Supplementary Material

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Table S1: Descriptive statistics of topsoil effective cation exchange capacity (ECEC) [$\mathrm{mmol_c\,kg^{-1}}$] of ZH forest (0–20 cm) split into calibration and validation sets (N: number of soil samples, Ns: number of unique sites, min: minimum, max: maximum, stdv: standard deviation, CV: coefficient of variation).

dataset	N	Ns	min	max	mean	median	stdv	CV
calibration	1316	1055	17.4	780.0	170.2	149.3	100.2	0.59
validation	528	293	17.8	492.4	150.4	121.4	94.0	0.63

Table S2: Frequency of *presence of waterlogged soil horizons* (horizon qualifiers "gg" or "r" according to Swiss soil classification, Jäggli et al., 1998) down to a given soil depth split into calibration and validation set (Ns: number of sites, #: number of present or absent, % percentage present).

depth [cm]	dataset	Ns	absent	present	
			#	#	%
0–30	calibration	764	662	102	13.4
	validation	198	173	25	12.6
0–50	calibration	764	563	201	26.3
	validation	198	152	46	23.2
0–100	calibration	764	448	316	41.4
	validation	198	133	65	32.8

Table S3: Frequency of drainage classes (aggregated profile qualifiers of Swiss soil classification, Jäggli et al., 1998), split into calibration and validation sets (Ns: number of sites, #: number of observations and % percentage of observations per level).

dataset	Ns	well drained		moderately well drained		poorly drained	
		#	%	#	%	#	%
calibration	732	476	65.0	94	12.8	162	22.1
validation	198	146	73.7	23	11.6	29	14.6

