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Application of Geostatistical Analysis with R Machine Learning Methodologies for Soil Organic Carbon Mapping

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Abstract

The emergence of new data processing and analysis techniques makes it possible to review and re-evaluate databases from previous projects and field campaigns. Historical data allows to know the evolution of the physical and chemical characteristics of the soil, as well as, for example, its affection after a wildfire. These techniques are being accepted and applied by the international scientific community. We are talking about Digital Soil Mapping (Malone et al., 2017) and, in our case, Soil Organic Carbon Mapping (FAO, 2018), by considering SOC as an indicator of changes in biological activity and soil productivity. Study area was the Chelva Forest Demarcation (except for the part of the Rincón de Ademuz). The methodology applied was based on the SCORPAN model (Soils, Climate, Organisms, Parent material, Age and (N) space or spatial position (Bratney et al., 2003)) as a reference framework. R and Qgis software were used for the geostatistical treatment of the data. Historical field data was converted into readable format by the software and was combined with covariates from the same period of the soil samples: digital terrain model, 20-year period mean temperature, 20-year period mean precipitation, NDVI, land use, soil type, lithology and the 7 bands of a Landsat image. The SOC mapping methods applied were Regression-Kriging (RK) and Random-Forest (RF). It has proven to be efficient for mapping soil properties across a wide range of data scenarios and scales of soil variability. This methodology allowed the mapping of SOC in the study area, which allowed to estimate SOC variations in wildfires, as well as the analysis of their impact on climate change scenarios.

Keywords: Soil organic Carbon, mapping, regression kriging, random forest

References

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