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Summary

Title: Pedometric mapping. Bridging the gaps between conventional and pedometric approach

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Modern users of soil geo-information require finer and finer scales of detail, and maps of soil properties rather than soil classes, along with estimates of the uncertainty. The technological and theoretical advances in the last 20 years have lead to a number of new methodological improvements in the field of soil mapping. Most of these belong to the domain of the new emerging discipline - **pedometrics**. Pedometric mapping is generally characterised as a quantitative, (geo)statistical production of soil geoinformation, also referred to as the **predictive** or **digital soil mapping**.

Many new pedometric techniques such as sampling optimisation algorithms, new interpolation techniques, fuzzy or continuous soil maps are, however, still not fully applied in soil mapping at smaller, i.e. regional scales. The polygon-based soil maps with crisp definition of soil classes are still used as the 'state of the art' methodology. For a long time, the term *pedometrics* has been used as a challenge or contradiction of soil taxonomies, i.e. traditional systems. This thesis is an attempt to bridge the gaps between the empirical and automated methods and improve the practice of soil mapping by designing an integrative pedometric methodology. The thesis covers seven research papers/topics listed down-bellow.

SAMPLING - The chapter demonstrates how allocation of points in the feature space influences the efficiency of prediction. It suggests how to represent spatial multivariate soil forming environment; how to optimise sampling design for environmental correlation and which sampling strategies should be used for a general soil survey purposes.

PRE-PROCESSING - In this chapter, systematic methods for reduction of errors (artefacts and outliers) in digital terrain parameters are suggested. These methods ensure more natural and more complete representation of the terrain morphology, which then also reflects on the success of spatial prediction.

PHOTO-INTERPRETATION - This chapter suggests a semi-automated method for extrapolating photo-interpretation from a limited number of study sub-areas to the whole area. The intention was to enhance and not to replace the mapper's knowledge and expertise.

INTERPOLATION - This chapter considers the development of a flexible statistical framework for spatial prediction that should be able to adopt both continuous and categorical soil variables. It suggests methods for dealing with non-normality of input data and multicollinearity of predictors.

VISUALISATION - In this chapter, an algorithm is suggested to visualize multiple memberships and to analyse geographical and thematic confusion. Multiple memberships are visualized using the Hue-Saturation-Intensity model and GIS calculations on colours.

ORGANIZATION - This chapter collates methods from previous chapters and describes organizational structure of a hybrid grid-based soil information system (SIS). It shows how to select a suitable grid size, how to aggregate and disaggregate soil information and what are the advantages and disadvantages of a grid-based SIS. The prediction maps are then made using both photo-interpretation and auxiliary maps, which ensures both continuous and crisp transitions.

QUALITY CONTROL - In this chapter, systematic steps are suggested to assess the effective scale, accuracy of soil boundaries, accuracy of map legends, thematic purity of mapped entities and overlap among the adjacent entities. This assessment was based on a number of control surveys including control profile observations and photo-interpretations.

The proposed pedometric mapping methodology can be used to enhance the practice of soil mapping making the soil maps more objective, detailed and more compatible for integration with other environmental geo-data. There is no need to use the concept of soil mapping units or use double-crisp soil maps anymore. On the other hand, instead of abandoning photo-interpretation, soil classification or empirical knowledge on soils, these methods can be successfully integrated with pedometric techniques.