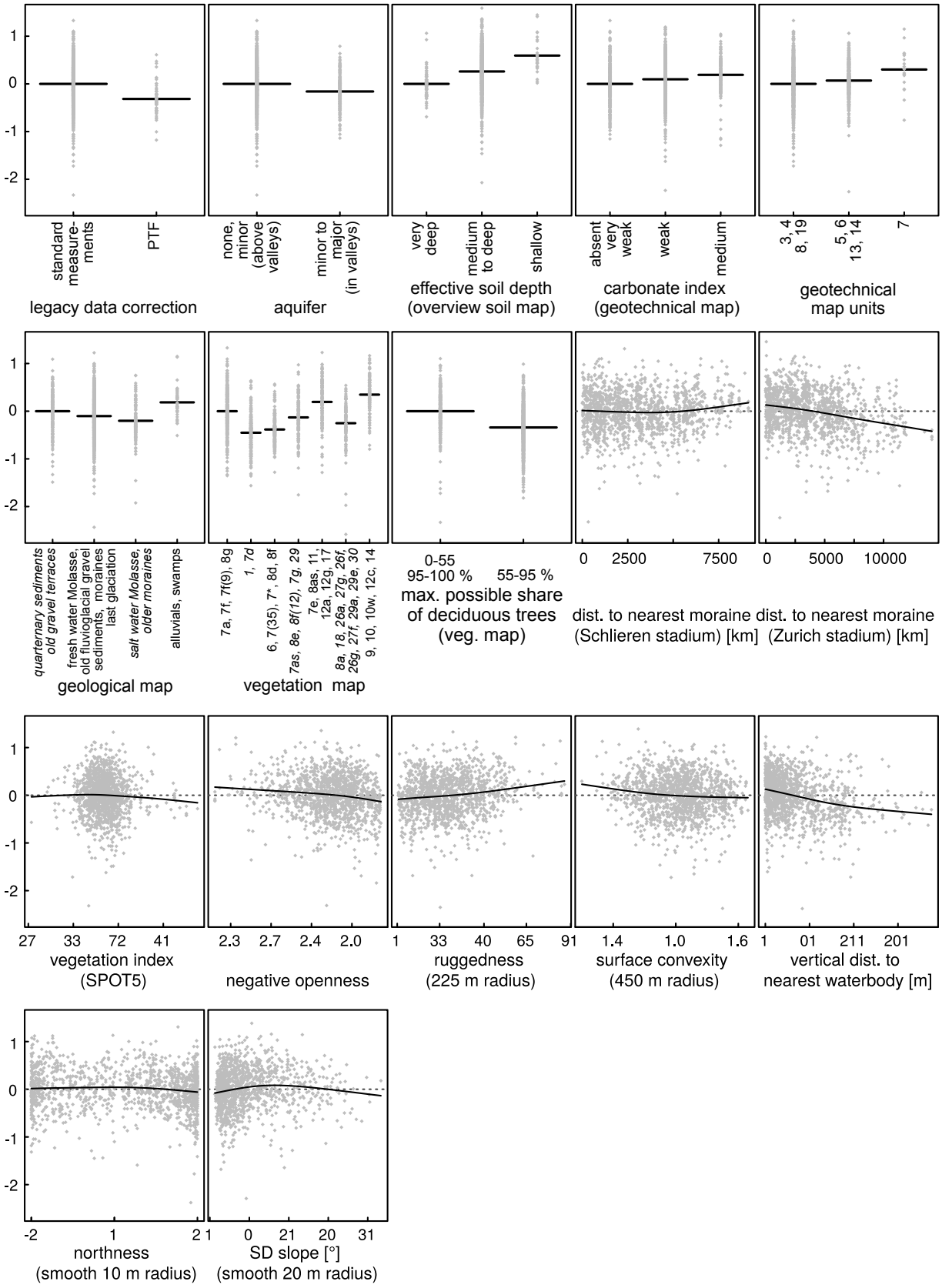

Figure S1: Partial residuals [log $\text{mmol}_c\,\text{kg}^{-1}$] for factors and smooth effects (continuous covariates) of model for effective cation exchange capacity (ECEC) in 0–20 cm, ZH forests (PTF: pedotransfer function predicting ECEC, SD: standard deviation in focal window).

