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Landscape Segmentaion, Representativity and Data Mining - Concepts for Digital Soil-Hydrological Mapping

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Representative data collecting plays a crucial role in fast and high resolution digital spatial environmental mapping. Based on a study in central Hesse, Germany, (Nidda catchment, 1200 km^2) we present an integrated approach combining stacked sampling schemes, Ground Penetrating Radar surveys, and data mining based digital soil mapping.

The sampling scheme focuses on landscape segmentation, patch sampling, and transect sampling to provide representative transects for linear operated soil sensing techniques. It accounts for landscape heterogeneity and thus offers the ability of valid extrapolations.

Landscape segmentation is based on existing medium scale soil maps (1:50.000) and spatial cluster analysis. Patch sampling searches optimized representative spatial subsets, within each landscape unit, in terms of a similar frequency distribution. The algorithm is implemented on the basis of a special moving window technique. Frequency distributions are compared using a chi^2 test. In the next step representative transects are searched on the basis of a randomized nearest neighbour algorithm within each patch. The optimization term is a minimized transect length. On the other hand all classes in a stratified map should only be covered once. This ensures that all relevant soil information can be surveyed over the shortest possible distance.

The surveyed sensor data can then be used to apply spatial data mining algorithms

for digital mapping of soil substratum, soil stratification and field capacity which are important for subsequent high resolution hydrological modelling.

All approaches introduced are automated and provide representative data for linear operated soil surveys forming the basis for high resolution soil-hydological maps at landscape scale