

## Supplementary Materials

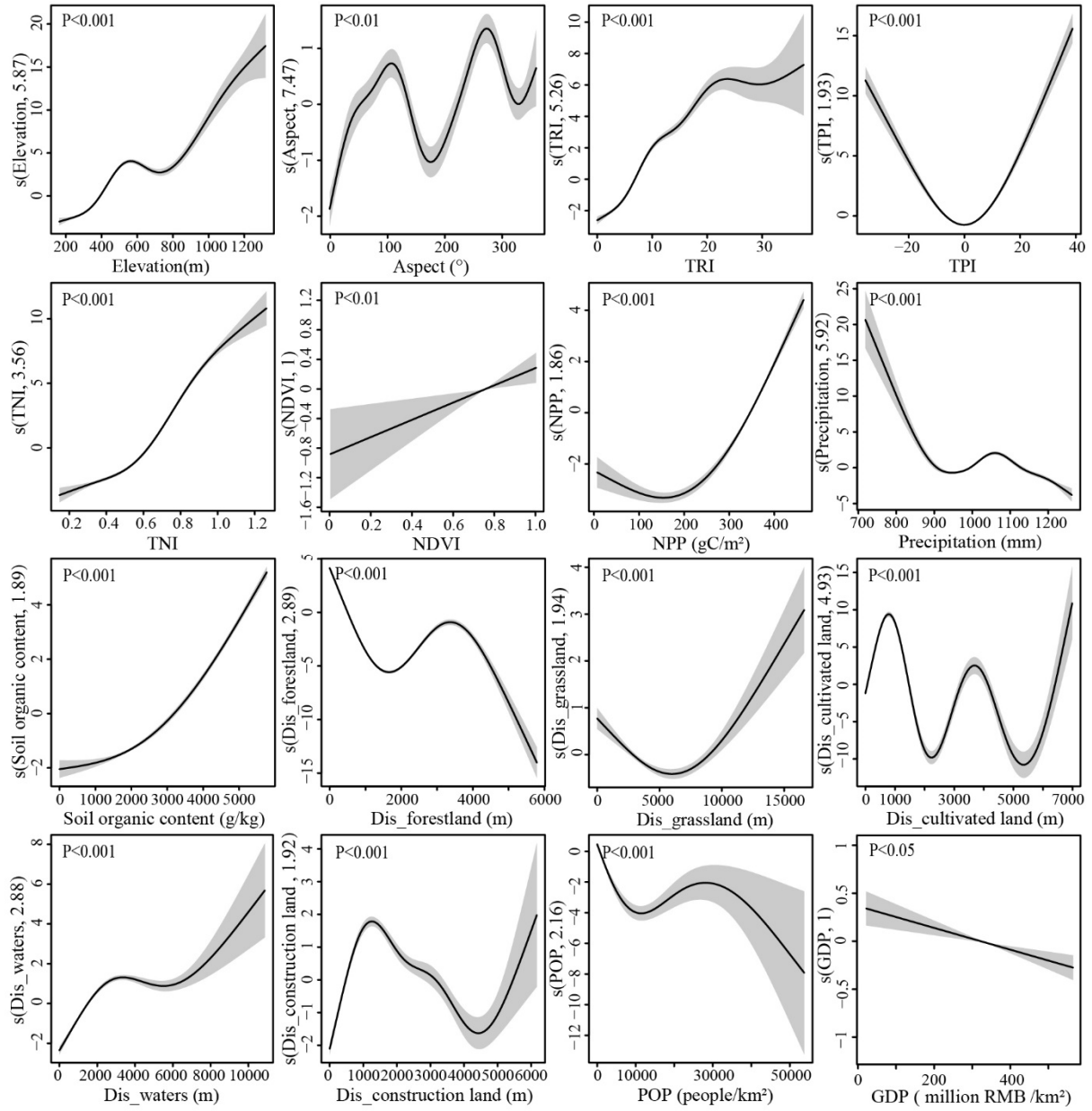
### Supplementary tables

**Table S1.** Hypothesis test results of generalized additive model fitting.

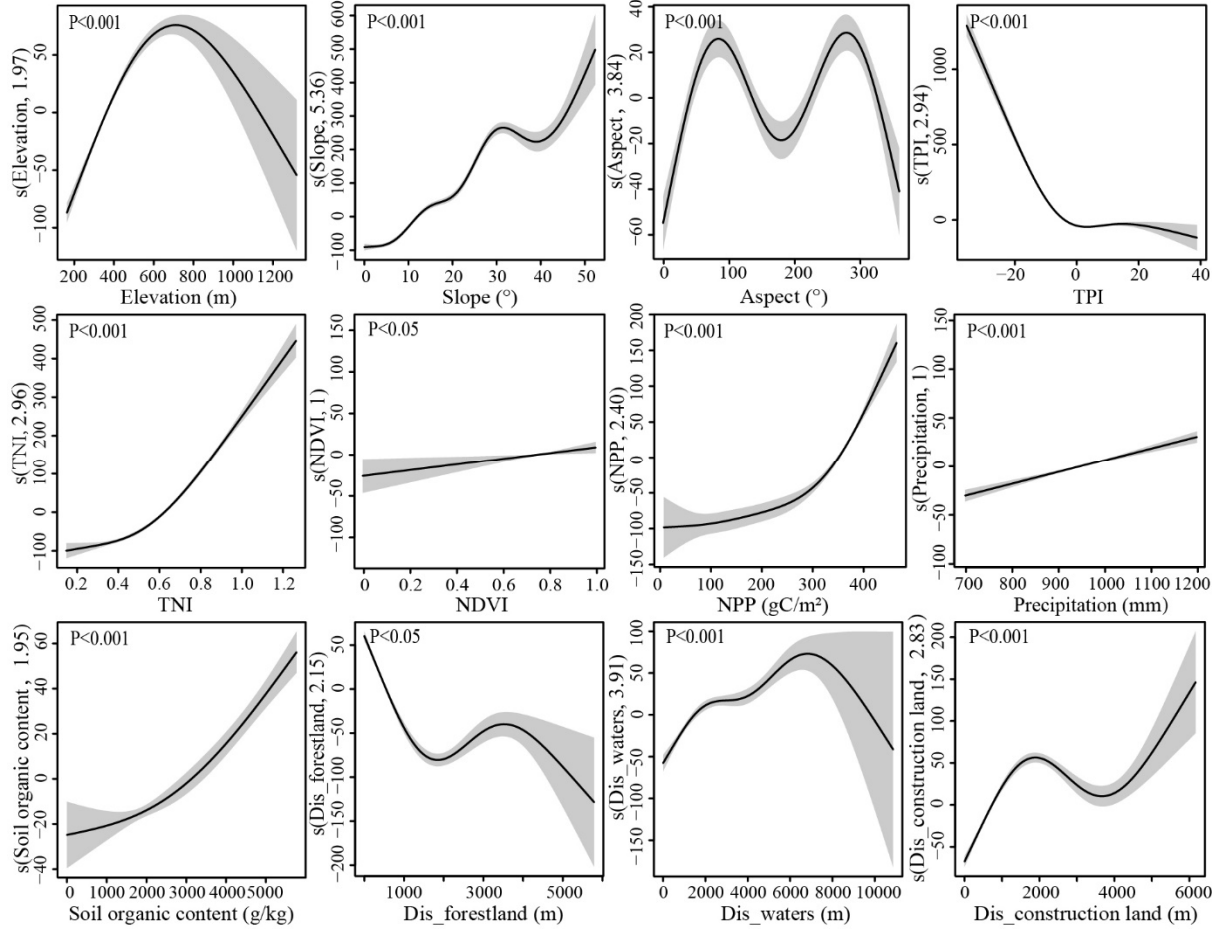
Smooth terms	Biodiversity			Carbon fixation			Soil conservation			Water conservation		
	Edf	F	P	Edf	F	P	Edf	F	P	Edf	F	P
s(Elevation)	9.23	9.17	<0.001***	5.87	8.25	<0.001***	1.97	157.48	<0.001***	1.00	147.08	<0.001***
s(Slope)	\	\	\	\	\	\	5.36	580.92	<0.001***	4.40	4.52	<0.001***
s(Aspect)	—	—	—	7.47	2.75	0.004**	3.84	6.99	<0.001***	3.05	2.95	0.028*
s(TRI)	—	—	—	5.26	3.82	0.001***	\	\	\	\		\
s(TPI)	—	—	—	1.93	17.96	<0.001***	2.94	1313.93	<0.001***	6.72	10.65	<0.001***
s(TNI)	3.40	4.04	0.002**	3.56	15.51	<0.001***	2.96	606.68	<0.001***	2.68	24.84	<0.001***
s(NDVI)	1.00	7.44	0.006**	1.00	8.28	0.004**	1.00	6.45	0.011*	4.76	70.80	<0.001***
