

Figure S1: Selected covariates: Sun-Dur) sunshine duration (DWD, 2017), Summ-D) summer days (DWD, 2018b), Mintemp) minimum temperature (DWD, 2018a), Precip) precipitation (DWD, 2018c), EU-DEM) digital elevation model (European Union Copernicus Land Monitoring Service, 2016), Net-Ero) net soil erosion and deposition rates (Borrelli et al., 2018), AWC) available water capacity (Ballabio et al., 2016), N) total nitrogen (Ballabio et al., 2019), pH) map of pH (Ballabio et al., 2019), %Clay) % Clay (Ballabio et al., 2016), BGL) soil scapes unit (BGR, 2008) [Legend], Bod-Klim) soil-climate region (Roßberg et al., 2007), HUK-HE) hydrogeological unit of hydrogeological map(BGR, SDG,

2019), GMK) geomorphographic map of Germany (BGR, 2007) [Legend], DLM) Landuse (BKG, 2019), Peat) Organic soils (Roßkopf et al., 2015).

Approach	Mean RMSE (g kg <sup>-1</sup> )	Mean MAE (g kg <sup>-1</sup> )	Mean MAPE (%)
AP1	32.6	12.3	49.0
AP1L	32.1	12.1	46.9
AP2	21.6	8.8	34.4
AP2L	21.3	8.7	34.3

Table 2: Mean of error metrics of the three models for each approach.



Figure S5: Spatial prediction of SOC content (g kg-1) of German agricultural soils based on the two-model approach for the three algorithms (BRT AP2L, RF AP2L, SVR AP2L). BRT = boosted regression trees, RF = random forest, and SVR = support vector regression.