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Decoding implicit information from the soil map of Belgium and implications for spatial modelling and soil classification

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A systematic soil survey of Belgium was conducted from 1948 to 1991. Field surveys were done at the detailed scale of 1:5000 with the final maps published at a 1:20,000 scale. Soil surveyors were classifying soils in the field according to physical and morphogenetic characteristics such as texture, drainage class and profile development. Mapping units are defined as a combination of these characteristics but to which modifiers can be added such as parent material, stoniness or depth to substrata. Interpretation of the map towards predicting soil properties seems straight forward. Consequently, since the soil map has been digitized, it has been used for e.g. hydrological modelling or for estimating soil organic carbon content at sub-national and national level. Besides the explicit information provided by the legend, a wealth of implicit information is embedded in the map. Based on three cases, we illustrate that by decoding this information, properties pertaining to soil drainage or soil organic carbon content can be assessed more accurately.

First, the presence/absence of fragipans affects the soil hydraulic conductivity. Although a dedicated symbol exits for fragipans (suffix "...m"), it is only used explicitly in areas where fragipans are not all that common. In the Belgian Ardennes, where fragipans are common, their occurrence is implicitly implied for various soil types mentioned in explanatory booklets. Second, whenever seasonal or permanent perched water tables were observed, these were indicated by drainage class ".h." or ".i.", respectively. Stagnic properties have been under reported as typical stagnic mottling – i.e. when the surface of soil peds are lighter and/or paler than the more reddish interior – were not distinguished from mottling due to groundwater gley. Still, by combining information on topography and the occurrence of substratum layers, stagnic properties can be inferred. Thirdly, soils with deep anthropogenic enriched organic matter (Anthrosols) are distinguished for their specific profile development (code "..m"). Obviously, when assessing soil organic carbon content these soil types need particular consideration. Soils in the Campine region with anthropogenic layers only 30 to 40 cm thick, not being Anthrosols, got a specific suffix code ("...3"). Still, as these soils may have a buried Ah horizon of up to 20 cm, their soil organic carbon content can be comparable to those of Anthrosols. The buried Ah horizon is however not explicitly mapped; its presence needs to be inferred from other environmental information.

In conclusion, conventional soil maps convey more information than what transpires from just the explicit legend's semantics. Although a challenge, decoding the implicit information should be particularly useful for spatial modeling. The cases also point to the importance of classifying soil characteristics explicitly, wherever possible, and in particularly when soil maps are integrated into geographical information systems.