s(NPP)	2.92	5.56	<0.001***	1.86	10.44	<0.001***	2.40	6.25	0.001***	3.63	11.00	<0.001***
s(Precipitation)	4.72	6.11	<0.001***	5.92	6.21	<0.001***	1.00	106.84	<0.001***	2.97	472.46	<0.001***
s(Soil organic)	2.87	4.82	0.004**	1.89	113.68	<0.001***	1.95	10.47	<0.001***	1.96	99.87	<0.001***
s(Dis_forestland)	2.94	17.05	<0.001***	2.89	23.54	<0.001***	2.15	3.15	0.022*	4.09	47.08	<0.001***
s(Dis_grassland)	—	—	—	1.94	22.57	<0.001***	—	—	—	4.66	9.23	<0.001***
s(Dis_cul)	6.99	12.51	<0.001***	4.93	22.23	<0.001***	—	—	—	4.66	7.39	<0.001***
s(Dis_waters)	3.86	2.43	0.032*	2.88	8.90	<0.001***	3.91	13.13	<0.001***	4.49	9.47	<0.001***
s(Dis_con)	2.94	8.53	<0.001***	1.92	19.85	<0.001***	2.83	6.09	<0.001***	1.00	49.01	<0.001***
s(POP)	2.26	2.78	0.049*	2.16	9.67	<0.001***	—	—	—	1.00	11.65	0.001***
s(GDP)	—	—	—	1.00	4.88	0.027*	—	—	—	2.99	71.61	<0.001***

