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# Nationwide updating of the 1:50,000 soil map of the Netherlands with digital soil mapping

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The national soil map at scale 1:50,000 is the main source of soil information in the Netherlands. Organic soils cover over half a million ha. Intensive use and deep drainage have resulted in an extensive decrease in the acreage of these soils. The national government therefore commissioned an update of the 1:50,000 soil map for the peatlands. A pedometric approach was developed for updating this map, and was applied to two areas in the northern peatlands that jointly cover 187,525 ha. This was the first time that digital soil mapping replaced conventional soil mapping in a nationwide, government-funded soil survey programme.

Soil classes were updated indirectly through mapping two quantitative diagnostic soil properties: the thickness and starting depth of the peat layer. Because the calibration data on thickness and starting depth were zero-inflated, a two-step simulation approach was implemented. First, peat presence/absence indicators were simulated from probabilities of peat occurrence that were predicted with a generalized linear model. Second, conditional peat thickness values were simulated from kriging with external drift predictions. The indicator and peat thickness simulations were combined to obtain the unconditional peat thickness. A similar approach was followed for the peat starting depth. From the simulated soil properties, probability distributions of three soil orders were derived. These orders were refined with information on (static) soil properties derived from the 1:50,000 map to obtain soil classes according to the 1:50,000 legend. The updated raster map was then incorporated in the 1:50,000 polygon map.

The prediction models were calibrated with legacy point data, that were updated for peat thickness before being used, in addition to a set of newly acquired point data. The uncertainty associated to the updated peat thickness values in the legacy dataset was quantified and accounted for by the prediction models.

The peat thickness map and a map with the three soil orders were validated with independent probability sample data. The overall purity of the soil order map was 66% for both mapping areas. For mapping area 1 this was a 12% purity improvement compared to the current 1:50,000 map, for mapping area 2 this was 3%. For area 1, the mean absolute error of the predicted peat thickness was 23.5 cm, and the R2 was 0.50. For area 2 these accuracy measures were 30.9 cm and 0.65.

We conclude that nationwide updating the 1:50,000 map with pedometric techniques is feasible. In order to increase the value and usability of the legacy point data as well as the large set of newly acquired field observations and the updated 1:50,000 map, we recommend installation of a soil monitoring network in the Dutch peatlands.