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The use of crop rotation for mapping soil organic content in farmland

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Most of the current digital soil mapping uses natural environmental covariates. However, human activities have significantly impacted the development of soil properties since half a century, and therefore become an important factor affecting soil spatial variability. Many researches have done field experiments to show how soil properties are impacted and changed by human activities, however, spatial variation data of human activities as environmental covariates have been rarely used in digital soil mapping. In this paper, we took crop rotation as an example of agricultural activities, and explored its effectiveness in characterizing and mapping the spatial variability of soil. The cultivated area of Xuanzhou city and Langxi County in Anhui Province was chosen as the study area. Three main crop rotations,including double-rice, wheat-rice,and oilseed rape-cotton were observed through field investigation in 2010. The spatial distribution of the three crop rotations in the study area was obtained by multi-phase remote sensing image interpretation using a supervised classification method. One-way analysis of variance (ANOVA) for topsoil organic content in the three crop rotation groups was performed. Factor importance of seven natural environmental covariates, crop rotation, Land use and NDVI were generated by variable importance criterion of Random Forest. Different combinations of environmental covariates were selected according to the importance rankings of environmental covariates for predicting SOC using Random Forest and Soil Landscape Inference Model (SOLIM). A cross validation was generated to evaluated the mapping accuracies. The results showed that there were siginificant differences of topsoil organic content among the three crop rotation groups. The crop rotation is more important than parent material, land use or NDVI according to the importance ranking calculated by Random Forest. In addition, crop rotation improved the mapping accuracy, especially for the flat clutivated area. This study demonstrates the usefulness of human activities in digital soil mapping and thus indicates the necessity for human activity factors in digital soil mapping studies.