The statistical significance levels were significant (\* $p < 0.05$ ), very significant (\*\* $p < 0.01$ ), and extremely significant (\*\*\*) $p < 0.001$ ). \: There were not incorporated into the models because of collinearity. —: There were not statistically significant. Edf: Estimated degrees of freedom, when edf>1, represents a nonlinear relationship, and when edf=1, represents a linear relationship; Dis\_cul: Distance to cultivated land; Dis\_con: Distance to construction land.

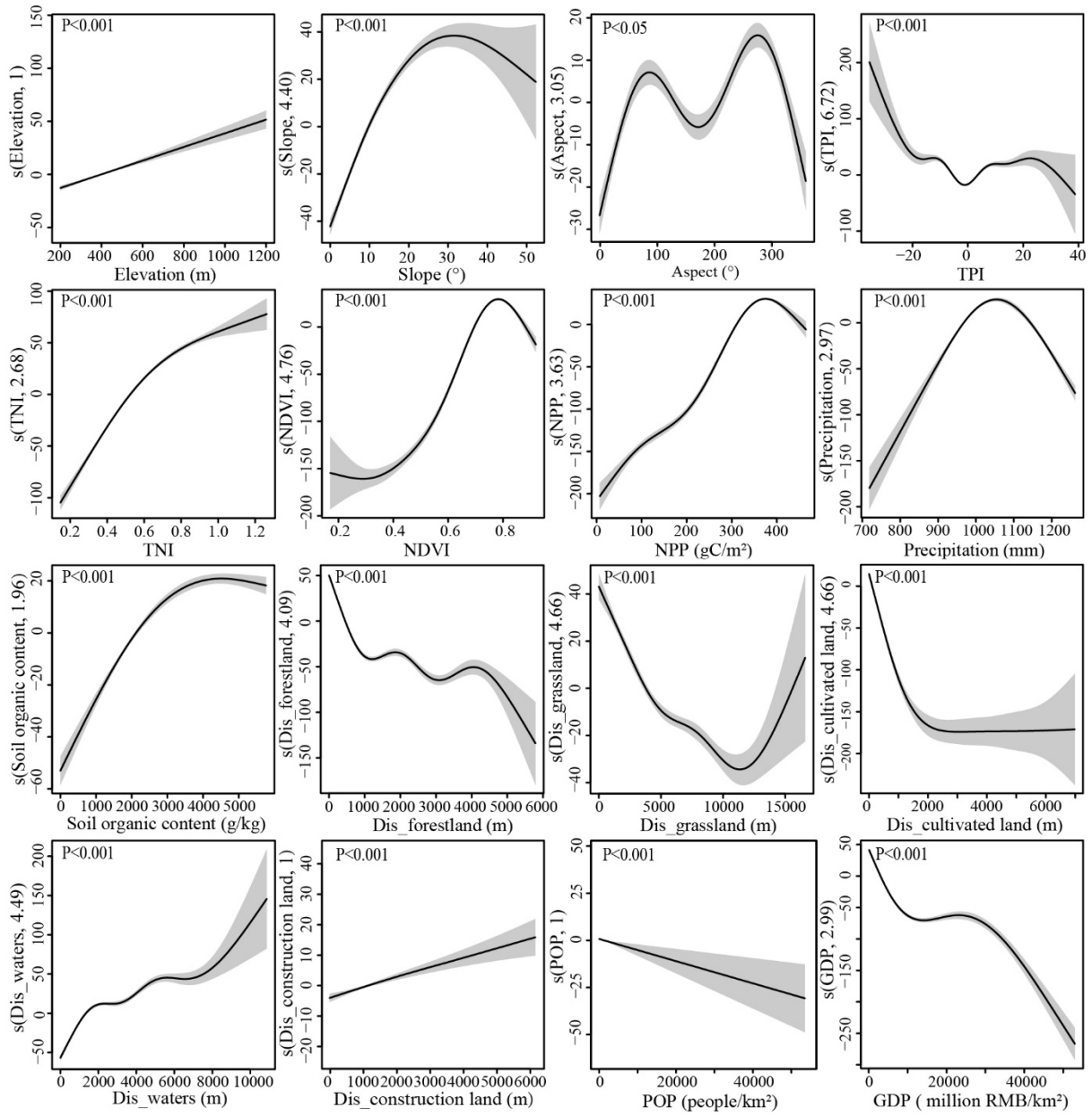
## Supplementary figures



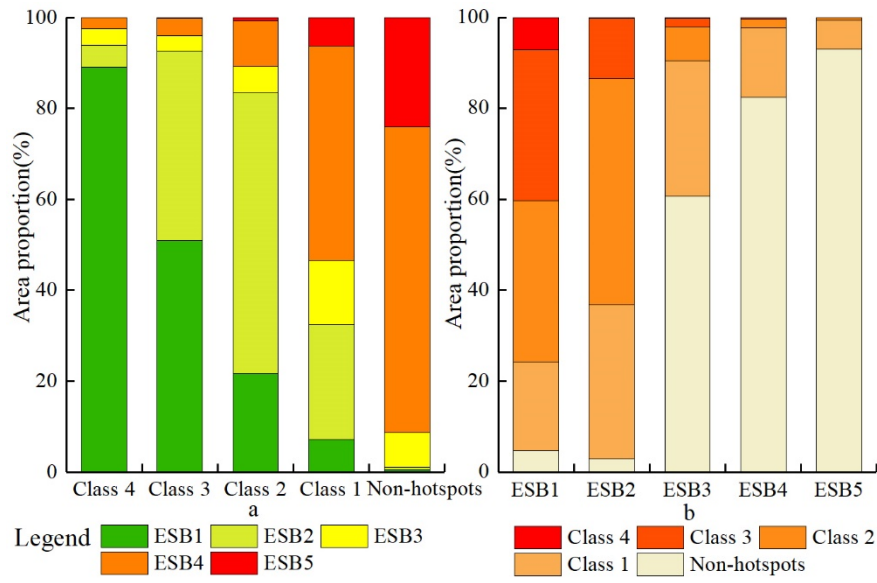
**Figure S1.** Smoothing functions of the covariate terms for carbon fixation GAM showing the effect of driving factors. Smoothers describe carbon fixation as a function of the respective predictor (lines) along with their 95% confidence intervals (grey shading) and partial residuals. Y axis represents partial residuals and the number in the y-axis label is estimated degrees of freedom of the smoothers function. X axis represents driving variables.



**Figure S2.** Smoothing functions of the covariate terms for soil conservation GAM showing the effect of driving factors. Smoothers describe soil conservation as a function of the respective predictor (lines) along with their 95% confidence intervals (grey shading) and partial residuals. Y axis represents partial residuals and the number in the y-axis label is estimated degrees of freedom of the smoothers function. X axis represents driving variables.



**Figure S3.** Smoothing functions of the covariate terms for water conservation GAM showing the effect of driving factors. Smoothers describe water conservation as a function of the respective predictor (lines) along with their 95% confidence intervals (grey shading) and partial residuals. Y axis represents partial residuals and the number in the y-axis label is estimated degrees of freedom of the smoothers function. X axis represents driving variables.



**Figure S4.** Area proportion of ecosystem services bundles (ESBs) in different ESs hotspots (a) and area proportion of multiple ES hotspots in different ESBs (b) in 2018.