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Mapping nitrate vulnerable zones in Hungary

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Soil maps can be usually considered on three different levels: map displaying (i) primary soil properties or soil classes, (ii) secondary soil properties, derived from primary properties and (iii) soil function and/or threats inferred from soil properties and external data. Primary soil maps are traditionally provided by soil surveys generally using soil mapping units. Digital soil maps using specific spatial inference models for the spatial extension of measured/observed data predicting soil properties over the full range of an area are also ranked as primary soil maps. Elaboration of soil maps with secondary soil properties, in addition to spatial inference, also requires property inference in the form of pedotransfer rules or environmental models. Soils maps can also depict soil related features in the context of soil functions and/or degradation processes. The resulted product is a functional soil map, which regionalises a specific soil function, soil threat. Recently there has been a shift in the characterization of the soils from their traditional description/classification towards their functions. One of the he six key soil functions is its environmental interaction (storage, filtering, and transformation).

Nitrate is the most widespread contaminant of groundwater and its loading is still a unsolved environmental problem. Diffuse input by the rural economy is the main cause of this loading. Council Directive of EU on nitrate pollution of waters requires identification of nitrate polluted waters and vulnerable zones together with the establishment and implementation of action programmes in order to reduce water pollution from nitrogen compounds in vulnerable zones. One of the used specific criteria refers to groundwaters, which contain or could contain, if preventative action is not taken,

nitrate concentrations greater than 50mg/l. All known areas of land contributing to nitrate pollution of these waters are to be identified for designation as Nitrate Vulnerable Zones (NVZs). Specific vulnerable zones in national territories are expected to be displayed on maps. Designation of NVZ's, that is identification of areas with higher risk of N-leaching, can be carried out by interpreting functional soil maps representing soil's nitrate filtering function. In order to produce a map of potential nitrate leaching, data on soil are to be combined with spatial information on specific environmental factors (climate, terrain, groundwater, land use etc.) in appropriate deterministic or stochastic inference models. This is just the issue what functional soil mapping is supposed to produce.

The first draft assignation of NVZ's was carried out in Hungary in the late '90s. A revised, more sophisticated map indicating NVZ's spatial distribution has been however expected by decision-makers. In our paper we present a functional soil mapping approach, which was used to provide nitrate vulnerability map in national level ($\sim$1:500,000). A rather simple environmental model was used taking into account few but really dominant environmental factors, but there has been a strong emphasis on the fine-tuning of the model features.

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