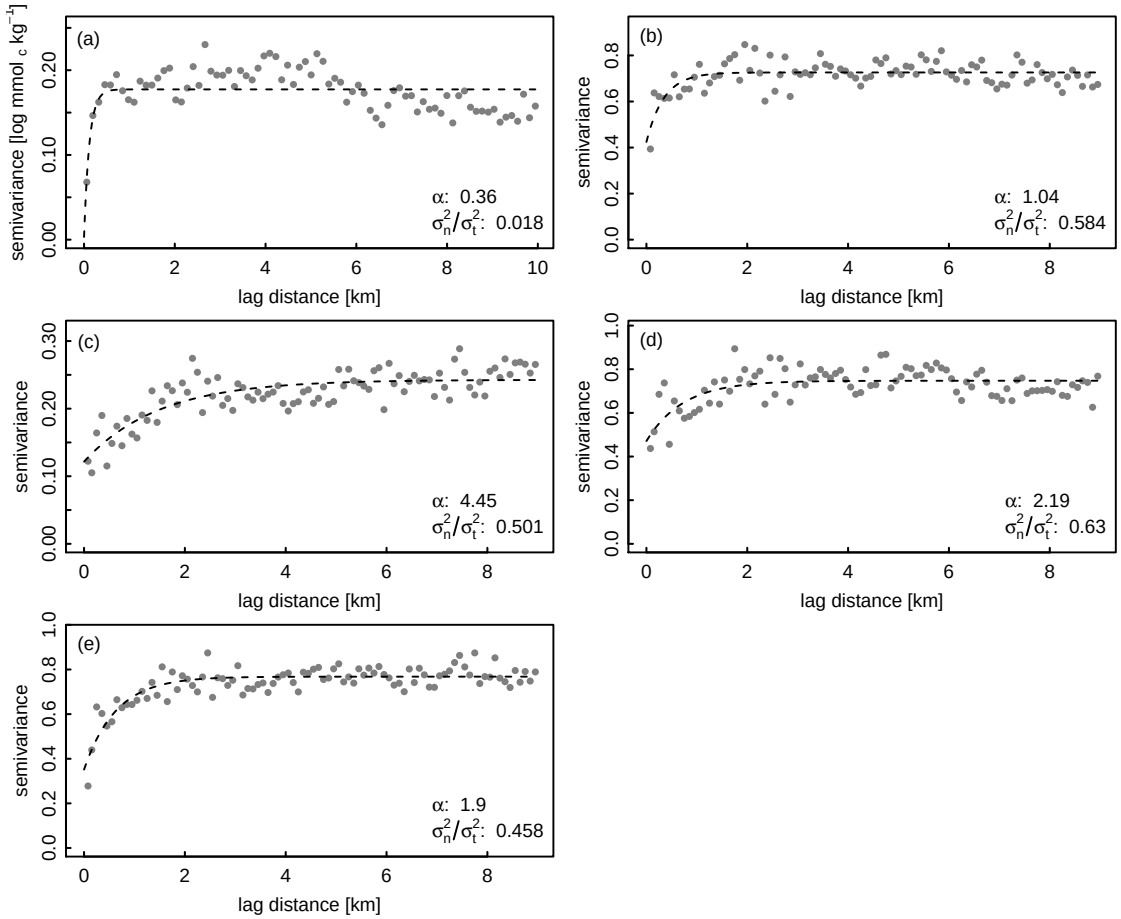

Figure S2: Sample variograms of the residuals at scale of additive predictor (grey dots, robust Qn-estimator) and least squares fit of exponential variogram (dotted line) for (a) ECEC 0–20 cm depth, (b) drainage classes, *presence of waterlogged soil horizons* in (c) 0–30 cm, (d) 0–50 cm and (e) 0–100 cm (α: effective range [km], σ_n^2/σ_t^2: ratio of nugget to total sill).

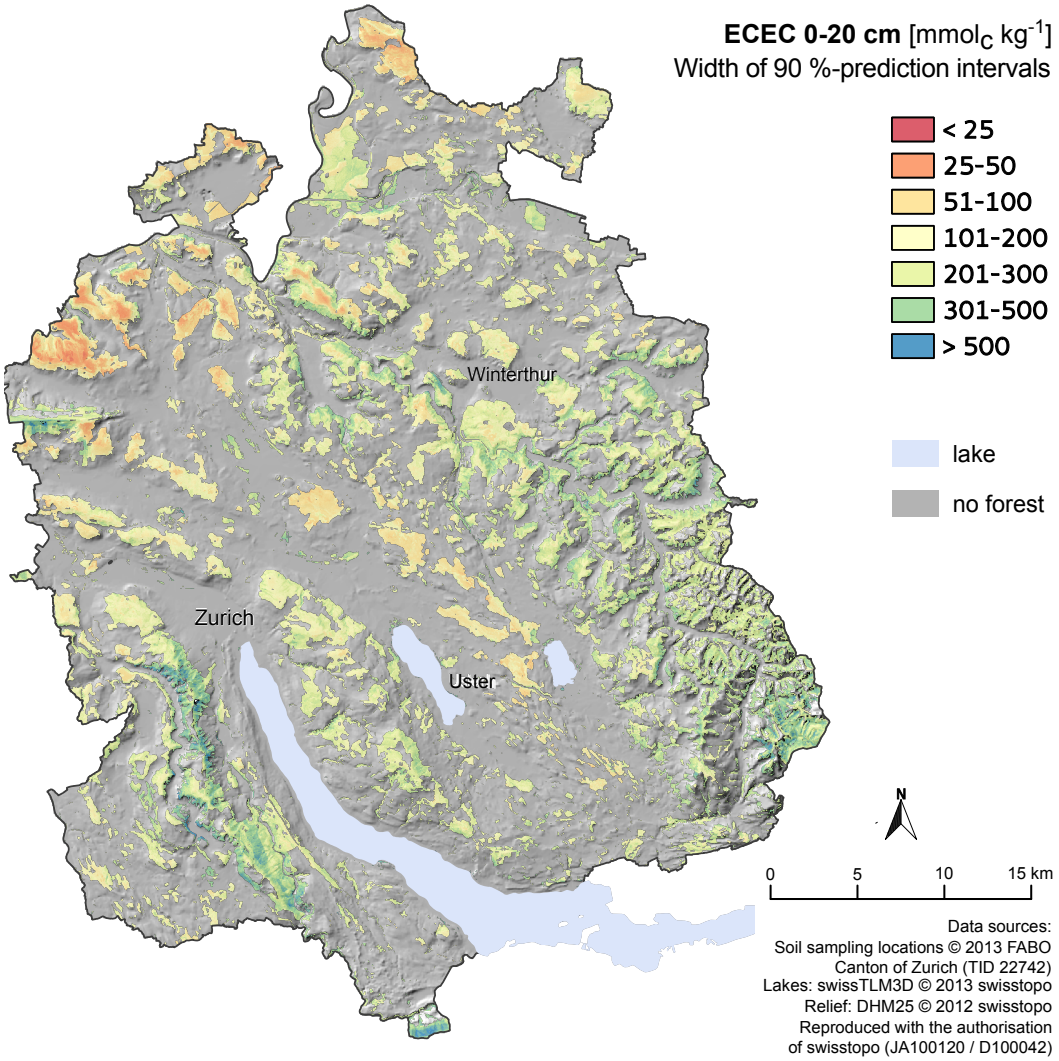

Figure S3: Width of 90 % prediction intervals for effective cation exchange capacity (ECEC) in 0–20 cm depth of ZH forests computed by model based bootstrapping (ECEC legend classes according to Walthert et al., 2004).

