respective spatial resolution.

The soil quality assessment is based on the estimation of the performance of the landscape budget using six different soil indicators: biotic potential yield, resistance to water and wind erosion, mechanical and physico-chemical filter function and runoff regulation function. Required comprehensive soil information are obtained from three soil maps at different spatial scales: the soil map 1:50,000 of Lower Saxony and the freely available nationwide soil maps of Germany on the scale of 1:200,000 and 1:1,000,000 (BÜK200, BÜK1000). Information of the CORINE CLC 2018 (100 m x 100 m) from the Copernicus Land Monitoring Service are used for land use data. All relevant climatic data originate from the German weather survey (DWD, 1 km x 1 km) and relief parameters are derived from the digital elevation model (DEM, 10 m x 10 m). Subsequently, the high resolution soil indicators (10 m x 10 m) are aggregated with the Site Comparison Method (SICOM) to spatially display the results and identify vulnerable regions. Thereby an area-weighted comparison index is determined for a defined reference unit (e.g. municipality, county) using the area share of comparison levels per reference unit. Results of the soil quality evaluation and their influence by the soil data will be presented for the federal state of Lower Saxony.