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Deriving soil function maps to assess related ecosystem services using imaging spectroscopy in the Lyss agricultural area, Switzerland

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Soils play an important role in the benefits offered by ecosystems services. In densely populated Switzerland soils are a scarce resource, with high pressure on services ranging from urban expansion to over-utilization. Key change drivers include erosion, soil degradation, land management change and (chemical) pollution, which should be taken into consideration. Therefore there is an emerging need for an integrated, sustainable and efficient system assessing the management of soil and land as a resource.

The use of remote sensing can offer spatio-temporal and quantitative information of extended areas. In particular imaging spectroscopy has shown to perfectly complement existing sampling schemes as secondary information for digital soil mapping. Although only the upper-most layer of soil interacts with light when using reflectance spectroscopy, it still can offer valuable information that can be utilized by farmers and decision makers.

Fully processed airborne imaging spectrometer data from APEX as well as land cover classification for the agricultural area in Lyss were available. Based on several spectral analysis methods we derived multiple soil properties, including soil organic matter, soil texture, and mineralogy; complemented by vegetation parameters, including leaf area index, chlorophyll content, pigment distribution, and water content. The surface variables were retrieved using a combination of index-based and physically-based retrievals. Soil properties in partly to fully vegetated areas were interpolated using regression kriging based methods.
This allowed the continuous assessment of potential soil functions as well as non-contiguous maps of abundances of combined soil and vegetation parameters. Based on a simple regression model we could make a rough estimate of ecosystem services. This provided the opportunity to look at the differences between the interpolated soil function maps and the non-contiguous (but combined) vegetation and soil function maps.

We demonstrate the use of interpolated soil function maps as well as non-contiguous (but combined) vegetation and soil function maps and comment on their combined usability to assess related ecosystem services.