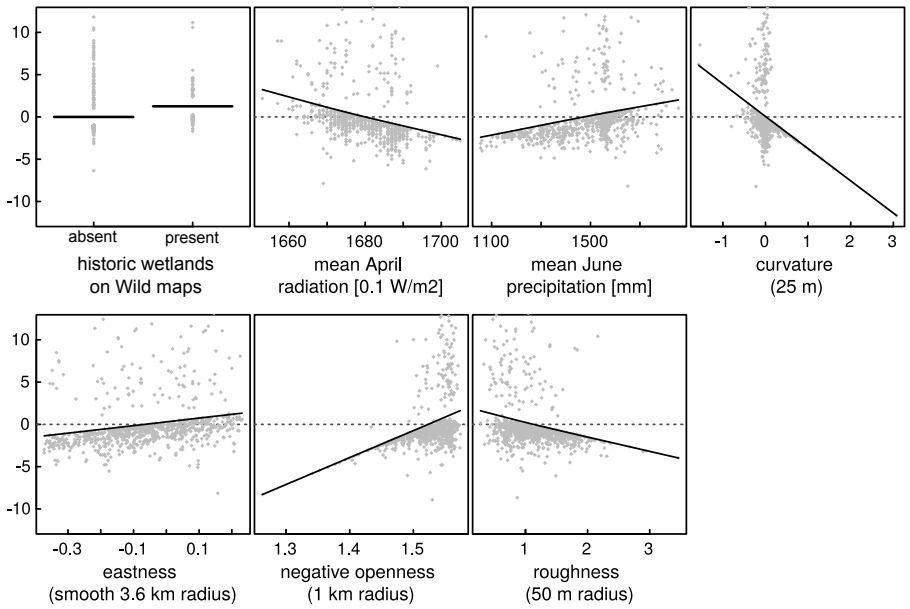

Figure S4: Partial residuals for parametric (binary covariates) and smooth effects (continuous covariates) of model for *presence of waterlogged soil horizons* down to 30 cm, Greifensee.

