

Publication

Copper distribution in European agricultural soils: an analysis based on LUCAS soil survey

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Copper (Cu) distribution in soil is influenced by climatic, geological and pedological factors. Apart from geological sources and industrial pollution, other anthropogenic sources, related to the agricultural activity, may increase copper levels in soils, especially in permanent crops such as olive groves and vineyards. This study uses 21,682 soil samples from the LUCAS topsoil survey to investigate copper distribution in the soils of 25 European Union (EU) Member States. Generalized Linear Models (GLM) were used to investigate the factors driving copper distribution in EU soils. Regression analysis shows the importance of topsoil properties, land cover and climate in estimating Cu concentration. Meanwhile, a copper regression model confirms our hypothesis that different agricultural management practices have a relevant influence on Cu concentration. Besides the traditional use of copper as a fungicide for treatments in several permanent crops, the combined effect of soil properties such as high pH, soil organic carbon and clay, with humid and wet climatic conditions favours copper accumulation in soils of vineyards and tree crops. Compared to the overall average Cu concentration of 16.85/mg/kg⁻¹, vineyards have the highest mean soil Cu concentration (49.26/mg/kg⁻¹) of all land use categories, followed by olive groves and orchards. Gaussian Process Regression (GPR) combined with kriging were used to map copper concentration in topsoils and to evidence the presence of outliers. GPR proved to be performant in predicting Cu concentration, especially in combination with kriging, accounting for 66% of Cu deviance. The derived maps are novel as they include information about the importance of topsoil properties in the copper mapping process, thus improving its accuracy. Both models highlight the influence of land management practices in copper concentration and the strong correlation between topsoil copper and vineyards.

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