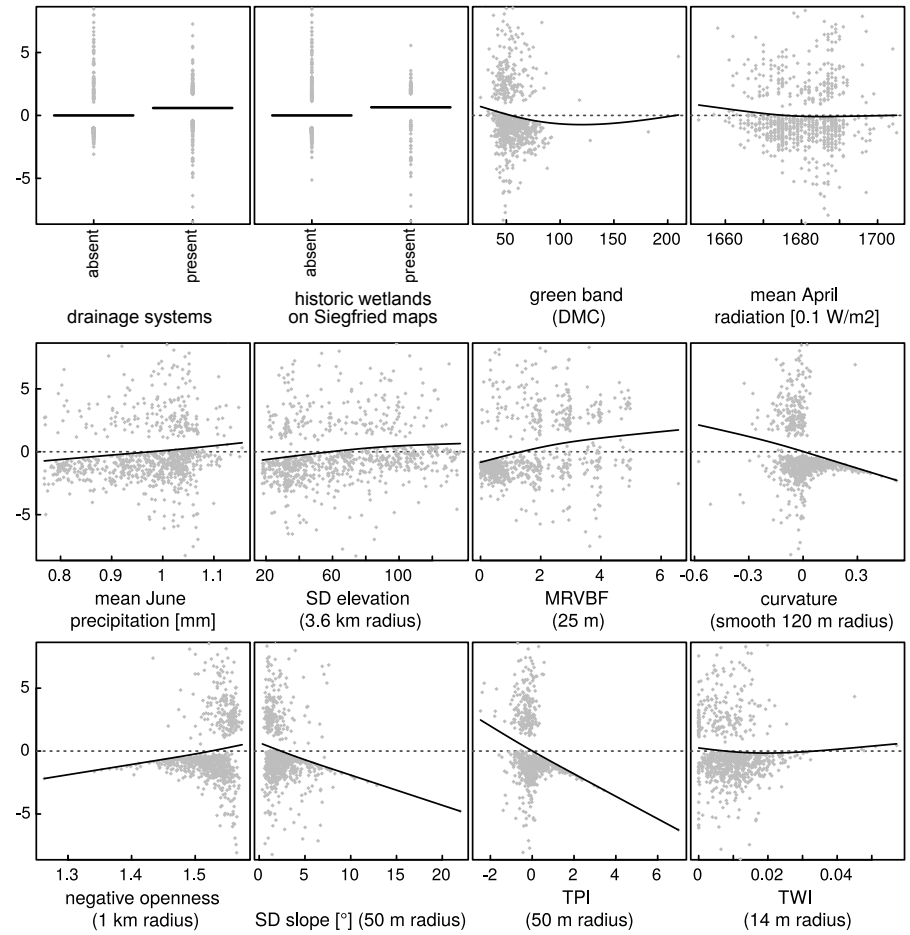

Figure S5: Partial residuals for parametric (binary covariates) and smooth effects (continuous covariates) of model for *presence of waterlogged soil horizons* down to 50 cm, Greifensee (SD: standard deviation in focal window, MRVBF: multi-resolution valley bottom flatness, TPI: topographic position index, TWI: topographic wetness index).

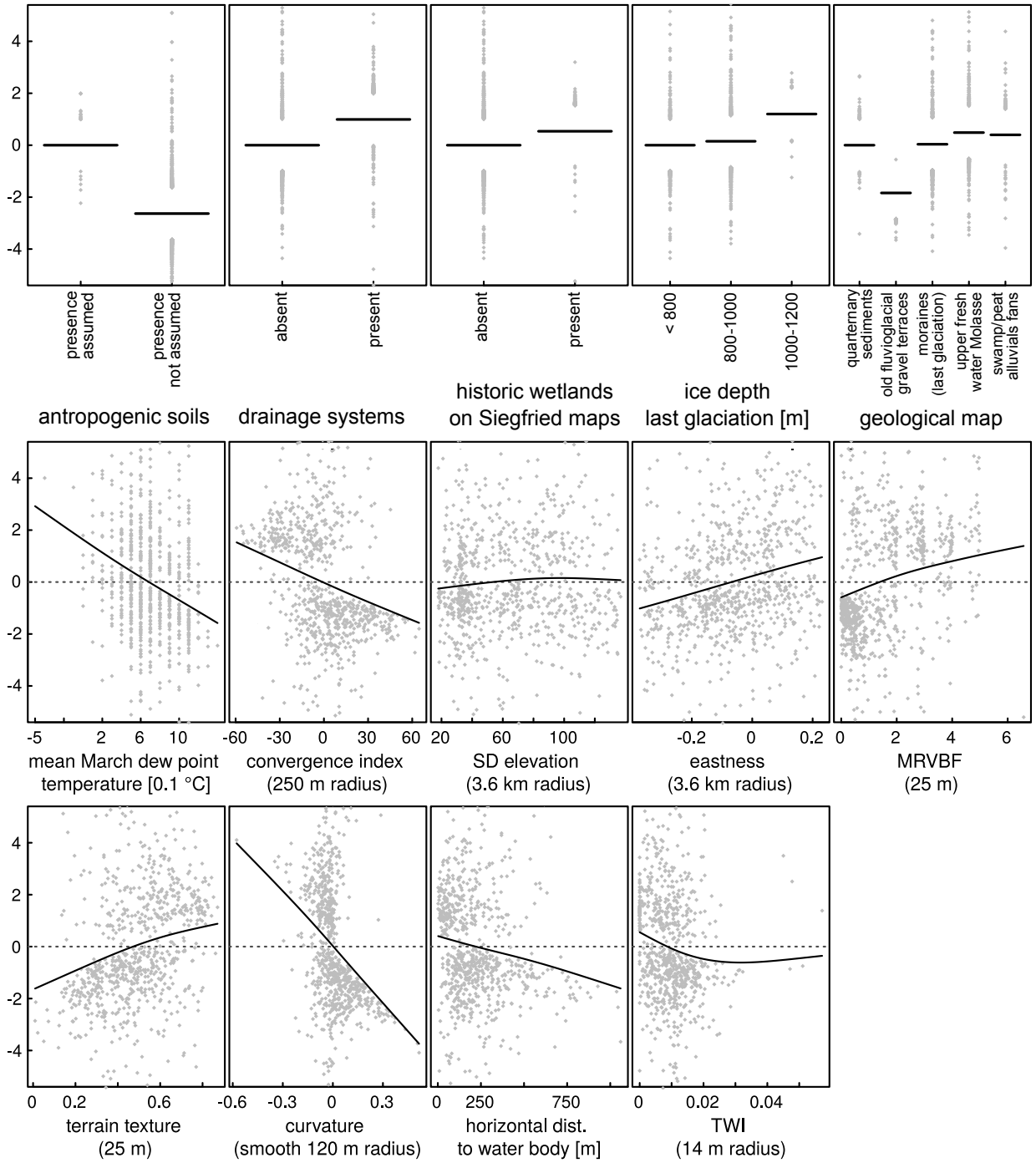

Figure S6: Partial residuals for parametric (binary and nominal covariates) and smooth effects (continuous covariates) of model for *presence of waterlogged soil horizons* down to 100 cm, Greifensee (SD: standard deviation in focal window, MRVBF: multi-resolution valley bottom flatness, TWI: topographic wetness index).

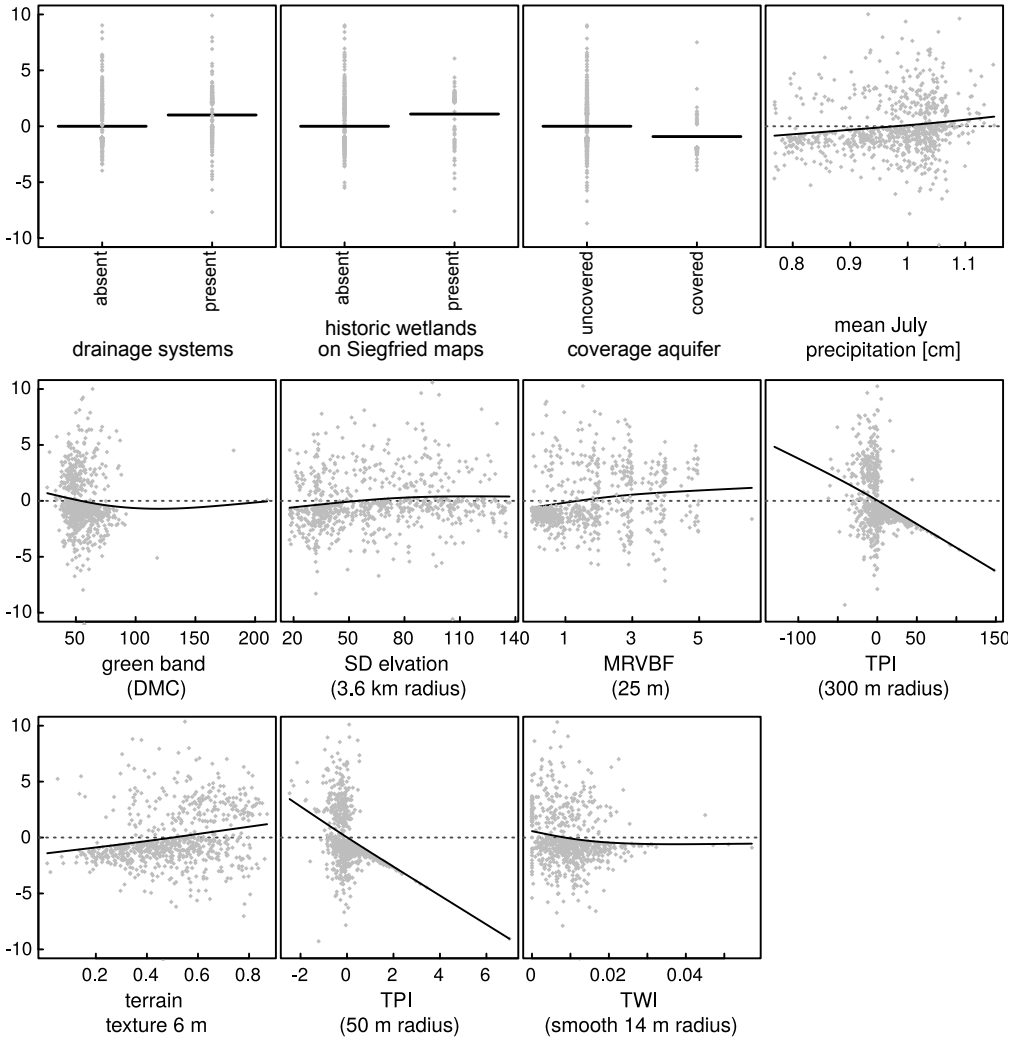

Figure S7: Partial residuals for parametric (binary covariates) and smooth effects (continuous covariates) of model for drainage classes, Greifensee (SD: standard deviation in focal window, MRVBF: multi-resolution valley bottom flatness, TPI: topographic position index, TWI: topographic wetness index).

References

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